

Innovation in developmental psychology, education, sports, and arts: Advances in research on individuals and groups

Edited by

Georgeta Panisoara, Radu Predoiu, Alexandra Predoiu
and Andrzej Piotrowski

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Innovation in developmental psychology, education, sports, and arts: Advances in research on individuals and groups

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Editorial: Innovation in developmental psychology, education, sports, and arts: advances in research on individuals and groups

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Editorial on the Research Topic

Innovation in developmental psychology, education, sports, and arts:
advances in research on individuals and groups

This Research Topic seeks to generate relevant information for psychologists, educators, and sports science specialists to facilitate growth and development in children, teenagers, and adults, increasing their performance levels.

Due to the ever-expanding wealth of knowledge surrounding us, we find ourselves constantly “besieged” by a multitude of data that entice our attention. Children's, adolescents', and adults' social, emotional, intellectual, and psychomotor development needs to be taken into account when determining their ability to meet the demands of education or a given sport or arts.

Growth and technological advances in the areas of educational psychology, sport, and arts have changed considerably over time, in relation to students' and athletes' preparation and performance. Technology supports specialists, with chatbot technology (an artificial intelligence—AI application) being used to improve learning practices and teaching (Okonkwo and Ade-Ibijola, 2021). The results of the study developed by Al-Abdullatif et al. showed that the use of AI-based tools, such as chatbots, enhances students' learning strategies and learning motivation. More exactly, the students who used the chatbot system showed more favorable levels of cognitive and metacognitive learning strategies and, also, demonstrated a higher level of self-efficacy for learning and higher scores in the case of perceived task value.

The manuscripts in this Research Topic explore the interplay between individual and environment: (1) how the COVID-19 pandemic affected university students in Turkey (Aslan and Çinar); (2) if birthplace (and relative age effect) is linked to athletes' sport performances (Thuany, Vieira et al.); (3) the influence of parenting style on children's outcomes (Șițoiu and Pânișoară); (4) how the conditions in which preteens live (preteens

from single-parent families, students having a parent working abroad, socially assisted students, and Roma preadolescents) influence their temperamental characteristics and behavior (Moanță et al.); (5) how caregivers of individuals with Down syndrome can change their perspective on their own life to handle adversities and challenging situations (Chiracu et al.); (6) the effects (on students' motivation and learning strategies) of implementation of a chatbot in Saudi higher education (Al-Abdullatif et al.); (7) the subject–environment interplay among runners from different Brazilian macro-regions (Thuany, Bandeira et al.); (8) the effectiveness of a dual career support system on Swedish athletes performances (Nyberg et al.); and (9) how risk-taking behavior and trait anxiety influence athletes' injury severity in competitions (Patenteu et al.).

Interpreted by many as a eulogy to physical exercise, Juvenal's dictum—"Mens sana in corpore sano"—cultivates the spirit of equal status, and even, according to the cliché, primacy. In an increasingly technological world, the concern of children (and parents), adolescents, and adults for their own growth and development is essential for their wellbeing, health, and productivity in the decades to come, and in turn, for their nations and communities to thrive. The study by Șitoiu and Pânișoară recommends the development of emotional intelligence (associated with the adoption of an authoritative parenting style) and self-esteem in parents. The two variables determine parental competencies (authors found that self-esteem plays a mediating role in the relationship between parents' emotional intelligence and parenting competence). The training of adults in terms of parental education is essential, the Barnum effect being felt regardless of parents' status or educational level.

With the suspension of traditional school education (during the COVID-19 pandemic), the difficulties for teaching became more serious, "due to the change in teacher–student relationships, but especially at early ages" (Quílez-Robres et al., 2022). The temperamental features of preteens at risk of educational and social exclusion (from disadvantaged classes—rural areas and those having low socioeconomic levels) were examined by Moanță et al. The authors stressed the need for specialists to decrease negative affectivity (including fear and frustration) and depressive mood in preadolescents and to increase effortful control—including inhibitory control and attention. Moreover, they asserted the need for a temperament-conscious education in parental education and teacher training.

However, the changes brought by the COVID-19 pandemic are experienced differently according to the person's system of reference—"the same factors might be perceived as barriers [...] or as opportunities for growth and development" (Drugas et al., 2023). The research of Aslan and Çinar revealed that during the COVID-19 pandemic, special attention must be paid to religious level, job loss, deterioration of economic status, gender, relationship status, and physical activities, as these variables have the potential to increase distress, anxiety, and depression level in university students.

We also found research, such as the one by Chiracu et al., which emphasizes that having a strong psychological capital (PsyCap), including hope, self-efficacy, optimism, and resilience,

enables the caregivers of individuals with Down syndrome to report higher levels of perceived quality of life. PsyCap represents an inner resource of caregivers to handle adversities and challenging situations and to perceive a higher level of subjective wellbeing.

Psychology often makes the difference between the first places and the other positions in the ranking. On the other hand, variables such as relative age effect (RAE) and birthplace (various regions present economic and social differences, influencing training facilities, and sports practice) can also make the difference when talking about athletes' sports performances. A higher frequency of Olympic athletes from Brazil was born in the first and second quartiles, while most of them were born in the Southeast region of the country, especially São Paulo state (Thuany, Vieira et al.). Exploring the educational background of Swedish world-class athletes, Nyberg et al. answered the question of whether different forms of Dual Career Support (DCS) have the potential to help talented athletes reach international-level performances. It seems that taking part in DCS is not essential for young athletes to register success (only 44% of world-class athletes had taken part in some form of DCS). Areas of science in which "practice lag behind research evidence are known as *valleys of death*" (Evans and Brewer, 2022). Therefore, it is required to advance the application of psychology in the sports science field, and, also, with respect to sports injury prevention and rehabilitation. According to Patenteu et al., a higher level of instrumental risk and a moderate or slightly below-average level of anxiety in unusual, new circumstances are linked with a decreased likelihood of severe injuries in athletes (competitive martial arts athletes were investigated). Moreover, in the case of Mixed martial arts (MMA), a higher value for anxiety in physically dangerous conditions is associated with more severe injuries.

Not least, environmental indicators, such as public illumination, sidewalks, green areas, perception about the weather, and perception about the built environment or pavement, were examined, as key factors influencing training and practice commitment among runners from different Brazilian macro-regions (Thuany, Bandeira et al.). Network topologies are different, and runners' performance could also be context-driven. On the other hand, it is known that the effect of deliberate practice on performance is larger for highly predictable activities (e.g., running) than for less predictable ones (e.g., handling a medical emergency) (Macnamara et al., 2014).

Educational psychology and psychological growth through sports are all in expansion. The extent to which the two environments spur growth is giving them value. In this Research Topic, there are relevant contributions that help specialists (teachers, psychologists, social workers, coaches, etc.) work with children, adolescents, or adults, guiding them to pay constant attention to progressive development and the ability to learn, change, and adapt.

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Dual career support among world-class athletes in Sweden: Performance, education, and employment

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In order to help talented athletes to combine sport and education, different forms of Dual Career Support (DCS) have been developed in many countries. The effectiveness of these support systems have been debated. Most studies have investigated young athletes in the beginning of their careers, less is known about athletes who reached the highest levels. Therefore, the aim of this study was to explore the extent to which former Swedish world-class athletes have attended dual career sport programs at upper secondary school. A retrospective design was used with 274 former world-class athletes who answered a questionnaire. In order to investigate whether there was a relationship between attending a dual career sport school and athletic characteristics, as well as post career educational and employment outcomes, a series of Chi-square tests were conducted. The main results show that more than half of the athletes did not take part in any DCS. These results indicate that DCS in Sweden is not a decisive factor for success in sports as intended. Half of all participants, regardless of whether they studied at DCS, have studied at university, and all participants had a job at the time of data collection. The majority also consider that their financial situation has improved after their sports career.

KEYWORDS

dual career, student-athlete, sport schools, world-class athletes, performance, education, employment

1. Introduction

Several studies indicate that dual career (i.e., combining education with elite sports) pathways make athletes better equipped for life after their sports career. For example, dual career athletes have larger social networks, a more balanced lifestyle and an identity more strongly linked to other domains than sports (Torregrosa et al., 2015; Linnér et al., 2019). Moreover, some scholars have shown that dual career athletes plan their time in a more effective and economical way (Tekavc et al., 2015), get enhanced retirement planning (Aquilina, 2013) and have greater access to the labor market (Tshube and Feltz, 2015). They

can therefore end their sports career with less retirement stress and on a more voluntary basis compared to other athletes (Torregrosa et al., 2015). Dual career can also provide other benefits for student athletes. For example, Debois et al. (2015) have shown that athletes with a successful and long career focus not only on their sports career but also on nonathletic components of life, such as education and employment, which serve as support to athletes during periods of decrease in or involuntary breaks from sports performance achievement. This line of research indicates that dual career can carry numerous psychological and psychosocial benefits for elite athletes. However, the balance of combining elite sport and education can be highly challenging (O'Neill et al., 2013; Stambulova and Ryba, 2014; de Subijana et al., 2015; Ryba et al., 2017; Linnér et al., 2019; Quinaud et al., 2022). For example, at upper secondary sport schools, many elite athletes experience difficulties in balancing their education, sports, and private life (Stambulova et al., 2015; Ryba et al., 2017). It seems common that dual career athletes most often choose the educational options that are the easiest to combine with elite sports (Küttel et al., 2020) and have to sacrificing educational success when integrate elite sport with education (Cosh and Tully, 2014). Moreover, the high demands placed on the athlete when trying to combine sports and education can cause stressful study situations, which in turn may result in psychological stress, overtraining and injuries (Gustafsson et al., 2008; O'Neill et al., 2013; Sisjord and Sorensen, 2018; Sorkkila et al., 2020). Harrison et al. (2022) and Linnér et al. (2021) have also shown that the higher the level of education, the more challenging it becomes for student athletes to combine studies with elite preparatory training, and that student-athletes need coping strategies and support to get optimal dual career balance.

Research has clearly shown that talented adolescent athletes may face many difficulties when trying to combine an elite sports career with a corresponding educational career. In order to address these difficulties and prepare athletes for a post-sport career, different forms of dual career support programs (e.g., elite sport school and study program support) for talented adolescent athletes have been developed in various countries (Lund, 2014; de Subijana et al., 2015; Stambulova et al., 2015; Tshube and Feltz, 2015; De Bosscher et al., 2016). As a result, a great deal of economic resources have been spent on dual career support programs across Europe in an attempt to help talented youth athletes attain the highest level in both their sports and education endeavors (European Commission, 2012), highlighting the need to examine the usefulness of dual career support programs.

In Sweden there are two types of dual career support programs: (1) Dual career support-international level (DCS-IL), and dual career support-national level (DCS-NL). Students who are admitted to DCS-IL are selected based on an assessment that they can reach the international elite sport level, and those who are admitted to DCS-NL are selected based on the assessment that they can at least reach the national elite sport level (Ferry, 2014). These designated sports school is an important part of the talent development program (Stambulova et al., 2015).

Attending a dual career sport program may seem advantageous, but researchers have shown some shortcomings, calling into question the usefulness of such programs. Sisjord and Sorensen (2018) have shown that athletes' expectations to perform at a high level decreased over a three-year period when attending a dual career support program (an upper secondary skiing school in Norway). The majority of participants reported that they intended to quit their sports career immediately after graduation. In addition, only 8% of Dutch students who took part in a dual career sport program at upper secondary school reached an international senior top level in their sports (van Rens et al., 2015). This shows the challenges in dual career sports program and talent development environments.

Although the intention of a dual career sport program is to help talented athletes achieve the highest possible level in sports as well as in education, the two aims can be difficult to combine. Several studies (van Rens et al., 2015; Küttel et al., 2020; Sæther et al., 2022) have found that most student athletes who stated that they wanted to reach the international top level prioritized their sport over their studies when studying at a sport school with a dual career sport program profile, contradicting the intention of such a program. A specific example is found in a study by Ronkainen et al. (2018) who showed that ice hockey coaches affected student athletes to prioritized their athletic career over their studies. Athletes who focused exclusively on their athletic career have been shown to be at risk of athletic identity foreclosure, which can lead to adaptation difficulties when ending one's sports career (Grove et al., 1997). Contradicting the main goal of dual support programs, van Rens et al. (2015) found that talented athletes who had not taken part in a dual career sport program at upper secondary school achieved better results in both sports and studies, and were more likely to continue studying at university. Moreover, they were significantly more motivated to do well in school compared to those who had attended a dual career sport program.

Despite some findings showing that dual careers may be advantageous for athletes (Debois et al., 2015; Torregrosa et al., 2015), the main findings above support the notion that dual career sport programs are struggling to facilitate help talented student athletes in reaching their full potential in sports as well as in education. Storm et al. (2021) believes that it is important that upper secondary sports school provide coordinated approaches to ensure both sport and study development for student-athlete. Therefore, it is important to develop the support for the whole environment in which the student-athlete are embedded, and not only focus on the individual student-athletes.

However, research in this area has almost exclusively focused on talented student athletes at the beginning of their sports career (Stambulova et al., 2015; van Rens et al., 2015; Sisjord and Sorensen, 2018; Davis et al., 2019; Sorkkila et al., 2020), while specific studies including world-class athletes are lacking. For example, the study by van Rens et al. (2015) of 242 talented athletes included only athletes at the beginning of their sports career, with a mean age of 21. The response rate was 20%, which

is considered too small to be able to draw any general conclusions, and as most talented athletes will likely not become elite athletes, this study is limited in its inclusion of only successful elite athletes at the beginning of their sports career. This makes it difficult to draw safe conclusions about the importance of dual career sport programs for successful athletes, as the goal of these programs is to help talented athletes attain the highest level in sports while also succeeding in their education endeavors (European Commission, 2012). Hence, it is especially important to investigate whether or not those who have reached the absolute top senior elite level have taken part in a dual career sport program at upper secondary school, and if so, to examine whether or not it has been beneficial.

One exception is a study by Emrich et al. (2009), looking at 199 successful elite athletes, was conducted included 2004 Summer Olympics and 2006 Winter Olympics participants. The purpose was to investigate whether there were any differences between school performance, post-school occupational prospects, and competitive success between those who had taken part in DCS and those who had not. The results show no differences between the groups in school performance. For the participants in the 2004 Summer Olympics there were no differences between DCS participants and non-participants in competitive performance, but for the participants in the 2006 Winter Olympics there was a connection between competitive performance success and being a DCS participant. These results are interesting but limited, as only 16% of the study group had taken part in DCS consistently and the response rate was only 32.6%. From this point of view, the aim of the current study is to explore the extent to which former Swedish world-class athletes have attended a dual career sport program at upper secondary school. The following research questions was put forward: Are there significant association between school options (DCS-IL, DCS-NL, and MSS) and gender, type of sport, sports performance, post-education, opportunities for higher education, employment attainment and post-athletic economic situation?

2. Materials and methods

2.1. Participants

A sample of all 431 former Swedish world-class athletes (42% women and 58% men) who had participated in the Summer or Winter Olympic Games, the World Cup, the European Championships, or corresponding championships (e.g., the European Cup, Grand Slam tournaments) between 2002 and 2012 were asked to participate in the study. The inclusion criteria entailed athletes who had competed on an international top elite level between 2002 and 2012 and had ended their elite athlete career during the time of the data collection. The inclusion criteria was also merits at least Nordic champion medalist or placement 4–10 in European championship, European Championship medalists, World Cup medalist, Olympic medalists, World

Champion medalists, World record holder and placing 1–3 in major competitions (i.e., Wimbledon in Tennis, Masters in golf).

Initially, a total of 274 participants (58% men and 42% women, mean age = 39.92, SD = 6.25) responded to the questionnaire (64% response rate). The participants were divided into 41 sports, both summer and winter, of which 27 were individual sports, athletics ($n = 16$), swimming ($n = 13$), biathlon ($n = 11$), snowboarding ($n = 11$), cycling ($n = 10$), cross-country skiing ($n = 9$), wrestling ($n = 8$), sport shooting ($n = 7$), golf ($n = 6$), ski cross ($n = 4$), table tennis ($n = 4$), tennis ($n = 4$), archery ($n = 4$), fencing ($n = 1$), gymnastics ($n = 2$), walking ($n = 9$), alpine skiing ($n = 8$), figure skating ($n = 4$), horse riding ($n = 4$), freestyle alpine ($n = 3$), ice skating/short track ($n = 3$), modern pentathlon ($n = 2$), taekwondo ($n = 2$), triathlon ($n = 2$), boxing ($n = 1$), judo ($n = 1$), weightlifting ($n = 1$), and 14 were team sports, football male ($n = 19$), football female ($n = 18$), ice hockey female ($n = 17$), ice bandy ($n = 13$), curling ($n = 12$), handball female ($n = 10$), ice hockey male ($n = 9$), sailing ($n = 7$), canoe ($n = 6$), handball male ($n = 6$), bob ($n = 2$), rodel ($n = 2$), rowing ($n = 2$), volleyball ($n = 1$). All but three participants were born in Sweden. Nearly half (48%) of the study group had grown up in a sparsely populated or small town, a third (31%) in a medium-sized to larger city, and a fifth (21%) in a metropolitan area. Half of the participants (51%) had university as their highest level of education, and 37% had upper secondary school and 4% had compulsory school as their highest level of education. The majority (61%) were employed at the time of data collection, and almost a quarter (35%) had their own company, while a minority (4%) were off duty, studying or were not employed for unknown reasons. Due to internal missing data, different numbers of participants will be presented in the results (e.g., 11 participants had not answered the question regarding what type of upper secondary school they studied at. Consequently, only answers from 263 participants are reported). We have based our division (in individual and team sports) on the same reason as Lupo et al. (2015), who described how team sports have a competition schedules spread over several month, while individual sport are more focused to specific periods; this can have an impact on how the student is able to manage the combination of studies and elite sports.

2.2. Instrument

In the current study we asked the following questions. Weather respondent attended a DCS-program or not was measured by the question, “Have you studied at any DCS-program?” Sport performance was measured by the question, “What is your highest sporting achievement during your elite sports career?” with free text as an answer option. Highest level of education was measured by the question, “What is your highest completed education?”. If elite sports career has been a hinder for higher education was measured by the question, “Elite sports career hindered your opportunities for higher education?”. Employment after elite sport career was measured by the question,

“What is your current occupation?” Economic situation was measured by the question, “Have your financial circumstances changed after your elite sports career ended?” Those respondents who answered that their economic situation had changed were asked to fill out at which form the economic situation had changed with the answer options, “For the better” and “For the worse.”

2.3. Procedure

After ethical approval from the Regional Ethics Board (Dnr 2016/428), a questionnaire was sent out to former world-class athletes. The respondents' addresses were found in various public address registers online, while some were obtained from different sports associations *via* telephone and e-mail. Participants were sent a letter informing them of the purpose of the project, how to complete the questionnaire, and ethical issues such as voluntary participation, anonymity, and the right to withdraw at any time if desired without consequences. Respondents were asked to return the completed questionnaire, in an enclosed postage-paid envelope, within 10 days. After 3 weeks from the first contact, the research team sent a first reminder letter. The second and final reminder was sent 3 weeks after the first one.

2.4. Data analyses

Data analyses were conducted using the statistics program SPSS 26.0. A series of Chi-square tests were conducted in order to investigate whether there is a relationship between school options (i.e., DCS-IL, DCS-NL, and MSS) and gender, type of sport, level of sporting success, and post-career outcomes (i.e., highest level of education, current employment, and economic situation). The significance level for the analysis was set to 0.05.

3. Results

3.1. Participant characteristics

The participants, representing former successful Swedish world-class athletes at a senior international level, were divided into three levels based on their highest success in their sport (Table 1). These categories are similar to the athlete classification system referred to in Swann et al. (2015) based on four types of elite performer: “world-class elite,” “successful elite,” “competitive elite,” and “semi-elite.” The most successful athletes in this study belong to Level 1, “world-class elite,” the second-most successful ones to Level 2, “successful elite,” and the least successful ones to Level 3, “competitive elite.” The category “semi-elite” incorporates athletes below the top elite standard level, and was therefore not included in this study. As seen in Table 1 more than half of the participants were world-class athletes, all of whom have won a medal at one of the major international championships (i.e.,

TABLE 1 Participants athlete classification based on their highest sporting success

| 1. World-class elite athletes (<i>n</i> =140; 51%) | 2. Successful elite athletes (<i>n</i> =87; 32%) | 3. Competitive elite athletes (<i>n</i> =47; 17%) |
|--|---|--|
| Olympic medalists, World Champion medalists, World record holder, placing 1–3 in major competitions (i.e. e., Wimbledon, Masters in Golf). | European Championship medalists, World Cup medal, placement 4–10 Olympics or World Cup. | Placement 4–10 European Championship, Nordic Championship medalist. Ranking 10–12 Olympics or World Cup, ranking 4–10 World Cup, National Championship medal, champion abroad, ranking 20 or less in the Olympics. |

Olympics or World Cup/Championships) or have broken a world record.

3.2. Attendance of dual career support program

Regarding what kind of upper secondary school the participants had attended, results showed that 44% (*n*=116) had attended some kind of dual career support program in upper secondary school (i.e., DCS-IL or DCS-NL), while the largest proportion (56%, *n*=147) had attended a mainstream upper secondary school (MSS). Notably, even though all participants had reached an international elite level, only 31% (*n*=82) of them had attended schools that were supposed to attract/select the best athletes (e.g., DCS-IL), indicating that DCS-IL is not a decisive factor in Swedish athletes reaching the highest international level in their sport (Table 2).

3.2.1. Gender and type of sport

As far as gender differences are concerned, the results showed that the proportion of boys and girls was largely evenly distributed across the different school forms (Table 2). However, a medium strong significant relationship (Pallant, 2020) was noted between the type of sport and attending a dual career sport program. Results in Table 2 show that more than double the proportion of individual athletes have studied in a dual career support program at an international level compared to team sport athletes. Concerning the other two school forms (i.e., DCS-NL and MSS) the distribution was more even distributed, with slightly more team sports in DCS-NL and more individual sports in MSS (Table 2). Thus, the results indicate that it is more common for individual athletes than team sport athletes in Sweden to choose to attend DCS-IL.

3.2.2. Sporting success

As shown in Table 2, 46% of the world-class elite athlete group attended some form of dual career support program (i.e., DCS-IL or DCS-NL), while the majority studied at a MSS. Almost the

TABLE 2 The relationship between attending a dual career sport program/school and athletic characteristics as well as post career educational and employment outcomes.

| Athletic characteristics and post career outcomes | DCS-IL | | DCS-NL | | MSS | | Total | χ^2 /value of p | Cramer's V |
|---|--------|------|--------|------|-----|------|-----------|------------------------|--------------|
| | n | (%) | n | (%) | n | (%) | | | |
| Gender | | | | | | | | 1.81/0.405 | 0.083 |
| Men | 52 | (34) | 18 | (12) | 81 | (54) | 151 (100) | | |
| Women | 30 | (27) | 16 | (14) | 66 | (59) | 112 (100) | | |
| Type of sport | | | | | | | | 13.69/0.001 | 0.228 |
| Team | 18 | (18) | 18 | (18) | 63 | (64) | 99 (100) | | |
| Individual | 64 | (39) | 16 | (10) | 84 | (51) | 164 (100) | | |
| Sporting success | | | | | | | | 1.43/0.839 | 0.052 |
| World class elite | 42 | (31) | 20 | (15) | 72 | (54) | 134 (100) | | |
| Successful elite | 27 | (32) | 8 | (10) | 48 | (58) | 83 (100) | | |
| Competitive elite | 13 | (29) | 6 | (13) | 26 | (58) | 45 (100) | | |
| Highest level of education | | | | | | | | 1.89/0.389 | 0.090 |
| University | 36 | (30) | 21 | (14) | 79 | (56) | 136 (100) | | |
| Upper secondary school | 33 | (35) | 12 | (13) | 50 | (53) | 95 (100) | | |
| Limited opportunities for higher education | | | | | | | | 9.21/0.056 | 0.134 |
| Yes | 17 | (40) | 4 | (9) | 22 | (51) | 43 (100) | | |
| Partly | 33 | (33) | 18 | (18) | 48 | (49) | 99 (100) | | |
| No | 29 | (25) | 11 | (10) | 76 | (65) | 116 (100) | | |
| Employment | | | | | | | | 4.84/0.304 | 0.097 |
| Employed | 45 | (29) | 19 | (12) | 91 | (59) | 155 (100) | | |
| Own company | 30 | (34) | 11 | (12) | 48 | (54) | 89 (100) | | |
| Off duty/student | 5 | (46) | 3 | (27) | 3 | (27) | 11 (100) | | |
| Economic situation | | | | | | | | 1.03/0.596 | 0.075 |
| Better | 41 | (30) | 18 | (13) | 77 | (57) | 136 (100) | | |
| Worse | 19 | (38) | 6 | (12) | 25 | (50) | 50 (100) | | |
| Total | 82 | (31) | 34 | (13) | 147 | (56) | 263 (100) | | |

DCS-IL = dual career support international level; DCS-NL = dual career support national level; MSS = mainstream secondary. Due to internal missing data, different numbers of participants may vary within each category. Cramer's V : 0.10—weak association, 0.30—moderate, 0.50—strong association.

same distribution was seen for the other levels of sporting success. Hence, there was no significant relationship between sporting success and attending any dual career sport program, indicating that attending neither DCS-IL nor DCS-NL is crucial for Swedish athletes in order to reach the top elite level in sports.

3.2.3. Education

Results in Table 2 show a non-significant relationship between attending a dual career support program and advancement to higher education. Although the results show that the proportion who advance to higher education is higher among athletes who have studied in DCS-IL compared to DCS-NL, almost the same distribution was detected for those who reported having upper secondary school as their highest level of education, indicating that DCS-IL is no better than DCS-NL in creating good conditions for advancing to higher education. Moreover, findings show a

marginally significant association between attending a dual career support program and perceived limited opportunities for higher education. A deeper analysis of the adjusted residuals indicates that it is mainly those who studied on DCS-IL programs who experience these limitations. In summary, these results indicate that attending a dual career support program is not crucial for Swedish athletes in order to advance to a higher level of education, or to avoid difficulties with educational attainment.

3.2.4. Employment

Results in Table 2 show a non-significant relationship between attending a dual career support program and employment. Notably, the proportion of employed or having one's own company was slightly higher among those who had attended a MSS than those attending any dual career sport program. To sum up, these results indicate that attending a dual career support program is not

crucial for Swedish athletes in order to be employed or start their own company.

3.2.5. Economic situation

As seen in Table 2, the majority of the former elite athletes believed that their financial situation had improved after their elite sports career while about a quarter considered that their financial situation had become worse after ending their elite sports career. These patterns appeared regardless of whether they had attended DCS-IL, DCS-NL, or MSS, indicating that attending a dual career support program is not crucial for Swedish athletes' economic situation post-athletic career.

4. Discussion

The main aim of this study was to explore the extent to which former Swedish world-class athletes had attended a dual career sports program at upper secondary school, and whether this support was related to their past sports performance, post-education and employment attainment, and post-athletic economic situation. Although the study group was represented by former Swedish world-class athletes, the main findings showed that only 44% had taken part in some form of DCS. Moreover, although all participants had reached the international level in their respective sport, results revealed that only 31% of them had attended schools (i.e., DCS-IL) supporting dual careers for athletes in order for them to reach the international top level.

In order to help talented adolescent student athletes attain the highest level in both their sport and their education, different forms of DCS have been developed in many countries (Lund, 2014; de Subijana et al., 2015; Stambulova et al., 2015; Tshube and Feltz, 2015; De Bosscher et al., 2016). Existing research has illustrated that DCS struggles in helping these athletes reach their full potential in sport and education in parallel (van Rens et al., 2015; Ronkainen et al., 2018; Sisjord and Sorensen, 2018), which may call into question its usefulness. However, most of the research conducted in this area has focused on young athletes at the beginning of their sports career (O'Neill et al., 2013; Stambulova et al., 2015; van Rens et al., 2015; Sisjord and Sorensen, 2018; Davis et al., 2019; Sorkkila et al., 2020), and, there is a lack of studies on athletes who have reached the world-class at senior level. In order to fill this gap of knowledge, we investigated Swedish former world-class athletes who had reached at least an international level, according to the classification system devised by Swann et al. (2015). Based on the proposed classification half of the participants belong to Category 1, "world-class elite athletes." A third belong to Category 2, "successful elite athletes," and almost a fifth to Category 3, "competitive elite athletes." We can therefore state that this study include "the best of the best athletes" at a senior level in Sweden.

The results show no difference between those who had taken part in any DCS and those attending mainstream upper secondary

school (MSS). These results are consistent with the findings by van Rens et al. (2015) and Emrich et al. (2009) that talented athletes attending elite sport schools that offer DCS are not more likely to achieve the highest sporting level compared to those attending MSSs. These results are surprising; while DCS-IL in Sweden has the goal of preparing student athletes to do well in international championships (Stambulova et al., 2015), our results indicate that it is not crucial to study within DCS-IL in order to reach an international elite level. The fact that as many as over half of our research group did not take part in any DCS means that one can question the importance of DCS for our research group's success in sports.

Emrich et al. (2009) suggest that upper secondary DCS foremost selects early-maturing athletes and thereby leaves out those who are late-maturing, as mentioned in the literature as the Relative Age Effect (RAE; Wattie et al., 2008). Research shows that the RAE is an important factor for an athlete to be selected for elite sports teams (Helsen et al., 2005; Hancock, 2017). For example Sæther et al. (2017) found that RAE was a decisive factor to attending a sport specialization program at lower and upper secondary school in both Norway and Sweden. Thus, the RAE (Coble et al., 2009) may explain why only 44% of our study group had taken part in DCS. Van Rens et al. (2015) found that student athletes who had taken part in any DCS at upper secondary school practiced their sport for more hours per week at a younger age, and had a higher sport performance level at the start of upper secondary school, than did their counterparts at MSSs. This can create early sporting specialization thinking in order to enter upper secondary school with DCS, and can result in a risk of later sporting stagnation and dropout from sports among young athletes (Emrich et al., 2009). Modest sports results at a young age due to late biological maturity may be one of the reasons why over half of our survey group did not take part in any DCS.

We believe that a danger of the RAE in terms of athletic success in early years is that young, promising athletes who develop late in sports may lose interest and quit when they discover they have not been selected for upper secondary school with DCS. It can also lead to increased training at a young age to accelerate one's sports development (Atkinson and Goodway, 2021), which goes against several studies that show support for the risks of early specialization, demonstrating that these young athletes are more likely to suffer various overuse injuries, burn out, eating disorders, later sports stagnation, and early dropout from sports (DiSanti and Erickson, 2019; Rugg et al., 2021; Mosher et al., 2022). Empirical studies also support one of the most heralded notions, that athletes do not need to specialize early in order to reach elite status as adults (Côté et al., 2009; DiSanti and Erickson, 2019; Atkinson and Goodway, 2021). This can be compared to our survey group, in which the majority started specializing upon entering upper secondary school between 15 and 16 years of age, which may be considered a reasonable age to specialize. So the question is how many prospective elite athletes quit prematurely, and how many are forced into early specialization in order to be selected for DCS at

upper secondary school? More than half of the athletes in the current study have not taken part in DCS at upper secondary school, which may indicate that taking part in DCS is not crucial in order to achieve success in sports and may indicate that these athletes have not been forced to early specialization, or it was their and their parents' decision, after considering, perhaps, the existing costs and benefits—further studies are needed to find an appropriate response to this situation. Atkinson and Goodway (2021) consider that many parents believe that their children have to specialize early to become an elite athlete and to get better sporting conditions, but the current findings might indicate that this is not the case.

The intention of DCS is to help talented youth athletes attain the highest level in both their sports and their education (European Commission, 2012). Recent research in Denmark (Storm and Eske, 2022) indicate that athletes at DCS did not have lower grades than non-athletes students. Our results show that almost 60% of the athletes (i.e., DCS-IL, DCS-NL, and MSS) have university as their highest education level, with slightly more for those attending DCS-NL and MSSs. Among those who attended DCS-IL, it is more common to only have upper secondary school as one's highest education level. The reason for this may be that the requirements for sports performance are higher for students at DCS-IL, thus forcing them to invest in sport at the expense of studies at upper secondary school. Several studies (van Rens et al., 2015; Sæther et al., 2017; Ronkainen et al., 2018; Küttel et al., 2020) also show that student athletes who take part in any DCS tend to prioritize their sport over their studies. Consequently, the DCS athletes attain lower educational results in upper secondary school, and are less motivated to study at university compared to their counterparts at MSSs. One reason for this may be that the focus on sports performance is greater when one is involved in DCS (Cosh and Tully, 2014; Küttel et al., 2020). Our results also show that more of those who have taken part in DCS-IL and DCS-NL agree that their sports career hindered their opportunities for higher education, which may also be because the DCS athletes needed to prioritize their sport over studies. This may lead to some shortcomings for student athletes, as athletes who focus exclusively on their athletic career have been shown to be at risk of athletic identity foreclosure and adaptation difficulties when ending their sports career (Grove et al., 1997; Park et al., 2013). It may be the case that those in our study who did not participate in DCS at upper secondary school were allowed to have a calmer sports development and as a result were able to focus more on their studies in parallel, which may have benefited their elite sports retirement process. On a positive note, it can be stated that more than half of all participants, regardless of whether they studied at DCS, have studied at university, and all participants had a job at the time of data collection. The majority also consider that their financial situation has improved after their sports career, which may also indicate that everyone, regardless of whether they took part in DCS, has succeeded in making a stable income after their elite sports career.

The main results of this study show that more than half of the survey group, comprised of former Swedish world-class athletes, did not take part in any DCS at upper secondary school, even though the goal of DCS is to help talented athletes attain the highest level in both their sports and education endeavors (European Commission, 2012). These results may indicate that DCS in Sweden is not a decisive factor for success in sports as intended. Our results also show that half of our survey group had university as their highest education level, and that there is no difference between those who had attended DCS and those who had not. These results may also indicate that DCS in Sweden does not result in study success any more than among those student athletes who attained MSS. In their study, van Rens et al. (2015) also found that attending DCS at upper secondary school did not influence the highest attained sport performance levels of talented athletes. They also found that DCS students attained lower educational levels in both secondary school and further education. Our results indicate that talented athletes at the beginning of their sports careers do not necessarily need to attend DCS during upper secondary school to succeed in reaching an international elite level in their sport and simultaneously succeed in their studies. These results may additionally indicate that MSSs have also developed supporting facilities for over half of our study group. More research is needed in order to draw such a conclusion. Based on governmental funding, an annual of 4 million euros (43 million SEK) is spent on DCS in Sweden. In addition, various types of subsidies from the student home municipalities (Regeringskansliet, 2020) and regional and local investments are added to the DCS system. When such a great deal of economic resources are spent on dual career support programs across Europe, and in Sweden, to try to help talented adolescent athletes attain the highest level in both their sports and education endeavors (European Commission, 2012), these results should be surprising. There is a need to review the recruitment of young athletes to DCS at upper secondary school. After all more successful elite athletes should be involved in DCS if extensive financial resources are invested in this support system.

4.1. Limitations and future research

Our study covers all Swedish world-class athletes who won medals at international events between 2002 and 2012, and we traced back what type of upper secondary school they attended. As our survey group answered a questionnaire, we did not have the opportunity to ask follow-up questions. This makes it difficult to determine why the respondents did or did not take part in DCS and we lack the respondents' experiences and opinions about DCS that are important to find out. In a future study it would be desirable to interview world-class athletes about their views on DCS at upper secondary school and to determine how world-class athletes have handled the combination of studies and elite sports without DCS both at upper secondary school and at university, as

a university path is another important factor in preparing student athletes for post-sports careers.

5. Conclusion

Most research on dual career support have focused on young athletes in the beginning of their sport careers. Little is known about successful athletes who reached the highest elite levels. In this study, including 274 former world-class athletes who had reached an international level, we found that only 44% had taken part in some form of DCS. Although all participants had reached the international level in their respective sport, results revealed that only 31% of them had attended specialized schools (i.e., DCS-IL) supporting dual careers for athletes in order for them to reach the international top level. Moreover, the results indicate that it is more individual athletes than team athletes who had studied at DCS-IL, and it is mainly those who studied on DCS-IL programs who perceived limited opportunities for higher education. Our results also show that more than half of each group (i.e., DCS-IL, DCS-NL, and MSS) have university as their highest education level, with slightly more for those attending DCS-NL and MSSs. Among those who attended DCS-IL, it is more common to have only upper secondary school as one's highest education level. The reason for this may be that the requirements for sports performance are higher for students at DCS-IL, thus forcing them to invest in sport at the expense of studies at upper secondary school. It was also found that more than half of all participants, regardless of whether they studied at DCS, have studied at university, and all participants had a job at the time of data collection. The majority also consider that their financial situation has improved after their sports career, which may also indicate that everyone, regardless of whether they took part in DCS, has succeeded in making a stable income after their elite sports career. Our results show that taking part in DCS is not crucial for young talent student athlete in order to achieve success in sports and education.

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Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by The Regional Ethics Board, Uppsala. The patients/participants provided their written informed consent to participate in this study.

Author contributions

CN, SW, HG, and OS contributed to conception and design of the study. CN organized the database and wrote the first draft of the manuscript. CN and SW performed the statistical analysis. SW, HG, and OS, wrote sections of the manuscript. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial of financial relationships that could be construed as a potential conflict of interest.

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Predictors and prevalence of stress, anxiety, depression, and PTSD among university students during the second wave of the COVID-19 pandemic in Turkey

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This study aimed to find the prevalence of stress, anxiety, depression, and PTSD; differences according to demographic variables; and predictors of mental health problems during the second wave of the coronavirus disease (COVID-19) pandemic in Turkey. Differences in exposure to COVID-19 during the first and second waves of the pandemic among students were compared. A total of 754 students from seven universities in different parts of Turkey participated in the survey between November and December 2020. Perceived Stress Scale (PSS-10), Generalized Anxiety Disorder (GAD-7), Patient Health Questionnaire (PHQ-9), Checklist-Civilian Version (PCL-C) scale measuring posttraumatic stress disorder (PTSD), and Satisfaction with Life Scale (SWLS) were used to measure the mental well-being of students. Descriptive statistics, one-way ANOVA, correlations, and multinomial logistic regression methods were used to analyze the data. The prevalence of high stress, high generalized anxiety (GAD-7 ≥ 10), high depression symptoms (PHQ-9 ≥ 10), and high PTSD in the total sample were 84.2, 36.2, 55.0, and 61.2%, respectively. High perceived stress, moderate generalized anxiety disorder, mild depression symptoms, high severity PTSD, and moderate satisfaction were found among students in Turkey. Religiosity and spirituality have significant negative correlations with anxiety, depression, and PTSD. Religiosity level, gender, relationship status, year of study, physical activity, symptoms of coronavirus, death of a close relative, job loss, and economic status are significant parameters for predicting psychological problems of students in Turkey.

KEYWORDS

depression, anxiety, PTSD—posttraumatic stress disorder, stress, COVID-19, students, university

1. Introduction

The coronavirus disease (COVID-19) is a highly infectious disease and has affected millions of people globally (Deng et al., 2021). Quarantine or social isolation, worsening economic situations, business closures, distance education, increasing unemployment, concerns about the present and future, deaths, and increasing number of cases were some major challenges that disrupted people's lives (Dagnino et al., 2020; Chaturvedi et al., 2021) and increased distress, loneliness, insomnia, anxiety, and depression prevalence, leading to some physical and mental health problems (Ahmed et al., 2020; Lee et al., 2021). The most serious problem was the increasing number of new cases and deaths, resulting in more fear among people as many had lost their family members and close friends, and they had a persistent fear of losing more members or getting infected. Much of the information distribution about the pandemic has occurred on social media platforms (Facebook, Twitter, Instagram, etc.) as essential sources of information during the pandemic due to social distancing rules, lockdowns, and strict quarantine measures. Media coverage and social media discourses, such as misinformation and infodemics, and unverified rumors about uncertainty over the disease's status have increased people's fear. However, alerting the public, increasing awareness, spreading knowledge and news, connecting people to get helps, and promoting certain preventive behaviors among the public were positive roles of social media (Chen et al., 2020; Cinelli et al., 2020; Kadam and Atre, 2020; Yassin et al., 2021).

This study was carried out among university students between November and December 2020 in Turkey. At the end of December 2020, there were about 15,000 new cases per day and 20,884 total deaths according to [Worldometers \(2021\)](#) statistics. The first confirmed case of COVID-19 in Turkey was reported on March 10, 2020. Closing schools and universities; physical or social distancing; quarantining; closing non-essential shops, restaurants, gyms, sport facilities, and theaters; banning all social gatherings; covering coughs and sneezes; hand washing and keeping unwashed hands away from the face; use of face masks; practicing good respiratory hygiene; and limiting traveling and socialization were some measures taken to minimize the risk of transmissions by governments during the pandemic in Turkey (Küçükali and Çınar, 2020).

Well-being is explained by less stress, optimism, self-esteem, higher life satisfaction, and the development of positive relationships with a state of physical, mental, spiritual, and social integration (Braun et al., 2020; Kilani et al., 2020). High stress, fear, worries, anxiety, and depression as main threats of well-being have increased to a dangerous level mainly due to social isolation related to restrictions, mandatory curfews, and layoffs due to financial difficulties and economic problems in Turkey (Aslan et al., 2020; Kikuchi et al., 2020; Chaturvedi et al., 2021; Ahmed et al., 2022). Higher education students were vulnerable to developing mental health disorders during

this pandemic due to academic pressure, losing track of studies and assignments, financial difficulties, and deviations from their everyday routines (Aslan, 2021a; Deng et al., 2021); high mental health deterioration has been seen among young adults (Elmer et al., 2020; Liang et al., 2020; Fried et al., 2022). Fear of infections, fear of losing relatives, and anxiety were found as the most serious responses during the COVID-19 pandemic among students (Aslan, 2021a). The students were mostly affected by the lockdowns (Matthewman and Huppertz, 2020), leading to depression, substance use, difficulties in sleeping disorders, stress, and mal eating habits (Hidayu and Vasudevan, 2020; Smith et al., 2020). In the study by Aslan et al. (2020), distance learning, increasing unemployment, more challenging career opportunities, obeying lockdown rules, decreased activities, financial situation, and completion of the semester were major negative factors affecting the well-being of students in Turkey. Higher levels of stress, depression, anxiety disorder, posttraumatic stress disorder (PTSD), and lower satisfaction were seen among university students under the conditions of the COVID-19 pandemic (Aslan et al., 2020; Ye et al., 2020; Aslan, 2021a). Students were more vulnerable to depression compared to other population groups as their mental health issues can decrease employment opportunities and result in low academic outcomes and earning opportunities in the future. It is aimed in this quasi-experimental design study to disclose the prevalence and predictors of mental health among university students during the second wave of the COVID-19 pandemic and to check whether there were improvements in their mental well-being compared to the first wave (April–May 2020) period in Turkey. Different from the first wave, the degree of associations between exposure to COVID-19 during the second wave and the risk of coronavirus-related PTSD was to be uncovered, as COVID-19 can turn out to become a significant risk for students in the long run. Moreover, relationships of religiosity and spirituality with mental health problems were determined to measure the resilience of students. Unlike the first study, a question about the students' intention to die by suicide was added. Students from seven universities in different parts of Turkey were surveyed in this study. This article assumes that the female gender, living in a rural area, higher education level, and lower religiosity and spirituality are risk factors for all measured mental health dimensions.

2. Literature review

High perceived stress, generalized anxiety disorder, depression, and PTSD have been seen among students during the pandemic. Perceived stress, defined by the level of symptoms of relaxation difficulty, nervous stimulation, quick worry, pressure, discomfort, overreaction, and intolerance (Doğan and Doğan, 2019), is an imbalance between an individual's perception and external demands. Generalized anxiety

disorder (GAD) is described by sadness, fear (Quek et al., 2019), persistence of excessive worries, distressing emotions, physiological arousal, bodily sensations, thoughts of danger avoidance and other defensive behaviors, and nervousness (Spitzer et al., 2006). Uncertainty, diminished medical access, isolation due to social distancing, and family relations (e.g., family concerns and domestic violence) were the causes of the deterioration of anxiety (Smith et al., 2020). People with high anxiety made hospitals crowded by going to physicians frequently for testing and controls around the world that they may be infected. High anxiety responses among students were seen due to not having a cure and vaccine. Also, the effects of COVID-19 on their studies, such as distance education and lockdowns, led to higher anxiety (Quek et al., 2019). Depression is defined by a feeling of worthlessness, dissatisfaction, despair, loss of interest, and low energy (Doğan and Doğan, 2019). People with a lack of social interactions have more tendency to depression (Shafiq et al., 2021). The depression could be related both directly and positively to the fear of COVID-19 and stress, and indirectly and positively mediated to anxiety during the lockdown among undergraduates (Rodríguez-Hidalgo et al., 2020). PTSD is defined as an uncontrollable thought process about the event, unwanted distressing memories of the traumatic event, sleeping and concentrating problems, flashbacks, nightmares, memory problems, and a lack of interest in activities (Kirkpatrick and Heller, 2014). Factors associated with increased levels of depression, anxiety, stress, and PTSD include an increase in time spent on social media, TV and movies, and sleep duration and a decrease in physical activities (Adewale et al., 2021).

From the studies conducted during the COVID-19 pandemic, it was found that limited resources, losing track of their studies, disruptions of relationships, fear of the COVID-19 (Hidayu and Vasudevan, 2020), presence of someone hospitalized for the COVID-19 in one's household, reduced learning time, conflicts at home and with neighbors, difficulties of the isolation, noise inside or outside one's home, the perceived ineffectiveness of the use of media entertainment (Bourion-Bédès et al., 2021), preexisting health conditions (Kim et al., 2020), lack of access to technology (Jawad et al., 2020), need for a quiet place to study, home duties, efforts in taking care of siblings (Hoyt et al., 2020), limited class interaction and inefficient time (Chaturvedi et al., 2021), decrease in family income, lack of media access (Jawad et al., 2020), social difficulties and lack of interpersonal communication (AlAteeq et al., 2020; Chaturvedi et al., 2021), rumors, panic, the unpredictability and uncertainty of the situation (AlAteeq et al., 2020), longer quarantine duration, infection fears, frustration, boredom (Shafiq et al., 2021), rumination focusing on negative emotions (Ye et al., 2020), decreased motor activities, increased alcohol use and tobacco consumption, shifts in the food habits, less exposure to sunlight, and physical distancing (Bourion-Bédès et al., 2021; Ahmed et al., 2022) were some sources

of stress affecting students well-being. Moreover, current studies and future career worries, non-opening of educational institutions, difficulties with the payment of tuition fees in India (Chhetri et al., 2021), academic difficulties (AlAteeq et al., 2020), worries about semester and graduation completion, being afraid of not finding a job after graduation due to a profession's lack of knowledge and professional skills (Valero-Chillerón et al., 2019), and worsening relationships (Aslan, 2021a) are some other sources of excessive stress among students. Also, in another study (Jawad et al., 2020), it was stated that many students have got graduated even without proper training and exams and that many students think that they may not be successful after graduation exams and their future will be affected due to detrimental effects on their performance. However, COVID-19 disruptions have caused some positive results besides challenges and drawbacks. Implementation of online learning, socialization opportunities by enhancing social interaction during virtual learning, being able to get online emotional and psychological support (Kee, 2021), improving online learning skills (Kumpikaitė-Valiūnienė et al., 2021), connecting strongly with family members, relating more to spirituality and religion as the appreciation of life, caring better for the environmental and personal hygiene, social unity and strengthening the connectedness of communities (Alghamdi, 2021), improving resilience against crises (Aslan, 2021a), raising compassion, and take more time to yourself are some perceived positive outcomes. Being continuously exposed to stressors can cause more serious mental problems such as depression, PTSD, and even suicide intentions in the long-term that people cannot face this stress anymore, leading to exhaustion, low energy, and mental fatigue (Membrive-Jiménez et al., 2020; Supervía and Bordás, 2020). Traumatic cases like the death of a relative, sexual assault, warfare, traffic collision, and threats to a person's life can cause PTSD (Bridgland et al., 2021; Menon et al., 2021). The students' PTSD symptoms were significantly predicted by family members suspected of COVID-19 or who died from COVID-19 (Li et al., 2021). This unconventional grieving process could deeply traumatize people and leave an unhealed psychological trauma for a long time. The lack of social support and the breakdown of social support structures due to the loss of loved ones were strong predictors of PTSD. Decreased life quality, loss of life satisfaction as low happiness and sense of worthwhile increasing the risk of transmitting the disease, more worries as "nothing will be the same" due to changes in lifestyles (sleep disruption, altered eating habits, and reduced physical activity) during the pandemic as stated in Caroppo et al.'s (2021) study, increased concerns about the future, and questioning the meaning of life as signs of posttraumatic growth levels are some consequences of COVID-19 (Fujiwara et al., 2020; Wright et al., 2020). Drug abuse, depression, and sleep problems can be developed if PTSD symptoms are not treated properly (Kirkpatrick and Heller, 2014; Alshehri et al., 2020). Psychological distress can decrease self-esteem or self-efficacy

and increase mental illnesses and suicidal ideations (Deng et al., 2021); globally, 90% of the suicide occurrences take place in extreme cases (Song et al., 2020). For example, economic loss, a significant risk for PTSD, is estimated to be a reason for increased suicides in Japan (Fujiwara et al., 2020; Kikuchi et al., 2020).

An increase in stress and anxiety and a slight decrease in depression were measured among Bingöl University students at the end of 2020 in Turkey. The slight decrease in depression could be explained by decreased panic and getting used to the distance education and situation (Aslan, 2021b). The experience of early life adversity (being neglected and abused) and exposure to traumas increasing psychological distress from a study applied to university students in China are risk factors for mental problems during the COVID-19 pandemic (Li et al., 2021). Moderate levels of perceived stress and anxiety during the pandemic were found, and 35.6% of students stated that they have emotional distress due to the COVID-19 pandemic (Hoyt et al., 2020). High stress, anxiety, and depression with lower well-being were found among students during the COVID-19 in Bangladesh, French, Pakistan, the United States of America (USA), and China (Jawad et al., 2020; Ahmed et al., 2022); 22% of French students had a prevalence of severe perceived stress (Bourion-Bédès et al., 2021), and 15% of the students had moderately severe depression during the pandemic in Bangladesh (Islam et al., 2020). A pooled depressive symptoms prevalence of 36% and anxiety symptoms prevalence of 32% were found among higher education students (Deng et al., 2021). The prevalence of PTSD among infected students was 27.1% (Li et al., 2021). In another study, students showed 48.2% of an elevated perceived stress level, 37% of anxiety, and 31% of depression during the period of the COVID-19 in USA (Aiyer et al., 2020). Two-fifth of students reported PTSD symptoms, one-fourth of students reported depression, and about one-fifth of students reported anxiety and stress in Nigeria (Adewale et al., 2021). International students living far from their families have had higher psychiatric suffering that Chinese students studying in the USA had a prevalence of 49.4% anxiety, 39.8% depression, and 37.5% PTSD (Song et al., 2020).

Anxiety and depression were predicted by low income or loss of income, living place, presence of children in the home, personal characteristics, current smokers, and preexisting health conditions in self and others during the lockdown and social distancing period (Hoyt et al., 2020; Kikuchi et al., 2020; Kilani et al., 2020; Shevlin et al., 2020; Kar et al., 2021). Strong gender influence was seen in that female students had a higher prevalence of depression and anxiety (Aiyer et al., 2020). Females and last-term students had higher worries about not finding a job after graduation, from the study by Aslan (2021a) applied during the first wave of the pandemic in 2020. Moreover, female students displayed a higher fear of COVID-19 than male students during the lockdown among undergraduates from Ecuador (Rodríguez-Hidalgo et al., 2020). Age as a risk

factor is noticeable among students, showing that being below the age of 24 years was linked to higher anxiety and depression (Debowska et al., 2022). Living in an urban area was linked to lower anxiety in China (Cao et al., 2020), but in Bangladesh to higher anxiety and depression (Islam et al., 2020). Students living in a village had the worst living conditions in Turkey (Aslan, 2021a). As a result, rural dwelling, being female, young, and being at risk of contact with COVID-19 were risk factors, while living in urban areas, living with parents, and having a stable family income were positive factors during the pandemic (Kar et al., 2021).

Religiosity and spirituality are fairly interconnected and difficult to separate, and they help in finding value in one's life, peace, and a sense of connection, affecting personal and academic life (Coppola et al., 2021). People with positive religious coping, intrinsic religiosity, and trust in God with guides, norms, and beliefs as a supporting system have less stress, creating positive impacts on them.

Greater meaning-based coping, the positive reappraisal, and reinterpretation of a stressor can make people more psychologically resilient against traumatic events. Spiritual well-being linked to a greater sense of purpose, meaning in life, satisfaction with life, and lower death anxiety (Ishabiyi and Khan, 2020; Arslan and Yıldırım, 2021) is a protective method, leading to lower stress and better psychological functioning on subjective well-being through dealing with fear during the pandemic (Chang et al., 2019; Arslan and Yıldırım, 2021). Psychological and physical health can be protected through spirituality and religious practices.

Moreover, spiritual well-being functions as a protective factor against addictive or suicidal behaviors (Arslan and Yıldırım, 2021), and dying by suicide is forbidden in Islam. More older people with the inevitability of death and women because of psychological differences are involved in religious and spiritual activities more, and they feel a more significant presence of God in everyday life (Coppola et al., 2021) that God can protect people from all evil and suffering (Kowalczyk et al., 2020). However, worship services have facilitated the spread of the SARS-CoV-2 virus in some countries. Feelings of anger toward abandonment or being punished by God, doubts about the truth of one's religious faith, questions about ultimate meaning and purpose in life, struggles with living up to one's moral values, and increasing conflicts with other people about religion are religious struggles questioned during the pandemic (Dein et al., 2020).

3. Materials and methods

This research was carried out between November and December 2020 during the second wave of the COVID-19 pandemic as a semi-replication of the first wave (April–May 2020) study at different universities located in various regions

of Turkey. In this study, different from the first wave study, PTSD, religiosity and spirituality, and students' intention to die by suicide were measured. This study aimed to measure the prevalence and predictors of mental problems during the second wave of the pandemic. Furthermore, the relationships of religiosity and spirituality and physical activity with mental problems are to be determined. The following research question was put forward: What are the relationships between PTSD, anxiety, perceived stress, depression and variables, such as gender, faculty, place of residence, relationship status, level of study, PA, COVID-19 symptoms, hospitalization, death of close relatives, religiosity and spirituality level, or job loss, in students, during the second wave of the COVID-19 pandemic?

3.1. Assessment of socio-demographic factors

There were 754 students from Bingöl University, Bingöl ($n = 153$, 20.3%); Atatürk University, Erzurum ($n = 265$, 35.1%); Ağrı İbrahim Çeçen University, Ağrı ($n = 142$, 18.8%); and Ağrı and Iğdır University, Iğdır ($n = 79$, 10.5%)—all in the eastern part of Turkey; Bursa Uludağ University, Bursa ($n = 27$, 3.6%) and Muğla Sıtkı Koçman University, Muğla ($n = 48$, 6.4%)—all in the western part of Turkey; and Başkent University, Ankara ($n = 40$, 5.3%)—in the central part of Turkey. When choosing universities, it was taken into account that there were close friends or contacts who would assist in conducting surveys at these universities.

In 2022 in Turkey, 50.3% of university students are male, and 49.7% of university students are female (YÖK, 2022). Overall, there were 66.2% of women ($n = 499$), and 94% of them ($n = 709$) were single; 76.7% of students ($n = 578$) live in cities, and just 19.6% of them ($n = 148$) live in villages, showing that students live mainly in urban areas; 48.7% ($n = 367$) and 27.5% ($n = 207$) of students are from medical and health sciences, and social sciences, respectively. Students are mainly undergraduates, and 61.1% of them are in their third and fifth year of study. Descriptive statistics about demographics in detail can be seen in [Table 1](#).

3.2. Procedure

A cross-national study was conducted online between 18 November and 26 December 2020, during the second wave of the COVID-19 pandemic. The survey was created *via* Google Forms. The sampling was convenience sampling, with the selection criterion being a university student. The invitation to the online study was sent to students by researchers *via* mails, WhatsApp, MsTeams, Instagram, and other social media platforms. The final total sample of university students participating in the study was 808, but 54 participants were

TABLE 1 Demographic characteristics of the study sample and COVID-related and psychological variables ($n = 754$).

| Demographic variables | N | % |
|---|-----|-------------|
| Gender | | |
| Women | 499 | 66.2 |
| Men | 255 | 33.8 |
| Social status | | |
| Married | 45 | 6 |
| Single | 709 | 94 |
| Place of residence | | |
| Village | 148 | 19.6 |
| Town | 28 | 3.7 |
| City | 578 | 76.7 |
| Faculty | | |
| Social Sciences | 207 | 27.5 |
| Humanistic & Art | 60 | 8.0 |
| Natural Sciences | 21 | 2.8 |
| STEM (Science, Technology, Engineering and Mathematics) | 99 | 13.1 |
| Medical & Health Sciences | 367 | 48.7 |
| Level of study | | |
| Foundation (2-years programs) | 233 | 30.9 |
| Undergraduates | 461 | 61.1 |
| Master or MBA | 41 | 5.4 |
| Doctoral | 19 | 2.5 |
| Year of study(years at university) | | |
| First | 166 | 22.0 |
| Second | 247 | 32.8 |
| Third | 72 | 9.5 |
| Fourth | 183 | 24.3 |
| Fifth | 69 | 9.2 |
| Studying more than 5 years at the university | 17 | 2.3 |
| University | | |
| Ağrı İbrahim Çeçen University | 142 | 18.8 |
| Atatürk University | 265 | 35.1 |
| Başkent University | 40 | 5.3 |
| Bingöl University | 153 | 20.3 |
| Bursa Uludağ University | 27 | 3.6 |
| Iğdır University | 79 | 10.5 |
| Muğla Sıtkı Koçman University | 48 | 6.4 |
| Exposure to COVID-19 (Yes) | | |
| COVID-19 symptoms of infection | 222 | 29.4 (6.14) |
| Tested for the COVID-19 | 153 | 20.3 (3.35) |
| Hospitalization due to the COVID-19 | 13 | 1.7 (0.28) |

(Continued)

TABLE 1 (Continued)

| Demographic variables | N | % |
|---|-----|---------------|
| Strict quarantine for at least 14 days | 129 | 17.1 (5.03) |
| COVID-19 infection in close relatives | 601 | 79.7 (22.06) |
| Death of close relatives due to the COVID-19 | 259 | 34.4 (5.31) |
| Job loss due to the COVID-19 | 330 | 43.8 (48.60) |
| Deterioration of economic status | 498 | 66 (64.80) |
| Anxiety (GAD-7) | | |
| Normal (0–4) | 299 | 39.7 (12.57) |
| Mild (5–9) | 179 | 23.7 (35.75) |
| Moderate (10–14) | 117 | 15.5 (28.77) |
| Severe (15–21) | 159 | 21.10 (22.91) |
| Depression (PHQ-9) | | |
| Normal (0–4) | 84 | 11.1 (9.50) |
| Mild (5–9) | 255 | 33.8 (27.66) |
| Moderate (10–14) | 137 | 18.2 (24.02) |
| Moderately severe (15–19) | 143 | 19.0 (23.74) |
| Severe (20–27) | 135 | 17.9 (15.08) |
| Neither depression nor anxiety diagnosis (score ≤ 10) | 345 | 45.7 (31.0) |
| Anxiety diagnosis (GAD-7 ≥ 10) | 276 | 36.6 (51.68) |
| Depression only diagnosis (PHQ-9 ≥ 10) | 415 | 55.0 (62.85) |
| Dual anxiety and depression diagnosis (scores ≥ 10) | 304 | 40.3 (45.54) |
| PCL-C(PTSD) | | |
| Mild (17–29) | 16 | 16.7 (na) |
| Moderate (30–44) | 232 | 30.8 (na) |
| High Severity (45–85) | 396 | 52.5 (na) |
| PTSD (PCL-C > 38) | 468 | 61.2 (na) |
| Satisfaction with life (SWLS) | | |
| Low (5–17) | 410 | 54.4 (56.42) |
| Medium (18–23) | 204 | 27.1 (24.58) |
| High (24–35) | 140 | 16.6 (18.99) |
| Perceived stress (PSS-10) | | |
| Low (0–13) | 30 | 4 (5.59) |
| Medium (14–19) | 89 | 11.8 (23.18) |
| High (20–40) | 635 | 84.2 (71.23) |

na, not applicable. Parentheses from previous work.

excluded from different universities due to being low sample size; hence, it is decided to include seven university participants for comparison purposes.

3.3. Ethics statement

The ethics committee approved the study protocol of the University Research Committee at the University of Bingöl, Turkey, with a decision no. 92342550/044/6137. The study

followed the ethical requirements about the anonymity and voluntariness of participation. Each person answered the informed consent question. Following the Helsinki Declaration, written informed consent was obtained from each student before inclusion. This study was part of an international research project: Well-being of undergraduates during the COVID-19 pandemic: International study, registered at the Center for Open Science (OSF) (Rogowska et al., 2020).

3.4. Measures

The Perceived Stress Scale (PSS-10) (Cohen et al., 1983) was conducted to measure whether the respondents considered the situation in their life as stressful. The PSS-10 consists of 10 items referring to the frequency of stressful events in the month preceding the study, which is assessed on a 5-point scale (0 = never to 4 = very often). PSS-10 has a Cronbach's alpha value of 0.665.

The 7-item Generalized Anxiety Disorder (GAD-7) Scale (Spitzer et al., 2006) is a self-reported measure designed to screen for symptoms. Students rate how often they experienced anxiety symptoms in the 2 weeks preceding the study on a 4-point Likert scale (0 = not at all, 1 = several days, 2 = more than half the days, and 3 = nearly every day). The GAD-7 ranges from 0 to 21 and evaluates the minimal, mild, moderate, and severe anxiety levels, respectively, with 0–4, 5–9, 10–14, and 15–21 scores (Spitzer et al., 2006). Scores above 10 points indicate an anxiety disorder (Lee et al., 2016). The anxiety scale has a Cronbach's alpha value of 0.912.

The Patient Health Questionnaire (PHQ-9) was used to measure depression symptoms. The PHQ-9 consists of 9 items conforming with DSM-V diagnostic criteria (APA [American Psychiatric Association], 2013). Participants used a Likert-type response scale (0 = not at all to 3 = nearly every day). The ranges of PHQ-9 scores are 0–4, normal; 5–9, mild major depressive disorder; 10–14, moderate; 15–19, moderately severe; and 20–27, severe. A cut-off score of 10 or above is recommended to screen for major depressive disorder (Kroenke et al., 2009; Prahars et al., 2017), and depression has a Cronbach's alpha value of 0.904.

Posttraumatic stress disorder using Checklist-Civilian Version (PCL-C) (0 = never to 4 = very often), which is a 17-item self-report developed by Weathers et al. (2013), was used. The total scores range from 17 to 85, and scores of 38 or higher indicate the presence of PTSD. PCL-C has a Cronbach's alpha value of 0.948.

The Satisfaction with Life Scale (SWLS) consists of five items using a seven-point Likert scale (from 1 = strongly disagree to 7 = strongly agree), and the scale has a Cronbach's alpha value of 0.863.

Demographic questions are related to age, gender, place of residence, the current level of study, year of study, and types

of faculty. An exposure to COVID-19 based on 8 questions about the coronavirus' consequences (1 = yes, 0 = no), the perceived impact of coronavirus (PIC) on the students' lives using 5 statements (from 1 = strongly disagree, to 5 = definitely agree), physical activity during a week physical exercise (from 0 = not 1 day to 7 = 7 days a week), and physical exercise minutes per week are other parts of the survey.

The scales used in this study have been translated from English to Turkish by using previous studies. The reliability and validity of PSS-10 (Erci, 2009), GAD-7 (Konkan et al., 2013), PHQ-9 (Sari et al., 2016), and PCL-C (Kocabaşoğlu et al., 2005) scales were checked for preventing misunderstandings and for overcoming language barriers in Turkey. SWLS Scale was translated from English to Turkish by the authors. Cronbach's alpha is used to measure reliability scales, and George and Mallery (2003) suggested Cronbach's alpha ≥ 0.6 as acceptable. SWLS, PSS-10, PCL-C, anxiety, and depression scales met the reliability criteria.

3.5. Statistical analysis and sampling

A preliminary analysis of the prevalence of all variables was examined before statistical tests were applied. A one-way ANOVA was performed to test the differences in mean scores. The normality assumption was checked using skewness and kurtosis scores and their decision rules: skewness and kurtosis values $< |1|$ = acceptable for normality (George and Mallery, 2016). Next, the multinomial logistic regression analysis was performed to test the odds ratio (OR) with 95% CI. All analyses were performed using SPSS 22.0 version.

The minimum required sample size at 99% CI and 5% margin of error and with the information from the previous study p (proportion of students with psychological problems) = 0.6 is 640 through the Cochran formula for an unlimited population size, and our sample size ($n = 754$) met the minimum sample size criteria. The analysis encompassed descriptive statistics: mean (M), standard deviation (SD), and 95% of confidence interval (CI) with lower limit (LL) and upper limit (UL).

4. Results

4.1. Descriptive statistics and the prevalence of perceived stress, anxiety, depression, and PTSD among university students

High perceived stress, moderate generalized anxiety disorder (GAD), mild depression symptoms (PHQ), high severity of PTSD, and moderate satisfaction were found among students as shown in Table 2. The greatest increase

was seen in anxiety from the mean of 6.43 (April–May 2020) to 9.66 (December–November 2020) as the pandemic was getting longer; students become more anxious while there were no considerable changes in perceived stress, depression, and satisfaction with life. A study by Weathers et al. (2013) showed that a score of 38 or higher indicates the presence of PTSD. In our study, the average total score of PTSD was 47.39, which shows that the pandemic has long-term effects on the mental well-being of students. Job search and professional development, relationships with colleagues and friends, financial situation, and completion of the semester and graduation were the highest rising negative impacts of the COVID-19 pandemic associated with the fear of the situation from the perception of the impact of COVID-19 on well-being as shown in Table 2 compared to the first wave. Relationships with loved ones, family, and friends have worsened as the most substantial change in the perception of the COVID-19 impact on the well-being group (PIC). It can be stated that the negative impacts of the pandemic have increased with a grand mean of 3.79 when compared to April 2020 with a grand mean of 3.75. Sufficient physical activity (PA) > 150 min weekly and insufficient PA < 150 min weekly are the categorization of physical activity according to WHO recommendations. Students were 75 min active weekly in April 2020, while they were 22.13 min active weekly during the second wave of the pandemic with insufficient physical activity (PA < 150 min weekly); the students' physical inactivity during the second wave could be explained mainly by restrictions and lockdowns.

COVID-19 infection in close relatives (79.7%), declining economic status (65%), and losing a job by a student or in the student's family (43.8%) were the strongest results of exposure to COVID-19. During the second wave, exposure to COVID-19 increased dramatically, especially in the death rates of relatives, as shown in Table 1. In contrast, there was not a noteworthy change in economic status. Even though 29.4% of them have shown symptoms of COVID-19 infection, just 17.1% of them had strict quarantine for at least 14 days, and 13 students were hospitalized due to COVID-19 infection; 34.4% (259) of them have stated the COVID-19-related deaths among their families.

Only 4% of students were characterized with low stress, while 84.2% showed a high stress level with a 13% increase compared to April 2020. More than half of the students had low satisfaction, similar to the first wave period; 15.5 and 21.10% of students have moderate and severe GAD symptoms, representing 36.6% anxiety diagnosis (GAD-7 ≥ 10), showing an improvement in GAD management compared to 51.68% of the first wave period; 17.9% of students have severe depression symptoms, higher than the 15.08% of April 2020 prevalence, while moderate and moderately severe symptoms decreased, but still 55.0% depression prevalence was high; 45.7% of students do not show any symptoms of depression and anxiety diagnosis (score ≤ 10), whereas 40.3% of them presented dual anxiety and depression diagnosis (score ≥ 10). About half of students

TABLE 2 Descriptive statistics ($n = 754$).

| Variable | Range | M | SD | 95% CI | |
|--|-------|---------------|-------|--------|-------|
| | | | | LL | UL |
| Perceived stress | 4–40 | 24.32 (22.74) | 5.74 | 23.91 | 24.73 |
| PCL-C (PTSD) | 5–85 | 47.39 (na) | 17.69 | 46.13 | 48.66 |
| Anxiety | 0–21 | 9.66 (6.43) | 5.40 | 9.28 | 10.05 |
| Depression | 0–27 | 12.24 (12.42) | 6.92 | 11.74 | 12.73 |
| Satisfaction with life | 5–35 | 16.79 (16.72) | 6.94 | 16.30 | 17.29 |
| Perception of the impact of COVID-19 on well-being | 5–25 | 18.95 (18.74) | 4.57 | 18.62 | 19.28 |
| Completion of the semester and graduation | 1–5 | 3.73 (3.36) | 1.40 | 3.63 | 3.83 |
| Job search and professional development | 1–5 | 3.98 (3.67) | 1.28 | 3.89 | 4.07 |
| Financial situation | 1–5 | 3.75 (3.82) | 1.32 | 3.66 | 3.85 |
| Relationships with loved ones: family | 1–5 | 3.64 (2.44) | 1.30 | 3.55 | 3.74 |
| Relationships with colleagues: friends | 1–5 | 3.83 (2.57) | 1.21 | 3.74 | 3.91 |
| Physical activity per week (days) | 0–7 | 1.72 (na) | 1.98 | 1.57 | 1.86 |
| Physical activity during pandemic (minutes per week) | – | 22.13 (75.53) | 28.40 | 20.10 | 24.16 |
| How religious do you consider yourself to be? | 0–3 | 1.9483 (na) | 0.71 | 1.89 | 1.99 |
| How spiritual do you consider yourself to be? | 1–4 | 2.96 (na) | 0.71 | 2.91 | 3.01 |

M, mean; SD, standard deviation; CL, confidence interval; LL, lower limit of the confidence interval; UL, upper limit of the confidence interval; na, not applicable; parentheses from previous work.

from the PHQ-9 depression symptoms scale: “*Thoughts that you would be better off dead, or thoughts of hurting yourself in some way?*” item had thoughts of suicide with several days (26.9%), more than half the days (9.7%), and nearly every day (10.6%), and 20.3% of students were under considerable suicide risk. Over half of the students’ population (61.2%) have presented clinical symptoms of PTSD (PCL-C > 38), and 30.8% of them have shown moderate PTSD. The results in detail are presented in [Tables 1, 2](#).

4.2. Correlation among variables

There is a significant negative correlation between satisfaction with life and psychological problems (anxiety, depression, and PTSD) except stress. Moreover, SWLS has a significant positive correlation with religiosity and spirituality level; religious and spiritual students can be more satisfied, and they have less psychological problems with significant negative correlations. The correlation between perceived stress (PSS) and COVID-19 impact (PCI) is positive and significant on students’ well-being ($r = 0.269$; $p < 0.001$). Furthermore, there are significant positive correlations between perceived stress and anxiety, depression and PTSD. Generalized anxiety disorder intensity had a high correlation with depression ($r = 0.799$; $p < 0.01$) and PTSD ($r = 0.650$; $p < 0.01$) with a large effect size based on [Turney’s \(2022\)](#) coefficient of determination (r^2) calculation that anxiety can be turned into more dangerous

mental problems. Physical activities are inversely correlated with depression ($r = -0.117$; $p < 0.05$) and PTSD ($r = -0.093$; $p < 0.05$) but positively correlated with satisfaction with life ($r = 0.079^*$; $p < 0.05$). Pearson’s r coefficients are presented in [Table 3](#).

4.3. Significance of differences according to demographic variables and exposure to COVID-19

One-way ANOVA was applied to find the significance of differences in satisfaction with life, perceived stress, anxiety, depression, and PTSD scales based on categorical ranges as shown in [Table 1](#) and normality, assuming that each group has equal variance. Significant differences according to gender, social status, place of residence, level of study, universities, year of study, faculty, and exposure to COVID-19 variables were searched using a one-way ANOVA test ($p < 0.05$ is considered significant difference), and a *post-hoc* Tukey’s multiple comparison test was applied for pair comparisons shown in [Table 4](#). There were no significant differences in relation to university types, gender, COVID-19 symptoms, strict quarantine, and COVID-19 infection ($p > 0.05$) for life satisfaction. However, there are significant differences according to social status ($F = 13.7$; $p = 0.00$) in favor of married students ($\mu = 20.4$), with medium satisfaction, while single students ($\mu = 16.5$) had low satisfaction. Students living in

TABLE 3 Correlation matrix with Pearson's r coefficient ($n = 754$).

| Variable | SWL | Anxiety | PTSD | Stress | Depression | Impacts | Religiosity | Spirituality | PA |
|------------|----------|----------|----------|---------|------------|---------|-------------|--------------|----------|
| SWL | 1 | −0.234** | −0.256** | 0.001 | −0.285** | −0.066 | 0.133** | 0.123** | 0.079* |
| Anxiety | −0.234** | 1 | 0.650** | 0.354** | 0.799** | 0.215** | −0.136** | −0.122** | −0.063 |
| PTSD | −0.256** | 0.650** | 1 | 0.377** | 0.690** | 0.269** | −0.127** | −0.055 | −0.093* |
| Stress | 0.001 | 0.354** | 0.377** | 1 | 0.308** | 0.162** | 0.041 | 0.046 | −0.002 |
| Depression | −0.285** | 0.799** | 0.690** | 0.308** | 1 | 0.172** | −0.184** | −0.114** | −0.117** |
| Impacts | −0.066 | 0.215** | 0.269** | 0.162** | 0.172** | 1 | −0.019 | −0.008 | −0.054 |
| Religious | 0.133** | −0.136** | −0.127** | 0.041 | −0.184** | −0.019 | 1 | 0.420** | 0.018 |
| Spiritual | 0.123** | −0.122** | −0.055 | 0.046 | −0.114** | −0.008 | 0.420** | 1 | −0.010 |
| PA | 0.079* | −0.063 | −0.093* | −0.002 | −0.117** | −0.054 | 0.018 | 0.010 | 1 |

* $p < 0.05$; ** $p < 0.01$.

villages had the worst life satisfaction, and significant differences were found in favor of students living in cities (city and big city) compared to villages by *post hoc* analysis. However, all students had low satisfaction (5–17), while just students living in big cities have medium satisfaction ($\mu = 17.8$). Master and Ph.D. students had medium satisfaction, while students at other levels had low satisfaction with significant differences in the level of study and year of study ($p < 0.05$). Students in their first and second years had the lowest satisfaction. Being hospitalized ($\mu = 23.6$) has significant and high satisfaction than not hospitalized students with low satisfaction ($\mu = 16.6$), and students tested for COVID-19 had medium satisfaction than non-tested students with low satisfaction. Deaths of close relatives, job losses, and deterioration of economic status were other significant reasons for the low satisfaction with significant differences. Place of residence, universities, and year of study were not significantly different for the stress scale ($p > 0.05$). Female and single students had higher stress with significant differences ($p < 0.05$). Master and Ph.D. students had lower stress significantly different ($p < 0.05$) from 2 years and undergraduate students. Having COVID-19 infection, deaths of a relative, losing a job, and worsening economic situation with significant differences are sources of higher stress than students selected (No) in exposures to COVID-19 items. Female students ($\mu = 10.2$) with moderate anxiety than male students ($\mu = 8.52$) with mild anxiety, students in big cities ($\mu = 10.1$) and villages ($\mu = 10.0$) with moderate anxiety than other residence places having mild anxiety, both Ağrı and Muğla Sıtkı Koçman Universities with moderate anxiety than other universities with mild anxiety, third-year students ($\mu = 12.1$) having significant differences from students studying in other years with mild anxiety symptoms, having symptoms of coronavirus, deaths of a relative, losing a job, and worsening economic situation were variables having significant differences in the anxiety scale. In contrast, hospitalization, tested for COVID-19, strict quarantine, and having COVID-19 infection variables had no significant differences in the anxiety scale.

Being female ($\mu = 12.8$) and single ($\mu = 12.4$) with moderate depression, having 2 years or 4 years of studies, being a third-year student with moderate depression, and being students of Ağrı University ($\mu = 14.0$) and Bursa Uludağ University ($\mu = 14.6$) with moderately severe depression were measured with significant differences in the depression scale. The exposures to COVID-19 have increased the depression rate in the second wave, and losing jobs and worsening economic situations were the most explicit source of depression symptoms. Female students ($\mu = 49.7$) were more inclined to PTSD than male students ($\mu = 42.7$) having moderate PTSD symptoms. Single students with high PTSD score were more inclined to PTSD. Students from Iğdır University had moderate PTSD symptoms, while students from other universities, especially Ağrı İbrahim Çeçen University students ($\mu = 51.2$), had high PTSD symptoms. Third-year students showed the highest PTSD symptoms, having significant differences from first- and fourth-year students. The COVID-19 symptoms and infections, deaths of relatives, and worsening economic situation could be the reasons for higher significant PTSD.

4.4. Predictors of stress, anxiety, depression, and PTSD

A logistic regression prediction model exploring whether socio-demographic variables (gender, place of residence, level of study, religion, exposure to COVID-19, etc.) are predictors of PTSD, anxiety, depression, and perceived stress among students during the COVID-19 pandemic was developed.

A likelihood ratio test and Nagelkerke's pseudo R -square values were applied to test the validity of the model, and stress (R -square: 0.252; $\chi^2 = 134.9$, $p = 0.000 < 0.05$), anxiety (R -square: 0.264; $\chi^2 = 212.21$, $p = 0.000$), depression (R -square: 0.261; $\chi^2 = 208.22$, $p = 0.000$), and PTSD (R -square: 0.258; $\chi^2 = 190.06$, $p = 0.000$) have fitted model values. Religious level (95%, $\chi^2 = 8.492$, $p = 0.014$), gender (95%, $\chi^2 = 18.99$, $p = 0.000$), and losing jobs (95%, $\chi^2 = 14.22$, $p = 0.001$) were predictors

of stress. Relationship status (95%, $\chi^2 = 12.34$, $p = 0.06$), year of study (95%, $\chi^2 = 43.32$, $p = 0.000$), PA (95%, $\chi^2 = 7.72$, $p = 0.05$), symptoms of COVID-19 (95%, $\chi^2 = 14.43$, $p = 0.002$), death of close relatives (95%, $\chi^2 = 9.8$, $p = 0.020$), and job loss (95%, $\chi^2 = 9.29$, $p = 0.026$) were significant predictors of anxiety; religious level (95%, $\chi^2 = 10.27$, $p = 0.016$), relationship status (95%, $\chi^2 = 11.47$, $p = 0.009$), year of study (95%, $\chi^2 = 23.97$, $p = 0.02$), PA (95%, $\chi^2 = 9.29$, $p = 0.026$), death of close relatives (95%, $\chi^2 = 11.54$, $p = 0.009$), job loss (95%, $\chi^2 = 9.26$, $p = 0.026$), and deterioration of economic status (95%, $\chi^2 = 7.76$, $p = 0.026$) were significant predictors of depression; and religious level (95%, $\chi^2 = 7.2$, $p = 0.027$), gender (95%, $\chi^2 = 17.6$, $p = 0.000$), year of study (95%, $\chi^2 = 26.07$, $p = 0.001$), university (95%, $\chi^2 = 11.6$, $p = 0.003$), PA (95%, $\chi^2 = 11.6$, $p = 0.003$), symptoms of COVID-19 (95%, $\chi^2 = 11.69$, $p = 0.003$), job loss (95%, $\chi^2 = 10.41$, $p = 0.005$), and deterioration of economic status (95%, $\chi^2 = 20.174$, $p = 0.000 < 0.05$) were significant predictors of the PTSD as presented in **Table 5**.

The last category was taken as a baseline for both dependent and independent variables. Odds ratio tests with significant ($p < 0.05$) values are analyzed in each model for stress, anxiety, depression, and PTSD. Religious and spirituality levels were entered in the model as covariates, while other independent variables were entered under the factor section in multinomial logistic regression. Demographic characteristics are shown in **Table 1**, and PA (<150 min per week = 0; >150 min per week = 1) and exposure to COVID-19 as yes or no were sub-categories of the variables.

The multinomial logistic estimates compare female students to male students for medium stress relative to high stress given the other variables in the model are held constant [coefficient (β) = -1.134 , odds ratio (OR) (Exp (B-odds ratio)) = 0.322 ; χ^2 (1) = 18.720 , $p = 0.000$]; the multinomial logistic estimate score is 1.134 unit lower for medium stress relative to high stress, and male students are more likely to have higher stress. The probability of female students having low stress with respect to high stress was 0.322 times lower than male students. Religious students show 0.863 unit lower for low stress relative to high stress [$\beta = -0.863$, OR = 0.422 ; χ^2 (1) = 8.49 , $p = 0.004$]. The married students for medium stress relative to high stress were 2.56 times higher than single students [$\beta = 0.941$, OR = 2.56 ; χ^2 (1) = 4.31 , $p = 0.038$]. Atatürk University [$\beta = -1.378$, OR = 0.252 ; χ^2 (1) = 4.38 , $p = 0.036$] and Iğdır University [$\beta = -1.97$, OR = 0.138 ; χ^2 (1) = 5.18 , $p = 0.023$] students for medium stress relative to high stress showed 1.37 and 1.97 lower than students in Muğla University. Students and their families not losing their jobs were more likely to have medium stress relative to high stress than students losing their jobs, 2.87 times higher relative probability [$\beta = 1.056$, OR = 2.87 ; χ^2 (1) = 12.95 , $p = 0.000$]. Participants exposed to COVID-19 were between 1 and 3.5 times more likely to report high stress (OR = 1.08 – 3.47).

Female students for normal anxiety (0–4) relative to severe anxiety (15–21) showed lower anxiety than male students

[$\beta = -0.6$, OR = 0.549 ; χ^2 (1) = 3.99 , $p = 0.046$]. The relative risk of having normal anxiety would be 0.549 times more likely when the other variables in the model are held constant. Undergraduate students had lower anxiety for normal anxiety relative to severe anxiety [$\beta = -1.69$, OR = 0.183 ; χ^2 (1) = 6.39 , $p = 0.011$] and for mild anxiety relative to severe anxiety [$\beta = -1.709$, OR = 0.181 ; χ^2 (1) = 8.06 , $p = 0.005$] than master and Ph.D. students. First-year students for normal anxiety relative to severe anxiety [$\beta = 1.95$, OR = 7.06 ; χ^2 (1) = 10.52 , $p = 0.001$] had higher anxiety, while third-year students for mild anxiety relative to severe anxiety [$\beta = -1.024$, OR = 0.359 ; χ^2 (1) = 4.52 , $p = 0.033$] had lower anxiety than sixth-year students. Furthermore, spiritual students showed 1.44 times higher anxiety for mild anxiety relative to severe anxiety [$\beta = 0.371$, OR = 1.44 ; χ^2 (1) = 5.27 , $p = 0.022$]. Participants having COVID-19 symptoms [$\beta = 0.93$, OR = 2.54 ; χ^2 (1) = 9.6 , $p = 0.002$] and losing jobs [$\beta = 0.8$, OR = 2.27 ; χ^2 (1) = 5.1 , $p = 0.023$] were 2.27 times and 2.54 more likely to report high anxiety in relation to normal anxiety, respectively. Hospitalization with OR = 4.99 ($p < 0.05$) had the highest relative risk for severe anxiety than normal anxiety.

Being religious ($\beta = -0.397$) and spiritual ($\beta = -0.321$) and involving physical activities ($\beta = -0.011$) represent effective coping factors against depression among university students (negative coefficients being observed). Women showed lower depression than men for normal (0–4) depression relative to severe (20–27) depression ($\beta = -0.758$, OR = 0.469 ; χ^2 (1) = 5.03 , $p = 0.025 < 0.05$). First-year students compared to 5 + level students had 3.65 times more depression for normal depression relative to severe depression [$\beta = 1.29$, OR = 3.65 ; χ^2 (1) = 4.004 , $p = 0.045$]. Being religious was found to be a slightly higher risk for students [$\beta = 0.548$, OR = 1.72 ; χ^2 (1) = 9.65 , $p = 0.002$] for mild in relation to severe depression. Participants exposed to COVID-19 were between 1.09 and 2.7 times more likely to report high depression. Job loss with OR = 2.7 and economic deterioration with OR = 2.19 are significant factors ($p < 0.05$) behind severe depression as shown in **Table 5**.

Female students for low to high severity PTSD [$\beta = -0.993$, OR = 0.371 ; χ^2 (1) = 16.266 , $p = 0.000$] and for medium to high severity PTSD [$\beta = -0.494$, OR = 0.61 ; χ^2 (1) = 6.26 , $p = 0.012$] showed less likely than men. First-year students are 4.5 times more likely to have severe PTSD than 5 + students [$\beta = 1.508$, OR = 4.5 ; χ^2 (1) = 9.37 , $p = 0.002$]. Religious students had higher PTSD scores from medium to high severity [$\beta = 0.348$, OR = 1.41 ; χ^2 (1) = 5.9 , $p = 0.014$]. Religious students showed lower PTSD [$\beta = -0.275$, OR = 0.759 ; χ^2 (1) = 4.01 , $p = 0.045$] in the overall model, while students being spiritual have a coefficient value of -0.162 but not significant ($p > 0.05$). Participants not exposed to COVID-19 were in general less likely to report severe PTSD symptoms but all items were found not significant ($p > 0.05$). Having COVID-19 symptoms (OR = 1.4), job losses (OR = 1.36), and economical determination (OR = 1.30) have higher relative

TABLE 4 Significant differences according to demographic variables and exposure to COVID-19 items.

| Variable | | SWL | | | Stress | | | Anxiety | | | Depression | | | PTSDs | | |
|--------------------|--------------------------|------|------|-------|--------|---------------------------|--------|---------|-------|--------|------------|--------|--------|-------|-------|--------|
| | | Mean | F | Sig. | Mean | F | Sig. | Mean | F | Sig. | Mean | F | Sig. | Mean | F | Sig. |
| Gender | Female (n = 499) | 16.8 | 0.04 | 0.82 | 24.9 | 16.6 | 0.000* | 10.2 | 17.4 | 0.000* | 12.8 | 13.3 | 0.000* | 49.7 | 27.9 | 0.000* |
| | Male (n = 255) | 16.7 | | | 23.1 | | | 8.52 | | | 10.9 | | | 42.7 | | |
| Social status | Married (n = 45) | 20.4 | 13.7 | 0.00* | 22.2 | 6.585 | 0.010* | 7.7 | 6.170 | 0.013* | 9.0 | 10.321 | 0.001* | 41.2 | 5.823 | 0.016* |
| | Single (n = 709) | 16.5 | | | 24.4 | | | 9.7 | | | 12.4 | | | 47.7 | | |
| Place of residence | Village (n = 148) | 14.7 | 6.9 | 0.00* | 23.9 | 0.81 | 0.48 | 10.0 | 2.6 | 0.040* | 12.2 | 1.7 | 0.16 | 47.7 | 2.0 | 0.11 |
| | Town (n = 28) | 15.9 | | | 23.8 | | | 8.3 | | | 11.5 | | | 47.5 | | |
| | City (n = 291) | 16.8 | | | 24.1 | | | 9.1 | | | 11.6 | | | 45.5 | | |
| | Big City (n = 287) | 17.8 | | | 24.7 | | | 10.1 | | | 12.9 | | | 49.0 | | |
| Level of study | Foundation (n = 233) | 16.1 | 3.50 | 0.02* | 24.3 | 5.6 1 and 3 2 and 3 | 0.004* | 9.4 | 5.26 | 0.005* | 12.0 | 4.71 | 0.009* | 47.2 | 2.11 | 0.122 |
| | Undergraduates (n = 461) | 16.8 | | | 24.6 | | | 10.0 | | | 12.6 | | | 48.0 | | |
| | Master and PhD (n = 60) | 18.8 | | | 21.9 | | | 7.7 | | | 9.7 | | | 43.0 | | |
| Universities | Ağrı (n = 142) | 15.7 | 1.8 | 0.08 | 23.9 | 0.44 | 0.85 | 10.5 | 1.9 | 0.006* | 14.0 | 3.7 | 0.001* | 51.2 | 2.42 | 0.025* |
| | Atatürk (n = 265) | 17.1 | | | 24.4 | | | 9.3 | | | 11.8 | | | 46.7 | | |
| | Başkent (n = 40) | 19.6 | | | 24.9 | | | 9.2 | | | 12.2 | | | 45.7 | | |
| | Bingöl (n = 153) | 16.6 | | | 24.1 | | | 9.2 | | | 11.8 | | | 46.9 | | |
| | Bursa (n = 27) | 16.3 | | | 25.2 | | | 12.1 | | | 14.6 | | | 50.5 | | |
| | Iğdır (n = 79) | 16.5 | | | 24.7 | | | 9.2 | | | 10.0 | | | 42.5 | | |
| | Muğla (n = 48) | 16.4 | | | 23.8 | | | 10.0 | | | 12.1 | | | 48.54 | | |
| Year of study | First (n = 166) | 16.6 | 2.5 | 0.03* | 23.6 | 0.70 | 0.59 | 8.4 | 6.2 | 0.00* | 10.8 | 5.0 | 0.001* | 43.7 | 4.2 | 0.002* |

(Continued)

TABLE 4 (Continued)

| Variable | | SWL | | | Stress | | | Anxiety | | | Depression | | | PTSDs | | |
|-------------------------------------|------------------------------------|------|------|-------|--------|-------|--------|---------|-------|--------|------------|-------|--------|-------|-------|--------|
| | | Mean | F | Sig. | Mean | F | Sig. | Mean | F | Sig. | Mean | F | Sig. | Mean | F | Sig. |
| | Second (<i>n</i> = 247) | 15.8 | | | 24.4 | | | 9.7 | | | 12.2 | | | 48.0 | | |
| | Third (<i>n</i> = 72) | 17.6 | | | 24.4 | | | 12.1 | | | 15.1 | | | 53.4 | | |
| | Fourth (<i>n</i> = 183) | 17.2 | | | 24.4 | | | 9.5 | | | 12.2 | | | 46.7 | | |
| | Fifth and over (<i>n</i> = 86) | 18.1 | | | 24.7 | | | 9.9 | | | 12.3 | | | 48.8 | | |
| COVID-19 symptoms | No (<i>n</i> = 532) | 16.9 | 0.77 | 0.37 | 24.0 | 3.2 | 0.070 | 9.2 | 10.5 | 0.001* | 11.7 | 9.0 | 0.003* | 45.6 | 17.0 | 0.000* |
| | Yes (222) | 16.4 | | | 24.9 | | | 10.6 | | | 13.4 | | | 51.4 | | |
| Tested for the COVID-19 | No (<i>n</i> = 601) | 16.5 | 4.1 | 0.04* | 24.1 | 2.9 | 0.08 | 9.4 | 3.3 | 0.068 | 11.9 | 5.8 | 0.015* | 47.0 | 0.929 | 0.335 |
| | Yes (<i>n</i> = 153) | 17.8 | | | 25.0 | | | 10.3 | | | 13.4 | | | 48.6 | | |
| Hospitalization | No (<i>n</i> = 741) | 16.6 | 12.9 | 0.00* | 24.3 | 0.51 | 0.472 | 9.6 | 0.40 | 0.52 | 12.2 | 0.001 | 0.972 | 47.40 | 0.017 | 0.897 |
| | Yes (<i>n</i> = 13) | 23.6 | | | 25.4 | | | 10.6 | | | 12.3 | | | 46.7 | | |
| Strict quarantine | No (<i>n</i> = 625) | 16.8 | 0.28 | 0.59 | 24.1 | 3.1 | 0.07 | 9.6 | 0.43 | 0.50 | 12.1 | 0.56 | 0.444 | 47.1 | 0.66 | 0.41 |
| | Yes (<i>n</i> = 129) | 16.5 | | | 25.1 | | | 9.95 | | | 12.66 | | | 48.5 | | |
| COVID-19 infection | No (<i>n</i> = 153) | 17.5 | 2.08 | 0.149 | 23.4 | 4.6 | 0.031* | 8.96 | 3.289 | 0.070 | 11.0 | 6.14 | 0.013* | 44.15 | 6.482 | 0.011* |
| | Yes (<i>n</i> = 601) | 16.6 | | | 24.5 | | | 9.8 | | | 12.5 | | | 48.22 | | |
| Death of close relatives | No (<i>n</i> = 495) | 17.1 | 3.9 | 0.04* | 23.6 | 17.51 | 0.000* | 9.1 | 15.43 | 0.00* | 11.5 | 15.43 | 0.000* | 45.8 | 10.7 | 0.001* |
| | Yes (<i>n</i> = 259) | 16.1 | | | 25.5 | | | 10.7 | | | 13.5 | | | 50.2 | | |
| Job loss | No (<i>n</i> = 424) | 17.8 | 24.7 | 0.00* | 23.8 | 7.9 | 0.005* | 8.8 | 24.22 | 0.000* | 11.1 | 25.10 | 0.000* | 44. | 37.1 | 0.00* |
| | Yes (<i>n</i> = 330) | 15.3 | | | 24.9 | | | 10.7 | | | 13.6 | | | 51.7 | | |
| Deterioration of economic status | No (<i>n</i> = 256) | 18.4 | 21.7 | 0.00* | 23.1 | 16.8 | 0.00* | 8.6 | 15.12 | 0.000* | 10.6 | 21.5 | 0.000* | 41.62 | 43.57 | 0.00* |
| | Yes (<i>n</i> = 498) | 15.9 | | | 24.9 | | | 10.2 | | | 13.0 | | | 50.36 | | |

*The mean difference is significant at the 0.05 level. Mean, mean of summed scale.

TABLE 5 Predictors of models from a socio-interpersonal perspective by multinomial logistic regression.

| Variable | Stress | | Anxiety | | Depression | | PTSD | |
|----------------------------------|-------------------------|-------|-------------------------|-------|-------------------------|-------|-------------------------|-------|
| | Chi-square (χ^2) | Sig. | Chi-square (χ^2) | Sig. | Chi-square (χ^2) | Sig. | Chi-square (χ^2) | Sig. |
| Religiosity level | 8.492* | 0.014 | 3.802 | 0.284 | 10.275* | 0.016 | 7.250* | 0.027 |
| Spirituality level | 2.921 | 0.232 | 6.828 | 0.078 | 1.821 | 0.610 | 1.965 | 0.374 |
| Gender | 18.99* | 0.000 | 5.499 | 0.139 | 6.335 | 0.096 | 17.604* | 0.000 |
| Relationship status | 4.284 | 0.117 | 12.343* | 0.006 | 11.472* | 0.009 | 5.048 | 0.080 |
| Place of residence | 9.569 | 0.144 | 14.574 | 0.103 | 9.236 | 0.416 | 11.483 | 0.075 |
| Faculty | 4.706 | 0.789 | 14.334 | 0.280 | 14.708 | 0.258 | 5.042 | 0.753 |
| Level of study | 4.184 | 0.382 | 11.457 | 0.075 | 5.187 | 0.520 | 1.575 | 0.813 |
| Year of study | 13.390 | 0.099 | 43.320* | 0.000 | 23.979* | 0.020 | 26.071* | 0.001 |
| University | 18.197 | 0.110 | 20.138 | 0.325 | 25.367 | 0.115 | 21.304* | 0.046 |
| PA | 0.332 | 0.847 | 7.721* | 0.05 | 9.682* | 0.021 | 11.645* | 0.003 |
| COVID-19 symptoms | 0.255 | 0.880 | 14.439* | 0.002 | 6.164 | 0.104 | 11.692* | 0.003 |
| Tested for the COVID-19 | 1.093 | 0.579 | 2.134 | 0.545 | 3.888 | 0.274 | 0.857 | 0.651 |
| Hospitalization | 2.855 | 0.240 | 2.677 | 0.444 | 2.436 | 0.487 | 0.515 | 0.773 |
| Strict quarantine | 2.801 | 0.247 | 2.793 | 0.425 | 3.932 | 0.269 | 2.101 | 0.350 |
| COVID-19 infection | 1.527 | 0.466 | 5.132 | 0.162 | 1.759 | 0.624 | 0.283 | 0.868 |
| Death of close relatives | 3.204 | 0.201 | 9.829* | 0.020 | 11.543* | 0.009 | 4.059 | 0.131 |
| Job loss | 14.222* | 0.001 | 9.291* | 0.026 | 9.261* | 0.026 | 10.415* | 0.005 |
| Deterioration of economic status | 2.569 | 0.277 | 7.394 | 0.060 | 7.762* | 0.05 | 20.174* | 0.000 |

PA, physical activity. * $p < 0.05$.

risks of PTSD. PA for severe PTSD had a significant negative coefficient ($\beta = -0.007$, OR = 0.99; Wald = 5.21, $p = 0.023$).

5. Discussion

Overall, 84.2% high perceived stress (20–40), 36.6% anxiety diagnosis (GAD-7 ≥ 10), 55.0% depression diagnosis (PHQ-9 ≥ 10), and 61.2% PTSD (PCL-C > 38) shown in **Table 1** were the prevalence of psychological factors. Anxiety and depression rates decreased compared to the first wave of the pandemic. In contrast, stress increased during the second wave. More than half of students (52.5%) showed high-severity PTSD, and the pandemic has long-term effects on students' well-being. The students' prevalence from different studies before the pandemic in Turkey was 17–23% depression and 35% anxiety in the study by [Deniz and Sümer \(2010\)](#); 29.5% depression, 50.3% anxiety, and 39.9% stress in the study by [Baykan et al. \(2012\)](#); and stress level: 55.4% normal, 19.2% mild, 24% moderate, 0.6% advanced, and 0.9% very advanced; anxiety: 47% normal, 6% mild, 24.3% moderate, 13.8% advanced, and 5.4% very advanced; and depression: 65.3% normal, 16.2% mild, 11.1% moderate, 4.5% advanced, and 3% very advanced ([Üstün and Bayar, 2015](#)), indicating a high increase in the prevalence of psychological problems compared to our results. As the weeks progress, stress, anxiety, and depression levels have increased,

while the quality of life has decreased in the study by [Jojoa et al. \(2021\)](#). Overall, 64.6% depression, 48.6% anxiety, 45.2% stress, and 34.5% PTSD from May 11 to 15, 2020, showed that PTSD has increased in the second wave ([Cam et al., 2021](#)), supporting mainly our study. High PSS (84.2%), severe anxiety (21.10%), and severe depression (17.9%) prevalence were risk factors requiring precautions. In this study, the highest increase was seen in anxiety and perceived stress, while there was no considerable change in depression. However, 17.9% of students have severe depression symptoms, higher than the 15.08% of April 2020 prevalence, while moderate and moderately severe symptoms decreased. There are more depression cases among students in Turkey compared to 36% pooled depressive symptoms and 32% anxiety symptoms prevalence around the world ([Deng et al., 2021](#)). [Dilmen Bayar et al. \(2021\)](#) found medium-level stress and depression in August–December 2020, and perceived stress is still a problem, while there was an improvement in depression. High perceived stress, moderate generalized anxiety disorder (GAD), mild depression symptoms (PHQ), high severity PTSD, and moderate satisfaction were found in the second wave, and the greatest increase was seen in anxiety, showing that the effects of COVID-19 have led to profound risks on mental well-being with high severity of PTSD (61.2%).

Even though there are decreases in the prevalence of dual anxiety and depression diagnosis (40.3%) and depression-only

diagnosis (55.0%) (scores ≥ 10) compared to Aslan et al. (2020) study, the rates are still high. Deng et al. (2021) found 61% of students having depressive symptoms and 49% of students having anxiety symptoms with financial difficulties, stating that financial problems have strong effects on mental well-being. Twenty-seven studies reported a pooled prevalence of 23, 13, and 8% for mild, moderate, and severe depressive symptoms, respectively (Deng et al., 2021), and moderate and severe depressive symptoms are higher in Turkey. A pooled depressive symptoms prevalence of students: 24% from Chinese students, 70% from Bangladeshi students, 55% from American students, and 29% from French students; and a pooled anxiety symptoms prevalence: 23% from Chinese students, 73% from Bangladeshi students, 74% from American students, 42% from French students, and 56% from Spanish students were found by Deng et al. (2021). The prevalence of PTSD was 53.8% during the outbreak period in China (Wang et al., 2020). Turkey students generally showed a lower anxiety rate. However, students in Turkey showed higher depression (55.00%) than the Chinese and French students and better scores than Bangladeshi, American, and Spanish students. A high PTSD rate of 61.2% implies that students need mental support in Turkey. Worsened and volatile economy with financial difficulties and insufficient government support could be reasons for that high rate. Furthermore, increased effects: deaths of close relatives due to COVID-19 (from 5.31 to 34.4%), tested for coronavirus (from 3.35 to 20.3%), strict quarantine for at least 14 days (from 5.03 to 17.1%) of the pandemic, and increased unemployment have negatively influenced students well-being. The worsened relationships of students with families and friends and decreased physical activities (Aslan, 2021b) could be other reasons for mental problems in Turkey.

Younger students (aged 18–20 years), single, and females were more vulnerable to a traumatic event (Chhetri et al., 2021; Chodkiewicz et al., 2021). Cantürk (2014) explained higher significant stress, anxiety, and depressions level before the pandemic with hormonal changes and expression of emotions and thoughts regarding their social situation. Twenty-two studies reported subgroup data by gender for anxiety symptoms, with a pooled prevalence of 44% for female students and 37% for male students (Deng et al., 2021). Women were more likely to report feeling of more stress than men in the second wave (Hutcheson et al., 2021). Indeed, it has been found that the likeliness of developing PTSD following exposure to a traumatic case is two times that for women than for men (Cam et al., 2021). In this study, younger students, females, and single students had higher stress with significant differences. Female students showed moderate anxiety and depression and high-severity PTSD with higher significant mean differences as shown in Table 4, more inclined to mental problems than male students. Students in their first and second years had the lowest satisfaction. First-year students were 4.5 times more likely to have severe PTSD than 5 + students. Third-year students with moderate depression showed the highest PTSD symptoms.

Married students had better satisfaction, while students living in villages had the worst satisfaction in life. Perceived stress is strongly related to anxiety and depression symptoms (Salleh, 2008; Mills et al., 2014; Aslan et al., 2020; Dilmén Bayar et al., 2021). In this study, there was a significant positive correlation between perceived stress and anxiety, depression, and PTSD, and high continuous stress can be explained by high perception of COVID-19 impacts. As people are satisfied more with life, they are less inclined to mental problems. Physical activities and turning back to normal life routines can decrease stress. Religious students show 0.863 unit lower for low stress relative to high stress. Being religious and spiritual and having physical activities have negative coefficients for severe depression to normal depression. Furthermore, religious students showed lower PTSD. Ağrı İbrahim Çeçen University and Muğla Sıtkı Koçman University students showed higher anxiety than other universities. Ağrı İbrahim Çeçen University and Bursa Uludağ University students had faced moderately severe depression. Students from Iğdır University had moderate PTSD, while students from other universities, particularly from Ağrı İbrahim Çeçen University students, had high PTSD symptoms, showing that Ağrı İbrahim Çeçen University students were under higher long-term mental problems compared to other universities. The fact that some universities (Ağrı İbrahim Çeçen University, Bingöl University, and Iğdır University) were established in 2007–2008 and not yet institutionalized may have contributed to these differences. In addition, political groupings and interest seeking in some universities may have had negative results on students. Therefore, individual studies for each university may be necessary to explain these significant differences.

Psychiatric sufferings can cause suicides. Correlations with suicidal attempts were found with mental disorders in the past. Some people died by suicide because of being infected and the economic crisis created by the COVID-19 pandemic (Jawad et al., 2020); 24% of the respondents reported having experienced suicidal thoughts compared to 10% of adult participants who had suffered from suicidal thoughts in Poland during the first wave of the pandemic, and prolonged pandemic increased the intentions of suicides (Chodkiewicz et al., 2021); 10.7% of respondents seriously considering suicide in the last 30 days were found, and this rate was 25.5% among young people (aged 18–24 years) in the USA in June 2020 (Czeisler et al., 2020). Anxiety and depressive disorders are associated with suicidal thoughts and low educational performances (ignoring classes, low grades, not submitting homework, etc.) from our study and similar studies from other countries (Membrive-Jiménez et al., 2020; Supervía and Bordás, 2020; Chodkiewicz et al., 2021). About 20.6% of students were under suicide risk from our study in Turkey, and their resilience to mental disorders is to be improved. Thus, they needed urgent support from families and governments. Women showed low-level coping with the pandemic situation with regard to mental health. Students' development can be improved with social and economic support besides mental support.

Students need financial support and improved relationships with colleagues and families. Protective factors improving individual adaptation and coping with trauma, tragedy, or extreme threats can enhance people's resilience as buffers (Jojoa et al., 2021). Spiritual experiences and spiritual resources; believing in religious faith (Arslan and Yıldırım, 2021; Kar et al., 2021); social support from family, community, and university; sharing problems with others; cognitive reappraisal (Bourion-Bédès et al., 2021; Chodkiewicz et al., 2021; Jojoa et al., 2021); building healthy mental responses; responding effectively to crisis; learning to adapt to adversity (Jawad et al., 2020); living with family (Coppola et al., 2021; Deng et al., 2021); physical exercise for calming down (Kilani et al., 2020; Bourion-Bédès et al., 2021); improved dietary quality and sleeping score (Kilani et al., 2020; Kar et al., 2021); hoping the best (positive strategy); and staying busy for preventing thinking about the current situation (Bourion-Bédès et al., 2021; Chodkiewicz et al., 2021; Kar et al., 2021) are some ways to overcome the current stressful situation. Furthermore, cognitive-behavioral therapy delivered remotely (*via* digital health platforms telehealth) for both depression and anxiety through enhancing an individual's awareness of own thoughts, feelings, and experiences and increasing personal resilience, requiring lifestyle changes (Aminoff et al., 2021; Surmai and Duff, 2022), hypnotic therapy, prolonged exposure therapy, stress inoculation therapy, group therapy, eye movement desensitization and reprocessing relaxation techniques, and pharmacological interventions are other improved treatment methods for the treatment of mental problems to reduce psychological problems in association with the pandemic (Cam et al., 2021).

This study was prepared as part of an international project (Rogowska et al., 2020), and some findings of the survey were used in another study (Ochnik et al., 2021) to compare with other countries in the second wave of the pandemic. The results of this study will guide university management, city administrators, social policy-makers, and families. This study fills the gap in the literature regarding the link between growing exposure to the COVID-19 pandemic from the first to the second wave of the pandemic and coronavirus-related stress, anxiety, depression, and PTSD among university students in Turkey.

5.1. Limitation of the study

Although this study found significant predictors for psychological problems, the main limitation regarding the cross-sectional design is not drawing any conclusions about the causality of the results. We do not have a baseline (pre-pandemic) measure, and longitudinal research is required in the future to verify the present findings. Self-reported measures may also include some sources of bias. In our study, 66.2% of participants were women, and it should be noted that in

other studies, the gender ratios are close to each other. Different studies are needed, separately, only for Ph.D. students, only Master, or only undergraduate students, investigating PTSD, anxiety, perceived stress, depression level, and satisfaction with life during different waves of the pandemic, according to gender, financial situation, family situation (students on social assistance, students from single-parent families, students from disorganized families), whether they are athletes or not, etc.

6. Conclusion

Religious level, gender, and losing jobs as significant predictors of stress; relationship status, year of study, physical activities, COVID-19 symptoms, death of close relatives, and job loss as significant predictors of anxiety; and religious level, relationship status, year of study, physical activities, death of a close relative, job loss, and deterioration of economic status as significant predictors of depression were found. Also, religious level, gender, year of study, university, physical activities, COVID-19 symptoms, job loss, and deterioration of economic status were significant predictors of PTSD. These predictors found that attention should be given to economic improvement, female students, less exposure to COVID-19, more physical activities, and improved spiritual level to alleviate the effects of psychological problems. Perceived meaning of life and afterlife, believing in the good and fate by doing no harm, and protecting the interest of others and helping them, mediating adherence to preventive measures through moral principles, and compliance to authorities are helpful sides of religiosity, and religious organizations, healthcare organizations, and universities may work together. Religious support can be given to students in order to increase moral values, to shape their behavior, and to find solutions or alternatives to problems.

High anxiety, depression, PTSD prevalence, and declared having suicidal thoughts show that the second wave of the pandemic negatively affected the mental health of the students, and they need support from family and universities to recover with additional psychological and therapeutic support in order not to further intensify the disorders but to reduce or eliminate them. Governments can support last year and graduated students for job searches and professional development. Students living in villages, younger students, females, and single students were high-risk groups for mental problems.

Data availability statement

The original contributions presented in this study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

This study was conducted according to the guidelines of the Declaration of Helsinki and approved by the local IRB: University Research Committee at the University of Opole, Poland, decision no.1/2020 and Bingöl University, decision no. 92342550/044/6137.

Author contributions

IA contributed to the conceptualization of the study, formal analysis, methodology, supervision, visualization, and writing (original draft preparation). Both contributed to the data curation, investigation, project administration, resources, and review and editing, and have read and approved the final version of the manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Psychological capital, quality of life, and well-being in mother caregivers of individuals with down syndrome

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Introduction: Caused by an error in cell division that produces an additional chromosome 21, Down syndrome (DS) is one of the most common developmental disorders in the world. This study aims to analyze the relationship between psychological capital, quality of life and well-being of caregivers of individuals with Down syndrome (DS).

Methods: The participants were 98 caregivers (mothers, $M = 52.13$, $SD = 11.39$) of individuals with Down syndrome. The instruments used were the Psychological Capital Questionnaire (measuring self-efficacy, resilience, optimism, and hope), Quality of Life Questionnaire (including social support, general satisfaction, physical/psychological health, absence of excessive workload/free time), and Psychological Wellbeing Scale, investigating the following dimensions: self-acceptance, positive relationships with others, autonomy, environmental mastery, purpose in life, and personal growth.

Results: The mediation analysis showed that self-efficacy, hope, and resilience are positively associated to quality of life, and optimism is positively associated to well-being. The total effects of psychological capital on well-being are positive and significant and quality of life mediates the relationship between psychological capital and well-being.

Discussion: These results show that psychological capital is an important inner resource for caregivers of DS individuals and must be improved through support services, so that caregivers have a higher perception of the quality of life and implicitly of well-being.

KEYWORDS

psychological capital, quality of life, well-being, down syndrome, caregivers

1. Introduction

Developmental disabilities are long-term psychological and physiological impairments which affect an individual's ability to perform activities of daily living, such as independent feeding, communicating, and mobilizing (World Health Organization and Unicef, 2012). Down syndrome (DS) is one of the most common developmental disorders in the world. In the European Union, out of 5.2 million births per year, approximately 104,000 (2.5%) have congenital anomalies. DS has a share of 8% of all congenital anomalies (European Commission

Report, 2019). There are no relevant statistics in Romania on the number of people with DS, but given that worldwide one in 700 children is born with DS (de Graaf et al., 2015), it is estimated that there are currently over 4,000 people with DS living in Romania. A preliminary statistic made through a project financed by the European Commission within Youth in Action program shows that there are currently 4,420 people with DS in Romania, of which 2,611 children and 1,809 adults (Apopei Pruteanu, 2022).

DS is a disorder caused by an error in cell division that produces an additional chromosome 21, present in every cell of the body. Because of this additional genetic material, the disorder is also called Trisomy 21 (Ghosh et al., 2009). DS is often accompanied by impairments in cognitive ability and physical growth, neurodevelopmental and behavioral disorders, mood and anxiety disorders (Moyal et al., 2014; Jonsson et al., 2017), developmental disabilities, a higher risk for a series of health problems, including heart diseases, problems with the digestive system or limbs, thyroid dysfunction, hearing and visual disturbances, and obstructive sleep apnea (Bull, 2011; Alexander et al., 2016). These determine the inability of people with DS to take care of themselves or to have a normal and autonomous functioning in the activities of daily living, which requires the presence of a permanent caregiver (Henn et al., 2008; Areias et al., 2011; El-Gilany et al., 2017).

People with DS have a lower rate of development and require greater parental involvement, which influences family dynamics (Most et al., 2006; Corrice and Glidden, 2009). Although this affects the whole family, the primary caregiver is the one who assumes full responsibility for providing physical, emotional, and drug assistance. Most studies point out that this role is most often played by the mother (Greenberg et al., 2004; Stoneman, 2007). Raising and caring for a child or an adult with disabilities, including DS, is an additional effort for the caregiver and the family in general because individuals with DS continue living with their parents also into adulthood (McKenzie et al., 2016). For this reason, the quality of life and well-being of caregivers should be a priority in social programs and policies (Masefield et al., 2020). It is widely acknowledged that family caregivers are more vulnerable to psychological distress, with higher rates of depression and anxiety (Liu et al., 2018; Connors et al., 2019; Teahan et al., 2021).

On the other hand, caring for a loved one can be a rewarding experience. The ability to build a positive perspective on the situation and the related tasks can lead to a decrease in the perception of burden and thus to an improvement in the quality of life, with positive effects on well-being (Bertrand, 2019). Caregiver's positive attitude toward his/her life context is based on a number of personal characteristics, which allow him to integrate reality as a challenge. It is well known that people with DS need special, permanent care that extends throughout their entire lives and becomes more and more complicated as they get older (Carvalho et al., 2015; McCarron et al., 2018). Therefore, the caregiver must possess or develop a set of attributes and skills that will support him in coping with the high demands of caring for a person with a disability. Psychological capital may be an important strength of caregivers of people with DS.

1.1. Psychological capital

Psychological capital (PsyCap) represents a set of individual characteristics and qualities that express a person's positive resources

(Luthans and Avolio, 2003). This construct contributes to the successful fulfillment of the responsibilities of daily life, through confidence in one's abilities, proactive actions, optimistic approach to life and the future, and persistence in overcoming obstacles (Santisi et al., 2020). PsyCap has four dimensions: self-efficacy, hope, resilience, and optimism (Luthans et al., 2007), thus being generated by the individuals' belief that they are able to strive to achieve their goals, to persevere in achieving these goals, and mobilize efforts and activities in this regard, resilience to difficult situations and flexibility in recovery of balance after experiencing them, and positive attitude regarding achievement of success at present or in the future (Luthans, 2002; Luthans and Youssef-Morgan, 2017). Self-efficacy is defined as one's confidence in his or her ability to mobilize the motivation, cognitive resources, and courses of action necessary to achieve certain levels of performance (Stajkovic and Luthans, 1998). Individuals with high self-efficacy will generalize their existing expectations of their abilities to perform tasks in different undertakings (Bandura, 1997) and in new situations (Sherer et al., 1982), being more useful when facing unknown challenging situations (Grether et al., 2018). Resilience is the capacity to bounce back from adversity, uncertainty, failure, and adapt to changing and stressful life demands (Masten and Reed, 2002; Tugade and Fredrickson, 2004). High resilience has been associated with good physical and mental health (Schure et al., 2013). Optimism refers to an individual's expectancy of positive outcomes (Scheier et al., 2001). Many studies have shown the beneficial aspects of optimism for different domains of life, such as physical health, prevention of depression, effective decision-making, or life satisfaction (Aspinwall, 2005; Magnano et al., 2015; Santilli et al., 2017). Hope is based on the interaction between two factors: goal-directed energy and pathways (Snyder et al., 1996). Higher hope is associated with specific goal-setting and goal-accomplishment behaviors that may increase the likelihood of successful goal attainment (Cheavens et al., 2019). All these positive psychological attributes can be improved and play an important role in individuals' personal growth.

1.2. Quality of life

Quality of life (QoL) is a concept used in many contexts, being correlated with health and well-being. After 1980, the content of the concept expanded to include the subjective experience of the individual regarding social life, daily activity, and health (Moreno and Ximenez, 1996), being defined as the subjective perception of individuals of their position in life (Church, 2004; Eiser et al., 2004). WHO defines QoL as an individual's perception of their position in life, in the context of the value systems and the culture in which they live, and in relation to their expectations, goals, concerns, and standards (World Health Organisation Quality of Life Assessment Group. (WHOQOL), 1994, 1998). This broad-ranging concept incorporates the person's psychological state, physical health, independence level, personal beliefs and values, social relationships, and, also, relationship to salient characteristics of the environment [World Health Organisation Quality of Life Assessment Group. (WHOQOL), 1994]. It follows from this definition that QoL does not refer to the real, objective conditions of a person's life, but to the personal experience of those conditions, representing the degree of satisfaction with regard to family, love, and social life, as well as the environment (Minayo et al., 2000). Life satisfaction, happiness, and

experienced well-being are mutually interrelated, being closely linked to perceived quality of life (Păunescu et al., 2018).

1.3. Well-being

Well-being is a construct that derives from positive psychology and refers to cultivating positive emotions to ensure the optimal functioning of individuals (Campbell et al., 1976; Ryan and Deci, 2001; Culbertson et al., 2010). Well-being refers to the development of skills and personal growth, its origins being found in concepts such as self-actualization (Maslow, 1968) or full functionality (Rogers, 1961). Ryff C. D. (1989) proposed a multidimensional model of well-being that includes six dimensions: self-acceptance, positive relationships with others, autonomy, environmental mastery, purpose in life, and personal growth. By self-acceptance, people try to feel good about themselves, while good relationships with others and the ability to love are characteristics of positive mental activity and mental health (Keyes et al., 2002). Autonomy refers to maintaining one's own beliefs, authority, and personal independence in different contexts of life to strengthen one's identity (Ryff and Keyes, 1995). Environmental mastery is the ability of the individual to create and choose environments that meet their personal needs and desires, and purpose in life is the need for people to set goals and pursue their goals (Keyes et al., 2002). The well-being of patients and their caregivers and close family members has been shown to be closely intertwined (Martire et al., 2004), suggesting that supporting the caregiver's well-being will positively affect the health of the patient, and vice versa.

1.4. Relationships among psychological capital, quality of life, and well-being

The developmental character of the components of PsyCap is supported by the fact that their presence determines “who you are here and now,” but also “who you can become” in the future (Jurek and Niewiadomska, 2021).

Self-efficacy is the belief in the ability to use one's own cognitive resources and skills and to make the necessary efforts to successfully complete a task (Bandura, 1997). People with high levels of self-efficacy interpret the hardships of life as challenges, have greater decision-making ability, are more motivated to be involved in proactive behaviors, and have control over their actions, which leads to success, to satisfaction with the tasks performed and to an adaptive and constructive coping (Bandura et al., 1999; Bandura, 2008; Diseth, 2011; Larson et al., 2013). All these lead to the idea that these individuals will have higher levels of quality of life and implicitly higher well-being.

Hope reflects the person's belief that he will succeed and that his success depends on his ability to plan and use alternative ways to achieve success and to overcome and avoid those ways that do not lead to success (Snyder, 2002). This leads to a sense of being in control of events and the ability to assess difficult situations as less threatening, determining an increase in motivation to initiate remedial actions (Avey et al., 2009). Hope plays an important role in setting goals and striving to achieve them. This mechanism leads to efficient behaviors, to a positive adaptation and implicitly to an increase in the likelihood of experiencing high quality of life and high well-being (Schulz et al., 2014; Rabenu and Yaniv, 2017).

Resilience contributes to a flexible adaptation to the demands of life, in an appropriate, consistent, and persistent way, both by adjusting one's abilities and by judiciously using environmental factors (Bonanno, 2004). Positive adaptation is reflected in the fact that the person is able to cope in a positive way with adversities, failures, traumatic events, and also with growing responsibility. Thus, resilience reflects the person's ability to endure adverse events and then return to their initial state of balance and functionality after experiencing these adverse events. People with high levels of resilience are characterized by self-confidence, independence, sense of humor, patience, positive emotions, openness to new experiences, and determination in action, which contributes to increased quality of life and well-being (Dorfman and Rubenstein, 1994; Luoh and Herzog, 2002; Dingemans et al., 2016).

Optimism is defined as the tendency to perceive, explain, and evaluate life in a positive rather than negative terms and to predict future events as fortunate rather than unfortunate (Peterson and Seligman, 1984). Optimistic people tend to interpret negative events as external, temporary, and situational, and positive events as personal, long-lasting, and universal. Optimism is a personal disposition, being accompanied by positive emotions, leading to greater involvement in goal-oriented activities, supporting the motivation to succeed, and thus improving the quality of life and well-being of the individual (Carver and Scheier, 2002; Carver et al., 2005).

PsyCap plays an important role in the personal development and growth of individuals (Newman et al., 2014). It facilitates the attention and memory processes needed to successfully overcome obstacles and achieve well-being (Diener and Biswas-Diener, 2008) and enhances the ability of individuals to manage adverse situations, which increases quality of life and well-being (Sweetman and Luthans, 2010). Positive relationships between PsyCap and quality of life have been found by many researchers (Luthans et al., 2007; Hansen et al., 2015).

A theoretical approach to the characteristics of caregivers of people with DS may be the Adaptation Hypothesis, which assumes that repeated exposure to the challenges of caring for people with various disorders increases and not decreases personal resources (Townsend et al., 1989). Two processes can be involved here: successful fulfillment of adjacent responsibilities can lead to increased skills, self-confidence and self-esteem, and exposure to stress can provide opportunities for personal well-being (Seltzer et al., 2004). One of the best-known theories that explains how individuals cope with the demands of caregiving was developed by McCubbin and Patterson (1983). The model has been extensively used in research on the care of people with disabilities, explaining the positive results by the presence of personal resources at stake, but also by the significance that people attribute to the events they face and the actions they take. Resources can include personal skills and attributes, such as PsyCap, but, also, financial and social capital. Therefore, PsyCap is closely related to QoL, and, also, to well-being.

QoL and well-being are often used interchangeably and inconsistently within studies (De Leo et al., 1998), primarily because of their objective and subjective components. Langlois and Anderson (2002) argue that QoL results from the congruence between the resources provided by the environment and the needs expressed by individuals, and well-being refers to the dynamic processes that lead to better conditions in life. QoL involves variables such as aspiration and recollection and is more neutral, while well-being is the positive physical, social, and mental state that stems from a series of collective goods and

relationships with people and places (Mohit, 2014). Well-being presupposes that basic psychological needs are met and are determined by conditions such as supportive personal relationships, community empowerment, good health, financial security, rewarding employment, and healthy and attractive environment (Rosly and Abdul Rashid, 2013).

1.5. The present study

With a strong PsyCap, the caregivers can change their perspective on their own life, so as to report high levels of QoL, which will lead to a high level of well-being. Through its components, self-efficacy, hope, resilience, and optimism, PsyCap becomes an inner resource of caregivers, contributing to increasing the quality of their lives and the positive perception of the present and the future.

Taking into account the above, the following hypothesis was established:

H1: Quality of life mediates the relationship between psychological capital and well-being among caregivers of individuals with DS.

2. Methods

2.1. Participants and procedure

Participants were 98 caregivers (mothers) of individuals with DS, all of them women, aged between 25 and 76 years ($M = 52.13$, $SD = 11.39$). The age of individuals with DS ranged between 4 and 42 years ($M = 23.53$, $SD = 10.83$) and the duration of caregiving ranged between 1 and 41 years ($M = 18.80$, $SD = 11.13$). Socio-demographic profiles of the participants are presented in Table 1 (the study took place in Romania).

After receiving the institutional approval (from the Research Ethics Committee of the University of Craiova, protocol no. 1/08.02.2021), recruitment partners were developed consisting in organizations and schools who had relationships with DS individuals' families. These included disability and social service providers, advocacy and support providers, and educational service providers. Participants were recruited online and invited to participate in the study. We provided email invitations, asking partners to reach parents for the recruitment announcement. Of 150 invited caregivers, only 98 agreed to participate in the study (65% response rate). Data were collected between June and December 2021. The questionnaires were administered online. The first section of the form contained a brief description of the study, the informed consent of the participants, and the GDPR agreement. The study was conducted in accordance with the Declaration of Helsinki. In the current research, the snowball sampling technique was used to investigate mother caregivers of individuals with DS, a hard-to-reach population, difficult to involve in public health programs or research (see Shaghaghi et al., 2011).

2.2. Instruments

Socio-demographics—data were collected on nine variables related to demographics of caregivers: gender, age, educational level

TABLE 1 Socio-demographic profile of caregivers.

| Variable | Total n | Total % |
|---------------------------|---------|---------|
| Education level | | |
| Secondary or less | 11 | 11 |
| Higher education | 87 | 89 |
| Monthly income | | |
| < 2,500 RON | 43 | 44 |
| 2,500–5,000 RON | 46 | 56 |
| > 5,001 RON | 9 | 9 |
| Marital status | | |
| Single | 19 | 19 |
| Married/in a relationship | 79 | 81 |
| Residence area | | |
| Rural | 22 | 22 |
| Urban | 76 | 78 |
| Occupation | | |
| Caregiver only | 45 | 46 |
| Caregiver and other | 53 | 54 |

(1—secondary education or less, 2—higher education), monthly income (1—< 2,500 RON, 2—2,500–5,000 RON, 3—> 5,001 RON, 1 USD = 4.69 RON on 3 January 2023), marital status (1—single, 2—married or in a relationship), residence area (1—rural, 2—urban), occupation (1—caregiver only, 2—caregiver and other occupation), caregiving duration, as well as data on age of individuals with DS.

Well-being was measured with Psychological Well-Being Scale (Ryff C. 1989), Romanian version (Kállay and Rus, 2014). The measure consists of 42 items and measures six dimensions of well-being: self-acceptance (e.g., “When I look at the story of my life, I am pleased with how things have turned out”), positive relationships with others (e.g., “Maintaining close relationships has been difficult and frustrating for me”), autonomy (e.g., “My decisions are not usually influenced by what everyone else is doing”), environmental mastery (e.g., “The demands of everyday life often get me down”), purpose in life (e.g., “I enjoy making plans for the future and working to make them a reality”), and personal growth (e.g., “I think it is important to have new experiences that challenge how you think about yourself and the world”). Responses are provided on a six-step Likert scale, where 1—*strongly disagree* and 6—*strongly agree* (there are reverse-scored items, for example, if the scored is 2, the adjusted score is 5, 1 becomes 6 and so on.). In the present study, we used the global score. The global score was calculated by summing the responses to all the 42 items; it ranges between 42 and 252, with an average value of 147; high scores reflect an increased level of well-being.

Psychological capital was measured with Psychological Capital Questionnaire (PCQ; Luthans et al., 2007). The questionnaire consists of 24 items, six for each of the four dimensions: self-efficacy, hope, resilience, and optimism. Responses are provided on a seven-step Likert scale, where 1—*total disagreement* and 7—*total agreement*. The scores for each dimension were calculated by arithmetic means on the answers of corresponding items; scores ranged between 1 and 7, with higher values reflecting higher levels of self-efficacy, hope, resilience, and optimism. Items example: self-efficacy—“I feel confident analyzing a long-term problem to find a solution,” hope—“I can think

TABLE 2 Means, standard deviations, Cronbach Alpha coefficients, and correlations among variables.

| | M | SD | α | SE | HO | RE | OP | QoL | WB |
|-----|--------|-------|----------|--------|--------|--------|--------|--------|----|
| SE | 5.22 | 1.67 | 0.90 | 1 | | | | | |
| HO | 5.89 | 0.86 | 0.83 | 0.62** | 1 | | | | |
| RE | 5.58 | 0.99 | 0.78 | 0.43** | 0.70** | 1 | | | |
| OP | 5.44 | 0.90 | 0.73 | 0.58** | 0.74** | 0.72** | 1 | | |
| QoL | 148.24 | 25.12 | 0.95 | 0.76** | 0.74** | 0.61** | 0.68** | 1 | |
| WB | 184.40 | 28.88 | 0.92 | 0.65** | 0.74** | 0.65** | 0.79** | 0.79** | 1 |

** $p < 0.01$; SE – Self-efficacy, HO – Hope, RE – resilience, OP – Optimism, QoL – Quality of life, WB – Well-being.

of many ways to reach my current (work) goals;” resilience—“I usually manage difficulties one way or another (at work);” optimism—“When things are uncertain for me (at work) I usually expect the best.” For the purpose of this study, those words that refer strictly to work and the organizational environment were removed from the items of the questionnaire, thus adapting the items for the activities of daily living.

Quality of life was measured with Quality of Life Questionnaire (QoLQ; Boixadós et al., 2009). Responses are provided on a five-step Likert scale, where 1—*never* and 5—*always*. The survey consists of 39 items and measures the quality of life, having four dimensions: social support (e.g., “Do you feel that you have someone to turn to when you need company or support?”), general satisfaction (e.g., “Do you feel that life is meeting your expectations?”), physical/psychological health (e.g., “Do you feel that you are in good health?”), and absence of excessive workload/free time (e.g., “Does your work leave you enough free time for other things that you want to do?”). In the present study, we used the global score. The global score was calculated by summing the responses to all the 39 items; it ranges between 39 and 195, with an average value of 117; high scores reflect an increased level of quality of life.

In the case of PCQ and QoLQ, the questionnaires were translated into Romanian by the authors of the current study in accordance with the rules of translation-retroversion-adaptation, a method that has been used in other studies (e.g., Makarowski et al., 2021; Piotrowski et al., 2021). The reliability coefficients (McDonald’s omega - ω) of the scales (considering the three questionnaires), in the present research, can be seen in Table 2.

2.3. Data analyses

All data were exported from Google sheet into SPSS.24 (IBM Corp, Released 2016, IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY). Descriptive statistics and Pearson’s correlation were executed through SPSS, while mediation analysis and the reliability of the scales were executed through Jamovi (The jamovi project, 2021). The effect size index for correlation, r^2 (the coefficient of determination) is interpreted as follows: $r^2 = 0.09$ —a moderate effect; $r^2 = 0.01$ —a small effect; and $r^2 = 0.25$ —a large effect (Cronk, 2020).

3. Results

Means, standard deviations, McDonald’s omega coefficients for the scales of the current study, and correlations among variables are presented in Table 2.

Skewness and kurtosis range between -1.12 and 1.36 , denoting a normal distribution of data (George and Mallery, 2016).

Overall, caregivers reported high levels of psychological capital, with the highest score for hope ($M = 5.89$, $SD = 0.86$), followed by resilience ($M = 5.58$, $SD = 0.99$), by optimism ($M = 5.44$, $SD = 0.90$), and finally by self-efficacy ($M = 5.22$, $SD = 1.67$). At the same time, the ratings for quality of life ($M = 148.24$, $SD = 25.12$) and for well-being ($M = 184.40$, $SD = 28.88$) are more than average.

The correlations among variables are strong. The caregivers with high self-efficacy report also high quality of life ($r = 0.76$, $p < 0.01$, $r^2 = 0.58$) and high well-being ($r = 0.65$, $p < 0.01$, $r^2 = 0.42$); the caregivers with high level of hope report high quality of life ($r = 0.74$, $p < 0.01$, $r^2 = 0.55$) and high well-being ($r = 0.74$, $p < 0.01$, $r^2 = 0.55$); the caregivers with high resilience report high quality of life ($r = 0.61$, $p < 0.01$, $r^2 = 0.37$) and high well-being ($r = 0.65$, $p < 0.01$, $r^2 = 0.42$); and the caregivers with high optimism report high quality of life ($r = 0.68$, $p < 0.01$, $r^2 = 0.46$) and high well-being ($r = 0.79$, $p < 0.01$, $r^2 = 0.62$).

3.1. Hypothesis testing

To test the research hypothesis, a mediation analysis was performed, with the four dimensions of psychological capital (self-efficacy, hope, resilience, and optimism) as predictors, well-being as a dependent variable and quality of life as a mediator. The indirect, direct and total effects of psychological capital on well-being and the component relationships among variables are presented in Table 3.

The indirect effect of self-efficacy on well-being is positive and significant, $b = 3.30$, $CI95\%(1.53, 5.08)$, $\beta = 0.20$, $z = 3.65$, $p < 0.01$; the indirect effect of hope on well-being is positive and significant, $b = 3.48$, $CI95\%(0.75, 6.22)$, $\beta = 0.11$, $z = 2.50$, $p < 0.05$; the indirect effect of resilience on well-being is positive and significant, $b = 1.98$, $CI95\%(0.05, 3.91)$, $\beta = 0.07$, $z = 2.01$, $p < 0.05$; and the indirect effect of optimism on well-being is insignificant, $b = 1.57$, $CI95\%(-0.66, 3.81)$, $\beta = 0.05$, $z = 1.38$, $p = 0.17$.

The component relationships among variables show that quality of life is positively associated with well-being, $b = 0.49$, $CI95\%(0.28, 0.70)$, $\beta = 0.43$, $z = 4.57$, $p < 0.01$, self-efficacy is positively associated with quality of life, $b = 6.71$, $CI95\%(4.55, 8.87)$, $\beta = 0.46$, $z = 6.09$, $p < 0.01$, hope is positively related to quality of life, $b = 7.07$, $CI95\%(2.42, 11.72)$, $\beta = 0.25$, $z = 2.98$, $p < 0.01$, resilience is positively associated with quality of life, $b = 4.01$, $CI95\%(0.50, 7.53)$, $\beta = 0.16$, $z = 2.24$, $p < 0.05$, but optimism is not linked to quality of life, $b = 3.19$, $CI95\%(-1.13, 7.52)$, $\beta = 0.12$, $z = 1.45$, $p = 0.15$.

The direct effects of psychological capital on well-being are insignificant for self-efficacy, $b = 0.31$, $CI95\%(-2.39, 3.02)$, $\beta = 0.02$,

TABLE 3 Mediation analysis for quality of life on the relationship between psychological capital dimensions and well-being.

| Type | Effect | Estimate | SE | 95% C.I. | | β | z | p |
|-----------|---|----------|------|----------|-------|---------|------|------|
| | | | | Lower | Upper | | | |
| Indirect | PCSE \Rightarrow QoL \Rightarrow WB | 3.30 | 0.90 | 1.53 | 5.08 | 0.20 | 3.65 | 0.00 |
| | PCHO \Rightarrow QoL \Rightarrow WB | 3.48 | 1.40 | 0.75 | 6.22 | 0.11 | 2.50 | 0.01 |
| | PCRE \Rightarrow QoL \Rightarrow WB | 1.98 | 0.98 | 0.05 | 3.91 | 0.07 | 2.01 | 0.04 |
| | PCOP \Rightarrow QoL \Rightarrow WB | 1.57 | 1.14 | -0.66 | 3.81 | 0.05 | 1.38 | 0.17 |
| Component | PCSE \Rightarrow QoL | 6.71 | 1.10 | 4.55 | 8.87 | 0.46 | 6.09 | 0.00 |
| | QoL \Rightarrow WB | 0.49 | 0.11 | 0.28 | 0.70 | 0.43 | 4.57 | 0.00 |
| | PCHO \Rightarrow QoL | 7.07 | 2.37 | 2.42 | 11.72 | 0.25 | 2.98 | 0.00 |
| | PCRE \Rightarrow QoL | 4.01 | 1.79 | 0.50 | 7.53 | 0.16 | 2.24 | 0.03 |
| | PCOP \Rightarrow QoL | 3.19 | 2.21 | -1.13 | 7.52 | 0.12 | 1.45 | 0.15 |
| Direct | PCSE \Rightarrow WB | 0.31 | 1.38 | -2.39 | 3.02 | 0.02 | 0.23 | 0.82 |
| | PCHO \Rightarrow WB | 3.21 | 2.65 | -1.98 | 8.40 | 0.10 | 1.21 | 0.23 |
| | PCRE \Rightarrow WB | 3.05 | 1.96 | -0.80 | 6.90 | 0.11 | 1.55 | 0.12 |
| | PCOP \Rightarrow WB | 10.11 | 2.38 | 5.45 | 14.78 | 0.33 | 4.25 | 0.00 |
| Total | PCSE \Rightarrow WB | 3.62 | 1.30 | 1.06 | 6.17 | 0.21 | 2.78 | 0.01 |
| | PCHO \Rightarrow WB | 6.69 | 2.81 | 1.19 | 12.19 | 0.21 | 2.38 | 0.01 |
| | PCRE \Rightarrow WB | 5.03 | 2.12 | 0.87 | 9.18 | 0.18 | 2.37 | 0.02 |
| | PCOP \Rightarrow WB | 11.69 | 2.61 | 6.58 | 16.80 | 0.38 | 4.48 | 0.00 |

SE – Self-efficacy, HO – Hope, RE – resilience, OP – Optimism, QoL – Quality of life, WB – Well-being.

$z=0.23$, $p=0.82$, for hope, $b=3.21$, $CI95\%(-1.98, 8.40)$, $\beta=0.10$, $z=1.21$, $p=0.23$, for resilience, $b=3.05$, $CI95\%(-0.80, 6.90)$, $\beta=0.11$, $z=1.55$, $p=0.12$, and positive and significant for optimism, $b=10.11$, $CI95\%(5.45, 14.78)$, $\beta=0.33$, $z=4.25$, $p<0.01$.

When talking about the total effects of psychological capital on well-being, these are positive and significant. For self-efficacy, $b=3.62$, $CI95\%(1.06, 6.17)$, $\beta=0.21$, $z=2.78$, and $p<0.05$; for hope, $b=6.69$, $CI95\%(1.19, 12.19)$, $\beta=0.21$, $z=2.38$, and $p<0.05$; for resilience, $b=5.03$, $CI95\%(0.87, 9.18)$, $\beta=0.18$, $z=2.37$, and $p<0.05$; and for optimism, $b=11.69$, $CI95\%(6.58, 16.80)$, $\beta=0.38$, $z=4.48$, and $p<0.01$.

4. Discussions

There is no doubt that caregivers of people with Down syndrome (DS) are prone to high levels of stress, given that DS is a lifelong disorder and that caregiver responsibilities increase as the person with DS gets older. However, families and caregivers are gradually developing certain personality attributes and skills that become essential resources in adapting to their life context. In line with the purpose of the current research, the relationship between psychological capital, quality of life, and well-being of caregivers of individuals with DS were investigated. The descriptive analysis showed that the participants reported high levels for all dimensions of PsyCap and well-being, as well as for QoL. Statistical analysis showed that three out of the four dimensions of PsyCap are positively associated with QoL (self-efficacy, hope, and resilience, but not optimism) and only one dimension (optimism) is associated with well-being—the direct effect, when talking about the mediation analysis. QoL is a significant mediator in the relationships between self-efficacy, hope, resilience, and well-being, but not in the relationship between optimism and

well-being. The total effects are, anyway, positive and significant, QoL being a significant mediator in the relationship between PsyCap and well-being in caregivers/mothers of individuals with SD.

These results can be attributed to the fact that caregivers are people who successfully integrate the responsibilities they have in relation to the individual with DS. The challenges posed by this situation lead to the development of traits and skills that lead to personal growth and good management of stressful or critical situations. High levels of self-efficacy, hope, and resilience can make caregivers feel that they have a normal life, perceiving a more than average QoL and benefiting from all its components: meaningful work, acceptable family relationships, time for self-care, and good health. This positive perception of QoL leads to a higher well-being, the caregivers being satisfied with their level of autonomy, their control over the environment, the quality of interpersonal relationships, have high levels of self-acceptance, personal growth, and maybe the most important, considering meaning of life. It should be noted that the participants are mothers of individuals with DS. In a family with a member with DS daily routines change, the home adjusts, relationships and priorities change, but in essence, life takes its course, and the responsibilities generated by this situation become real challenges that must be successfully overcome. A number of studies showed that mothers of children with DS experienced better well-being and less burden than mothers of children with other intellectual disabilities (Hodapp et al., 2001; Hodapp, 2002). The above-average results for QoL and well-being could be attributed to marital status, 81% of mothers being married and having a stable relationship. Previous studies reported that married couples split the care and responsibilities, which can contribute to a higher well-being (Zajicek-Farber et al., 2015).

Optimism was not significantly associated with QoL, which may be due to the fact that QoL is a variable that refers to the concrete living conditions of the individual, to the way he/she lives the daily life, and

optimism can diminish the pragmatic nuance of caregivers' existence, who have increased responsibilities in the family. Conversely, optimism is positively associated with well-being, which reflects its subjective nature. Well-being implies the subjective perception of the reality in which the individual lives his life, thus it is natural that optimism contributes to a higher well-being, allowing the caregiver to view life in a positive light. Optimism has a special contribution in building well-being because it predisposes the person to a positive approach to the life situations. None of the other three dimensions of PsyCap were directly associated with well-being, but only through the mediation exerted by QoL. Manzano-Garcia and Ayala (2017) obtained similar results in a study on the relationship between PsyCap and well-being among specialists working with people with autism. As mentioned authors asserted, PsyCap is a valuable personal resource and through its components helps the caregiver to successfully cope with the demands, obstacles, and adversities they face. In the same direction, Larue (2014), in a study on social workers working with traumatized people, analyzed the relationship between PsyCap and well-being, as well as the mediating role of flexible coping. Their results showed that only PsyCap is responsible for the high level of well-being, but not flexible coping. On the other hand, Isa et al. (2016) showed that adaptive coping contributes to increasing the well-being of caregivers of children with disabilities (especially optimism, acceptance, and religiosity). Self-efficacy, as a component of PsyCap, has also been shown to be an important resource in maintaining a high level of well-being and even of health state (Rezendes and Scarpa, 2011; Guíllamón et al., 2013). Also, Truitt et al. (2012) showed that hope (another component of PsyCap) contributes significantly to increasing adaptation to uncertainty among caregivers of children with DS, which implicitly leads to increased well-being.

We consider that psychological capital can provide a viable solution to enhance the quality of life and well-being of caregivers of individuals with DS. The power of people to move forward and face life's obstacles is immeasurable. If at the level of individuals with Down syndrome, there are implemented programs aimed to improve some components of the quality of life (Cosma et al., 2017; Barbu et al., 2021), counseling activities of caregivers should be taken into consideration with more involvement, at least in Romania. Support groups can be set up for caregivers to talk about their own experiences, about the obstacles they have faced and about the ways in which they have overcome them. This sharing of information and the search for the normalization of their life experiences will facilitate a better understanding and adaptation to the role of caregiver and will probably increase overall psychological capital. In addition, these meetings can help increase socialization and thus improve the quality of life with positive implications for well-being. Support groups may be moderated by psychologists or other specialists to further inform caregivers and suggest ways to overcome mental barriers.

The present research has some limitations. One of the limitations refers to the exclusive participation of women and the online application of the questionnaires (explicit measures/self-report tools assume the issue of desirable answers, aspect known in the literature; see Predoiu et al., 2022). However, the relatively large number of mother caregivers of individuals with DS tested represents a strength of the research. Another limitation is the *ex post facto* design, a longitudinal study, in the future, being more relevant in order to follow the evolution, over time, of psychological capital, perceived quality of life, and caregivers' well-being, differentiating, also, between those with a shorter duration and those with a longer duration of caregiving activity. Also, further studies could

examine, separately, dimensions of well-being, such as self-acceptance, autonomy, positive relationships with others, environmental mastery, purpose in life, personal growth, and dimensions of quality of life—general satisfaction, social support, physical/psychological health, and absence of excessive workload/free time. Not least, the results might be different if only younger (or older) women were investigated, or taking into account the age of individuals with DS (only children, teenagers, or adults).

5. Conclusion

In summary, caregivers (mothers of individuals with DS) reported high levels of psychological capital, with the highest score for hope, followed by resilience, optimism, and self-efficacy. People with higher levels of PsyCap are better able to handle adversities and challenging situations, so they can perceive a higher QoL and have a higher level of subjective well-being. Considering the perceived quality of life and well-being the results are, also, above average. An indirect effect of self-efficacy, hope, and resilience on caregivers' well-being was highlighted. Quality of life was positively related to well-being, hope, self-efficacy and resilience, but not with the optimism level, while the direct effects of psychological capital on well-being are insignificant for self-efficacy, hope, resilience, but significant for optimism. PsyCap dimensions (SE, HO, and RE) were directly associated with well-being, but only through the mediation exerted by QoL.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Research Ethics Committee of the University of Craiova, protocol no. 1/08.02.2021. The patients/participants provided their written informed consent to participate in this study.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Implementing the Bashayer chatbot in Saudi higher education: measuring the influence on students' motivation and learning strategies

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Since the fourth industrial revolution, intelligent software and applications that attempt to mimic human behavior have become increasingly common. The chatbot is an example of an artificial intelligence-based computer program that simulates human behavior by having a conversation and interacting with users using natural language. The implementation of chatbot technology in the educational context is still in its nascent stage, and further investigation into measuring its effectiveness in supporting learning and teaching processes is required, particularly in the context of higher education. Thus, this study presents the design and implementation of a task-oriented chatbot, that is embedded into the WhatsApp application, called Bashayer. It aims at supporting postgraduate students' motivation and learning strategies in Saudi Arabia. A quasi-experimental design with a single-subject experimental approach was adopted with a sample of 60 Saudi postgraduate students. The descriptive analysis of the collected data showed promising results of postgraduate students utilized the Bashayer chatbot system. Participants in the experimental group that used Bashayer were more motivated to learn than those in the control group. Participants also practiced more cognitive and metacognitive learning strategies while utilizing the chatbot compared to the control group. The results of this study are encouraging for the development of chatbot systems similar to Bashayer to support postgraduate students' successful learning. These results contribute to bridging the research gap and adding to the literature on chatbots use in postgraduate educational contexts.

KEYWORDS

chatbot, artificial intelligence (AI), higher education, motivation, learning strategies, Saudi Arabia

Introduction

The use of artificial intelligence (AI) technologies in the educational context is increasing. Chatbot technology is an AI application promoted to improve teaching and learning practices (Okonkwo and Ade-Ibijola, 2021). Through conversational interactions and simple user interfaces, chatbots encourage users to actively communicate, explore, and build knowledge (Poncette et al., 2020; Chang et al., 2022). Chatbots are defined as conversational tools that provide users instant services and responses (Smutny and Schreiberova, 2020; Okonkwo and Ade-Ibijola, 2021). According to Pérez et al., "a chatbot is a tool that combines artificial intelligence (AI) and natural language processing or other

technology, which enables it to interact to a certain level of conversation with a human interlocutor through text or voice” (2020, p. 1). Chatbots have been gaining popularity in a variety of industries because of their ability to mimic human conversation, which results in automated services and, consequently, reduced human labor (Ondáš et al., 2019; Alhassan et al., 2022; Kuhail et al., 2022b). Joseph Weizenbaum created the first chatbot, ELIZA, in 1966. Since then, the ubiquity of chatbots on the internet has grown rapidly (Fryer et al., 2019). The global chatbot industry is predicted to be worth 1.23 billion dollars by 2025 (Kaczorowska-Spychalska, 2019). Chatbots have the potential to support the field of teaching–learning and act as intelligent tools that accommodate students’ habits and needs (Tamayo et al., 2020; Troussas et al., 2022). This is particularly true for higher education contexts, where students are autonomous, self-regulated learners.

Chatbots have the potential to transform the educational landscape by engaging learners, customizing learning experiences, assisting instructors, providing deep insight into learner behavior, and creating a more personalized, engaging learning environment for students (Gonda et al., 2018; Cunningham-Nelson et al., 2019; Bezverhny et al., 2020; Villegas-Ch et al., 2020; Kuhail et al., 2022b). These pedagogical agents allow students to obtain individualized and timely feedback through conversations and be guided through virtual environments (Gonda et al., 2018). Chatbots are becoming increasingly prevalent to promote student learning in e-learning systems (Colace et al., 2018). As support for mobile learning, they are embedded in several e-learning environments, including learning management systems, social network platforms, and digital learning platforms (Wollny et al., 2021; Troussas et al., 2022). Chatbots can instantly provide students with course content, practice questions and answers, assessment criteria, important due dates, academic advising services, directions around campus, and study materials (Mabunda and Ade-Ibijola, 2019; Durall and Kapros, 2020; Okonkwo and Ade-Ibijola, 2021). But these intelligent systems do not stop there; they can also improve student participation and reduce teachers’ workloads, allowing the latter to devote more time to curriculum development and evaluation (Cunningham-Nelson et al., 2019).

Several studies have been conducted on the application of chatbot technology to the educational context, such as to answer students’ queries, help students learn computer programming concepts, provide assessments of students’ performance capabilities, and provide administrative services (Clarizia et al., 2018; Sinha et al., 2020). Moreover, with the rising demand for learning, higher education institutions are under a great deal of pressure to accommodate a larger number of enrolments. As the number of students increases, academic support for students significantly decreases. This has been known to lead to ineffective learning and result in higher dropout rates. Although there are several theoretical solutions to this issue, most are impractical to implement due to budgetary and organizational constraints (Hien et al., 2018). In order to tackle this enormous challenge, tertiary instructors have begun to integrate chatbots into their teaching as pedagogical agents. Chatbots can support individual student learning in large-scale learning environments by assisting the

instructor in instantly replying to students’ queries, training learners using a variety of learning resources, reintroducing course content and materials, and collecting feedback on training courses (Winkler and Söllner, 2018; Almutadha, 2019).

Despite the promising results shown by many chatbot application studies in improving the teaching and learning process, their widespread incorporation in higher education contexts is still in its infancy and requires extensive research and study, particularly in the field of how students learn through these smart systems. The current study thus seeks to investigate the effect of a task-oriented chatbot system called Bashayer, which is embedded into WhatsApp, in supporting postgraduate students’ motivation and learning strategies.

Significance and contribution of the study

The COVID-19 pandemic has had a drastic effect in changing the higher educational landscape. Among the most prominent effects is greater reliance on mobile technology and its applications for learning, particularly with the growing number of mobile users and increasing internet availability around the globe (Bahja et al., 2020; Almurayh, 2021). This has led to a significant increase in the use of AI-based tools in education, especially chatbots as a conversational system that serve remote learning (Troussas et al., 2019). For example, Sandu and Gide (2019) confirmed that in the 2021 academic year, 48.9% of higher education students in India used chatbots to communicate with their academic institutions. The study predicted that chatbots will become the most popular technology to solve students’ educational problems due to their increased availability and convenience. According to Hien et al. (2018), chatbots can assist higher education institutions in enhancing their existing services, minimizing staff expenses, and providing new and innovative services. Chatbot technology implementation in teaching–learning practices is anticipated to be ubiquitous in the future. This is particularly true for higher education and is driven by the current emphasis on digital transformations in the direction of AI-enhanced learning environments imposed by the fourth industrial revolution and fifth-generation technologies. In this context, this research study is motivated by the recommendations of existing literature, which has identified the need to integrate smart AI-chatbot systems into the education sector to implement student-centered learning and address various learning challenges (Sandu and Gide, 2019; Heryandi, 2020; Sjöström and Dahlin, 2020). In their recent systematic literature review, Kuhail et al. (2022b) recommended that future investigations should focus on exploring the impact of chatbots on learner satisfaction and learning effectiveness.

Despite the large body of research that measured the effects of chatbot technology on teaching and learning practices, most studies have been conducted on undergraduate and K-12 students. There is a scarcity of chatbot research with postgraduate students that measures its impact on their motivation and learning strategies. Due to the nature of postgraduate education, and the emphasis

TABLE 1 Recent empirical studies on integrating chatbot technology to promote teaching and learning.

| Study | Purpose | Sample and context | Key findings |
|----------------------------|--|---|--|
| Troussas et al. (2019) | Exploring the effect of a developed chatbot in supporting personalized learning experience | K-12/language learning/mobile learning | Promising results in supporting students' learning process. |
| Pereira et al. (2019) | Investigating the influence of using a chatbot to promote learning motivation and peer-to-peer assessment | Undergraduate students/massive open online course (MOOC)/ higher education | The use of a chatbot improved peer assessment and overall learning. Ninety percent of the students support using chatbots in their future classes. |
| Nghi et al. (2019) | Assessing the effectiveness of using chatbots to support learning engagement and performance | Undergraduate students/language learning/higher education | The majority of students indicated the potential for chatbots to enhance their learning process. They also indicated that learning became more fun and exciting with chatbots. |
| Chen et al. (2020) | Examining the influence of employing a designed chatbot for acquiring Chinese language. | Undergraduate students /language learning (Items)/higher education | Students confirmed that the chatbot supported their Chinese item acquisition. Significant improvement in students' learning achievements. |
| Lin and Chang (2020) | Exploring the effect of chatbots on promoting writing skills | Post-secondary writers/language learning (writing)/k-12 education | Chatbot has a positive influence on students' writing skills and peer feedback process. |
| Mendoza et al. (2022) | Evaluating a proposed chatbot system to support teacher-student interaction. | Third-year middle school students and teachers/online learning/k-12 education | Third-year teachers and students indicated positive outcomes of using a chatbot to support student-teacher interaction. |
| Lee et al. (2020) | Investigating the use of a developed chatbot as an online instructor in a computer science course | Undergraduate students/online learning higher education | Students showed a positive reaction toward the use of a chatbot as an online tutor and suggested its integration into other e-learning platforms. |
| Chuah and Kabilan (2021) | Examining the perceptions of English teachers toward using chatbot technology to support teaching-learning process <i>via</i> a mobile learning environment. | English teachers/mobile learning/teacher education | Chatbot was useful in providing feedback, stimulating interaction cycles, and increasing the level of social presence that results in an active learning environment. |
| Deveci Topal et al. (2021) | Investigating the influence of chatbots on attitudes and learning achievement. | Fifth-grade students in science course/k-12 education | Chatbot has no significant effect on learning achievement. Students indicated the usefulness and enjoyment of using chatbots, which resulted in a positive online learning experience. |
| Kumar (2021) | Exploring the effectiveness of using educational chatbots on learning performance within a collaborative learning environment. | Undergraduate students/online learning higher education | Educational chatbots improved learning performance, collaboration, and teamwork. However, there was no impact on self-efficacy, motivation, or cognition. |
| Yin et al. (2021) | Investigating the impact of a chatbot within a micro-learning environment on motivation level and learning performance. | Undergraduate students enrolled in micro-learning/higher education | Chatbot increased students' intrinsic motivation and learning performance. |
| Chang et al. (2022) | Assessing the influence of a mobile chatbot to improve learning performance and self-efficacy among nursing students | Nursing students/professional training program | Chatbot improved nursing students' learning performance, engagement, success, and self-efficacy. |
| Fidan and Gencel (2022) | Exploring the impact of a chatbot embedded in instructional videos to support learning performance and enhance intrinsic motivation | Undergraduate pre-service teachers/online learning/higher education | Chatbot enhanced preservice teachers' intrinsic motivation and learning performance. |
| Khalil and Rambech (2022) | Investigating students' perception toward an integrated chatbot in Telegram learning-based platform | Undergraduate students/online learning/higher education | Students found learning with the chatbot was easy, useful, efficient, and engaging. |
| Kohnke (2022) | Exploring the influence of chatbot use in supporting distance learning | Undergraduate students/distance learning/higher education | Students considered the instructional chatbot helpful in giving a sense of human interactions; reduced feelings of loneliness resulted in better learning engagement. |

on students being self-learners, self-motivators, and self-regulators of their learning strategies, it is important to measure chatbot technology's effect on learning motivation and strategies at this level. Furthermore, a thorough investigation of related literature reveals that motivation and learning strategies have not been comprehensively explored in the postgraduate context. Most

chatbot studies focus on measuring impact on general learning motivation and cognitive skill acquisition. Hence, our study is unique in its use of the framework developed by Pintrich (1991) to comprehensively measure the Bashayer chatbot system's influence on motivational orientation through task value, self-efficacy, and cognitive and metacognitive learning strategies. Additionally, there

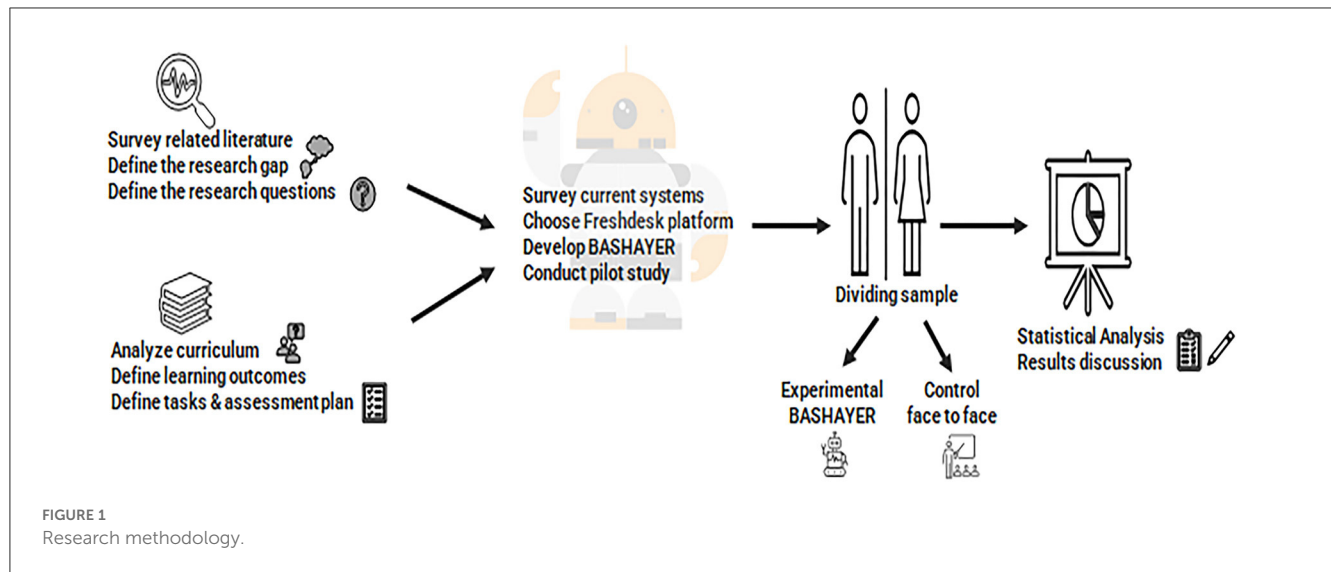


TABLE 2 MLSQ scale reliability test.

| MLSQ | | Item No. | Pilot study α | Current study α | Original scale α |
|---------------------------|--|----------|----------------------|------------------------|-------------------------|
| Scale | Subscale | | | | |
| Motivation scale | Task value | 6 | 0.78 | 0.80 | 0.75 |
| | Self-efficacy for learning and performance | 8 | 0.84 | 0.86 | 0.70 |
| | Total | 14 | 0.81 | 0.85 | 0.73 |
| Learning strategies scale | Cognitive | 12 | 0.81 | 0.82 | 0.72 |
| | Metacognitive self-regulation | 12 | 0.85 | 0.87 | 0.79 |
| | Total | 24 | 0.83 | 0.86 | 0.76 |

has been a paucity of empirical research conducted in Saudi higher education environments. Only two studies, conducted by Alqaidi et al. (2021) and Al-Ghadhban and Al-Twairash (2020), were found to explore the effects of chatbots in supporting Saudi undergraduate students' learning enquires. However, these studies did not focus on measuring actual learning practices or students' motivational orientations toward chatbots. Therefore, the results of our study will contribute to bridging the research gap in the field of chatbot applications in the Saudi higher education context.

To achieve this goal, the current study aims to integrate the Bashayer chatbot system into a social learning platform via WhatsApp and investigate its effect on the motivation and learning strategies of postgraduate students at King Faisal University, Saudi Arabia. It intends to contribute to the literature on integrating chatbot technologies into education by focusing on two significant factors: learning motivation (task value and self-efficacy for learning and performance) and learning strategies (cognitive and metacognitive self-regulation). These results will contribute to bridging the research gap and adding to the pool of existing literature on chatbot use among postgraduate students. These findings will shed light on the potential of such intelligent tools in increasing learners' motivation and

facilitating the practice of learning strategies both cognitively and metacognitively.

Literature review

The chatbot technology and its architecture

Chatbots rely on a variety of frameworks that govern their operations. For example, chatbots developed by Microsoft differ from those developed by Facebook (Manaswi, 2018). Although they both have the same purpose of receiving instant messages, they differ in the programming languages used in their development, the type of conversations they provide to the user, and the data models stored in their databases (Hwang and Chang, 2021). Chatbot architecture can be divided into two types. The first is task-oriented chatbots. These are concerned with accomplishing a specific task, and they are prepared in a way that answers the user's inquiries through dialogue. The second is non-task oriented chatbots, which aim to add humor and fun to ordinary conversations without a commercial purpose (Hussain et al., 2019; Vijayakumar et al., 2019).

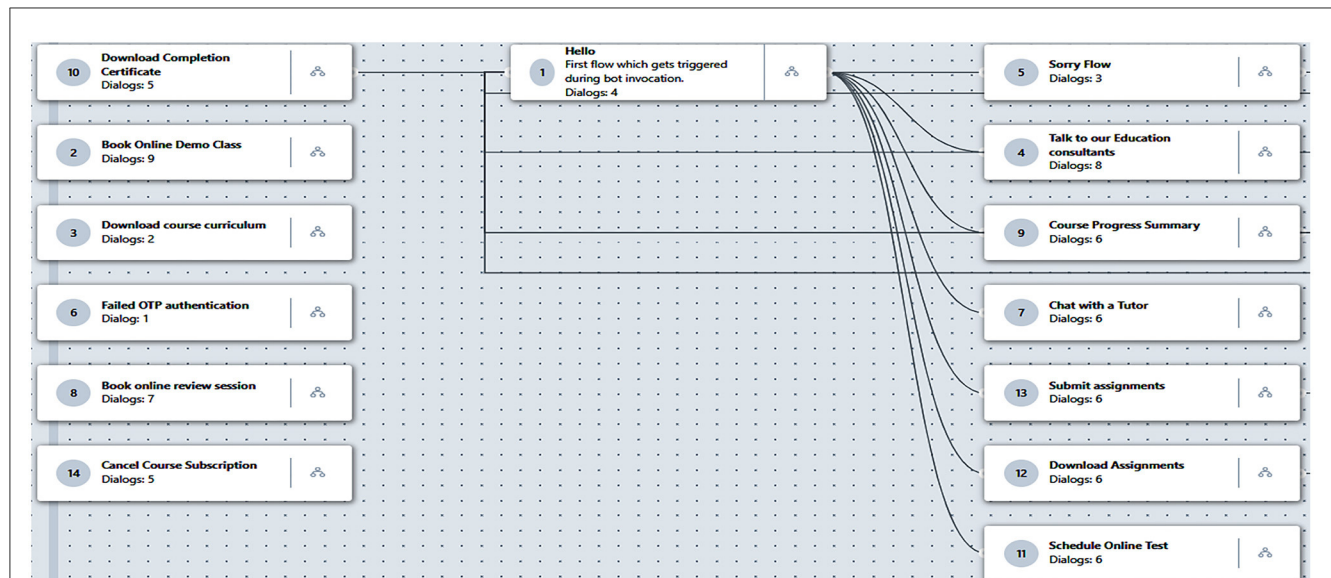


FIGURE 2
Navigation flow map for the Bashayer chatbot system.

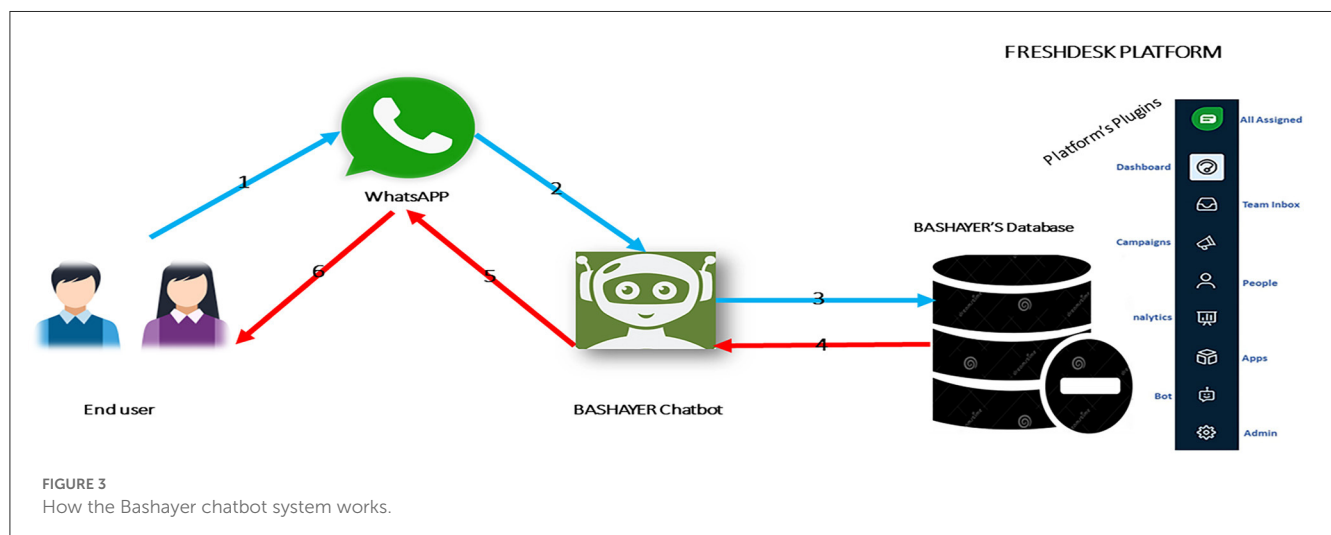


FIGURE 3
How the Bashayer chatbot system works.

Hwang and Chang (2021) identified two key components of the chatbots that engage with users using natural language. First, the user message analysis component determines the user's intentions and purpose. Second, the response generation component provides the user with an appropriate response depending on the context and information available to it from the existing dialogue (e.g., user data, geographical area, login times, and clicks to navigate within the chatbot system). In this manner, appropriate responses are presented to the user considering the intent of the conversation and contextual information (Hwang and Chang, 2021). Studies have shown that chatbots have three types of appropriate response generation models: pattern-based, retrieval-based, and generative models (Manaswi, 2018). The pattern-based model generates appropriate responses depending on the exact match between the question and the answer stored in the database. The retrieval-based model has a higher degree of flexibility and relies on available

queries and analyses, such as the context of the user information and data. The generative model relies on analyzing past and current user contexts to generate appropriate responses.

In the current study, the proposed Bashayer chatbot system employs the retrieval model to provide increased flexibility and support in the educational services it provides to postgraduate students. It is also a task-oriented chatbot built to attain a set of learning goals through interactions with postgraduate students in their courses.

The adoption of chatbot technology in education

Chatbots integration into e-learning environments over the past decade reflects an increasing interest in their utility in

teaching–learning modalities (Troussas et al., 2019; Smutny and Schreiberova, 2020). Pedagogically, chatbots can be used as conversers, helplines, and recommendation tools (Lin and Chang, 2020). According to Pérez-Marín (2021), chatbots may engage with students in the role of advisors, tutors, classmates, or gamers. These innovative tools can promote student learning motivation, cognitive skill acquisition, and overall performance (Lin and Mubarak, 2021; Okonkwo and Ade-Ibijola, 2021; Pérez-Marín, 2021; Fidan and Gencel, 2022). Learners can develop their skills by using chatbots to assess their behavior and keep track of their advancement (Colace et al., 2018). Chatbots' consistency, availability, and accessibility as conversational agents facilitate active interactions, which result in engaging experiences for learners (Sriwisathiyakun and Dhamanitikul, 2022). Such easy and flexible interactions, powered by chatbot technology, enhance autonomous learning, learning engagement, goal orientation, learning strategies, and achievement (Winkler and Söllner, 2018; Durall and Kapros, 2020; Pérez et al., 2020; Smutny and Schreiberova, 2020; Du et al., 2021; Haristiani and Rifai, 2021). In addition, chatbots have the potential to activate students' problem-solving and critical thinking skills (Goda et al., 2014; Pérez-Marín, 2021; Cabrera et al., 2022), develop learning self-efficacy and self-organization (Durall and Kapros, 2020; Pérez et al., 2020), promote stress management and self-direction (Park et al., 2019), and enhance self-regulation in education (Calle et al., 2021; Cabrera et al., 2022).

Chatbot technology has many positive effects and great potential for learning and teaching applications. The chatbot-based environment greatly accentuates how content and materials are presented through the segmentation of learning modules and the organization of learning tasks. Thus, it supports autonomous learning, which is when a learner is able to determine their own learning priorities (Pérez et al., 2020; Haristiani and Rifai, 2021). This allows them to decide what, how, and when to learn, thus supporting the principles of mastery learning (Troussas et al., 2019). This can be facilitated by offering various activities and enabling students to engage step by step in learning while providing continuous support and feedback, which ultimately allows learners to master the required knowledge and skills. This makes chatbots' learning environments full of educational opportunities characterized by quality and efficiency. Chatbots also promote participatory learning and the exchange of learning materials between individuals regardless of temporal and special boundaries. In addition, they provide immediate support for learning activities by peers within the same learning environment. This results in the enhancement of the concept of personalized learning by providing learning modules that are compatible with students' cognitive styles (Okonkwo and Ade-Ibijola, 2021; Troussas et al., 2022). Furthermore, chatbots support mobile learning and thus benefit from constant availability. They are thus considered to be a practical application of the concept of ubiquitous learning (Heryandi, 2020; Sjöström and Dahlin, 2020). Chatbot applications are characterized by a familiar user interface that relies on the dialogue style, which is a human characteristic, and easy operating systems that students use in their daily life, such as Android or Apple. Chatbots depend on the transfer of knowledge to the learner through dividing and displaying content in a way that facilitates memorization, retrieval, and, thus, mastery

of learning. Chatbots also rely on innovative methods to provide tests, assessments, and feedback that are compatible with mobile devices' physical characteristics (Troussas et al., 2020; Wollny et al., 2021).

Many researchers have designed and developed chatbots for various educational contexts and using different sample populations, but they all have one common goal: to evaluate the influence of these intelligent systems on the effectiveness and quality of teaching and learning practices. Findings from recent empirical research on chatbot use to support teaching and learning has been summarized in Table 1.

Most of these studies have been conducted in the context of higher education and employ undergraduate students as the sample population. Few have been developed to assess the effect of chatbots on students' learning in K-12 education. These studies have been carried out in different educational contexts and learning environments, including distance learning (Kohnke, 2022), online learning (Lee et al., 2020; Troussas et al., 2020; Mendoza et al., 2022), mobile learning (Troussas et al., 2019; Chuah and Kabilan, 2021), massive open online courses (MOOCs) (Pereira et al., 2019), micro-learning (Yin et al., 2021), teacher education (Chuah and Kabilan, 2021), professional training (Chang et al., 2022), K-12 language learning (Chen et al., 2020; Lin and Chang, 2020; Troussas et al., 2022), and science education (Deveci Topal et al., 2021). The vast majority of chatbots have been employed as teaching agents and assessed using the experimental approach, and the findings largely point to improved learning performance and satisfaction (e.g., Pereira et al., 2019; Chen et al., 2020; Yin et al., 2021; Khalil and Rambech, 2022). Only two studies reported chatbot use to have a non-significant effect on learning outcomes (Deveci Topal et al., 2021), cognition, motivation, and self-efficacy (Kumar, 2021).

From a teaching perspective, many studies have indicated that using chatbots on teaching practices yields positive results. For example, Gonda et al. (2018) discussed the use of a chatbot developed to advance the teaching process, particularly learning assessment. Wu et al. (2020) found that chatbots within e-learning platforms outperformed teachers in acting as a helpline service. Huang et al. (2021) evaluated the use of chatbots pedagogical and social contexts. They discovered that chatbots appeared to promote students' social presence through open, emotive, and coherent dialogue. Bii et al. (2018) investigated teachers' attitudes toward employing chatbot technology for teaching–learning purposes, and the results were found to be highly positive. Hobert (2019) designed Coding Tutor, a tutoring chatbot system, to enhance the teaching of a programming course. It was found to be successful in assisting both teaching and learning. In general, in most studies, a positive trend was observed toward an increase in the use of chatbots in future education (Pereira et al., 2019; Lee et al., 2020; Chuah and Kabilan, 2021; Fidan and Gencel, 2022; Khalil and Rambech, 2022; Mendoza et al., 2022).

Related works

Song et al. (2017) designed and developed a chatbot system to encourage meaningful interactions between graduate students in online courses. Their findings demonstrated that immediate

interactions related to course content between learners and chatbot systems are best suited to graduate-level online courses. Alkhoodri et al. (2020) developed the UniBud chatbot, which provided students with voice interaction systems for academic advising. UniBud was found to support a restricted range of academic queries, which permitted academic advisors to answer more involved questions. Kuhail et al. (2022a) developed MyAdvisor, a chatbot for academic advising that used real-world advising scenarios. Students were found to quickly understand it and found it useful. Calle et al. (2021) developed a chatbot-based recommendation system to help students self-manage their learning by delivering suggestions for time, sessions, resources, and activities inside a virtual platform to achieve better outcomes. All four studies dealt with measuring chatbots systems' capabilities in terms of their efficiency in supporting interactions with and academic advising for university students. Given the importance of measuring chatbots' influence on actual learning processes, the current study differs from this literature pool. It empirically measures chatbots' effectiveness in developing motivation levels and supporting cognitive and metacognitive learning strategies.

Another study by Abbasi and Kazi (2014) found that chatbot use had a positive effect on students' memory retention and learning performance. Goda et al. (2014) demonstrated that chatbot use improved students' critical thinking skills and learning engagement in learning the English language. Bailey et al. (2021) created Storybot, a narrative-focused chatbot for language acquisition, and it was found to enhance the students' reading comprehension. They indicated that Storybot was easy to navigate and helped them achieve their learning goals. The current study agrees with this body of research in focusing on the impact of chatbot systems on the learning process, such as achievement and learning engagement. However, it varies from these studies in that it comprehensively measures motivation level through task value and self-efficacy as well as cognitive and metacognitive learning strategies using the conceptual framework by Pintrich (1991). Also, the current study employs a sample of postgraduate students, unlike previous studies that focused only on undergraduate students.

Chatbots are widely utilized in the context of language learning because they provide a free and accessible form of language interaction (Fryer et al., 2019; Haristiani, 2019). Troussas et al. (2017) developed the ALICE chatbot to teach English while providing integrated support to students' learning and assessment. The results indicated that the built-in conversation was beneficial to the mobile learning experience, and the students' feedback was very encouraging. This study is similar to the current research in the possibility of providing students continuous learning support and educational content in a variety of forms. The current study is also characterized by its provision of multiple types of immediate or deferred support and feedback. Haristiani and Rifai (2021) developed Gengobot, a chatbot-based Japanese grammar learning system that was demonstrated to be an engaging, creative, and interactive tool for autonomous learning. Lin and Chang (2020) developed a chatbot to promote the writing skills of post-secondary writers, and they concluded that it has positive effects. They discovered that chatting with chatbots during lessons motivates students to learn, and chatbots make learning easier, more manageable, and more enjoyable. All the aforementioned

studies developed chatbot systems and tested their impact on the language learning outcomes of K-12 students. The current study has the advantage of examining chatbot system effectiveness in a different context of language learning with postgraduate students.

Troussas et al. (2020) developed a smart educational application through Facebook called i-LearnC#. It aimed to support student learning by relying on the virtual trainer method to establish a private teaching platform. The application employed the cluster analysis method to recommend optimal groups for student cooperation. The results indicated that the application was educationally beneficial for higher-education students, and it worked to promote effective learning through its role as an adaptive, smart, social learning environment. This study is similar to our current study in that our study relies on the WhatsApp application, and the virtual tutor's method. The current study differs in that it employs the Bashayer system in the context of postgraduate studies and focuses on measuring cognitive and metacognitive learning strategies instead of only determining their impact on enhancing learning and the consequent extent of acceptance.

Troussas et al. (2022) presented an educational application based on mobile learning to provide interactive educational activities and motivational feedback for primary school students to develop their cognitive skills. The results revealed the efficiency of the designed application in developing students' cognitive skills and internal motivations. This study aligns with our current study in its focus on measuring motivation and cognitive learning, but the current study deals with a different study population of postgraduate students. Furthermore, it focuses not only on the acquisition of cognitive skills but also on chatbots' impact in supporting both cognitive and metacognitive learning skills.

Methodology

The current study followed a quantitative approach, which examines an educational phenomenon from the participants' point of view (Leedy and Ormrod, 2005). Therefore, a quasi-experimental design was adopted to determine the relationship between the current study's variables, which mainly depends on the field rather than laboratory experimentation (Neuman and Robson, 2014). The study relied on single-subject experimental methods based on studying the effect of the independent variable on the dependent variables (Neuman and McCormick, 1995). It aimed to investigate the effect of the Bashayer chatbot system (independent variable) integrated into a social network (WhatsApp) to support both motivation and learning strategies (dependent variables). Therefore, the current study attempts to answer the following research questions: (1) Does the use of the Bashayer chatbot system enhance postgraduate students' learning motivations? (2) Does the use of the Bashayer chatbot system enhance postgraduate students' learning strategies?

This study's procedures are outlined in Figure 1. It began by analyzing the relevant literature and identifying the research gap and research questions. Following this, the targeted courses were analyzed in terms of defining learning outcomes, learning tasks, and assessment methods. Current chatbot systems were then reviewed and a platform (Freshdesk) was determined

accordingly. The Bashayer chatbot system was designed and exported on the platform. A pilot study was conducted to evaluate the initial design and propose any changes and required amendments. Next, the student sample was divided into two study groups, the control and the experimental, and Bashayer was applied to the experimental group. Finally, the study survey instrument was administered to the two groups, and the necessary statistical measurements were calculated to answer the research questions.

Setting and sample

The study sample consisted of male and female Saudi postgraduate students enrolled in the Master of Educational Technologies program at the College of Education at King Faisal University. Participants were enrolled in two courses: Reading in Educational Technologies in English Language and Dissertation. A purposeful random sample of 70 male ($N = 15$) and female ($N = 55$) students was selected. The participants' ages ranged from 21 to 30 years, and all were enrolled in the first semester of the 2022–2023 academic year. For the purpose of this study, the sample was divided into 10 postgraduate students in the pilot study, 30 postgraduate students in the experimental group (who were taught via online mode using the Bashayer chatbot system), and 30 postgraduate students in the control group (who were taught via traditional face-to-face mode). The participants had to provide informed consent to participate in this study and submit responses to the questionnaires, which ensured their voluntary participation, privacy, and data confidentiality. All their information was used for scientific research purposes only.

Measurement

To achieve the purpose of this study, the motivated strategies for learning questionnaire (MSLQ) was utilized (Pintrich, 1991). It is a self-reported instrument developed to investigate learning motivation and learning strategies. The survey questionnaire consists of two main scales with a total of 38 items: the motivation scale (14 items) and the learning strategies scale (24 items). The motivation scale includes two subscales: task value (6 items) and self-efficacy for learning and performance (8 items). According to Pintrich (1991), task value refers to the degree that students perceive the course material to be interesting, important, and useful, whereas self-efficacy refers to students' confidence and ability to successfully perform learning tasks. The learning strategies scale (24 items) includes two subscales: cognitive learning strategies (12 items) and metacognitive self-regulation learning strategies (12 items). Cognitive learning strategies in this context refers to the cognitive processes that students perform when learning. It ranges from simple practices, such as remembering (listing and naming) and understanding (paraphrasing and summarizing), to the practice of organizing (clustering and outlining), to critical thinking (reasoning and problem solving). However, for the purpose of this study, we focus on cognitive learning strategies that include remembering,

understanding, and organizing, while the metacognitive self-regulation learning strategies relate to control and self-regulation. These entail students planning, monitoring, and regulating their own learning. Examples include setting goals, tracking cognitive learning, self-testing, and checking and correcting learning as they progress through a task. The participants were asked to respond to the 38-item MSLQ using a 5-point Likert scale. The scale score ranged from 38 (lowest) to 190 (highest).

The MSLQ survey questionnaire has been empirically validated by Pintrich (1991). For this study, the questionnaire was translated into Arabic; therefore, the validity of its content was assessed. This was ascertained by consulting the opinion of three experts who specialized in educational technology and were proficient in English. They examined the translation in terms of meaning accuracy and consistency with the original MSLQ items. The experts deemed the majority of the 38 items to be accurate and advised a few items be rephrased for improved clarity. After following these suggestions, the instrument was finalized.

The statistical reliability of the MSLQ was measured by calculating each subscale's internal consistency using Cronbach's alpha coefficients on a pilot sample of 10 postgraduate students who were randomly selected and excluded from the study sample. The values of Cronbach's alpha for all subscales ranged from 0.81 to 0.86, which indicates a good level of reliability (Field, 2013). Furthermore, the reliability was further checked by administering the MSLQ instrument on the pilot sample two distinct times. After 2 weeks had passed since the first administration, the scale was again applied to the same pilot sample to calculate Pearson's correlation coefficient. The correlation value between the two applications was 0.84, which represents high reliability. Table 2 shows the alpha coefficients for the pilot study sample and current study sample and compares them to the original scale by Pintrich (1991). In the current study sample, the Cronbach's alpha was 0.85 for the motivation scale and 0.87 for the learning strategy scale, which demonstrated a high degree of reliability for this study's instrument.

Data collection

To conduct the current study, approval was obtained from the Scientific Research Ethics Committee at King Faisal University under the number KFUEC-2022-SEP-ETHICS184. To implement the Bashayer chatbot in two master's degree courses, the researchers developed an integrated teaching plan and review for each course. Then, the weekly lesson plans were disseminated at the beginning of semester one of the academic year 2022–2023. An integrated assessment plan was also developed, including weekly assignments and final projects. To assess the homogeneity between the two sample groups, at the beginning of the course, all participants ($n = 60$) completed the MSLQ survey questionnaire as a pre-test. Once the application of the Bashayer chatbot system with the experimental group ended at week 13, its participants completed the post-test.

Experimental procedures

In order to assess the design and content validity of the proposed Bashayer chatbot system prior to the experiment, an initial version was presented to three experts who were selected for their extensive experience with information and communication technologies. The purpose of the chatbot, the nature of the courses, and the intended learning outcomes were presented and discussed. The navigation flow map of the Bashayer chatbot system (shown in Figure 2) was also explained to the experts, who then expressed their opinions about the chatbot's appropriateness for the study purpose and target group. They suggested amendments to certain design elements, such as backgrounds, font sizes, and student registration system, which they believed would enhance readability. Furthermore, to support validity, five postgraduate students within the pilot sample were asked to navigate the system to provide suggestions for improvement. The students suggested some modifications to the location of the main menu buttons, and they were adjusted accordingly. After the authors implemented the recommendations, the final version of the Bashayer chatbot was created.

The Bashayer chatbot system was implemented in the study according to Figure 3. The students of the experimental group interacted with the system through WhatsApp using text conversations. The chatbot was produced and hosted using the Freshdesk platform, which enables the free integration of chatbots into social media applications. WhatsApp was chosen due to its immense popularity as a text messaging application; it is even the most popular among university students. After specifying the name of the chatbot, it was linked to the teacher's WhatsApp number and then made available to participants. The teacher began communicating with the students through his own dashboard on the Freshdesk platform. Thus, Bashayer was managed by the teacher using Freshdesk as a host platform. After the students interacted with Bashayer through WhatsApp, their questions and inquiries about the course were directed to Freshdesk, which the system was hosted on. The answers were then searched for in the system database, which was also attached to the platform. Finally, the appropriate responses were directed to the students through Bashayer via WhatsApp.

To initiate the experiment, postgraduate students of the experimental group were introduced to the Bashayer chatbot system and informed about its purpose, its use, and how to communicate with it through WhatsApp. The 11 functions included in the chatbot were explained to the participants, the first of which was the welcome and electronic registration "hello" function. Through this, postgraduate students could log in to Bashayer. This information was stored in the system database separately for each student in order to perform subsequent functions on it, such as registration and course enrolment. If such information has not been recorded, the system asks the user to record it. The second function was the electronic registration for the course, the "book online" demo class function. This function enables postgraduate students to electronically register for courses via the Bashayer chatbot system and provides instructors with a list of those registered with them. The third was the "download

curriculum" function, where postgraduate students were given the opportunity to download course plans, materials, and lectures.

The fourth function was the "talk to our education consultant" function. Through this, the postgraduate students were given the opportunity to talk with their teachers and obtain answers to their repeated, periodic, or detailed inquiries and questions about the course, whether at the level of the course content and materials or in terms of coordination. To receive responses from the teacher, the chatbot system asked postgraduate students to select their preferred means of communication, such as their university email or by phone via their WhatsApp registered number. The fifth function was "book online review session." Postgraduate students were given the opportunity to book an electronic review session to discuss their weekly duties and provide feedback on the assignments provided to them. This could be done individually, and sometimes, more than one student would gather within the same session. Sixth was the "course progress summary" function. The students were given the opportunity to download all the course progress summaries, worksheets, and references on a weekly basis. Seventh was the "download assignment" function. This function allowed students to download weekly assignments through the chatbot by clicking on external links that were renewed weekly through the system. All weekly assignments were made first to the control group via the learning management system (Blackboard). Then, all assignments were provided to students in the experimental group as external links to the Blackboard, due to the limited download space provided by the Freshdesk free version that was used for the experimental group. When students clicked the assignment's external link, it downloaded directly without displaying the Blackboard environment. Therefore, students interacted only with the chatbot learning environment. Students then uploaded their responses to the chatbot, which was stored on the Freshdesk platform. Managing the process of learning for the experimental group was done in isolation from the Blackboard environment.

The eighth function was the "submit assignment" function. Postgraduate students could upload their assignments for the teachers to review and evaluate through Freshdesk. This made it possible for instructors to display the list of students who completed their weekly duties and the means of communication by which they chose to receive feedback. Ninth was the "schedule online test" function. The students were given the opportunity to choose appropriate dates and times to hold midterm exams from several available days through Bashayer. Tenth was the "download completion certificate" function. This allowed the students to download the course-completion certificate after taking the final exam. Eleventh was the "cancel course subscription" function. The postgraduate students were given the opportunity to cancel their course registration within the first 2 weeks of the first term.

Finally, if any data was entered by the students, and there was no appropriate response registered in the system database for it, the system issued the message, "Sorry, I can't fulfill your request now." The student was then either transferred to the main menu to start again or a ticket was left for the course instructor. The instructors could log in to the Freshdesk platform at their own convenience to respond to the inquiries, as all student data was available on the platform.

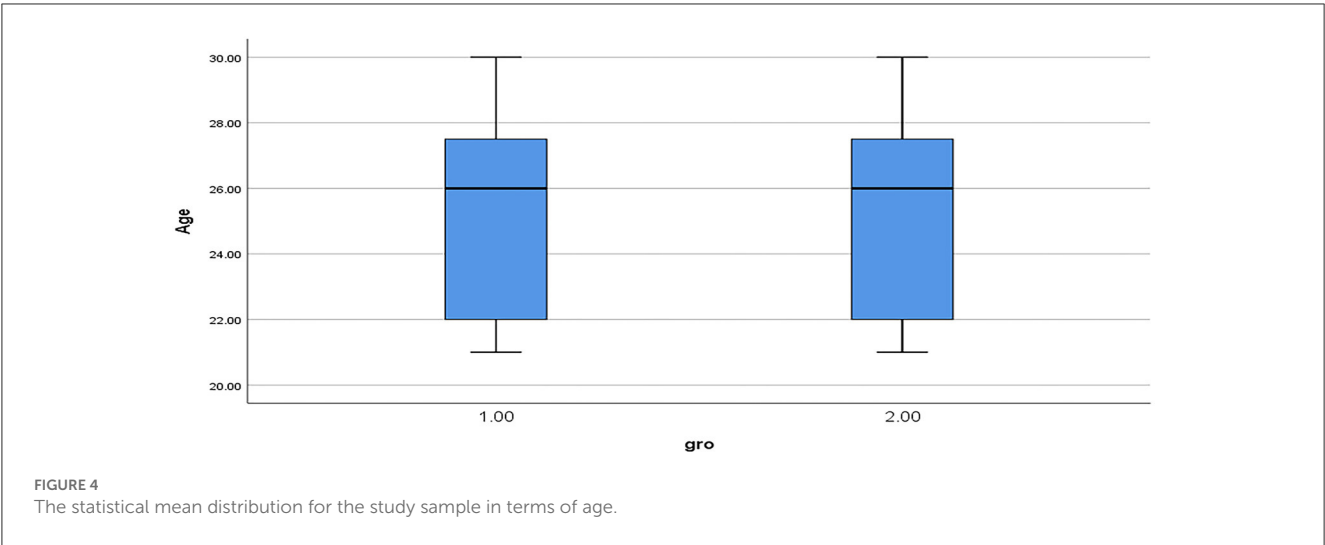
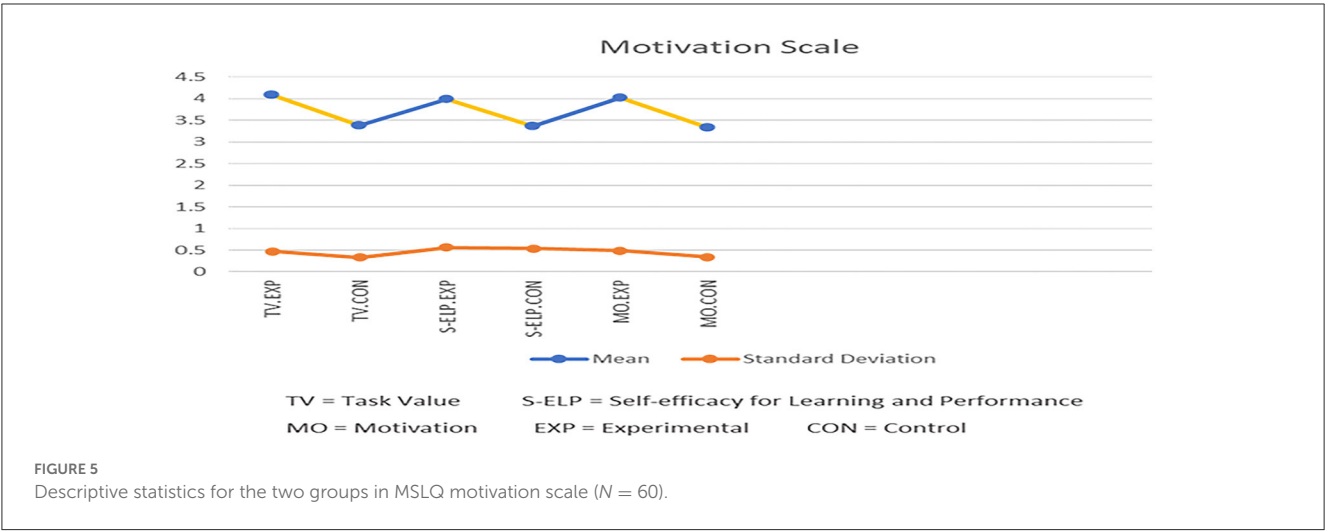


TABLE 3 Comparison between the two groups in MSLQ motivation scale (N = 60).

| Subscale | Control group | | | Experimental group | | | T-test | | |
|---|---------------|------|------|--------------------|------|------|--------|------|-------|
| | M | SD | SE | M | SD | SE | df | t | sig |
| Task value | 3.38 | 0.33 | 0.06 | 4.08 | 0.47 | 0.08 | 58 | 6.64 | 0.000 |
| Self-efficacy of learning and performance | 3.37 | 0.54 | 0.09 | 3.99 | 0.56 | 0.10 | 58 | 4.33 | 0.000 |
| Total for motivation scale | 3.34 | 0.34 | 0.06 | 4.03 | 0.49 | 0.09 | 58 | 6.25 | 0.000 |



Findings

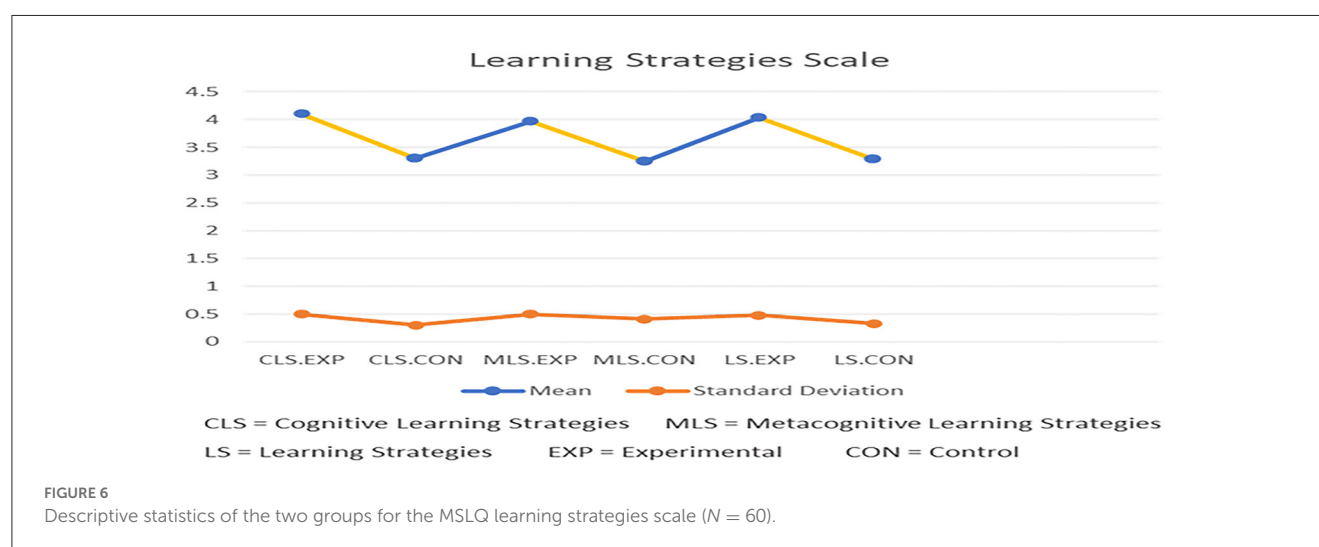
To measure the homogeneity of the study sample, we calculated the independent samples *t*-test on both groups' pre-test responses. No statistically significant difference ($t = 0.097$, $p > 0.05$) was found between the control group ($M = 12.83$, $SD = 2.704$) and experimental group ($M = 12.76$, $SD = 2.608$). This confirms the homogeneity of the study sample. Furthermore, in terms of the age variable, Figure 4 shows the mean and standard deviation of the control group ($M = 24.97$; $SD = 0.49$) and the experimental group ($M = 24.82$; $SD = 0.48$), which indicates that the statistical

distribution for the study sample is normal. The Kolmogorov-Smirnov test score was 0.20, the Shapiro-Wilk test score was 0.15, and $p > 0.05$. Therefore, the two groups were homogeneous before the experiment began and follow normal distribution of data.

To carry out the statistical analysis of the current study, data collected from the post-test, which was conducted after the experiment, were tabulated and entered in IBM SPSS v.26 software. The statistical analysis followed two steps. First the descriptive statistics (*M*, *SD*, and *SE*) of the two MSLQ scales (motivation and learning strategies) and their four subscales (task value, self-efficacy for learning and performance, cognitive learning strategies, and

TABLE 4 Comparison between the two groups in MSLQ learning strategies scale ($N = 60$).

| Subscale | Control group | | | Experimental group | | | T-test | | |
|------------------------------------|---------------|-----------|-----------|--------------------|-----------|-----------|-----------|----------|------------|
| | <i>M</i> | <i>SD</i> | <i>SE</i> | <i>M</i> | <i>SD</i> | <i>SE</i> | <i>df</i> | <i>t</i> | <i>sig</i> |
| Cognitive learning strategies | 3.33 | 0.30 | 0.06 | 4.11 | 0.51 | 0.09 | 58 | 7.18 | 0.000 |
| Metacognitive learning strategies | 3.25 | 0.41 | 0.08 | 3.97 | 0.51 | 0.09 | 58 | 6.07 | 0.000 |
| Total of learning strategies scale | 3.29 | 0.33 | 0.06 | 4.04 | 0.48 | 0.09 | 58 | 6.89 | 0.000 |



metacognitive self-regulated learning strategies) were calculated. Second, the independent samples *t*-test were performed to measure the statistical differences between the mean scores of the two groups. The two research questions and their associated findings are discussed below.

The first research question is as follows: does the use of the Bashayer chatbot system enhance graduate students' learning motivation? Table 3 and Figure 5 show a comparison of the descriptive statistics (*M*, *SD*, and *SE*) for postgraduate students' responses in both the control and experimental groups according to the two MSLQ motivation subscales of task value and self-efficacy for learning and performance. As shown in Table 3, postgraduate students' mean response for task value was 0.7 greater in the experimental group (4.08) than the control group (3.38). Similarly, in terms of self-efficacy for learning and performance, the mean response of the postgraduate students from the experimental group (3.99) was 0.6 greater than those from the control group (3.37). In terms of the MSLQ motivation scale in total, the students from the experimental group ($M = 4.03$) showed 0.7 greater level of motivation than their peers in the control group ($M = 3.34$).

The result from the independent samples *t*-test, as shown in Table 3, indicates that there was a statistically significant difference between the two groups in terms of postgraduate students' responses for the task value ($t = 6.64$, $p < 0.05$) and self-efficacy for learning and performance ($t = 4.33$, $p < 0.05$) questions of the MSLQ motivation scale ($t = 6.25$, $p < 0.05$), which favored the experimental group. This means that postgraduate participants in the experimental group (who used the Bashayer chatbot system)

were more motivated to accomplish their learning tasks than those in the control group. These results confirm the positive effect that using the Bashayer chatbot has on postgraduate students' learning motivations.

The second research question is as follows: does the use of the Bashayer chatbot system enhance graduate students' learning motivation? Table 4 and Figure 6 show a comparison of the descriptive statistics (*M*, *SD*, and *SE*) of students' responses in both the control and experimental groups according to the two MSLQ learning strategy subscales: cognitive and metacognitive self-regulation learning strategies. In terms of cognitive learning strategies, the mean response of the postgraduate students from the experimental group (4.11) was 0.8 greater than the control group (3.33), as shown in Table 4. Similarly, in terms of metacognitive self-regulation learning strategies, the mean response of the postgraduate students from the experimental group (3.97) was 0.7 greater than those of the control group (3.25). In terms of the total MSLQ learning strategies scale, the mean response of the postgraduate students from the experimental group (4.04) was 0.8 higher than the control group (3.29).

Furthermore, the result from the independent samples *t*-test, as shown in Table 4, indicates a statistically significant difference between the two groups in terms of their responses to the practices of cognitive learning strategies ($t = 7.18$, $p < 0.05$) and metacognitive self-regulation learning strategies ($t = 6.07$, $p < 0.05$) of the MSLQ learning strategies scale ($t = 6.89$, $p < 0.05$). This favored the experimental group. This means that postgraduate participants using the Bashayer chatbot system

and its functionalities were able to better cognitively practice learning and metacognitively regulate their learning strategies. This confirmed that Bashayer chatbot use positively influenced postgraduate participants' learning strategies.

Discussion

The focus of this study was on understanding the effect of a developed Bashayer chatbot system on learning motivation and learning strategies among postgraduate students in Saudi higher education. The study findings are discussed in the following section, and its several implications are suggested accordingly.

The results of the study indicated that postgraduate students in the experimental group demonstrated higher levels of motivational orientation toward learning when using the Bashayer chatbot system than their peers in the control group. Postgraduate students' motivational orientation was assessed using two elements: task value and self-efficacy for learning and performance. In terms of task value, postgraduate students viewed their learning experience using the Bashayer chatbot system as being more motivating, meaningful, convenient, and beneficial as compared to the traditional learning environment. These results align with previous research studies on chatbot systems' potential to support learning motivation (Nghi et al., 2019; Chen et al., 2020; Yin et al., 2021; Fidan and Gencel, 2022; Khalil and Rambech, 2022). In terms of self-efficacy for learning and performance, the results indicated that the chatbot enhanced students' confidence and ability to successfully perform and accomplish learning tasks compared to in a conventional learning environment. Similar results have been found in previous studies such as Chen et al. (2020), Pérez et al. (2020), and Chang et al. (2022).

The positive effect of the Bashayer chatbot on postgraduate students' learning motivation may be attributed to its design and embedded features, which create an accessible, flexible, and convenient learning environment (Sjöström and Dahlin, 2020). For example, the chatbot provided a consolidated presentation of relevant content, materials, resources, and assignments for students to view learning procedures, details of all learning tasks, and due dates. It also allowed students to balance between handing over their assignments and devoting themselves to subsequent learning steps and procedures. Instant and continuous feedback via the "inquiry ticket" feature was among those that helped raise students' motivation. The postgraduate students initiated questions that were answered from the lecturer's interface. Responding to students' questions and inquiries greatly helped in guiding them and increasing their involvement in learning activities. Providing feedback and stimulating the interaction cycle that supports social presence are important factors in active engagement with the chatbot learning environment (Lee et al., 2020; Huang et al., 2021; Kohnke, 2022; Mendoza et al., 2022). Moreover, the Bashayer chatbot system provided postgraduate students with a weekly summary of what had been taught over the past week, which the students could review and use to conveniently follow up on learning activities. This helped to bridge students' learning gaps in subjects that had not yet been mastered, thus building confidence in Bashayer's potential to support learning performance. The students were thus motivated by this learning environment

that they considered important and of great benefit, which was as advocated by the learning-based chatbot technology of many studies (Pereira et al., 2019; Yueh and Chiang, 2020; Kumar, 2021; Chang et al., 2022; Troussas et al., 2022).

The results of our study indicated that postgraduate students who used the Bashayer chatbot demonstrated a better level of practicing learning strategies than their control group peers. Postgraduate students' learning strategies were evaluated using two elements: cognitive learning strategies and metacognitive self-regulation learning strategies. In terms of the former, the students using the Bashayer chatbot system were able to practice various strategies, even more than those who studied in the traditional environment. This signifies that cognitive learning strategies, such as remembering (listing and naming), understanding (paraphrasing and summarizing), and organizing (clustering and outlining) were enhanced by the learning environment created by the Bashayer chatbot. Despite recent studies (e.g., Deveci Topal et al., 2021; Kumar, 2021) that found no significant influence of chatbot use on K-12 and undergraduate students' cognition and learning achievements, the results of our study highlight the significant potential of chatbot-based learning environments in enhancing and supporting cognitive learning strategies among postgraduate students. This positive result could be attributed to the instant, flexible retrieval of course information (Chuah and Kabilan, 2021), which might positively influence students' memory retention (Abbasi and Kazi, 2014), skill acquisition, and overall learning performance (Lin and Mubarak, 2021; Okonkwo and Ade-Ibijola, 2021; Pérez-Marín, 2021).

Similar results were found in terms of metacognitive self-regulated learning strategies. The results showed that the Bashayer chatbot system enhanced postgraduate students' confidence and ability to be more self-regulated and exert more control over their learning strategies when compared to their peers in the traditional learning environment. Through the chatbot learning environment, postgraduate students were able to better plan, manage, and monitor their learning, including setting goals, tracking cognitive learning, self-testing, and self-checking. These results confirm other studies' findings about chatbot systems' potential to support metacognitive learning strategies, such as self-regulation (Calle et al., 2021; Du et al., 2021; Cabrera et al., 2022), self-organization (Pérez et al., 2020), and self-direction (Park et al., 2019).

Through the Bashayer chatbot system, several features were made available for students to control and manage their own learning. For example, it provided a reference to the learning record feature for each student, which is a record of students' information saved in the application's database. This contains everything related to the students' data on their learning process, such as their assignments, submission dates, grades, feedback, and previous inquiries. This gave students the confidence that their learning steps were recorded and saved so that they could be followed up by the teacher anytime and anywhere. The layout and navigation of the Bashayer chatbot system contributed to reducing distractions and cognitive load. This facilitated the practicing of cognitive learning strategies, such as repeatedly viewing and memorizing course readings; extracting information from resources; and understanding, summarizing, and organizing them at their own pace. In terms of metacognitive self-regulation learning strategies, the postgraduate students were able to track

and monitor their own learning progress to adjust and correct their behavior as they learned.

Implications, limitations and future work

The present study and its findings have yielded several important implications. The results imply that chatbot system designers should focus on providing students with customized, personalized learning environments (Cunningham-Nelson et al., 2019; Bezverhny et al., 2020; Krouska et al., 2020; Yueh and Chiang, 2020). The more meaningful the learning environment is for students, the more motivated to learn, and the more involved in learning activities, they will be (Fryer et al., 2019; Yin et al., 2021). This can be achieved through the inclusion of more intelligent functions that can analyse student-entered data and their interaction styles within the chatbot to better support learning. In addition, the results of this research confirm that when designing a chatbot system, its construction should reflect and be properly aligned with conceptual course maps, learning outcomes, and students' characteristics. Also, it should be designed to provide levels of curiosity, challenge, and mastery. Therefore, chatbots should be designed according to students' cognitive learning styles (Sjöström and Dahlin, 2020). All the learning activities carried out by the students should be targeted to achieve the best outcomes, thus building students' confidence in chatbot-based learning environments.

There are several limitations in the current study. First, due to the quasi-experimental nature of this study, the small sample of 60 postgraduate students limits the possibility of generalizing the obtained results to the wider population. Future studies should thus conduct descriptive studies with a larger sample size of the target population. Second, in terms of context, the nature of the courses that the Bashayer chatbot system was implemented in is theoretical. Therefore, the results may vary when the chatbot is applied to courses from other disciplines that are of an applied or practical nature. Accordingly, it is advisable to design and test a chatbot system specifically for such courses and measure its effectiveness on postgraduate students' motivation and learning strategies. In addition, the experiment was conducted only over a short duration of one semester. Our courses are taught in a one-semester system and not extended throughout the year. Therefore, we propose conducting future research when the application period is extended across one or two academic years and includes a variety of courses. This should reduce the potential negative impacts of novelty and eliminate potential biases due to a group's exceptionality in one semester. Third, this study relied on a quantitative methodology through the application of the MSLQ scale; therefore, judgments are based on quantitative data only. Qualitative data would have provided a deeper, richer understanding of the phenomenon. This is especially true for the subject of learning strategies and whether students practice them through cognitive or metacognitive self-regulation, as well as regarding chatbots as an artificial intelligence tool that simulates human performance. Therefore, tools such as observation, interviews, and reflective notes would have helped gain a greater understanding of postgraduate students' experiences with the Bashayer chatbot system. It is recommended that mixed

methods research studies be conducted in the future to better understand chatbot technology adoption in learning contexts.

Fourth, there were limitations in terms of the architecture and functionalities of the Bashayer chatbot system. In the current study, the database that fed Bashayer with necessary data was not always enough to answer all students' queries. Therefore, it is recommended that future chatbot system designs be based on more sophisticated algorithms that enable the designer to expand the range of data stored within them and, thus, generate varied responses commensurate with students' questions. Fifth, the current system relied on databases. These were used to provide a specific set of responses in line with the nature of the content and tasks provided through the application, which could be somewhat limiting. Therefore, the current study recommends including interactive databases or a set of libraries based on activating a recommendation system to provide responses. On the one hand, these can be related to discussions and human vocabulary, and on the other hand, they can help provide creative solutions related to the various learning procedures within the chatbot environment.

Furthermore, it is suggested that future research should focus on measuring more complex cognitive learning strategies, such as reasoning and problem-solving. The Bashayer chatbot design was limited to the basic cognitive skills of remembering, understanding, and organizing, with control and self-regulation as the metacognitive skills. Additionally, communication between students and their instructors was conducted through traditional means such as email, phone, or texting via WhatsApp. To further enhance the role of the teacher within the chatbot learning environment, future designs can include an avatar for the instructor (in the form of a virtual teacher) that simulates the instructor's personality and provides support and feedback to students. Furthermore, for future designs, the chatbot systems can include functions that analyse students' facial features, personal expressions, and communication skills and generate appropriate responses to provide a more personal learning experience. Moreover, these future design could incorporate smart strategies to classify students according to either their cognitive styles or previous experiences that are necessary for new learning.

Conclusion

The adoption of AI-based tools, such as chatbots, to support teaching and learning has proliferated. This study's main goal was to determine the influence of a chatbot system named Bashayer on postgraduate students' learning motivation and learning strategies. A quasi-experimental design was implemented with a sample of 60 Saudi postgraduate students divided into experimental and control groups. The MSLQ survey questionnaire (Pintrich, 1991) was utilized as the main instrument for this study. Learning motivation was assessed by measuring postgraduate students' perceptions toward two main subscales: the task value (the interest, usefulness, and importance of course material) and self-efficacy for learning and performance (the confidence and ability to perform learning tasks). The results showed that the students in the experimental group (who were using the Bashayer chatbot system) revealed a higher level of perceived

task value and self-efficacy for learning and performance than those in the control group. Likewise, learning strategies were instigated by measuring postgraduate students' perceptions toward two main subscales: cognitive learning strategies (remembering, understanding, organizing, and reasoning) and metacognitive self-regulation learning strategies (control and self-regulation of learning). The results indicated that by using the chatbot system, participants in the experimental group demonstrated more favorable levels of both cognitive and metacognitive learning strategies than their peers in the control group. All results obtained in this study demonstrated the positive influence of the Bashayer chatbot system, an AI-based tool, on enhancing motivation and learning strategies for Saudi postgraduate students. These results are promising in terms of the potential of chatbot adoption to enhance learning motivation and support cognitive and metacognitive learning strategies among postgraduate students. This study offers motivating results that support the development of more chatbot systems that are similar to Bashayer to support successful learning.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by the Scientific Research Ethics Committee at King Faisal University under the ethics number (KFU-REC-2022-SEP-ETHICS184). The patients/participants provided their written informed consent to participate in this study.

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Author contributions

AAl-A, AAl-D, and AD contributed to conception and design of the study and implemented the experimental procedures and collected data. AAl-A obtained the ethics and funding of the study and wrote the first draft of the manuscript. AAl-D and AD performed the statistical analysis and wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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The temperament of pre-teens at risk of educational and social exclusion

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Introduction: Vulnerability and poverty increase the educational and social exclusion of pre-teens. The goal of the present study was to identify the temperamental characteristics of pre-teens at risk of educational and social exclusion, depending on type of vulnerability and gender.

Methods: For the study, 329 students (167 boys and 162 girls) at risk of early school leaving were involved and grouped into four categories: preadolescents from single-parent families, students with an absent parent (for example, is working abroad), socially assisted students, and Roma pre-teens (socially assisted). To assess temperament the Early Adolescent Temperament Questionnaire (EATQ-R) was used.

Results: The results underline that in the case of the four super factors and for the two behavioral scales investigated, the scores (at group level) are, generally, within the average limits. The study highlights the importance of specialists to increase, in the case of pre-teens at risk of early school leaving, Effortful Control, and to decrease Negative Affectivity (which includes frustration and fear) and Depressive Mood. Significant differences between vulnerable boys and girls were observed, in the case of Surgency, Affiliation, and Depressive Mood. Also, using the Mann-Whitney (U) test and an independent sample *t*-test, gender-dependent differences were highlighted (considering the EATQ-R scales), in the case of each type of vulnerability. Using single-factor multivariate analysis of variances, the differences between preadolescents, depending on the type of vulnerability, were presented.

Discussion: In the case of Surgency, boys registered significantly higher scores than girls, while in the case of Affiliation and Depressive Mood girls obtained higher values. Gender- and type of vulnerability-dependent differences in temperament were discussed in the case of pre-teens, and showed a temperament-conscious education is necessary in future parental education and teacher training.

KEYWORDS

temperament, social exclusion, school dropout, pre-teens, pre-teens temperament

1. Introduction

School dropout represents a considerable social problem in Romania, with the consequences observed for both individuals and society (Chalita et al., 2012). Educational and social exclusion was worsened by the COVID-19 pandemic, with poverty often making access to technology impossible. As Quílez-Robres et al. (2022) argued, the suspension

of traditional school education (to minimize the infectious spread of the SARS-CoV-2 virus) “was a handicap for teaching due to the change in teacher-student relationships, but especially at early ages and in relation to the most disadvantaged classes (rural areas-low socioeconomic level).” Poor access to technology and preadolescents’ vulnerabilities (for example innate or acquired learning difficulties, or high levels of stress and anxiety), together with older siblings’ and parents’ attitude regarding school and learning, represent variables which have a strong impact on the decision to drop out of school (Terry, 2008; Pelin et al., 2021). Parental education (an important pillar of society) has the potential to diminish/mitigate the negative impact of factors which can determine the social exclusion of a child, such as belonging to a single-parent family or living in poverty (Churchill and Clarke, 2009). Developing emotional intelligence in parents (and teachers) makes parenting (and teaching) practices more efficient (Kokkinos et al., 2021).

In 2021, the percentage of social exclusion in Romania was the highest across the European Union (EU) Member States (34%), with Bulgaria (32%) ranking second and Spain and Greece third, both at 28% (Eurostat, 2022). When talking about educational exclusion and school dropout in lower secondary education, over the last 20 years various studies have been carried out in Romania. For example, an increase in the number of students who dropped out of school before entering upper secondary education (high-school) was observed—the value almost tripled from 2000 to 2008 (Gyönös, 2011). Also, between 2008 and 2013, on average, only 83% of children enrolled in grade 1 (8 years ago) were still in school at the end of grade 8/lower secondary education (Ministry of National Education, 2018).

Since the 1980’s researchers have examined the role of temperament in education, school adjustment, and academic achievement and presented them as essential variables investigated (Al-Hendawi, 2013). Considering middle school, it was found that students who dropped out (ages 11–13) were lethargic and casual in nature, reflective, and accepting, whereas those who continued with education were more practical, critical, active, premeditated, and responsible in nature (Singh, 1989). Teachers, parents, and peers, together with a child’s academic self-concept, mediate the temperament effect on educational result (Martin, 1992). A negative temperament is linked to disruptive classroom behavior (in primary grade children), high maintenance students manifesting higher levels of overt aggression, attentional difficulties, emotional-oppositional behavior, and covert disruptive behavior (McClowry et al., 2013).

Researchers mention that school performance is influenced by the individual differences in pre-teens and adolescent’s temperament (Valiente et al., 2007; Checa and Rueda, 2011). Academic failure also represents a major indicator of dropping out of school—low grades predict social and educational exclusion (Dockery, 2012). During preadolescence, temperament assessment is important to predict school adaptability, the risk for externalizing or internalizing problems and, also, the level of development of emotional and social abilities (Liu et al., 2011). Checa and Abundis-Gutierrez (2017) emphasized a positive correlation between temperament factor of regulation and school success and a negative link between temperament factor

of reactivity and academic success. Following a meta-analysis, Poropat (2009) asserted that “extroverts have better school results due to their increased energy and positive attitudes” (features which are accompanied by a desire to assimilate and to understand the lessons), while negative emotions and low scores for emotional stability are related to low academic results and absenteeism.

As temperament (or dynamic-energetic subsystem of the personality) has a strong genetic determination, something which can be understood from an early period in a person’s life (Kagan and Snidman, 1999; Rothbart, 2007), it is one of the components of personality which is investigated in primary selection. Temperament manifests itself in a person’s behavior, being the most easily ascertainable component of the personality (Predoiu et al., 2021), affecting the intensive and mobility features at cognitive, affective, motor, and verbal levels (for example, voice intensity, rhythm, and speech tempo. However, temperament does not determine their quality—e.g., the persuasive force of the verbal message). It also refers to the biological and neuro-chemical properties of nervous systems (Sulis, 2018) and determines the internal way in which an individual reaches a given state (with a higher or lower energy consumption) and it changes throughout life, especially in terms of expression, as a result of maturation—for example, the explosive nature of the newborn is no longer manifested in the same way in adults (Mitrache and Predoiu, 2016). As Cyniak-Cieciura (2021) mentioned, temperament describes “the speed of learning new and unlearning emotional and behavioral reactions.”

Research on temperament in children has been dominated by two theoretical models. The first is based on research by Jerome Kagan and colleagues and has behavioral inhibition as its central concept. Behavioral reactions associated with behavioral inhibition include avoiding unfamiliarity, reducing the frequency of smiles and verbalizations, and increasing closeness to family members (Kagan et al., 1984; Reznick et al., 1986). Unlike the first model that operates with a dichotomy (inhibited temperament vs. uninhibited temperament), Rothbart (2007) proposed a three-factor model of temperament during childhood and adolescence, referring to Negative Affect, Surgency-Extraversion, and Effortful Control. It is worth mentioning that, recently, Lipska et al. (2022) discussed this “composition” of temperament when investigating Polish children. When talking about early adolescence, a fourth factor, called affiliativeness, was emphasized (Ellis and Rothbart, 2001; Putnam et al., 2001), involving a need and desire for closeness with others, and concern for others (Ellis and Rothbart, 2001). Rothbart discusses (in the psychobiological model developed) reactivity and self-regulation (Rothbart et al., 2000a). Reactivity refers to the Negative Affect and Surgency/Extraversion (level of activation), while, when talking about self-regulation, literature refers to Effortful Control (Putnam et al., 2006). Temperament is conceptualized as the self-regulation of attention-related processes and activities, while reactivity refers to the physiological excitability of neural systems, through self-regulating individuals are able to modulate this involuntary, automatic reactivity (Rothbart, 2011). As Rothbart and Rueda (2005) asserted, behavioral activation processes help individuals to sustain or to initiate a non-dominant response, while behavioral

inhibition processes allow us to suppress a dominant response when needed.

The Negative Affect dimension includes frustration and fear, referring to a predisposition to experience negative emotions, including discomfort, dysphoria, and/or anger (see Hoffmann et al., 2017). Frustration can activate approach tendencies in relation to a new, unfamiliar situation, while fear implies a predisposition toward inhibitory tendencies. Inhibition has adaptive purposes in the sense that non-discriminatory approach tendencies to all stimuli can be dangerous (Rothbart and Bates, 1998). Extraversion/Surgency is the result of an increased sensitivity to rewards, refers to the level of activity, and is manifested by a tendency to explore new stimuli and situations (Rothbart and Bates, 2006); emotional reactivity is expressed by positive emotionality, and can be assessed in laboratory studies in children younger than one (Rothbart et al., 2000b). Effortful Control is a consequence of the development of executive attention functions and involves the ability to regulate emotional states by redirecting attentional resources, as well as the ability to suppress initial behaviors and reactions (that may interfere with personal goals), in order to adapt to the demands of the situation (Rothbart and Bates, 2006; Fitzpatrick et al., 2022). From the age of three, studies have shown that voluntary control skills remain relatively stable from preschool to adolescence (Kochanska et al., 2000).

The goal of the current research was 2-fold: to identify the temperamental characteristics of pre-teens at risk of educational and social exclusion, depending on type of vulnerability, and to underline gender differences in vulnerable preadolescents (considering temperament). Four groups were formed: students with an absent parent (for example, is working abroad), socially assisted students, Roma preadolescents (socially assisted), and pre-teens from single-parent families.

The following research questions were asked:

- 1) What are the temperamental features of pre-teens at risk of educational and social exclusion depending on type of vulnerability?
- 2) What are the gender-dependent differences in vulnerable preadolescents, when talking about temperament?

2. Materials and method

2.1. Participants

Three hundred and twenty-nine students (167 boys and 162 girls) at risk of educational and social exclusion were involved in the current study. They were students in grades V-VII (between 11 and 13 years old, $M_{Age} = 12.4$) at different schools, from various regions of Romania: Bacău county, Brașov county, Bucharest, Buzău county, Timiș, Neamț, and Dâmbovița county.

Of the 329 students, 38 had an absent parent (is working abroad; 22 boys and 16 girls), 184 were socially assisted pre-teens (87 boys and 97 girls), 70 were Roma preadolescents (socially assisted; 39 boys and 31 girls), and 37 were pre-teens from single-parent family (19 boys and 18 girls).

2.2. Measures

The longer version of the Early Adolescent Temperament Questionnaire—revised form (EATQ-R)—was used in the present research. EATQ-R was developed starting from Rothbart theory (Ellis and Rothbart, 2001; Viñas et al., 2015) and was calibrated for the Romanian population, being part of the PEDb computerized platform developed by Cognitrom (Miclea et al., 2012).

The 11 temperament scales of the EATQ-R are distributed according to four super factors: three scales belong to the Effortful Control super factor—Attention (e.g., *I find it easy to concentrate on my homework*); Inhibitory Control (the capacity to suppress inappropriate verbal and motor responses)—e.g., *When I'm told to stop doing something, it's easy for me to stop*; and Activation Control (the capacity to carry out a task even if there is a strong tendency to avoid it)—e.g., *When someone asks me to do something, I do it immediately, even if I don't really want to*. Two scales relate to the Surgency super factor—Activation level (engaging in activities involving high levels of physical activity)—e.g., *I'd rather play a sport than watch TV*; and High Intensity Pleasure (the pleasure generated by activities involving high intensity or novelty)—e.g., *I would get excited about the idea of driving a race car*. Two scales belong to the Negative Affectivity super factor—Frustration (e.g., *It annoys me when I try to make a call and it rings busy*) and Fear (e.g., *I worry about getting into trouble*), while 4 scales belong to the Affiliation super factor—Affiliation (the need for closeness with others)—e.g., *I want to be able to share my personal thoughts with someone else*; Shyness (e.g., *I'm shy about meeting new people*); Pleasure Sensitivity (pleasure determined by activities involving low intensity, complexity, or novelty)—e.g., *I like to look at the trees and walk among them*; and Perceptual Sensitivity (ability to identify low-intensity stimuli in the environment)—(e.g., *I tend to notice small changes that others don't notice*). EATQ-R also assesses two behavioral scales: Aggression (e.g., *If I am angry with someone I tend to say things that I know will hurt them*) and Depressive Mood (e.g., *I feel like crying very easily*). The questionnaire consists of 103 items (and is a self-report measure).

The participants responded using a 5-step Likert scale, where 5 = always true; 4 = usually true; 3 = sometimes true, sometimes false; 2 = usually false; and 1 = always false. In the current study, internal consistency estimates (McDonald's omega coefficient— ω) ranged from 0.72 to 0.80 for the behavioral scales (aggression and depressive mood) and the four super factors.

2.3. Procedure

The participants completed the EATQ-R (Early Adolescent Temperament Questionnaire) between June 2021 and September 2022. The questionnaire was applied following direct contact with pre-teens in the camps organized within the project entitled “Sustainable social and educational integration through sports activities—PNP001 2019–2023” (the camps took place at the seaside and in the mountains in Romania), and at the schools involved in the project. EATQ-R was applied in groups of 7–22 preadolescents (eligible for the project carried out).

In the current study, the purposive sampling technique was used, and preadolescents at risk of educational and social exclusion were investigated (socially assisted, from single-parent families, with a parent working abroad, or Roma preadolescents—socially assisted). Informed consent from the children's parents was obtained.

2.4. Statistical analysis

Through a single-factor multivariate analysis of variance, children's temperament was investigated depending on type of vulnerability. In the case of the Levene's test (homogeneity of variance), when $p < 0.05$ the Tamhane *post-hoc* test was interpreted, and when the p -values were insignificant the Scheffe *post-hoc* test was reported (Popa, 2010). SPSS 20 was used. Also, using jamovi program (The Jamovi Project, 2020), the reliability of the scales was calculated (McDonald's omega coefficients— ω). Independent sample t -test and Mann-Whitney U -test were also used. Normality condition (in the case of t -test) was checked through the skewness scores, with the absolute values being <1 (Morgan et al., 2004). The effect size index—Hedges's g was interpreted as follows: 0.2 small effect, 0.5 moderate, and 0.8 strong effect size (Predoiu, 2020). In the case of r (for Mann-Whitney U test), the values are: 0.1—small effect, 0.3—moderate, 0.5—strong effect (Ellis, 2010).

3. Results

First, we present the scores in the case of the four super factors of temperament (Effortful Control, Surgency, Negative Affectivity, and Affiliation) and the behavioral scales (Aggression and Depressive Mood) measured through EATQ-R according to the type of vulnerability (Table 1). The values are expressed in T scores, automatically generated, where 61–100 represents a high score, 45–55 represents an average score, and 0–39 represents a low score, 56–60 is slightly above average, while 40–44 is slightly below average (using the T scores gender and age variations were eliminated).

The results presented above underline that, in the case of the four super factors and for the behavioral scales, the values (at group level) are, generally, within the average limits (45–55); only in some cases (depressive mood and affiliation) are the scores slightly above average (55–60). We mention the importance of specialists to increase, in the case of pre-teens at risk of early school leaving, Effortful Control (includes inhibitory control and attention), and to decrease Negative Affectivity (including frustration and fear) and Depressive Mood.

In a second phase, we investigated whether there are significant differences between girls and boys considering the six dependent variables (DVs) regardless of the type of vulnerability. T -test was used for independent samples (Table 2). The values for the alpha significance threshold, in the case of the Levene test, were insignificant— $p > 0.05$ (except for Effortful Control). The skewness values were <1 (the absolute values), meaning the condition of normality was ensured.

It can be observed that there are significant differences between vulnerable boys and girls in the case of Surgency, Affiliation, and

TABLE 1 Descriptive statistics—preadolescents at risk of educational and social exclusion.

| EATQ-R | Socially assisted pre-teens ($n = 184$) | | |
|--|---|-----------|-----------|
| | <i>M</i> | <i>SD</i> | <i>SE</i> |
| 1 | 50.73 | 8.24 | 0.60 |
| 2 | 50.83 | 7.21 | 0.53 |
| 3 | 52.21 | 8.21 | 0.60 |
| 4 | 52.24 | 6.19 | 0.45 |
| 5 | 50.06 | 10.69 | 0.78 |
| 6 | 53.59 | 11.55 | 0.85 |
| A parent is working abroad ($n = 38$) | | | |
| 1 | 49.99 | 6.54 | 1.06 |
| 2 | 53.27 | 4.85 | 0.78 |
| 3 | 52.21 | 7.96 | 1.29 |
| 4 | 56.50 | 5.87 | 0.95 |
| 5 | 48.68 | 8.41 | 1.36 |
| 6 | 53.13 | 7.14 | 1.15 |
| Pre-teens from single-parent families ($n = 37$) | | | |
| 1 | 51.64 | 9.28 | 1.53 |
| 2 | 54.94 | 9.25 | 1.52 |
| 3 | 55.06 | 8.36 | 1.37 |
| 4 | 54.73 | 5.71 | 0.93 |
| 5 | 52.38 | 11.84 | 1.94 |
| 6 | 55.11 | 11.23 | 1.84 |
| Roma preadolescents—socially assisted ($n = 70$) | | | |
| 1 | 47.81 | 5.22 | 0.62 |
| 2 | 51.29 | 6.28 | 0.75 |
| 3 | 54.87 | 6.90 | 0.82 |
| 4 | 52.01 | 6.53 | 0.78 |
| 5 | 54.33 | 8.85 | 1.05 |
| 6 | 56.06 | 11.24 | 1.34 |

1: Effortful Control; 2: Surgency; 3: Negative Affectivity; 4: Affiliation; 5: Aggression; 6: Depressive Mood.

Depressive Mood. In the case of Surgency, boys registered higher scores than girls ($M_{\text{boys}} = 53.32$, $SD = 7.35$; $M_{\text{girls}} = 49.95$, $SD = 6.56$), while in the case of Affiliation and Depressive Mood girls obtained higher values ($M_{\text{girls Affiliation}} = 54.17$, $SD = 5.92$; $M_{\text{boys Affiliation}} = 51.79$; $SD = 6.52$; $M_{\text{girls Depressive Mood}} = 56.01$, $SD = 11.66$; $M_{\text{boys Depressive Mood}} = 52.50$, $SD = 10.12$). The effect size is $g = 0.48$ (Surgency), $g = 0.38$ (Affiliation), and $g = 0.32$ (Depressive Mood).

In order to have a more detailed picture of the existing differences between boys and girls at risk of educational and social exclusion (considering temperament), the individual scales of EATQ-R were also examined. Various types of vulnerability were taken into account: pre-teens from single-parent family (M group), pre-teens with a parent working abroad (PP group), socially assisted

TABLE 2 Vulnerable pre-teens - boys ($n = 167$) vs. girls ($n = 162$).

| EATQ-R | t | P | 95% confidence interval | |
|----------------------|--------|-------|-------------------------|--------|
| | | | Lower | Upper |
| Effortful control | −1.465 | 0.144 | −2.925 | 0.428 |
| Surgency | 4.388 | 0.000 | 1.862 | 4.889 |
| Negative affectivity | −0.833 | 0.405 | −2.473 | 1.001 |
| Affiliation | −3.465 | 0.001 | −3.735 | −1.029 |
| Aggression | 0.322 | 0.747 | −1.883 | 2.620 |
| Depressive mood | −2.961 | 0.004 | −5.877 | −1.142 |

preadolescents (AS), and Roma preadolescents—socially assisted (R). The non-parametric test Mann-Whitney (U) was used for M and PP groups (considering the reduced sample size), and t -test for independent samples was used for AS and R groups. Normality (in the case of t -test) was checked through the skewness scores (the absolute values were <1).

Analyzing Table 3, significant differences were highlighted between boys and girls (preadolescents from single-parent families) when talking about Fear and Aggression. Boys registered lower values than girls for both Fear and Aggression—Fear ($M_{\text{boys}} = 52.13$, $SD = 8.61$; $M_{\text{girls}} = 61.40$, $SD = 10.16$; $p = 0.039$) and Aggression ($M_{\text{boys}} = 47.54$, $SD = 8.91$; $M_{\text{girls}} = 57.28$, $SD = 12.78$; $p = 0.014$).

Regarding the effect size index, $r = 0.34$ (Fear) and $r = 0.40$ (Aggression). Thus, the impact of the group variable on the results for Fear and Aggression is moderate to strong.

Significant differences were found between boys and girls (PP group) in the case of Activation Control ($M_{\text{boys}} = 52.95$, $SD = 6.46$; $M_{\text{girls}} = 58.00$, $SD = 11.57$; $p = 0.048$), Fear ($M_{\text{boys}} = 51.05$, $SD = 5.94$; $M_{\text{girls}} = 59.88$, $SD = 6.87$; $p = 0.003$), Perceptual Sensitivity ($M_{\text{boys}} = 49.80$, $SD = 9.27$; $M_{\text{girls}} = 57.38$, $SD = 7.17$; $p = 0.021$), and Depressive Mood ($M_{\text{boys}} = 51.05$, $SD = 5.94$; $M_{\text{girls}} = 56.00$, $SD = 7.82$; $p = 0.036$).

Considering the effect size, $r = 0.32$ (Activation Control), $r = 0.47$ (Fear), $r = 0.37$ (Perceptual Sensitivity), and $r = 0.34$ (Depressive Mood). In other words, the impact of the group variable (girls or boys, from PP group) on the scores for Activation Control, Fear, Perceptual Sensitivity, and Depressive Mood, is moderate or moderate to strong (Predoiu, 2020).

Considering socially assisted preadolescents, according to Table 4, the mean values for Activation Control and Activation level scales are significantly higher ($p = 0.015$, respectively $p = 0.008$) in girls (Activation Control: $M_{\text{girls}} = 55.75$, $SD = 10.61$; Activation level: $M_{\text{girls}} = 53.20$, $SD = 8.25$) compared to boys (Activation Control: $M_{\text{boys}} = 52.01$, $SD = 9.80$; Activation level: $M_{\text{boys}} = 49.02$, $SD = 11.85$). The Hedge's g -value was calculated (effect size)— $g = 0.36$ (Activation Control), $g = 0.41$ (Activation level). Therefore, there is a moderate to weak difference between the results. A significant difference between boys ($M_{\text{boys}} = 52.87$, $SD = 8.02$) and girls ($M_{\text{girls}} = 47.70$, $SD = 8.03$) when talking about Shyness ($p = 0.000$) was also highlighted, $g = 0.64$, which underlines a moderate to strong difference between the scores obtained for Shyness by socially assisted boys and girls.

TABLE 3 U-test - pre-teens (boys vs. girls) according to the type of vulnerability.

| EATQ-R scales | Pre-teens from single-parent families boys ($n = 19$) and girls ($n = 18$) | | |
|---------------|--|-------|-------|
| | Z | P | r |
| AC | −1.218 | 0.223 | 0.200 |
| AL | −1.111 | 0.267 | 0.182 |
| Attention | −0.529 | 0.597 | 0.086 |
| Affiliation | −1.033 | 0.302 | 0.169 |
| Frustration | −0.902 | 0.367 | 0.148 |
| Fear | −2.065 | 0.039 | 0.34 |
| IC | −1.008 | 0.314 | 0.165 |
| HIP | −1.403 | 0.161 | 0.230 |
| PS | −0.106 | 0.916 | 0.017 |
| PERS | −1.166 | 0.244 | 0.191 |
| Shyness | −1.716 | 0.086 | 0.282 |
| Aggression | −2.419 | 0.014 | 0.40 |
| DM | −1.568 | 0.118 | 0.257 |
| EATQ-R scales | A parent is working abroad boys ($n = 22$) and girls ($n = 16$) | | |
| | Z | P | r |
| AC | −1.977 | 0.048 | 0.32 |
| AL | −0.566 | 0.572 | 0.091 |
| Attention | −0.587 | 0.557 | 0.095 |
| Affiliation | −1.331 | 0.183 | 0.215 |
| Frustration | −0.779 | 0.436 | 0.126 |
| Fear | −2.926 | 0.003 | 0.47 |
| IC | −1.341 | 0.180 | 0.174 |
| HIP | −0.894 | 0.371 | 0.145 |
| PS | −0.189 | 0.850 | 0.030 |
| PERS | −2.304 | 0.021 | 0.37 |
| Shyness | −0.730 | 0.465 | 0.118 |
| Aggression | −0.711 | 0.492 | 0.115 |
| DM | −2.109 | 0.036 | 0.34 |

AC, Activation Control; AL, Activation level; IC, Inhibitory Control; HIP, High Intensity Pleasure; PS, Pleasure Sensitivity; PERS, Perceptual Sensitivity; DM, Depressive Mood.

In the case of Roma preadolescents (socially assisted), the mean result for Affiliation is higher ($p = 0.013$) in boys ($M_{\text{boys}} = 54.17$, $SD = 10.15$) compared to girls ($M_{\text{girls}} = 48.47$, $SD = 7.26$). The Hedge's g -value is 0.63 (there is a moderate to strong difference between the scores obtained by the investigated groups). Also, the mean result for Pleasure Sensitivity is lower ($p = 0.052$ —a marginal significant difference can be observed) in boys ($M_{\text{boys}} = 54.11$, $SD = 8.88$) compared to girls ($M_{\text{girls}} = 58.40$, $SD = 8.48$). The Hedge's g -value is 0.49 (a moderate difference is emphasized); the upper limit is 0.043, whereas the lower limit is -8.614 .

TABLE 4 *T* test - pre-teens (boys vs. girls) socially assisted ($n = 87$ boys, $n = 97$ girls) and Roma preadolescents—socially assisted ($n = 39$ boys, $n = 31$ girls).

| EATQ-R scales | <i>t</i> | | <i>P</i> | | 95% confidence interval | | | |
|---------------|----------|--------|----------|-------|-------------------------|--------|--------|--------|
| | AS | R | AS | R | Lower | | Upper | |
| | | | | | AS | R | AS | R |
| AC | −2.450 | 0.464 | 0.015 | 0.645 | −6.749 | −3.279 | −0.727 | 5.260 |
| AL | −2.691 | −1.297 | 0.008 | 0.199 | −7.236 | −8.287 | −1.113 | 1.764 |
| Attention | 1.145 | 0.535 | 0.254 | 0.595 | −1.328 | −3.154 | 4.998 | 5.458 |
| Affiliation | 0.906 | 2.564 | 0.366 | 0.013 | −1.521 | 1.259 | 4.104 | 10.150 |
| Frustration | −0.681 | 0.615 | 0.497 | 0.541 | −3.935 | −2.369 | 1.917 | 4.474 |
| Fear | −1.643 | −0.952 | 0.102 | 0.345 | −6.230 | −8.413 | 0.569 | 2.985 |
| IC | 0.116 | −0.329 | 0.908 | 0.743 | −2.546 | −5.085 | 2.865 | 3.647 |
| HIP | 0.545 | 1.255 | 0.586 | 0.214 | −2.096 | −1.293 | 3.696 | 5.655 |
| PS | 0.642 | −1.979 | 0.522 | 0.052 | −2.084 | −8.614 | 4.094 | 0.043 |
| PERS | −1.219 | 0.199 | 0.224 | 0.843 | −4.513 | −3.781 | 1.067 | 4.619 |
| Shyness | 4.329 | 0.460 | 0.000 | 0.647 | 2.815 | −3.205 | 7.530 | 5.119 |
| Aggression | 1.116 | 0.302 | 0.266 | 0.764 | −1.353 | −3.630 | 1.605 | 4.926 |
| DM | −1.703 | −1.164 | 0.090 | 0.249 | −6.168 | −8.524 | 2.599 | 2.244 |

AS, socially assisted; R, Roma preadolescents (socially assisted); AC, Activation Control; AL, Activation level; IC, Inhibitory Control; HIP, High Intensity Pleasure; PS, Pleasure Sensitivity; PERS, Perceptual Sensitivity; DM, Depressive Mood.

Also, using single-factor multivariate analysis of variances we verified the existing differences considering temperamental features in preadolescents depending on the type of vulnerability. SPSS 20 and type I procedure was used (for MANOVA).

There are weak correlations between the six DVs (Effortful Control, Negative Affectivity, Surgency, Affiliation, Aggression, and Depressive Mood), with linearity assumption being emphasized. Investigating the Box *M*-test— $p = 0.000$, therefore, we referred to the Pillai's Trace test value. Partial Eta Squared result ($\eta^2 = 0.05$) indicates a moderate effect size (Predoiu, 2020), while the Observed Power is very high (>0.996). The confidence considering the stability of the results is strong. When homogeneity of variance was assured, we interpreted the Scheffe test and when $p < 0.05$ (Levene's test) we interpreted the Tamhane test.

Table 5 comprises only the significant differences between the investigated groups (pre-teens from single-parent family—M group, pre-teens in which case a parent is working abroad—PP group, socially assisted—AS group, Roma preadolescents—R), in terms of the six DVs examined.

After running *post-hoc* tests (see Table 5), the following significant differences were emphasized:

- for Effortful Control ($p = 0.006$), between socially assisted pre-teens ($M_{\text{socially assisted}} = 50.73$) and Roma preadolescents (socially assisted)— $M_{\text{Roma preadolescents}} = 47.81$;
- for Affiliation, between students with a parent working abroad— $M_{\text{a parent is working abroad}} = 56.50$ and socially assisted preadolescents ($p = 0.002$, $M_{\text{socially assisted}} = 52.24$) and Roma pre-teens—socially assisted ($p = 0.005$, $M_{\text{Roma pre-teens}} = 52.01$);
- for Aggression, between Roma preadolescents (socially assisted) and socially assisted students ($p = 0.009$) and pre-teens with a

parent working abroad ($p = 0.010$)— $M_{\text{Roma preadolescents}} = 54.33$; $M_{\text{socially assisted}} = 50.06$; $M_{\text{a parent is working abroad}} = 48.68$.

4. Discussion

Considered the precursor of personality (Rothbart, 2007), temperament reflects the inter-individual differences in physiological and emotional reactions linked with the level of mental arousal and self-regulation (Rothbart et al., 2000a). Even if temperamental characteristics are relatively stable, as a result of children's learning experiences, certain aspects can be modeled (Kagan et al., 2007).

Understanding temperament is very important in order to promote school performance and adjustment (Checa and Abundis-Gutierrez, 2017). Also, research into temperament in children and adolescents is of great relevance, leading to comprehension of children's communication and interactions with others (Viñas et al., 2015). A particularly important problem refers developing positive (desirable) behaviors in pre-teens and adolescents and suppressing inappropriate ones (Pelín et al., 2018). It seems that a lower level of emotional reactivity (as a temperament trait) is associated with a good level of self-control (Necka et al., 2019), an important component of academic success, while “negative emotionality is associated with high psychological and behavioral controlling attempts of mothers” (Laukkanen et al., 2014).

In the case of preadolescents at risk of educational and social exclusion (in the current study), the following recommendations are made: teachers, psychologists, and parents can increase Effortful Control (the ability to regulate emotional states and to suppress initial reactions in order to adapt to the demands of the situation, also referring to concentration and mobility of attention) and

TABLE 5 Post-hoc tests—one-way MANOVA ($n = 184$ —AS group, $n = 38$ —PP group, $n = 70$ —R group, and $n = 37$ —M group).

| Dependent variables | | (I) Vulnerability | (J) Vulnerability | p | 95% confidence interval | |
|---------------------|---|----------------------|----------------------|-------|-------------------------|-------------|
| | | | | | Lower bound | Upper bound |
| Effortful control | Tamhane (Levene's test: $F = 5.477$, $p = 0.001$) | AS | PP | 0.991 | −2.571 | 4.067 |
| | | | M | 0.995 | −5.419 | 3.600 |
| | | | R | 0.006 | 0.604 | 5.235 |
| | | PP | AS | 0.991 | −4.067 | 2.571 |
| | | | M | 0.941 | −6.704 | 3.389 |
| | | | R | 0.403 | −1.171 | 5.515 |
| | | M | AS | 0.995 | −3.600 | 5.419 |
| | | | PP | 0.941 | −3.389 | 6.704 |
| | | | R | 0.138 | −0.695 | 8.355 |
| | | R | AS | 0.006 | −5.235 | −0.604 |
| | | | PP | 0.403 | −5.515 | 1.171 |
| | | | M | 0.138 | −8.355 | 0.695 |
| Affiliation | Scheffe (Levene's test: $F = 0.193$, $p = 0.901$) | AS | PP | 0.002 | −7.3551 | −1.1612 |
| | | | M | 0.173 | −5.6261 | 0.6368 |
| | | | R | 0.995 | −2.2096 | 2.6719 |
| | | PP | AS | 0.002 | 1.1612 | 7.3551 |
| | | | M | 0.677 | −2.2507 | 5.7777 |
| | | | R | 0.005 | 0.9872 | 7.9914 |
| | | M | AS | 0.173 | −0.6368 | 5.6261 |
| | | | PP | 0.677 | −5.7777 | 2.2507 |
| | | | R | 0.197 | −0.8069 | 6.2584 |
| | | R | AS | 0.995 | −2.6719 | 2.2096 |
| | | | PP | 0.005 | −7.9914 | −0.9872 |
| | | | M | 0.197 | −6.2584 | 0.8069 |
| Aggression | Tamhane (Levene's test: $F = 3.172$, $p = 0.024$) | AS | PP | 0.946 | −2.90 | 5.65 |
| | | | M | 0.855 | −8.08 | 3.44 |
| | | | R | 0.009 | −7.79 | −0.75 |
| | | PP | AS | 0.946 | −5.65 | 2.90 |
| | | | M | 0.552 | −10.15 | 2.76 |
| | | | R | 0.010 | −10.30 | −0.99 |
| | | M | AS | 0.855 | −3.44 | 8.08 |
| | | | PP | 0.552 | −2.76 | 10.15 |
| | | | R | 0.945 | −7.99 | 4.09 |
| | | R | AS | 0.009 | 0.75 | 7.79 |
| | | | PP | 0.010 | 0.99 | 10.30 |
| | | | M | 0.945 | −4.09 | 7.99 |

AS, socially assisted students; PP, students in which case a parent is missing (is working abroad); R, Roma preadolescents (socially assisted); M, preadolescents from single-parent families.

decrease Negative Affectivity (which includes frustration and fear) and Depressive Mood. Systematic practice of physical activity can help in this matter. Greeff et al. (2017), following a meta-analysis, underlined that physical activity has positive effects on attention and academic performance in pre-teens. Physical activity plays an essential role in children's lives as it positively influences their health, both physically and mentally (Biddle and Asare, 2011), and also contributes fundamentally to their social, emotional, and cognitive development (Ahn et al., 2018). It is known that exercising regularly can reduce stress and improve mood, school performance, memory, and creativity in children (Goodliff et al., 2018; Mattke, 2019). Physical activity can increase children's enthusiasm, optimism, self-esteem, and help regulate behavior (Limpo and Tadrist, 2021). It also reduces anxiety, tension, and depression (Chavan, 2019). Motor activities, practiced on a group level, can stimulate teamwork, cooperation, communication, friendship and, therefore, social integration—especially when children regularly play sports (Wiese-Bjornstal et al., 2009; Pelin et al., 2021). Researchers argued for the beneficial effects of physical education activities at motor, structural-functional, and psychological levels (see Pelin et al., 2020). Aslan et al. (2020) asserted that “the attention levels of primary school students doing sports were better than those who were not doing sports,” recommending that children should be involved in physical activities, which decreases learning difficulty.

Statistical data processing highlighted that, in the case of Surgency, boys obtained significantly higher scores than girls, while in the case of Affiliation (the need for closeness with others) and Depressive Mood girls registered higher values. Thus, specialists can involve girls (pre-teens) to a greater extent in physical activities, in new and complex tasks involving collaboration and communication with others, and can teach preadolescents positive reframing/reappraisal, as this technique is associated with a reduced level of depression (Beck and Strong, 1982; Swoboda et al., 1990).

Considering the type of vulnerability:

- Socially assisted pre-teens have a significantly better ability to regulate emotional states by redirecting attentional resources, as well as a significantly better capacity to suppress initial reactions for better adaptation to the environment, compared to Roma preadolescents (socially assisted).
- Students with an absent parent (for example, is working abroad) have a significantly higher need for warm and close relationships with others compared to socially assisted pre-teens.
- Roma preadolescents have a significantly higher score for aggression (verbal aggression, hostility, and object- and person-directed physical violence) compared to both socially assisted students and preadolescents with a parent working abroad. It should be noted that the results (at group level) are within average limits.

When talking about gender-dependent differences, statistical data processing showed that boys (Roma preadolescents—socially assisted) feel a greater need for closeness to others, and also feel less pleasure in activities involving low intensity, complexity, or novelty

compared to girls. With respect to socially assisted preadolescents (AS group), Activation level is lower in boys than in girls, while boys are significantly more shy than girls. When talking about Fear (PP and M groups), girls obtained higher scores than boys. In the case of pre-teens from single-parent families, girls registered a higher level of Aggression than boys, while in the case of pre-teens with a parent working abroad (is missing), girls obtained a significantly higher score for Depressive Mood. Specialists can thus intervene with priority in the case of girls (from PP and M groups) in order to reduce depressive mood and fear, and in boys (from AS group) for a higher activation level. In the case of children with low activity levels, researchers asserted that the benefits are greater when parents encourage their children to explore new stimuli (Blandon et al., 2010). Considering depressive mode in middle school students (6 grade), Moritz Rudasill et al. (2014) highlighted that depression symptoms in preadolescents were predicted by emotional reactivity (while negative emotionality predicted emotional reactivity), teachers' perceptions of student-teacher relationship quality, and pre-teens' perceptions of teacher support. The risk for depressive symptoms in children is higher, also, when parents use an authoritarian parenting style, based on discipline and strict punishments, at the expense of democratic discussions (Liu et al., 2022).

The way in which a professor, a psychologist, or a parent interacts with and motivates pre-teens and adolescents and guides them verbally or behaviorally plays a decisive role in student's success—in various activities (Lagace-Seguin and Coplan, 2005; Mitrache et al., 2018; Predoiu et al., 2020; Predoiu and Predoiu, 2022). Shi and Campione-Barr (2021) discuss the similarities between the parenting style and siblings' temperamental features. It seems that “a higher level of parenting similarity was related to more positive family relationships when siblings were more similar in their temperaments.” However, in the context of less sibling temperament similarity, a lower level of parenting similarity is preferable. Recent studies highlight the effect of screen time intake in child development, more specifically, screen media use (an exceedingly frequent activity) being detrimental to the development of Effortful Control (including attention, the ability to suppress inadequately answers—verbal or motor), and thereby shaping young children's temperaments (Fitzpatrick et al., 2022). Also, researchers found that parental monitoring acts as a protective factor for early substance use, especially in the case of more aggressive youth and those with low Effortful Control (Clark et al., 2015).

Recent specialized literature discusses the link between the levels of externalizing problems and temperamental factors (Surgency/Extraversion, Effortful Control, and Negative Affectivity), with maternal psychological distress partly explaining this link (see Garon-Carrier et al., 2022). As Liu et al. (2011) mention, internalizing behavior reflects a child's psychological or emotional state and typically includes depressive and anxious symptoms, social withdrawal, somatic complaints, and even teenage suicide. Externalizing behaviors on the other hand are described as aggressive, delinquent behaviors, being reflected by actions toward the physical environment (Eisenberg et al., 2001). Therefore, as Mullola et al. (2014) highlighted, “a temperament-conscious education needs to be taken into account in future

teacher training” (and also in parental education, as an important pillar of society), early manifestations of self-control being linked to consequential life outcomes (Clark et al., 2015). The current research fills a gap in the literature considering the temperamental characteristics (according to vulnerability and gender) of pre-teens at risk of educational and social exclusion.

This research has some limitations. The first limitation is the reduced number of pre-teens from PP and M groups (pre-teens with a parent working abroad and from single-parent families). Also, the time a parent spent abroad was not investigated (in the case of PP group). The results could be different if other categories of students were investigated (for example, adolescents), if the research was carried out in another country, or if other temperamental typologies were approached (Jung and Eysenck typology, Pavlov's types of nervous system, Hippocrates-Galen temperaments, constitutional typologies, etc.). In the current research, an explicit tool was used, the possible effect (possible socially desirable responses) being emphasized by the literature (Predoiu et al., 2022). The large number of respondents represents, however, a strength of the study. Future studies could focus on children in a certain grade (5th, 6th, etc.), on children from a specific region in Romania, on children with special educational needs (having disabilities or learning difficulties), or could examine different factors of temperament in relation to academic performance.

5. Conclusion

The conclusions of the current study, carried out in various regions of Romania, show that in the case of the four super factors of temperament and for the behavioral scales, the values (at group level) are, generally, within the average limits. In the case of pre-teens at risk of educational and social exclusion, specialists should increase Effortful Control (which includes inhibitory control and attention) and decrease Negative Affectivity (which includes frustration and fear) and Depressive Mood. In the case of Surgency, boys registered significantly higher scores than girls, while in the case of Affiliation and Depressive Mood girls obtained higher values. Gender-dependent differences in temperament were presented in the case of pre-teens from single-parent families (M group), with a parent working abroad (PP group), socially assisted preadolescents (AS), and Roma preadolescents—socially assisted (R). Also, differences considering temperamental features in preadolescents were highlighted, depending on the type of vulnerability (M, PP, AS, and R). The particularly important role of systematic physical activity is underlined, having the ability to reduce depression, improve mood, and help regulate behavior.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The present study was approved by the Local Ethics Committee of the National University of Physical Education and Sport, Bucharest, authorization number assigned is ID: 187. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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A-trait and risk-taking behavior in predicting injury severity among martial arts athletes

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Introduction: Trait anxiety (A-trait) can be seen as a multiplicative function of the person–situation interaction. Considering risk-taking behavior (R-TB), literature highlights instrumental and stimulating risk. The aim of the research is to investigate the level of A-trait (in physically dangerous conditions and in new, unusual situations) and the level of R-TB (instrumental and stimulating risk) in athletes, and to verify to what extent A-trait and risk-taking behavior predict injury severity.

Materials and methods: One hundred and fifty-four senior martial arts athletes from grappling combat sports, striking combat sports and mixed martial artists (MMA) participated in the study. For assessing trait anxiety and risk-taking behavior, the Romanian adaptation of the Endler Multidimensional Anxiety Scales (EMAS), respectively the Romanian adaptation of the Makarowski’s Stimulating and Instrumental Risk Questionnaire were used.

Results: Using multivariate analysis of variance, significant differences between athletes (according to the sports disciplines practiced), in terms of A-trait and R-TB, were examined. Next, we checked the existing correlations between injury severity, A-trait and R-TB scores in athletes practicing striking combat sports, grappling combat sports and MMA. To verify whether there are significant differences in terms of trait anxiety, stimulating and instrumental risk between athletes who have suffered mild, moderate and/or severe injuries and athletes who have suffered only minor/mild injuries, t-Test for Independent Samples was used. Binomial logistic regression procedures were, also, performed, predicting athletes’ likelihood of injury, based on R-TB and A-trait.

Conclusion: A moderate or slightly below average level of anxiety in new, unusual situations and a higher level of instrumental risk are linked with a decreased likelihood of severe injuries in athletes. Martial arts athletes (in entire sample) who have suffered more severe injuries are more adrenaline-seeking in competition and use less rational thinking, taking more pleasure in just performing technical executions, regardless of the outcome.

KEYWORDS

trait anxiety, sports injury, martial arts, risk-taking behavior, athletes

1. Introduction

Combat sports and martial arts are part of the heuristic sport disciplines, requiring for athletes to be inventive, to make fast decisions and carry out appropriate technical-tactical actions in competitions and training, showing cold blood under stressful circumstances (Predoiu et al., 2018). When talking about the relationship between combat sport and martial arts, Kalina (2000) highlighted - “every combat sport is martial arts but not vice versa” (p. 18). With respect to the forms of direct confrontation, martial arts can be divided into two categories (see Predoiu et al., 2022a): Grappling combat sports (judo, jiu-jitsu, freestyle wrestling) which use techniques of throws, ground locks, grips of immobilization of opponent's body and finishing with joint forcing or choking techniques (Andreato et al., 2017; Coswig et al., 2018) and Striking combat sports (e.g., boxing, kick-boxing, karate, Muay Thai, kenpō, taekwondo, fencing - working with weapons in this case). Considering mixed martial arts (MMA), represents a category which combines techniques from both fighting styles - striking and grappling (Di Bacco et al., 2020).

Combat sports and martial arts have the potential to convey moral values, one of the key elements of martial arts training being the social, ethical and moral development of people practicing (Kostorz and Sas-Nowosielski, 2021).

During a sporting career, competitive athletes may face injuries, a severe injury (or even moderate) being a traumatic event, affecting the psychophysical health in athletes (Brewer, 2007). Injury is seen as “any sports-related musculoskeletal complaint that resulted in an athlete to stop, limit, or modify participation for one or more days” (Li et al., 2015). Also, James and Pieter (2003) defined injury as any situation for which medical assistance was sought, including time-loss injury for a minimum of 1 day. With the increase in the level of performance in sport, an increase in injuries of all kinds was observed (Macedo-Filho et al., 2019; Moriarty et al., 2019). However, in martial arts, as expertise increased the number of injuries decreased (Birrer and Birrer, 1982), a higher frequency of injuries being observed during lower level competitions (when comparing with higher level ones) - Frey et al. (2004).

Injuries in contact sports have a different typology and anatomical regions are affected differently depending on the fighting style (Bledsoe et al., 2006; Del Vecchio et al., 2018). In striking sports injuries are due to limb strikes (fist, elbow, knee, leg), the most common being contusions and tegumentary injuries, with limbs and head (face area) being affected (Hammami et al., 2018; Goes et al., 2020). After a systematic review considering injuries in karate, Thomas and Ornstein (2018) discuss about the following rates/1000AE, in males: lacerations/ contusions/ bruises/ abrasions/ tooth avulsion - 68.1; sprains/ strains - 3.5; epistaxis/ bleeding/ hematomas - 11.4; dislocations - 2.9; concussions - 2.5; fractures - 2.9. The authors assert that “rates of injury/1000AE and/1000 minutesAE were similar for males (111.4/1000AE, 75.4/1000 minAE) and females (105.8/1000AE, 72.8/1000 minAE),” in competitions. Considering boxing (also, a striking combat sport), traumatic brain injuries during competitions are the most severe ones (Jayarao et al., 2010).

In grappling sports the mechanisms are joint sprains and strains, and the typology includes dislocations/subluxations, sprains, ligament injuries, tendon injuries and fractures. The areas affected are the joints of the upper and lower limbs, and intra- and periarticular structures

(Pappas, 2007; Jensen et al., 2017; Johnson et al., 2019). In grappling combat sports (e.g., judo), anterior cruciate ligament ruptures are one of the most severe injuries (Lambert et al., 2022). After analyzing the injury incidence during a World Judo Championship, Miarka et al. (2018) found miscellaneous traumas (42.6%) and a higher prevalence of soft-tissue injuries (58.8%) which occurred during gripping fight or when being thrown. A lower prevalence of injuries was observed in the Final, when comparing to Eliminary phases of the competition. In 2014, researchers (Pococco et al., 2013) highlighted (following a systematic literature review) that a few retrospective and prospective studies dealing with judo injuries are available in the literature. Not least, with respect to the freestyle wrestling, specialized literature underlines that knee joint, hands, wrist, the lumbar and cervical spine, and the area of the trunk are the most common locations for injuries; each of the experienced wrestlers suffered contusions, 55.81% damage to tendons and of articular structures (Brzezińska et al., 2022).

When talking about Mixed-Martial-Arts (MMA) “the injury rate was 9.9 injuries per 100 athletic-exposures (AE)” - for upper limb injuries (Fares et al., 2022), while “head injury rate constituted 35 injuries per 100 athletic-exposures (AE)” - Fares et al. (2021). Among all martial arts and combat sports the most frequent injuries have been damages of knee ligaments (16%) and broken bones (21%) (Cynarski and Kudłacz, 2008). In this context, is very important for specialists to combine psychological and physiological techniques to find preventive actions. In Evans and Brewer (2022) argued that “areas of science in which policy and practice lag behind research evidence are known as *valleys of death* [...] and developments in the evidentiary base are required to reach and cross the valley of death to advance the application of psychology to sport injury prevention and rehabilitation over the next 10 years.”

On the severity of injuries in sport, Maffulli and Caine (2005) emphasized a comparison with respect to the existing data in the literature (11 selected studies were investigated and cited), taking into account the time loss from competition, fractures and hospitalization, in: (1) mild (maximum 3 days missed), moderate (4–14 days missed), severe injuries (long-term sequela expected); (2) mild (maximum 1 week time loss), moderate (1–3 weeks time loss), severe injuries (more than 3 weeks time loss); (3) minor (2–7 days time loss), moderate (8–24 days time loss), severe (more than 25 days time loss); (4) minor (maximum 7 days missed), moderate (8–27 days missed), severe (minimum 28 days missed). Also, as Piedade et al. (2021) asserted (talking about martial artists), “in mild injuries the wrestler returns to training and competition according to his symptoms, typically in 2–3 weeks,” while Brzezińska et al. (2022) mentioned that in freestyle wrestling, unfortunately, about 30% of the injuries required surgical treatment. After investigating the existing data in the literature we can conclude that after 2–3 weeks missed/ time loss we are talking about (at least) a moderate injury.

According to The Global Psychological Model of Sports Injury (see Souter et al., 2018), anxiety, stress, depression enhance the risk of injury. Also, Williams and Andersen (1998), in their model of injury and stress, are discussing about personality traits (including anxiety) which can increase distress and the chance of injury in athletes. An A trait-person (person with trait anxiety) is perceiving a broad range of circumstances as being threatening, “and the individual reaction to life events is typically disproportionate to the actual fear properties of the stimulus” (LeUnes, 2008). Considering risk-taking behavior (R-TB), literature highlights instrumental and stimulating risk (Zaleśkiewicz,

2001): instrumental risk is characterized by greater focus on possible losses, the person is reflexive, cognitive processes dominate, as well as reason in decision-making, while stimulating risk is characterized by impulsive, unconscious decision-making and emotional processes dominate. Therefore, R-TB can have two motivations: experiencing pleasurable physiological arousal (stimulating risk) - regardless of the result, or achieving an important goal (instrumental risk). Investigating martial arts athletes, in 2021, Makarowski et al. (2021) emphasized that athletes from Spain registered the lowest results considering stimulating risk, while Romanian martial arts athletes reported the highest values. When talking about the instrumental risk, Russian athletes achieved the lowest values, while Spanish athletes reported the highest scores.

Specialized literature mentions that a high level of anxiety and low coping resources increase the risk of injury in athletes, especially in competition (González-Reyes et al., 2017; Şenışık and Köyağasıoğlu, 2021). Wiese-Bjornstal theory presents the biopsychosocial sport injury risk profile (see Wiese-Bjornstal et al., 1998; Frykholm, 2022) - four categories are taken into account: biological, psychological, physical, and sociological, each holding various levels of risk behavior, risk exposure, and vulnerability to injury.

It was found that anger and fatigue (Galambos et al., 2005), type A athletes - impatient, more aggressive (Nigorikawa et al., 2003), or perfectionistic concerns/ athletes' perfectionism (but maladaptive perfectionism) - Madigan et al. (2019) are related to an increase likelihood of being injured. Also, meta-analyses show that neuroticism and extraversion are related to dangerous behaviors, accidents, and injuries (Beus et al., 2015).

In an attempt to identify the athletes' psychological profile considering the vulnerability to injuries, Andreu et al. (2014) discuss about lower levels of success-oriented motivation and hardiness, and higher levels of motivation oriented to avoid failure and competitive anxiety. It seems that low values on Negative Energy Control and Emotional Stability (Berengüi-Gil et al., 2013), and high scores for Impulsive Sensation Seeking and considering the General Anxiety Disorder Scale (GAD-7) (Madzar et al., 2017) are increasing the likelihood of being injured in athletes. Not least, Berengüi-Gil and Puga (2015) are talking about competitive trait anxiety (high scores) and self-confidence (low values), as predictors of the number of injuries in athletes (in the total sample: athletics - 33.9%, cycling - 12.2%, freestyle wrestling - 21.7%, canoeing - 16.5% and taekwondo - 15.7%). However, in the above prospective study (over a period of 10 months), the number of lesions were counted and correlated to the investigated variables, without providing clear information considering the injury severity. Also, trait anxiety was less examined separately, as in the present research: anxiety of physical danger and anxiety in new, unusual situations, so it's still worth investigating this topic. We mention a lack of attention to the risk-taking behavior (stimulating and instrumental risk), and A-trait levels (we refer to anxiety in new or ambiguous situations and anxiety in physically dangerous conditions) among martial arts athletes, especially in relation with injury severity.

1.1. The current study

The aim of the research is to investigate the level of trait anxiety (in physically dangerous conditions and in new, unusual situations)

and the level of risk-taking behavior - R-TB (stimulating and instrumental risk) in competitive martial arts athletes, according to the practiced sports discipline. In the current study we refer to grappling combat sports, striking combat sports, and, also, to striking and grappling sports (Mixed Martial Arts, which combines techniques from both fighting styles), as in previously studies (Predoiu et al., 2022a). At the same time, we wanted to capture the differences between athletes who have suffered at least medium severity injuries and athletes who have not suffered such sports injuries up to the time of testing (considering A-trait and R-TB) and to verify to what extent A-trait and R-TB predict injury severity in martial artists.

1.2. Objectives

- Knowing the A-trait and R-TB level in martial arts athletes from striking combat sports, grappling combat sports, respectively striking and grappling (Mixed Martial Artists);
- Identifying the links between injury severity, athletes' anxiety in new conditions, in physically dangerous circumstances and martial arts' level of instrumental and stimulating risk;
- Establishing the differences between martial arts athletes, in terms of A-trait and R-TB, taking into account injury severity;
- Identifying predictors of injury severity in the case of martial arts athletes.

H1: There are significant differences between martial arts athletes according to the specifics of the sports disciplines (striking combat sports, grappling combat sports, respectively striking and grappling - MMA), in terms of A-trait and risk-taking behavior.

H2: There are significant correlations between athletes' injury severity and martial arts' level of A-trait and R-TB.

H3: Investigation of martial arts athletes who have suffered mild, moderate and/or severe injuries and athletes who have suffered only minor/mild injuries reveals significant differences between the two groups in terms of A-trait and R-TB.

H4: The results for R-TB represent a better predictor of injury severity among martial arts athletes than the results obtained for A-trait.

2. Materials and methods

2.1. Participants

One hundred and fifty-four Romanian martial arts athletes, affiliated to various sports clubs in Romania, participated in the study, 132 male and 22 female, aged 20–32 years ($M_{age} = 24.6$, $SD = 4.12$). The athletes had a minimum of 4 years of competitive experience and have been practicing martial arts for an average of 8.39 years, $SD = 3.10$ (in the entire sample). Inclusion criteria: minimum 4 years of competitive experience, minimum 20 years old (seniors), and minimum 12 matches/ official fights per year. Also, athletes investigated in the

current study should not have suffered severe injuries before the investigated period (January 2018–December 2021).

We mention that 188 eligible martial arts athletes (in terms of age and competitive experience) were tested in the initial stages of the study, but 154 remained for future analysis because: seven athletes could not declare the number of official matches/fights (per year) in the last 4 years, because they did not have/no longer have the competition planning and results obtained, nor could they check online (or with the coach) the number of matches held in certain competitions, and eight athletes reported less than 12 official matches/fights per year (consistently). Also, 19 martial arts athletes reported that they suffered at least one severe injury prior the investigated period (January 2018–December 2021). The reasoning behind the decision to remove from the study the 19 athletes (mentioned above) is linked with the existing challenges, for athletes, when returning in competitions from serious injuries, including anxiety related to injury recovery, anxiety associated with return to play (see, for example, Ogu and Adegbesan, 2013; Bennett and Lindsay, 2016) and fear of reinjury (Cassidy, 2006). By removing these martial arts athletes from the research, we wanted to provide a relatively similar level in terms of the severity of injuries suffered by athletes, at time t_0 (knowing, also, that psychological and physical readiness to return to sport after sports injuries are not synonymous - Podlog and Eklund, 2006).

The snowball sampling technique was used in the current study due to the specifics of the investigated athletes - part of hard-to-reach population: senior martial arts athletes, having minimum 4 years of competitive experience, having only mild injuries, or minimum one injury of at least medium severity, minimum 12 official matches/ fights per year, and who have not suffered severe injuries before the beginning of the investigation period.

The distribution of the participants is captured in Table 1.

It is worth mentioning that the highest risk for time loss (after sports injury, in different sports branches) was registered between 20 and 24 years (Kujala et al., 1995).

In the case of martial artists having minimum one injury of at least moderate severity in the last 4 years, these athletes suffered, also, mild injuries in competitions (but unlike the group with *Only minor injuries*, the differences are clear—see Table 1). When talking about martial arts athletes with only minor/mild injuries, the number of these injuries was not of interest for the current study, being relatively common in competitions and training.

Athletes having international or national level performances were classified as elite/experts (according to the athletes' highest standard of performance—Swann et al., 2015), while a second group obtained regional or local level results. In both groups (according to the standard of performance) athletes suffered all kinds of injuries—mild, moderate and severe (described in Table 1).

2.2. Measures

For assessing trait anxiety (A-trait), the Romanian adaptation of the Endler Multidimensional Anxiety Scales (EMAS) was used (Miclea S. et al., 2009), more exactly, anxiety in new or ambiguous conditions and anxiety in physically dangerous circumstances. EMAS (created by Endler et al., 1991) is a “factorial approach to anxiety assessment,” anxiety being seen as a “multiplicative function of the person–situation interaction” (LeUnes, 2008). There are 15 items in

each scale - the items are the same, the martial arts athletes being asked to imagine themselves in the described circumstance. Specifically, for anxiety in physically dangerous situations the standard tutorial was - “We are interested in your reactions to the situations that involve dealing with physically dangerous or potentially harmful things, objects or events,” while for anxiety in new, unusual conditions the tutorial was - “We are interested in your reactions to new, unfamiliar situations and when you are not sure what to expect.” These situations (physically dangerous and new, unusual) are specific, especially, in sports with active and creative opponents, where a greater adaptability of the athlete is needed, as in martial arts, where decisions can be made in a split second.

EMAS was calibrated for the Romanian population by the Cognitrom Company, being part of the CAS⁺⁺ platform (Miclea M. et al., 2009). The interpretation of the results (T scores, automatically generated by the computerized platform, eliminating gender and age differences) is: 45–55 = average results; under 40 = low scores; over 60 = high values; 40–45 = slightly below average results; 55–60 = slightly above average results. Participants responded on a 5-point Likert scale, where 1 - “Not at all,” and 5 denotes “Very much.” Examples of items: “I feel worried,” “I feel comfortable,” “I trust myself,” “I am agitated,” etc. The reliability of the two scales in the present study was verified using the McDonald's omega coefficient (ω). Considering anxiety in new, ambiguous situations, ω was 0.72, and for anxiety in physically dangerous conditions ω was 0.74 (a satisfactory internal consistency).

In order to assess risk-taking behavior, the Romanian adaptation of the Makarowski's Stimulating and Instrumental Risk Questionnaire was used (Makarowski et al., 2021). The instrument has 8 items, each scale: stimulating risk and instrumental risk having four items (allowing a rapid assessment of risk levels in athletes). There are five ways of answering, from “a” which denotes True (5 points), to “e” which denotes Untrue (1 point). There are no reverse-scored items. The internal consistency of the two factors was calculated for the current research (using McDonald's omega coefficient). The values were: $\omega = 0.79$ for stimulating risk, and $\omega = 0.76$ in the case of the instrumental risk.

With respect to the stimulating risk - martial arts athletes are searching for highly stimulating situations, that bring pleasure, being focused on sensation seeking. Athletes do not think about the result/outcome, it is the actions performed and the pleasure felt that count. Stimulating risk involves a state of excitement and an increase level of physiological arousal. In contrast, instrumental risk implies rational thinking - athletes think about the outcome of the technical executions they perform, choosing risk only when they consider there is a chance of winning (see, also, Predoiu et al., 2022b).

The Desirability Scale of the Zuckerman-Kuhlman Personality Questionnaire (part, also, of the computerized platform CAS⁺⁺, calibrated on the Romanian population - Miclea M. et al., 2009) was used, in order to minimize the likelihood of inadequate responses from athletes (no martial art athlete was removed from the research following the answers to this scale).

An injury report form was created starting from previous studies (e.g., Willick et al., 2013), gathering the following information through 10 questions (close- and open-ended questions were used): (1) gender; (2) age; (3) type of sport; (4) competitive experience (in years); (5) number of official matches/ fights per year - in competitions (from January 2018 to December 2021); (6)

TABLE 1 Descriptive statistics of surveyed martial arts athletes.

| Variable | Value |
|---|--|
| Gender <i>N</i> (%) | |
| Male | 132 (85.7%) |
| Female | 22 (14.3%) |
| Age, <i>M</i> (<i>SD</i>) | 24.6 (4.12) |
| Sports disciplines <i>N</i> (%) | |
| Striking sports disciplines (boxing, karate, kickboxing, taekwondo) | 64 (41.5%)—54 male (M) and 10 female athletes (F) |
| Grappling sports disciplines (judo and jiu-jitsu–BJJ) | 39 (25.3%)—31 M and 8 F |
| Striking and Grappling (Mixed martial arts–MMA) | 51 (33.1%)—47 M and 4 F |
| Injuries <i>N</i> (%) | |
| Striking sports disciplines | |
| Minimum one injury of at least medium severity | 30 M and 2 F (50%) |
| | - 14 athletes had only 1 or 2 moderate injuries: grade 2 sprain, tendon injury, dislocation |
| | - 12 athletes suffered only one severe injury: grade 3 sprain or fracture (e.g., forehead fracture, broken cheekbone/upper jaw, skull fracture, fracture of the shin bone/tibia, around the knee or in the foot) |
| | - 6 athletes suffered one severe and also 1 or 2 moderate injuries |
| Only mild injuries | 24 M and 8 F (50%) - grade 1 sprain, contusion, concussion, laceration |
| Grappling sports disciplines | |
| Minimum one injury of at least medium severity | 18 M and 5 F (59%) |
| | - 11 athletes had only 1 or 2 moderate injuries: grade 2 sprain, tendon injury, dislocation |
| | - 8 athletes suffered only one severe injury: grade 3 sprain or fracture (e.g., at the wrist, elbow, shoulder, ankle, around the knee) |
| | - 4 athletes suffered one severe and also 1 or 2 moderate injuries |
| Only mild injuries | 13 M and 3 F (41%) - grade 1 sprain, contusion, concussion, laceration |
| Striking and grappling sports disciplines (MMA) | |
| Minimum one injury of at least medium severity | 29 M and 3 F (62.7%) |
| | - 15 athletes had only 1 or 2 moderate injuries: grade 2 sprain, tendon injury, dislocation |
| | - 10 athletes suffered only one severe injury: grade 3 sprain or fractures (mentioned above) |
| | - 7 athletes suffered one severe and also 1 or 2 moderate injuries |
| Only mild injuries | 18 M and 1 F (37.3%) - grade 1 sprain, contusion, concussion, laceration |
| Sports performances <i>N</i> (%) | |
| Striking sports disciplines | |
| International/national level | 20 (31.3%) |
| Regional/local level | 44 (68.7%) |
| Grappling sports disciplines | |
| International/national level | 15 (38.5%) |
| Regional/local level | 24 (61.5%) |
| Striking and grappling sports disciplines (MMA) | |
| International/national level | 19 (37.3%) |
| Regional/local level | 32 (62.7%) |

highest sports performance; (7) at least one severe injury existing before the investigated period - prior to January 2018 (answer options Yes/ No); (8) injury severity (type of injuries) (a) mild injuries (e.g., grade 1 sprain, contusion, concussion, laceration, or

something else—a free space was available, also, for athletes to complete, following the listed/available variants) during training or competition, each year (Yes/No), (b) moderate injuries (minimum 2–3 weeks missed), e.g., grade 2 sprain, tendon injury, dislocation

or something else (a free space was available, also, for athletes to complete, following the mentioned/available variants), (c) severe injuries (months missed/ time loss), e.g., grade 3 sprain or fracture (a free space was available, also, for athletes to complete, following the listed/available variants); (9) place where moderate or severe injury occurred (a) only in competitions/official matches, (b) only during training, (c) in competition or training. A tenth question (close-ended) concerned whether athletes carried out psychology-based counseling programs after injuries, regardless of severity (Yes/No - 17.5% of martial arts athletes gave a positive answer). At question 8 (a), all martial artists declared that they suffered mild injuries during trainings or competitions (each year), and at question (9) athletes reported that moderate or severe injuries were suffered only in official fights/ matches (in competitions). In this context it is worth mentioning Thomas and Thomas' systematic review of injuries in martial arts (2018), in which researchers asserted that "there are no studies of training injuries of professionals [...] or long-term follow-up of musculoskeletal injuries or neurological damage."

2.3. Research design

The investigation is based on *ex post facto* design - the analysis started (the online surveys were applied) after the fact has occurred, martial art athletes already suffered certain injuries (between January 2018–December 2021) and obtained various sports results in competitions, without interference from the researchers (is a retrospective research).

2.4. Procedure

The questionnaires for assessing A-trait, risk-taking behavior, and the injury report form (including socio-demographic information, and data regarding injury severity and the highest sports performance achieved at the time of the survey) were applied *via* Google forms (Google LLC, Mountain View, CA, United States), between March 2022–September 2022. The research was conducted in Romania. We mention that because of the COVID-19 pandemic, for approximately 1 year (starting from March 2020, when the World Health Organization classified the coronavirus disease 2019 as a pandemic), the sports activity (in sports clubs) was constantly interrupted or stopped (the vaccination campaign began, in Romania, on December 27, 2020). During the pandemic "martial arts competitions were organized in Romania (and televised), but without spectators. Only athletes and coaches had access in the competition hall, and they were previously tested against COVID-19" (Predoiu et al., 2022c). In this period, the martial arts athletes from the current research trained exclusively at home (during the lockdown period), and when the conditions relaxed, they practiced outdoors (in parks, on sports fields), respecting the measures of social distancing. Each athlete had minimum 12 official matches/ fights per year (including during the first year of the pandemic), the maximum number of fights (in 1 year) being 25. More exactly, 68.84% of athletes had between 12 and 18 fights per year (in official competitions, $M = 15.25$, $SD = 1.71$), while 31.16% - between 19 and 25 matches per year ($M = 20.83$, $SD = 1.80$). In the case of martial arts athletes who suffered at least one

severe injury - this is the case for 47 of the participants in the current study (30.5%), being out from competitions for several months following the severe injury, matches were counted (minimum 12 matches/fights per year, as inclusion criteria) during 1 year starting from their first competition after recovery. Moderate and severe injuries occurred to athletes in competitions and training in the last 4 years (between January 2018–December 2021) were counted. It is worth mentioning that (in the present study) no athlete reported moderate or severe injuries during trainings (but only mild injuries). Sixteen martial arts athletes had the same moderate injury twice (a recurrent injury), being counted once, the same as in Li et al. (2015) study (see Table 1 for the distribution of athletes according to self-reported injuries).

2.5. Statistical analysis

IBM SPSS Statistics Version 27.0 (Armonk, NY, IBM Corp) was used for the statistical analysis. In the case of the single-factor multivariate analysis of variance, taking into account the Levene's test results (equality of variance- $p > 0.05$), Scheffe post-hoc test was interpreted (Popa, 2010). Using Pearson correlation (r) for parametric tests, relationships between variables were highlighted: strong = $0.51(-0.51) - 0.75(-0.75)$; weak and moderate = $0.26(-0.26) - 0.50(-0.50)$; very strong and perfect = $0.76(-0.76) - 1.00(-1.00)$; null and very weak = $0.00-0.25(-0.25)$ (Weinberg and Abramowitz, 2002). Considering the effect size for correlation (the coefficient of determination) $r^2 = 0.25$ - a large effect, $r^2 = 0.09$ - a moderate effect, $r^2 = 0.01$ - a small effect (Cronk, 2020). *t*-Test for Independent Samples was also used. Investigated variables were normally distributed, with Skewness coefficients (in absolute value) being less than 1 (Morgan et al., 2004). Finally, analysis of the results involved using binomial logistic regressions, effect size (Nagelkerke R^2) being interpreted as follows: 0.2 small effect size, 0.15 medium, 0.35 large effect size (Cohen, 1992).

3. Results

With respect to the preliminary data analysis (stem-and-leaf) no outliers were registered. Also, due to the online survey/submission (all items had to be rated), there were no missing data.

First, we were interested to emphasize if there is a significant association between the level of athletes' performance (1–international/national, 2–regional/local) and injury severity (1–only mild injuries, 2–one or two moderate injuries, 3–only one severe injury, and 4–athletes suffered one severe injury and one or two moderate injuries), separately, for Striking, Grappling, respectively Striking and Grappling disciplines. The degree of association–Gamma coefficient, between the variables (sports performance and injury severity) was insignificant: Gamma =

-0.180 , $p = 0.389$ (Striking); Gamma = 0.247 , $p = 0.278$ (Grappling); Gamma = 0.199 , $p = 0.323$ (Striking and Grappling). Therefore, no significant associations were found between the level of sports performances and injury severity in martial arts athletes (analyzed separately, according to the sports disciplines practiced).

The results obtained by athletes for the dependent variables analyzed (at descriptive level), according to the sport discipline

TABLE 2 Descriptive statistics—A-trait and R-TB, martial arts athletes.

| | | | |
|--|--|------|-------|
| Instrumental risk | Striking combat sports | Mean | 17.06 |
| | | SD | 2.115 |
| | Grappling combat sports | Mean | 16.56 |
| | | SD | 2.479 |
| | Striking and grappling combat sports (MMA) | Mean | 16.22 |
| | | SD | 3.164 |
| Stimulating risk | Striking combat sports | Mean | 10.97 |
| | | SD | 4.276 |
| | Grappling combat sports | Mean | 10.82 |
| | | SD | 3.926 |
| | Striking and grappling combat sports (MMA) | Mean | 11.45 |
| | | SD | 3.936 |
| Anxiety in physically dangerous conditions | Striking combat sports | Mean | 38.72 |
| | | SD | 7.188 |
| | Grappling combat sports | Mean | 40.41 |
| | | SD | 5.665 |
| | Striking and Grappling combat sports (MMA) | Mean | 36.78 |
| | | SD | 6.577 |
| Anxiety in new, unusual situations | Striking combat sports | Mean | 47.05 |
| | | SD | 7.291 |
| | Grappling combat sports | Mean | 48.26 |
| | | SD | 6.695 |
| | Striking and grappling combat sports (MMA) | Mean | 46.37 |
| | | SD | 7.597 |

practiced are presented in [Table 2](#) (in the case of trait anxiety, results are expressed in T-scores, see *Measures* section for T-scores interpretation).

Using multivariate analysis of variance (MANOVA) we tested whether there were significant differences between martial arts athletes in the disciplines of Striking, Grappling, Striking and Grappling, respectively, in terms of trait anxiety and risk-taking behavior.

There are weak and very weak positive correlations between the four dependent variables, with the linearity condition being assumed (in the case of MANOVA). The value of the Box M test is insignificant ($p=0.181$), therefore we refer to the Wilks Lambda test values: Wilks' Lambda = 0.918, $F(8, 296) = 1.618$, $p=0.119$. The type I procedure (for group inequality) was selected. Considering the Test of Between-Subjects Effects, the sports discipline practiced significantly influence only the results for anxiety in physically dangerous situations ($F=3.361$, $p=0.037$, Partial Eta Squared = 0.043). The homogeneity of variances condition was met - $p>0.05$ (Levene test), therefore the Scheffe post-hoc test was interpreted ([Table 3](#)).

Significant differences between martial arts athletes by sport discipline were found only in the case of anxiety in physically dangerous situations - $p=0.039$ ([Table 3](#)), between the sports disciplines of Grappling ($M_{\text{GRAPPLING}} = 40.41$, $SD = 5.66$) and Striking and Grappling (MMA) - $M_{\text{STRIKING and GRAPPLING}} = 36.78$, $SD = 6.57$.

Next, we checked the existing relationships between injury severity, A-trait and R-TB scores in martial artists, separately,

according to the sports disciplines. In the case of injury severity: 1—only minor/mild injuries, 2—one or two moderate injuries, 3—only one severe injury, and 4—athletes suffered one severe injury and one or two moderate injuries. [Table 4](#) contains only the significant relationships between variables.

[Table 4](#) emphasizes no significant correlations between injury severity and results for A-trait and R-TB ($p>0.05$) in the case of both striking and grappling combat sports. However, a significant positive correlation was observed ($r=0.643$, $p<0.001$, the coefficient of determination/ effect size $r^2=0.41$ —in striking combat sports; $r=0.761$, $p<0.001$, $r^2=0.58$ —in grappling combat sports) between anxiety in new situations and anxiety in physically dangerous circumstances. In the case of Mixed Martial Arts athletes a significant relationship between injury severity and anxiety in physically dangerous situations was found ($r=0.408$, $p=0.020$, $r^2=0.16$). A higher score for this facet of anxiety (at group level athletes scored below average, according to the standard/norms) is associated with more severe injuries. We can say that 16% of the total variation is shared/common between the two variables, the rest being due to other influences (the relation between injury severity and anxiety in physically dangerous conditions is moderate to strong; 95% confidence interval: lower limit = 0.15 and upper limit = 0.614). Also, the results in [Table 4](#) emphasize a significant positive correlation between anxiety in physically dangerous circumstances and: stimulating risk ($r=0.441$, $p=0.012$, $r^2=0.19$), respectively anxiety in new situations ($r=0.416$, $p=0.018$, $r^2=0.17$).

TABLE 3 Post-hoc Scheffe test—single-factor multivariate analysis of variance.

| Variables | (I) Sports discipline | (J) Sports discipline | Mean difference (I-J) | <i>p</i> |
|--|--|------------------------|-----------------------|--------------|
| Instrumental risk | Striking combat sports | Grappling | 0.50 | 0.640 |
| | | Striking and grappling | 0.85 | 0.224 |
| | Grappling combat sports | Striking | −0.50 | 0.640 |
| | | Striking and grappling | 0.35 | 0.819 |
| | Striking and grappling combat sports (MMA) | Striking | −0.85 | 0.224 |
| | | Grappling | −0.35 | 0.819 |
| Stimulating risk | Striking combat sports | Grappling | 0.15 | 0.984 |
| | | Striking and grappling | −0.48 | 0.820 |
| | Grappling combat sports | Striking | −0.15 | 0.984 |
| | | Striking and grappling | −0.63 | 0.768 |
| | Striking and grappling combat sports (MMA) | Striking | 0.48 | 0.820 |
| | | Grappling | 0.63 | 0.768 |
| Anxiety in physically dangerous conditions | Striking combat sports | Grappling | −1.69 | 0.456 |
| | | Striking and grappling | 1.93 | 0.302 |
| | Grappling combat sports | Striking | 1.69 | 0.456 |
| | | Striking and grappling | 3.63 | 0.039 |
| | Striking and grappling combat sports (MMA) | Striking | −1.93 | 0.302 |
| | | Grappling | −3.63 | 0.039 |
| Anxiety in new, unusual situations | Striking combat sports | Grappling | −1.21 | 0.714 |
| | | Striking and grappling | 0.67 | 0.885 |
| | Grappling combat sports | Striking | 1.21 | 0.714 |
| | | Striking and grappling | 1.88 | 0.476 |
| | Striking and grappling combat sports (MMA) | Striking | −0.67 | 0.885 |
| | | Grappling | −1.88 | 0.476 |

TABLE 4 Correlation (Pearson *r*) between injury severity, A-trait and R-TB scores.

| | | IS | A | B | C | D |
|------------------------------|----------|--------|--------|--------|----------|--------|
| Striking combat sports | | | | | | |
| D | <i>r</i> | 0.284 | −0.134 | 0.346 | 0.643 | 1.000 |
| | <i>p</i> | 0.115 | 0.464 | 0.053 | 0.000*** | . |
| Grappling combat sports | | | | | | |
| D | <i>r</i> | 0.171 | −0.242 | 0.128 | 0.761 | 1.000 |
| | <i>p</i> | 0.436 | 0.267 | 0.561 | 0.000*** | . |
| Striking and Grappling (MMA) | | | | | | |
| C | <i>r</i> | 0.408 | −0.181 | 0.441 | 1.000 | 0.416 |
| | <i>p</i> | 0.020* | 0.321 | 0.012* | . | 0.018* |

IS, Injury severity; A, Instrumental risk; B, Stimulating risk; C, Anxiety in physically dangerous conditions; D, Anxiety in new, unusual situations.

p* < 0.05; **p* < 0.001.

To verify whether there are significant differences in terms of trait anxiety and risk-taking behavior between martial arts athletes who have suffered mild, moderate and/or severe injuries (*n* = 87) and athletes who have suffered only minor/mild injuries - *n* = 67, t-Test for Independent Samples was used (dependent variables were normally distributed, the skewness values being less than 1). The results for

descriptive statistics (in the case of A-trait and R-TB, according to injury severity) are highlighted in Table 5.

The results in Table 6 underline that the average value for instrumental risk is significantly higher [*t* = −2.05, *p* = 0.042] in martial arts athletes who have suffered only mild injuries (obtained a high score, according to the norms - see Makarowski et al., 2021) compared to athletes who have suffered mild, moderate and/or severe injuries (registered a lower score). When talking about anxiety in new, unusual situations, we emphasized, also, a significant difference [*t* = 2.11, *p* = 0.037] between athletes who have suffered only mild injuries and those who experienced more severe injuries (the results, for both groups, ranged from 45 to 55 T-scores, meaning average results). Hedge's *g* (the effect size index) = 0.31 (instrumental risk), respectively *g* = 0.34 (anxiety in new conditions), a moderate to weak difference (between the two investigated groups) being emphasized.

In the next phase, knowing that instrumental risk and anxiety in new, unusual situations are important psychological variables considering injury severity among martial arts athletes, we verified to what extent the two psychological dimensions predict injury severity. To achieve this goal two separate logistic regressions (binomial) were performed.

The models are statistically significant (Table 7, *p* < 0.05, Omnibus test - Model). In the case of the Hosmer and Lemeshow goodness of fit test, *p* = 0.698 (for instrumental risk) and *p* = 0.141 (for anxiety in new situations) emphasizing that the models are not a poor fit. The logistic regression models were statistically

TABLE 5 Descriptive statistics—martial arts athletes results for A-trait and R-TB according to injury severity (regardless of sports disciplines).

| Dependent variables | | Mean | SD | SE |
|--|---------------------------------------|-------|------|-------|
| Instrumental risk | Mild, moderate and/or severe injuries | 16.44 | 2.92 | 0.314 |
| | Only minor/mild injuries | 17.22 | 1.81 | 0.222 |
| Stimulating risk | Mild, moderate and/or severe injuries | 11.41 | 4.06 | 0.436 |
| | Only minor/mild injuries | 10.67 | 4.04 | 0.494 |
| Anxiety in physically dangerous conditions | Mild, moderate and/or severe injuries | 38.83 | 6.60 | 0.708 |
| | Only minor/mild injuries | 38.09 | 6.92 | 0.846 |
| Anxiety in new, unusual situations | Mild, moderate and/or severe injuries | 47.86 | 6.76 | 0.725 |
| | Only minor/mild injuries | 45.51 | 7.00 | 0.855 |

TABLE 6 Inferential statistics—dependent sample t test.

| Variables | | Levene's test | | | | | | |
|-----------|-------------------|---------------|----------|----------|-------|----------|---------------------|--------|
| | | F | <i>p</i> | <i>t</i> | df | <i>p</i> | Confidence interval | |
| | | | | | | | Lower | Upper |
| A | Unequal variances | 9.49 | 0.002 | −2.05 | 145.9 | 0.042 | −1.546 | −0.028 |
| B | Equal variances | 0.012 | 0.914 | 1.125 | 152 | 0.262 | −0.561 | 2.045 |
| C | Equal variances | 0.558 | 0.456 | 0.673 | 152 | 0.502 | −1.427 | 2.904 |
| D | Equal variances | 0.100 | 0.753 | 2.110 | 152 | 0.037 | 0.149 | 4.560 |

A, Instrumental risk; B, Stimulating risk; C, Anxiety in physically dangerous conditions; D, Anxiety in new, unusual situations.

TABLE 7 Results of the binomial logistic regressions analysis.

| | Instrumental risk | Anxiety in new situations |
|---|-------------------|---------------------------|
| Omnibus test—model (Chi-square, value of <i>p</i>) | 4.44 (0.035) | 4.76 (0.029) |
| Hosmer and Lemeshow test (Chi-square, value of <i>p</i>) | 5.54 (0.698) | 8.29 (0.141) |
| Nagelkerke <i>R</i> ² | 0.048 | 0.051 |
| Overall percentage (Predicted—Percentage correct) | 56.7 | 58.4 |
| Wald test | 4.266 | 4.365 |
| <i>B</i> | −0.051 | 0.149 |
| SE | 0.025 | 0.071 |
| Odds ratio values | 1.052 | 0.862 |
| Confidence interval for <i>Exp(B)</i> | 1.009–1.104 | 0.750–0.991 |

significant: instrumental risk - $\chi^2(1) = 4.44$, $p = 0.035$; anxiety in new conditions - $\chi^2(1) = 4.76$, $p = 0.029$. In the case of martial arts athletes, the results for A-trait in new or unusual situations represent a slightly better predictor of injury severity than the values for instrumental risk - one can observe that the differences between the two models are almost non-existent, both psychological factors having the capacity to predict injury severity in martial arts athletes. The models correctly classified 56.7% (instrumental risk), respectively 58.4% (anxiety in new, unusual circumstances) of cases. The contribution of the two psychological phenomena in predicting injury severity is important, representing valuable resources for athletes, sports psychologists, physiotherapists, present and future martial arts coaches. Nagelkerke *R*² (effect size index) shows a moderate to weak relation between both psychological dimensions and injury severity. We can assert that a moderate or slightly below average level of anxiety in new situations and a higher level of

instrumental risk are associated with a decreased likelihood of severe injuries in martial arts athletes.

4. Discussion

In sports field, severe injuries may predispose athletes to mental health issues such as depression, anxiety, distress, to adverse health behaviors and lower self-esteem (Gulliver et al., 2015). Martial arts and combat sports suppose a behavioral code which includes moral and ethical values (Makarowski et al., 2021). But the “win-at-all-costs philosophy” in competition, which manifests, especially, among youth athletes, can generate violence and hostile aggression (Urzeală and Teodorescu, 2018), leading to sports injuries. Maybe the most important question which the coach, athlete, parents etc. ask is “When will I/ she / he be able to play again?” (Gomez-Piqueras et al., 2018). Specialized

literature asserted that in combat sports (judo) mean absence from competition and training after injuries sustained during the Summer Olympic Games (London) was comprised between 1 and 7 days (Engelbrechtsen et al., 2013), while in the case of lower level competitions mean absence ranged from 21 to 29 days (Green et al., 2007). However, there are researchers who found the opposite - higher injury rate as sports performance increases (Bauer and Steiner, 2009). The current study underlined that no significant relationships exists between the level of sports performances and injury severity in martial arts athletes (investigated separately - striking combat sports, grappling combat sports and mixed martial artists). It seems that other variables have a more important role (than competition level, in martial artists) with respect to athletes' injury severity.

In a first phase we highlighted the existence of significant differences between martial arts athletes, taking into account the sports disciplines, for anxiety in physically dangerous situations. Athletes from grappling combat sports (judo and BJJ) registered a slightly below average level of anxiety in physically dangerous conditions, while athletes from striking and grappling combat sports (MMA) obtained a low score. No significant differences between martial arts athletes from striking sports, grappling sports disciplines and Mixed Martial Arts were found, in terms of instrumental and stimulating risk, or considering anxiety in new situations.

Further we verified the existing correlations between injury severity, A-trait and risk-taking behavior (R-TB) in athletes, separately, according to the sports disciplines practiced. Only in the case of striking and grappling combat sports (MMA) a significant relation between injury severity and anxiety in physically dangerous situations was found. A higher score for this facet of anxiety is linked with more severe injuries. Although anxiety in physically dangerous conditions is below average (at group level), Mixed Martial Arts athletes having a lower score (highly below average) are at an advantage, considering the severity of recorded injuries.

Even if no significant correlations between injury severity and results for A-trait and R-TB were found in the case of athletes from striking combat sports (karate, taekwondo, boxing and kick-boxing) and practicing grappling combat sports (judo and jiu-jitsu), the following associations were, however, observed, between: (1) anxiety in new situations and anxiety in physically dangerous conditions (in both groups - striking and grappling, but also in MMA athletes); (2) anxiety in physically dangerous conditions and stimulating risk (in MMA). One can observe that: martial arts athletes with higher scores for anxiety in new, unusual situations registered, also, a higher anxiety in potentially harmful situations (linked with more severe injuries in MMA); athletes from Mixed Martial Arts with higher scores for anxiety in physically dangerous conditions analyze less rationally the situations in competition, instead they are more adrenaline-seeking in competition, take more pleasure in just performing technical executions without thinking about success or failure, engaging more in risky actions. These results are consistent with studies noting that more anxious individuals exhibit higher stimulating risk, in other words, they act more according to the *all-or-nothing* principle (Makarowski et al., 2016). The outcome in MMA athletes - more moderate and/or severe injuries reported (we must not forget the above mentioned relation between injury severity and anxiety in physically dangerous situations in Mixed Martial Arts athletes).

In the next phase, the existing differences considering trait anxiety and risk-taking behavior between martial arts athletes who have suffered mild, moderate and/or severe injuries and athletes who have suffered only minor/mild injuries were examined (regardless of combat sports

disciplines). The results emphasized that the values for instrumental risk are significantly higher in athletes who suffered only mild injuries, compared to those who have experienced mild, moderate and/or severe injuries. The scores were, instead, lower (in the first group) with respect to anxiety in new, unusual situations (a moderate to weak difference between the results was highlighted). Martial arts athletes who think more about the outcome of the technical executions they perform (use more rational thinking), choosing risk only when they consider there is a chance of winning and searching less for highly stimulating situations, reported less severe injuries. The same aspect was observed (less severe injuries) in athletes having a lower level of anxiety in new, unusual situations.

Not least, we were interested in highlighting to what extent anxiety in new situations and instrumental risk predicts injury severity among martial arts athletes. We can argue that A-trait in new, unusual situations represent a slightly better predictor of injury severity than instrumental risk. A moderate or slightly below average level of anxiety in new circumstances and a higher level of instrumental risk are associated with a decreased likelihood of severe injuries in martial arts athletes. Ivarsson and Johnson (2010) found, also, that "somatic trait anxiety, psychic trait anxiety, stress susceptibility, and trait irritability" represent important psychological dimensions, predicting injuries in athletes (soccer players were examined), while Nippert and Smith (2008) asserted that personality traits and stress generated by various life situations have the potential to influence the occurrence of sports trauma. The predictor variables in the current study represent valuable resources for present and future sports psychologists, coaches, physiotherapists and medical practitioners. We mention a gap in the literature considering the instrumental and stimulating risk level of martial arts athletes and its connection with sports injuries.

Specialists need to be aware of the psychological impact that sports injuries entail (Walker et al., 2007). As Van Niekerk and Lynch (2012) asserted "the high level of anxiety associated with players who suffered shoulder injuries has to be targeted with anxiety management skills as part of a player development and injury management program." In the case of martial arts athletes, in order to reduce trait anxiety and distress (e. g., from negative life event—an indirect effect on injury frequency, see Ivarsson et al., 2012), for athletes' personal development, and for injury prevention, various techniques and psychology-based counseling programs could be used. These may involve: stress management strategies, containing visualization, relaxation, emotional relief, self-monitoring of emotional reactions, cognitive restructuring (Perna et al., 2003); analytical relaxation and autogenic training, increasing self-confidence (Gould et al., 2002); internal techniques (breathing, meditation), reducing state hostility and aggressive impulses in martial arts athletes (Hernandez and Anderson, 2015); positive self-talk (inner monolog) and a greater involvement in tasks which gives satisfaction to athletes (Lyubomirsky et al., 2005); social support, strengthening the athlete's coping resources (Junge, 2000). Also, biofeed-back training together with cognitive-behavioral training seems to be a performant strategy to decrease the occurrence of sports' injuries (Edvardsson et al., 2012), while Vasile (2022) discusses about "an integrative model of intervention against psychological (chronical and traumatic) stress," involving the following aspects: emotional, cognitive, and behavioral (body). After a sport injury occurs, positively reframing and emotional support helped athletes with serious sport-related injuries to persevere (Podlog and Eklund, 2007; Salim et al., 2016), while verbal emotional disclosure played an important role in the sport injury-related growth (Salim and Wadey, 2018). Returning from sports injuries presents,

therefore, numerous challenges, including the anxiety surrounding injury recovery. [Bennett and Lindsay \(2016\)](#) present a detailed intervention program in this situation (considering anxiety related to injury recovery), focusing on “mindfulness and relaxation strategies to reduce imagined pain associated with an old injury and manage anxiety associated with return to play.” [Mohammed et al. \(2018\)](#) highlight, also, the benefits of a Mindfulness Based Stress Reduction intervention to decrease anxiety/stress and increase pain tolerance of injured athletes.

The results of the current research extend previous studies and addressed gaps in literature. Regarding the limitations of the study, one could argue that each combat sport and martial art discipline should be separately investigated. New studies might focus, therefore, on one specific sports branche (e.g., boxing, judo, taekwondo, etc.), taking into account, also, that “individual sport athletes are more likely to report anxiety and depression than team sport athletes” ([Pluhar et al., 2019](#)). However, anxiety of injury did not vary significantly when athletes from individual or team sports were examined ([Tanyeri, 2019](#)).

Taking into account the research design (a retrospective study using online survey) and that “the frequency of fractures demonstrated in retrospective studies based on institutional documentation (RD) was considerably higher than in retrospective studies utilizing questionnaires (RQ) and in prospective studies” ([Pocecco et al., 2013](#)), further RD studies and prospective cohort researches (longitudinal studies that follows martial arts athletes over time, to determine how A-trait and risk-taking behavior affect injury rate in competition and training) are needed. Also, an equal number of fights/ competitions (for each athlete) could be taken into account.

In the present research self-report tools were used, being known the possible recall bias/ memory bias when talking about explicit measures ([Predoiu et al., 2022c](#)) and the problem of possible desirable responses. The social desirability scale was used to minimize the risk of athletes giving inappropriate answers, the relatively large number of participants represents a strength of the paper, and it is worth mentioning that questionnaires were used, also, in previously studies which investigated injury severity (e.g., [Williams et al., 2020](#); [Roşu, 2022](#)). Moreover, as [Rădoi et al. \(2019\)](#) asserted, “self-report measures [...] are critical tools for identifying patients with persistent post-concussion symptoms and their follow-up.”

A-trait and risk-taking behavior were investigated after the events occurred (*ex post facto*), after martial arts athletes suffered different sports injuries (in the last 4 years) and after various events in athletes’ life, so we cannot assert to what extent (1) injuries suffered, or other stressful events, have generated a higher anxiety in new conditions, or a lower level of instrumental risk, taking into account Williams and Andersen’s theoretical stress-injury model (1998) - a stressful event, which could originate, also, outside of the sport context, could affect athletes’ reactions, generating distractibility, reduced ability to analyze specific situations in competition, increased muscle tension and, as a consequence, could increase injury risk, or (2) A-trait and risk-taking behavior, as personality traits (relatively stable at personality level, which hardly changes - [Ciolcă et al., 2019](#)) influenced injury severity. The present study is a retrospective one, based on questionnaires, which emphasized that anxiety in new, unusual conditions and instrumental risk (played the role of the independent variables) are important predictors of injury severity in martial arts athletes.

Not least, another facets of trait anxiety must be investigated, for example, separation anxiety, only training injuries because studies of training injuries of competitive martial arts athletes are missing ([Thomas and Thomas, 2018](#)), or other important aspects in relation to sports

injuries, such as: competitive system, athletes’ exercise capacity, recovery and nutrition, etc.

5. Conclusion

In summary, we emphasize that a moderate or slightly below average level of anxiety in new, unusual conditions and a higher level of instrumental risk are associated with a decreased likelihood of severe injuries in martial arts athletes. Additionally, we highlight that in the case of striking and grappling combat sports (MMA) a higher score for anxiety in physically dangerous situations is linked with more severe injuries. Athletes from Mixed Martial Arts with higher scores for anxiety in physically dangerous conditions analyze less rationally the situations in competition, instead they seek more adrenaline, engaging more in risky actions, while athletes from striking combat sports (boxing, kick-boxing, karate, taekwondo) who are more anxious in new situations are more adrenaline-seeking, taking more pleasure in just performing technical executions regardless of the outcome. Not least, martial arts athletes (in entire sample) who have suffered mild, moderate and/or severe injuries, compared to athletes who suffered only minor/mild injuries, look for more highly stimulating situations in competition, and use less rational thinking when evaluating the outcome of the technical executions they perform.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by the local ethics committee of the National University of Physical Education and Sport, Bucharest, authorization number assigned is ID:946. Data were treated confidentially and the anonymity of the participants was ensured. The patients/participants provided their written informed consent to participate in this study.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The emotional intelligence of today's parents – influences on parenting style and parental competence

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The emotional intelligence of parents and parental competence become two premises of effective parenting. This study contributes to the understanding of how parents' emotional intelligence exerts its effect on both their parenting style and parenting competence. The present research also sought to identify the factors that determine the level of parental competence. The research method used is the questionnaire-based survey. The research sample, represented by 610 respondents, was determined by the sampling strategy based on convenience, respectively by the snowball method. The results indicated that the emotional intelligence of parents is associated with an increased level of parental competence ($r=0.24$, $p<0.001$), and 15% of the variability of parental competence is determined by the level of parental emotional intelligence ($R=0.38$, $p<0.00$, $R^2=0.15$). It was demonstrated that 6% of the variability of parental competence is determined by the level of parents' self-esteem ($R=0.24$, $p<0.001$, $R^2=0.06$). The emotional intelligence and self-esteem of the parents contribute to the development of a high level of parental competence, while the level of education of the respondents according to this research partially influences the development of parental competence. Despite the fact that a high educational level of parents is assumed to give them access to quality information, the Barnum effect is experienced regardless of educational level. According to the field of parenting, the Barnum effect refers to consulting non-scientifically validated sources and trusting information that responds to parents' wishes, but not to children's educational needs. These results highlight the role of parents' emotional intelligence on the growth and education of children, but also the usefulness of training programs in the field of parenting with the aim of training parents in the necessary skills for effective parenting.

KEYWORDS

emotional intelligence, parental competence, parenting style, self-esteem, Barnum effect

1. Introduction

Parental education is considered an important pillar of society because it has the potential to mitigate or even diminish the negative effects of some factors that can determine the social exclusion of the child, such as: poverty, belonging to a single-parent family, the minimum level of parental education (1). The purpose of parenting education is to improve the conditions of child rearing and to provide support to parents in managing both child and parental behaviors (2).

Parental education involves a complex process often being avoided as a result of parents' lack of resources to get involved in this process or the limited availability of time due to the multiple responsibilities associated with parenthood (3). found that as adults experience parenting anxiety, children experience higher rates of academic burnout.

Emotional intelligence is a component of social intelligence, representing a person's ability to monitor their own feelings and emotions, respectively to differentiate them (4). This type of intelligence facilitates a person's adaptation to stressful situations (5). According to Goleman (6), emotional intelligence has the following branches: "self-awareness, social awareness, managing one's own emotions, managing relationships."

A scientific approach to emotional intelligence considers the training of emotional skills, which lead to living a fulfilled and productive life (7), since emotional intelligence offers visible results in terms of the quality of social relationships, but also the development of some prosocial behaviors (8).

In agreement with Baumrind (9), the parenting style includes a series of practices and attitudes on the part of the parent related to his/her child, delineating three types of parenting: authoritarian, authoritative and permissive. These styles follow two dimensions of parenting, authority and affection. The first dimension, authority or exigency, refers to the parent's level of control over his child's behaviors by establishing limits, rational standards. The second dimension, affection or responsiveness, considers how the parent expresses love towards the child and the parent's flexibility to accept the child's viewpoints (10).

Regarding parental competence, following the research carried out by Glăveanu (11), a factorial model of it was identified, which includes the following factors: knowledge, discipline, time management, emotional support and crisis management. This type of competence represents a complex system of skills intended to support adults in fulfilling their parental responsibilities, respectively in preventing or dealing with difficult situations that may arise in the child's education and that require management for the purpose of his development (12).

Parental competence evolves as a result of the permanent education to which the parent is subjected throughout his life in a society focused on knowledge, thus improving the quality of family life (13). It mediates parents' reflective functioning, which refers to their ability to reflect on their children's mental states and children's emotional adjustment (14).

Based on the aforementioned aspects of the literature, this research tested the link between parents' emotional intelligence and parenting style, as well as the link between emotional intelligence and parental competence. At the same time, parental competence was analyzed in relation to the level of parents' self-esteem, but also in relation to its determining factors.

1.1. Research aim and research hypotheses

The variables on which the entire study was conducted were the following: emotional intelligence, parenting style, parenting competence, parental self-esteem, and the Barnum effect. In order to test certain hypotheses, the variable referring to the educational level of the parents was also included. Starting from the previously mentioned variables, the purpose of the research was to establish the influences that parents' emotional intelligence has on the parenting style adopted by them, but also on the level of parental competence. A second aim of the research was to identify the factors that determine the level of parents' parental competence.

The research was based on the following objectives:

O1: Identifying the influence of parents' emotional intelligence on the level of parental competence.

O2: Determining how the level of parental competence varies according to parents' self-esteem.

O3: Identifying the factors that determine the level of parental competence.

O4: Identifying the role that parents' self-esteem has on the relationship between emotional intelligence and parental competence.

O5: Identifying how parental competence varies by parents' educational level.

O6: Identifying the link between parents' emotional intelligence and parenting style.

O7: Identifying the role of the Barnum effect on parental competence.

Based on the aforementioned objectives, the following research hypotheses were formulated:

H1: As the level of emotional intelligence of parents increases, parental competence develops.

H2: Along with the increase in self-esteem of parents, the level of parental competence varies in a positive sense.

H3: Parental competence is determined by factors such as parents' emotional intelligence and self-esteem.

H4: The relationship between emotional intelligence and parental competence is mediated by the level of parents' self-esteem.

H5: Parental competence varies according to parents' educational level.

H6: As the level of parents' emotional intelligence increases, the preference for the authoritative parenting style increases.

H7: As the parent experiences the Barnum effect at a high level, the level of parental competence decreases.

2. Literature review

2.1. Emotional intelligence in parenting

Parents are often faced with the existence of inappropriate behaviors of the child, which can be the source of conflicts in many families. Since emotions specific to a conflict can be difficult to manage for most parents, at the same time influencing the appearance of the feeling of personal inadequacy or disappointment towards the child, the importance of emotional intelligence in order to ensure quality parenting even in tense situations is noted (15).

Emotional intelligence is closely interdependent with the education of feelings, which is why, including in the field of parental education, this type of intelligence requires more and more valorization (16). Goleman (17) defines emotional intelligence as the human ability to self-motivate and persevere in the face of stressful situations. This intelligence is also associated with a person's resistance to controlling their impulses and delaying gratification.

After extensive studies conducted over 25 years, researcher Reuven Bar-On established the defining components of emotional intelligence as follows: intrapersonal aspect, interpersonal aspect, adaptability, stress control, general mood (18).

This intelligence is associated with people's resistance to challenging life experiences, such as raising a child, experiences that they later integrate into new ways of acting (19). In a systematic review and meta-analysis, researcher Vega et al. (20) demonstrated that increased levels of emotional intelligence are associated with decreased aggressive behaviors that may occur as a result of stressful situations experienced by parents.

Personality traits such as: openness to experience, conscientiousness, extraversion, agreeableness are associated with the development of emotional intelligence (21) and implicitly with the formation of effective interpersonal and intrapersonal relationships (22), respectively with the ability to resolve conflicts (23). Therefore, this type of intelligence is found to become a predictor of individual psychological well-being (24).

In the absence of developing emotional intelligence, parents can experience what Goleman calls emotional overstimulation, a phenomenon in which they act and say things they would not have thought of if they were relaxed. These behaviors are associated with difficulties in children managing negative emotions such as anger (25). The acquisition of emotional intelligence in the case of parents is associated on the other hand with what (26) call "Sensitivity to context" referring to their ability to regulate their emotional responses according to the context in which they are.

In the case of parents, emotional intelligence becomes particularly important because it has been found that it alleviates their tendency towards perfectionism in the parenting process, which further leads to mental exhaustion (27). At the same time, the emotional intelligence makes parenting practices more efficient (28), having positive effects on the child's development from all points of view. From the perspective of parental education, reducing stress as a result of parents' emotional intelligence contributes to children's socio-emotional development (29).

In a study that aimed to identify the roles of the intrapersonal and interpersonal dimensions of emotional intelligence in the parenting process, it was demonstrated that the intrapersonal dimension of this

intelligence is associated with a decrease in the level of parental exhaustion (30).

2.2. Parenting style

From the perspective of researchers such as Baumrind (31), Maccoby and Martin (32), parenting style contributes to the study of child development, representing a combination of parental practices used to raise and educate him.

Parenting dimensions according to Baumrind (33) and Maccoby and Martin (32) cited in Zheng et al. (34) refer to responsiveness and demandingness. The first dimension is operationalized in terms such as respecting the child's individuality, providing opportunities for the child to regulate his behavior and assert himself. Other behaviors specific to the responsive parent are supporting the child and adapting to the needs and requirements specific to the developmental stage. The second dimension refers to the requirement that must take care of him, which demonstrates the pressure exerted on the child in order to integrate into the family, the request of requirements that involve his early maturity, the making of efforts to discipline the child according to some high standards. Parental demand is also correlated with the parent's desire to confront his own child at the expense of the effective relationship with him.

The reference model regarding parenting styles is represented by the two-dimensional model developed by Maccoby and Martin, a model that presents empirical evidence regarding parenting styles and child adaptation. According to this model, there are two dimensions through which parents relate to children, namely warmth and severity (35–42). Parental warmth is represented by the measurement in which parents offer children love, acceptance, approval, support, but also availability for dialogue (35), while parental severity is highlighted by the measurement in which parents use discipline in education children, monitoring their behavior, setting limits and at the same time maintaining his authority over them (36).

Based on the two dimensions, four parenting styles were identified: the authoritarian parenting style based on severity in the absence of warmth, the authoritative parenting style based on the balance between severity and parental warmth, the permissive/indulgent parenting style represented by the presence of parental warmth in the absence of strictness and the parental style careless which is characterized by the absence of both dimensions, warmth, respectively parental severity (35–37, 42–45).

Authoritative parenting style has been associated with stimulating proactive behaviors among children by improving the level of self-esteem and growth mindset (46), but also with the acquisition of their emotional autonomy (47). Parents following this style managed to find a balance between authority, flexibility and gentleness in the parenting process, while also demonstrating empathy towards children. Empathy felt by children whose parents chose to approach authoritative education is associated with reduced delinquency during adolescence (48).

In agreement with Shahsavari (49) the authoritative parenting style encountered in the specialized literature and in the form of the concept of democratic or authoritative parenting style is defined by showing a balance between exercise control over children and emotional support and maintaining an optimal level in terms of the child's independence. Parental control from the perspective of this

parental style can be operationalized in the form of the concept of the child and ensuring the optimal conditions in which it can develop and not the manifestation of an attitude of superiority towards it. Parents following this parenting style cause their children to be free to think, while also giving them opportunities to develop some skills.

Authoritarian parenting style has in mind high expectations of parents from children, emphasizing children's compliance with rules at the expense of democratic discussions with them. Also, this parenting style is based on discipline and strict punishments in order to follow the rules, being also associated with an increased risk of child maltreatment (50, 51), but also with depressive symptoms among them (52).

The despotic or authoritarian parenting style is characterized by monitoring and evaluating children's behavior according to certain standards, having high expectations from them and demonstrating a low level of acceptance of their attitudes and behaviors. A consequence of parents' excessive authority over children's development is mental and emotional instability, diminishing the possibility of experiencing well-being [(53) cited in (49)].

Parental authority is associated with children's extreme concern for the mistakes of others and the imposition of high self-standards (54). Authoritarian parenting style causes externalizing behaviors such as aggression, delinquency, hyperactivity and internalizing behaviors such as social isolation, anxiety and suicidal behavior among children (55).

The permissive parenting style is associated with a high level of atypical behavior of children, but at the same time with generalized anxiety among them (56), respectively with the decrease of the feeling of academic self-efficacy (57). Those children who perceive their parents as permissive face during their life a decrease in the process of personal growth (58) and a reduced tendency to offer help to those around them in different situations (60). At the same time, the permissiveness of the parents in the parenting process is also noted by the absence of consequences when the rules are broken, i.e., giving the child the opportunity to make his own decisions despite the fact that he is not ready for this in all situations (61).

Parents following a permissive style of raising and educating their child do not possess the necessary skills to guide and regulate his behavior from early childhood. A consequence of this parenting style is the lack of optimal moral development and the formation of values during youth. At the same time, parental permissiveness is also associated with negative influences on children's cognitive development, they face immaturity, decision-making in the presence of impulsiveness, respectively rebellion (59) cited in (49).

The negligent parenting style is defined by a low level of control, acceptance and receptivity in the parent-child relationship, failing to be optimally involved in its growth and development. The consequences of parental neglect are highlighted by the reduced experience of some moments of parent-child affection, but also by ridicule [(62) cited in (49)].

Kotchick et al. (63) respectively Cowan et al. (64) cited in Vafaenejad et al. (65) concluded from the studies carried out that the attachment style of the parent, but also the family conditions in the past such as the stress experienced and the supportive relationships developed within the frame. Family influences the parenting style. The secure attachment of adults in agreement with the family of origin is transposed in the form of authority style with the acquisition of parent status, being more responsive to children and establishing a healthy

relationship with them. In contrast to the secure attachment, the attachment based on absence or anxiety developed by the adult within the families of origin can face an authoritarian parenting style being dominated by anger and choosing to show a distant attitude towards the child. All these behaviors resulting from the acquired attachment style can have long-term consequences in terms of the effectiveness of interpersonal relationships, respectively the mental health of parents and children alike.

Maccoby and Martin's two-dimensional model has led to a series of debates aimed at identifying the best parenting style for optimal child development and adjustment. Classic studies on parenting carried out in the Anglo-Saxon context demonstrated that the child's psychosocial adaptation is largely influenced by authoritarian parenting (36, 39, 66, 67).

Authoritative parenting style was not found to be the most appropriate in child adjustment following studies conducted in ethnic groups in the United States, such as Chinese-Americans (68), African-Americans (69) and of some studies started in Arab societies (70). In their case, it was concluded that the authoritarian parenting style causes the children to adapt best to the society in which they live.

In the case of European and Latin American countries, it has been demonstrated that parental indulgence largely determines the child's adaptation in society (37, 38, 41, 44) and long-term (35, 45, 71–74).

2.3. Parental competence

The term parental competence includes a series of many competences such as: communication, conflict resolution, negotiation, self-esteem development skills, but also social, motivational, cognitive and normative skills (75). This competence is associated with an involved parenting according to which it is important to protect the child by "ensuring protection in physical or psychological conditions of real danger, which represents a concrete attack on the physical or mental integrity of the child and on his well-being" (78, p.28). This is also associated with the balance that parents manage to establish between the children's desire for autonomy and the need to provide them with guidance at all times. They succeed by combining gentleness with moderate firmness to make the child responsible (79).

The need to develop parental competence among adults derives from the multitude of challenges that they have to face in the process of educating the child (76).

Parental competence involves practices that are based on love, behavior modeling, intentional learning, and discipline (77). As a result of these skills and practices used, a family climate is established defined by the sense of belonging, the creation of trusting relationships, the development of psychological safety as well as values regarding the management of emotions (80). The parent who fulfills this competence promotes practices that take into account the child's physical health and safety, practices that contribute to the child's cognitive, emotional and social development, but also practices that take into account the optimal organization of the environment in which the child lives, of routines as well as the disciplinary approach based on positivism (81).

A competent parent approaches behaviors by which he finds out in detail what is happening with the child, what he feels, being with him and not against him; accepts the child's feelings, even if he does not understand them very well at the initial stage of the critical situation, but acceptance is an essential behavior for later

understanding; abandons the idea that in a conflict the parent must be right and replaces this idea with strategies to calm the child and redirect his attention (82); uses active listening by paraphrasing the child's words so that he realizes that the parent has understood his situation; guides the child in solving the critical situation and does not take responsibility as a parent for solving the situation (83).

Regardless of the type of family the child belongs to, the most important aspect remains the management of all factors that can affect its evolution, and this management becomes all the more effective as the level of parental competence increases (86).

2.4. Parents' self-esteem

Self-esteem is embodied in the way a person thinks about himself, about the values, the abilities he possesses (87), therefore this concept is associated with self-awareness (88), but also with general well-being (89).

People with high self-esteem experience the feeling of security in their own abilities and constructive pride in the successes achieved, while people with low self-esteem avoid externalizing their feelings, do not recognize their abilities, showing insecurity (90). For these reasons, self-esteem becomes an essential construct for understanding a person's well-being and success (84).

The constant feeling of dignity, but also the ability to solve problems competently represent two attributes of the concept of self-esteem (85). People with a high level of self-esteem are self-confident and self-directed towards success (91), while low self-esteem is associated with the inability to manage various problems and one's own existence, as well as the lack of energy (92), tending to procrastinate (93) and experiencing social anxiety (94, 95). High self-esteem is associated with feeling confident when a person wants to try new things, but also when faced with challenges (96).

In the case of adults, the way they perceive those around them, or the way they think they are perceived by those around them, influences self-esteem (97).

From a parenting perspective, parents' self-esteem can have effects on children's self-esteem as adults. It has been proven that a low self-esteem of parents influenced the formation of low self-esteem in the case of children reaching adulthood (98).

2.5. The Barnum effect in parenting

The Barnum effect, also often found in the field of parenting, involves recognizing oneself in general statements (99), ambiguous as being descriptive of one's own personality (100) especially when those statements offer valid perspectives (101). This effect can also be found under the name of the Forer effect as a result of the one who first demonstrated that individuals willingly endorse universally valid statements as meaningful for the situation in which they find themselves (102). The same author found that individuals tend to accept false statements about themselves as long as they find them flattering and positive (103).

In agreement with the field of parenting, the Barnum effect is experienced in situations where parents are informed about the child's upbringing and education from non-scientifically validated sources, supported by people without expertise in the

field or with minimal training in this regard. As a result of the Barnum effect, parents' perception of parenting is distorted. They believe that the parental practices identified in different sources are applied regardless of the specifics of the child, not paying the necessary attention to the child's needs. In this situation, the parent's action strategy for educating his child is not personalized. Experiencing the Barnum effect by parents can have negative consequences for child development as a result of existing limitations in parenting practices that are not based on scientific information (104).

3. Materials and methods

3.1. Participants and procedure

The sampling strategies used were convenience and snowball sampling.

The research sample consists of 610 respondents, 530 female, representing 87% of the total number of respondents, and 80 male, representing 13% of the total number of respondents. From the perspective of the age range of the research participants, 6 of them are under 20 years old (1%), 67 respondents are between 21 and 30 years old (11%), 205 respondents are between 31 and 40 years old (34%). The majority category of respondents from the perspective of age are those who fall between 41 and 50 years old, numbering 216 (35%), and the last category, representing the age of over 50, includes 116 respondents (19%).

From the point of view of educational level, the majority category of respondents is represented by those who completed university studies, in number 271 (44%), followed by those who completed post-graduate studies, in number 185 (30%) and by those who graduated from high school, in number 102 (17%).

The implementation of the research was carried out with the permission of the Ethics and Academic Integrity Commission of the University of Bucharest. Data collection was carried out between March 2022 and May 10, 2022, and the research tool was available on the Google Forms platform, with respondents having the opportunity to access it via a link. The data specific to each variable were collected in the Google forms platform, processed in an Excel database and later transferred to the Jamovi (105) statistical program. Another statistics program used was Jasp (106).

3.2. Measures

The research variables were parents' emotional intelligence, parenting style, parental competence, parents' self-esteem, the Barnum effect, and parents' educational level.

The level of emotional intelligence and implicit empathy of parents was measured with the instrument ESCQ-45 - Emotional Skills and Competence Questionnaire, Vladimir Taksic (107). The questionnaire consists of 45 items distributed in three scales: The Perception and Development of Emotions scale, the Expression and Labeling of Emotions scale and the Management and Regulation of Emotions scale. The responses being provided on a five-step Likert scale, where 1 – Never and 5 – Always. Examples of items: Unpleasant experiences teach me how not to act in the future, When I see how

someone feels, I usually know what happened to that person, My behavior is a reflection of my inner feelings.

The dominant parenting style was identified using the tool PSDQ – Short version – Parenting Styles and Dimensions Questionnaire (108). The tool consists of 41 items, there are three parenting styles investigated (authoritative, authoritarian, respectively permissive parenting style), the answers being provided on a five-step Likert scale, where 1 – Never and 5 – Always. Examples of items: I give my child reasons why the rules must be followed, I allow my child to contribute to the family rules, I punish my child by taking away privileges, giving little or no explanation.

The level of parental competence was measured using the tool Parenting Sense of Competence Scale – (109). The questionnaire consists of 17 items, the responses being provided on a six-step Likert scale, where 1 - Strongly disagree and 6 - Strongly agree. Examples of items: Even though parenthood could provide many satisfactions, right now I am a parent with many frustrations, Being a parent is easy to manage, and problems that may arise always have a solution, I meet my own expectations regarding child care.

The level of parents' self-esteem was measured using the RSES tool - Rosenberg Self-Esteem Scale, Morris (110). The questionnaire consists of 10 items, five being negatively worded, the responses being provided on a four-step Likert scale, where 1 – Strongly agree and 4 – Strongly disagree. Examples of items: I know I have a number of qualities, I wish I had more self-respect, I often tend to feel like a failure.

The Barnum effect found in the specialized literature and known as the Forer effect was measured using the personality questionnaire developed by Bertram Forer (102). The questionnaire consists of 13 items to which 7 items were added that highlight the extent to which the parent is a follower of social networks and non-scientifically validated sources to receive information about the child's upbringing and education. Answers to all items being provided on a five-step Likert scale, where 1 - To a very large extent and 5 - To a very small extent. Examples The items of this personality test were supplemented with a series of statements about the Barnum effect based on the literature (111). Examples of items: Although you have some personality weaknesses, you are generally able to compensate for them, Disciplined and self-controlled on the outside, you tend to be anxious and insecure on the inside, Security is one of your major goals. These items are part of the questionnaire developed by Bertram Forer (102) that highlights the extent to which respondents experience the Barnum effect. To adapt the questionnaire to the sample and the purpose of the research, 4 more items were added to the 13 items that highlight the extent of experiencing the Barnum effect in parenting. Table 1 lists the 4 items that were added to the personality questionnaire developed by Bertram Forer (102).

In the case of ESCQ-45, PSDQ, the Parenting Sense of Competence Scale, RSES, and the Forer's personality questionnaire, they were translated into Romanian through retroversion, a method that has been used in other research (see, for example (112)). For each tool, the score was obtained by summing the responses to all the items. In the case of the RSES instrument there were 5 reverse-scored items. The reliability coefficients (Cronbach's Alpha coefficients - α) in the present study were: $\alpha=0.90$ (ESCQ-45), $\alpha=0.75$ (PSDQ), $\alpha=0.77$ (PSOC), $\alpha=0.86$ (Rosenberg Self-Esteem Scale), respectively $\alpha=0.74$ (Forer's questionnaire).

3.3. Analysis plan

This research is part of the quantitative paradigm, based on objectivism, while pursuing a precise analysis of the data collected from the respondents.

The research variables were parents' emotional intelligence, parenting style, parental competence, parents' self-esteem, the Barnum effect, and parents' educational level. Data analysis involves a series of statistical operations. Along with descriptive statistics used to measure specific parameters, the following operations were used: distribution analysis, correlation analysis, linear regression, mediation analysis, Anova analysis of variance, confirmatory factor analysis.

4. Results

The results were interpreted based on the collected data from a sample of 610 responses. The distribution of the sample by gender, age-range, and educational level can be viewed in Table 2.

The means, standard deviations, standard error, minimum, maximum, skewness, kurtosis for each variable are presented in Table 3. The value of skewness varies between - 0.97 and 0.88, and the value of kurtosis varies between - 0.33 and 1.40. Both ranges of values are statistically acceptable. Therefore, after the normality of the research variables was analyzed, all skewness and kurtosis values were within an acceptable range.

4.1. Correlational and regression analysis between the level of parents' emotional intelligence and the level of parental competence

In order to test the association between parents' emotional intelligence and parental competence, a correlational analysis was carried out between the scores obtained on the questionnaire to measure the level of parental competence and the scores obtained on the three subscales of emotional intelligence. Following this analysis, it was demonstrated that between the two variables: parental competence and emotional intelligence divided into the three subscales, there are positive, statistically significant correlations as follows: parental competence and the subscale Perceiving and understanding emotions ($r=0.31$, $p<0.001$), parental competence and the subscale Expressing and labeling emotions ($r=0.33$, $p<0.001$), parental competence and the subscale Managing and regulating emotions ($r=0.30$, $p<0.001$; Table 4). Following the correlation analysis, it was demonstrated that the hypothesis according to which as the level of emotional intelligence of parents increases, parental competence develops supported by the data.

This association highlighted the usefulness of specific skills and components of emotional intelligence for raising and educating the child. The better the parent is able to understand, express and manage their own emotions, the more effectively they will be able to manage the entire parenting process.

In order to determine how the level of parental competence varies according to the level of emotional intelligence of the parent, the linear regression was performed between the dependent variable parental

TABLE 1 Analysis of the distribution of responses.

| Forums, parenting groups are a safe space to keep abreast of new trends in parenting | Parents' educational level | | | | |
|---|----------------------------|---------------------|------------------------|--------------------|----------------------|
| | Secondary studies | High-school studies | Post-secondary studies | University studies | Postgraduate studies |
| To a very small extent | 2 | 31 | 10 | 62 | 45 |
| To a small extent | 4 | 28 | 15 | 87 | 62 |
| To a moderate extent | 4 | 25 | 10 | 85 | 64 |
| To a large extent | 2 | 12 | 5 | 34 | 11 |
| To a very large extent | 0 | 6 | 0 | 3 | 3 |
| As long as the information is relevant to my child's situation, it does not matter who wrote it or shared it | Parents' educational level | | | | |
| | Secondary studies | High-school studies | Post-secondary studies | University studies | Postgraduate studies |
| To a very small extent | 2 | 33 | 17 | 77 | 62 |
| To a small extent | 6 | 20 | 13 | 87 | 52 |
| To a moderate extent | 2 | 24 | 7 | 71 | 52 |
| To a large extent | 2 | 20 | 5 | 29 | 15 |
| To a very large extent | 0 | 5 | 1 | 7 | 4 |
| If I attended a parenting course, I would be more interested in the topics discussed than the professional training of the person giving the course | Parents' educational level | | | | |
| | Secondary studies | High-school studies | Post-secondary studies | University studies | Postgraduate studies |
| To a very small extent | 2 | 9 | 9 | 53 | 37 |
| To a small extent | 3 | 22 | 5 | 71 | 43 |
| To a moderate extent | 4 | 37 | 11 | 85 | 59 |
| To a large extent | 3 | 22 | 11 | 49 | 39 |
| To a very large extent | 0 | 12 | 4 | 13 | 7 |
| It is more important to want to know more about the child's education than the source of information | Parents' educational level | | | | |
| | Secondary studies | High-school studies | Post-secondary studies | University studies | Postgraduate studies |
| To a very small extent | 2 | 19 | 11 | 49 | 36 |
| To a small extent | 2 | 15 | 5 | 71 | 55 |
| To a moderate extent | 3 | 30 | 5 | 71 | 55 |
| To a large extent | 5 | 24 | 13 | 56 | 31 |
| To a very large extent | 0 | 14 | 6 | 24 | 8 |

competence and the independent variable emotional intelligence. The regression coefficient R , which represents a correlation coefficient with a value of 0.38 ($R = 0.38$) indicated a reasonable association between the two variables, statistically significant ($p < 0.001$). The value of the regression coefficient $R^2 = 0.15$ indicated that 15% of the variability of parental competence is due to the level of emotional intelligence of the

parent. The overall regression was statistically significant [$R^2 = [0.15]$, $F(1, 608) = [103.97]$, $p = [< 0.001]$; Table 5].

Following the correlational analysis and the linear regression, it was demonstrated that the hypothesis according to which as the level of emotional intelligence of parents increases, parental competence develops supported by the data.

4.2. Correlational and regression analysis between parents' self-esteem and parenting competence

Based on the correlational analysis between the parental competence variable and the self-esteem variable, a positive, statistically significant association was obtained between the two variables ($r=0.24$, $p<0.001$), which indicates that as the parents' self-esteem increased, an evolution was also registered in the level of parental competence (Table 6).

In order to determine how the level of parental competence varies according to the parents' self-esteem, a linear regression was performed between the dependent variable parental competence and the independent variable self-esteem. The regression coefficient R with a value of 0.24 ($R=0.24$) indicated a statistically significant association between the two variables ($p<0.001$). The value of the coefficient $R^2=0.06$ demonstrated

that 6% of the level of parental competence varies according to the level of parents' self-esteem. The overall regression was statistically significant [$R^2=[0.06]$, $F(1, 608)=[36.55]$, $p=[<0.001]$; Table 7].

The data obtained through the regression and correlational analysis confirm the hypothesis that along with the increase in self-esteem of parents, the level of parental competence varies in a positive sense. This is possible due to the fact that parents with high self-esteem manage to cope well with the specific challenges of the parenting process, thus developing their parenting skills and implicitly parenting skills.

4.3. Factor analysis for determining parental competence

The purpose of the confirmatory factor analysis was to analyze the factorial model that determines a high level of parental competence.

TABLE 2 Frequency of respondents according to gender, age and educational level.

| | Level | Count | Total | Proportion |
|-------------------|------------------------|-------|-------|------------|
| Gender | Female | 530 | 610 | 0.87 |
| | Male | 80 | 610 | 0.13 |
| Age-range | Under 20 years | 6 | 610 | 0.01 |
| | 21–30 years old | 67 | 610 | 0.11 |
| | 31–40 years old | 205 | 610 | 0.34 |
| | 41–50 years old | 216 | 610 | 0.35 |
| | Over 50 years old | 116 | 610 | 0.19 |
| Educational level | Secondary studies | 12 | 610 | 0.02 |
| | High-school studies | 102 | 610 | 0.17 |
| | Post-secondary studies | 40 | 610 | 0.07 |
| | University studies | 271 | 610 | 0.44 |
| | Postgraduate studies | 185 | 610 | 0.30 |

H_0 is proportion $\neq 0.5$.

TABLE 3 Descriptive analysis of research variables.

| | Emotional intelligence | Parental competence | Authoritative parenting style | Authoritarian parenting style | Permissive parenting style | Self-esteem | Barnum effect |
|---------------------|------------------------|---------------------|-------------------------------|-------------------------------|----------------------------|-------------|---------------|
| N | 610 | 610 | 610 | 610 | 610 | 610 | 610 |
| Missing | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mean | 174.48 | 72.58 | 64.60 | 20.98 | 35.64 | 15.63 | 54.82 |
| Median | 176.00 | 71.00 | 66.00 | 20.00 | 36.00 | 16.00 | 55.00 |
| Standard deviation | 16.33 | 10.07 | 6.91 | 6.23 | 6.16 | 1.59 | 8.40 |
| Minimum | 106.00 | 43 | 30 | 12 | 18 | 11 | 24 |
| Maximum | 221.00 | 100 | 75 | 51 | 54 | 23 | 84 |
| Skewness | −0.42 | 0.20 | −0.97 | 0.88 | 0.10 | 0.30 | −0.16 |
| Std. error skewness | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| Kurtosis | 0.51 | −0.33 | 1.40 | 0.91 | −0.07 | 1.01 | 0.58 |
| Std. error kurtosis | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |

TABLE 4 Correlational analysis between emotional intelligence scores and parenting competence scores.

| | | Parental competence | Perceiving and understanding emotions | Expressing and labeling emotions | Emotion management and regulation |
|---------------------------------------|-------------|---------------------|---------------------------------------|----------------------------------|-----------------------------------|
| Parental competence | Pearson's r | — | | | |
| | p-value | — | | | |
| Perceiving and understanding emotions | Pearson's r | 0.31 | — | | |
| | p-value | <0.001 | — | | |
| Expressing and labeling emotions | Pearson's r | 0.33 | 0.56 | — | |
| | p-value | <0.001 | <0.001 | — | |
| Emotion management and regulation | Pearson's r | 0.30 | 0.48 | 0.52 | — |
| | p-value | <0.001 | <0.001 | <0.001 | — |

TABLE 5 Linear regression between the parental competence variable and the emotional intelligence variable.

| Overall Model Test | | | | | | |
|--|----------|----------------|--------|--------|-----|--------|
| Model | R | R ² | F | df1 | df2 | p |
| 1 | 0.38 | 0.15 | 103.97 | 1 | 608 | <0.001 |
| Model Coefficients - Parental competence | | | | | | |
| Predictor | Estimate | SE | t | p | | |
| Intercept | 31.47 | 4.05 | 7.77 | <0.001 | | |
| Emotional intelligence | 0.24 | 0.02 | 10.20 | <0.001 | | |

The factorial model was composed of the following factors: parental competence, emotional intelligence, and parental self-esteem.

For a valid analysis of this factorial model, specific indicators of self-esteem with a negative load were removed. In Table 8 it can be read the estimated values of each indicator specific to the variables parental competence, emotional intelligence, self-esteem. The variables on the basis of which the factor analysis was calculated were coded as follows: PC - Parental Competence, EI - Emotional Intelligence, SE - Self esteem. It is also observed that positive correlations are established between all indicators of the three factors ($p < 0.001$). From Table 9 specific to the factor covariances, it was identified that a positive, reasonable correlation was established between the parental competence factor and the emotional intelligence factor ($r = 0.44$, $p < 0.001$), and between the parental competence factor and the parents' self-esteem factor established a positive, high correlation ($r = 0.67$, $p < 0.001$).

Starting from the confirmatory factor analysis, the hypothesis according to which parental competence is determined by factors such as parents' emotional intelligence and self-esteem supported by the data. As parental emotional intelligence increases and self-esteem levels are high parental competence develops. Emotional intelligence together with self-esteem contributes to the development of interpersonal intelligence, respectively intrapersonal intelligence, which favors the parent's relationship with his child in a competent

way based on an authoritative style and well-established parenting skills (113).

4.4. Mediation analysis of parental self-esteem on the relationship between emotional intelligence and parenting competence

In order to test the hypothesis that the relationship between emotional intelligence and parental competence is mediated by the level of parents' self-esteem, a mediation analysis was calculated through which was identified the causal relationship between the emotional intelligence of the parent, which represents the independent variable, IV and parental competence representing the dependent variable, DV, but also the causal effect of emotional intelligence on the mediator, M, represented by the parent's self-esteem. A series of regression analyzes were calculated to test the aforementioned hypothesis.

Results indicated that parents' emotional intelligence predicted parental competence level $p < 0.001$, $d = 0.24$, 95% CI [0.19, 0.28]. Analyzing the indirect effect, self-esteem significantly mediated the relationship between parents' emotional intelligence and parental competence $p < 0.001$, $d = 0.02$, 95% CI [0.01, 0.03] (Table 10).

Emotional intelligence has a positive effect on self-esteem $p < 0.001$, $d = 0.02$, 95% CI [0.01, 0.03] and self-esteem has a positive effect on the level of parental competence $p < 0.001$, $d = 1.08$, 95% CI [0.61, 1.54] (Table 11).

However, the results suggested that even after taking into account the mediating role of parent self-esteem, parent emotional intelligence had a positive effect on parental competence $p < 0.001$, $d = 0.22$, 95% CI [0.17, 0.26] (Table 11). As the indirect and direct effect are statistically significant the mediation was partial. The level of parents' self-esteem represented 8.62% of the total effect of the emotional intelligence of the parent on the level of parental competence, while the emotional intelligence of the parent determined a high level of parental competence in proportion to 91.38% (Table 10). Using Jasp

TABLE 6 Correlational analysis between the scores obtained on parental competence and those obtained on self-esteem.

| | | Parental competence | Self esteem |
|---------------------|-------------|---------------------|-------------|
| Parental competence | Pearson's r | — | |
| | p-value | — | |
| Self esteem | Pearson's r | 0.24 | — |
| | p-value | <0.001 | — |

TABLE 7 Linear regression between the parental competence variable and the self-esteem variable.

| Overall Model Test | | | | | | |
|--|------|----------|-------|-------|--------|--------|
| Model | R | R2 | F | df1 | df2 | p |
| 1 | 0.24 | 0.06 | 36.55 | 1 | 608 | <0.001 |
| Model Coefficients - Parental competence | | | | | | |
| Predictor | | Estimate | SE | t | p | |
| Intercept | | 49.07 | 3.91 | 12.55 | <0.001 | |
| Self-esteem | | 1.50 | 0.25 | 6.05 | <0.001 | |

program, the graph of the previously presented mediation model was made (Figure 1).

These results demonstrated that the hypothesis according to which the relationship between emotional intelligence and parental competence is mediated by the level of parents' self-esteem supported by the data. As the parent demonstrates an increased level of self-esteem, increases the possibility that his emotional intelligence will determine an increased level of parenting competence.

4.5. Anova analysis of variance between parental competence and parents' educational level

An Anova analysis of variance was conducted to determine if there was a significant difference between the level of parental competence based on the educational level of the parents. It was hypothesized that high educational level is associated with a high level of parental competence. The results showed that the level of parental competence differ significantly according to the educational level of the respondents ($df = 4$ $F = 3.68$, $p = 0.009$, $p < 0.05$; Table 12).

According to the Shapiro–Wilk normality test, this condition is not met for the analysis of variance of parental competence according to the educational level of the respondents, $W = 0.99$, $p = 0.005$, $p < 0.05$ (Table 12).

The homogeneity of the variance of the level of parental competence according to the educational level is not met, $F = 2.57$, $p = 0.03$, $p < 0.05$ (Table 12).

The Tukey Post-Hoc Test was used to analyze the dependent variable, parental competence. The result of *post hoc* showed that there are statistically significant differences in the level of parental competence depending on the educational level of the respondents in the case of respondents with high school and postgraduate studies, $p = 0.010$, $p < 0.05$ (Table 13).

TABLE 8 Confirmatory factor analysis between factors: parenting competence, emotional intelligence, and parental self-esteem.

| Factor | Indicator | Estimate | SE | Z | p |
|------------------------|-----------|----------|------|-------|--------|
| Parental competence | PC_1 | 0.36 | 0.04 | 8.34 | <0.001 |
| | PC_2 | 0.86 | 0.06 | 14.40 | <0.001 |
| | PC_3 | 0.88 | 0.06 | 14.85 | <0.001 |
| | PC_4 | 0.82 | 0.05 | 15.18 | <0.001 |
| | PC_5 | 0.56 | 0.05 | 10.30 | <0.001 |
| | PC_7 | 0.39 | 0.06 | 6.90 | <0.001 |
| | PC_9 | 0.86 | 0.06 | 15.62 | <0.001 |
| | PC_11 | 0.40 | 0.05 | 8.36 | <0.001 |
| | PC_12 | 0.56 | 0.06 | 10.03 | <0.001 |
| | PC_13 | 0.34 | 0.05 | 6.56 | <0.001 |
| | PC_14 | 0.56 | 0.06 | 9.54 | <0.001 |
| | PC_15 | 0.49 | 0.04 | 11.24 | <0.001 |
| | PC_16 | 0.79 | 0.05 | 14.37 | <0.001 |
| | PC_17 | 0.34 | 0.06 | 5.84 | <0.001 |
| | PC_6 | 0.20 | 0.06 | 3.52 | <0.001 |
| | PC_8 | 0.20 | 0.05 | 3.91 | <0.001 |
| | PC_10 | 0.19 | 0.05 | 3.66 | <0.001 |
| Emotional intelligence | EI_2 | 0.38 | 0.04 | 10.53 | <0.001 |
| | EI_3 | 0.30 | 0.04 | 8.19 | <0.001 |
| | EI_13 | 0.38 | 0.03 | 12.65 | <0.001 |
| | EI_14 | 0.35 | 0.03 | 9.99 | <0.001 |
| | EI_15 | 0.35 | 0.03 | 12.33 | <0.001 |
| | EI_16 | 0.45 | 0.04 | 12.55 | <0.001 |
| | EI_17 | 0.49 | 0.03 | 15.36 | <0.001 |
| | EI_18 | 0.41 | 0.03 | 14.88 | <0.001 |
| | EI_19 | 0.39 | 0.03 | 13.16 | <0.001 |
| | EI_20 | 0.35 | 0.03 | 12.05 | <0.001 |
| | EI_21 | 0.54 | 0.03 | 17.44 | <0.001 |
| | EI_22 | 0.51 | 0.03 | 16.16 | <0.001 |
| | EI_23 | 0.46 | 0.03 | 15.25 | <0.001 |
| | EI_24 | 0.50 | 0.03 | 16.99 | <0.001 |
| | EI_25 | 0.40 | 0.03 | 12.13 | <0.001 |
| | EI_26 | 0.34 | 0.03 | 11.30 | <0.001 |
| | EI_30 | 0.29 | 0.03 | 8.84 | <0.001 |
| | EI_31 | 0.31 | 0.04 | 7.91 | <0.001 |
| | EI_32 | 0.33 | 0.03 | 12.05 | <0.001 |
| | EI_33 | 0.27 | 0.02 | 11.47 | <0.001 |
| | EI_34 | 0.39 | 0.03 | 13.21 | <0.001 |
| | EI_35 | 0.47 | 0.04 | 12.81 | <0.001 |
| | EI_36 | 0.42 | 0.03 | 14.47 | <0.001 |
| | EI_37 | 0.40 | 0.03 | 13.39 | <0.001 |
| | EI_38 | 0.43 | 0.03 | 14.11 | <0.001 |

(Continued)

TABLE 8 (Continued)

| Factor | Indicator | Estimate | SE | Z | p |
|-------------|-----------|----------|------|-------|--------|
| | EL_39 | 0.40 | 0.03 | 14.19 | <0.001 |
| | EL_42 | 0.43 | 0.03 | 14.66 | <0.001 |
| | EL_43 | 0.51 | 0.03 | 17.81 | <0.001 |
| | EL_44 | 0.48 | 0.03 | 16.08 | <0.001 |
| | EL_45 | 0.37 | 0.03 | 12.84 | <0.001 |
| | EL_1 | 0.29 | 0.04 | 8.24 | <0.001 |
| | EL_4 | 0.24 | 0.03 | 8.25 | <0.001 |
| | EL_5 | 0.11 | 0.04 | 2.81 | 0.005 |
| | EL_6 | 0.22 | 0.04 | 5.19 | <0.001 |
| | EL_7 | 0.26 | 0.05 | 5.38 | <0.001 |
| | EL_8 | 0.24 | 0.04 | 5.83 | <0.001 |
| | EL_9 | 0.24 | 0.03 | 7.76 | <0.001 |
| | EL_10 | 0.02 | 0.05 | 0.32 | 0.751 |
| | EL_11 | 0.14 | 0.03 | 4.43 | <0.001 |
| | EL_12 | 0.28 | 0.03 | 10.66 | <0.001 |
| | EL_27 | 0.25 | 0.04 | 7.23 | <0.001 |
| | EL_28 | 0.17 | 0.04 | 4.54 | <0.001 |
| | EL_29 | 0.26 | 0.03 | 8.72 | <0.001 |
| | EL_40 | 0.26 | 0.03 | 8.78 | <0.001 |
| | EL_41 | 0.34 | 0.04 | 7.60 | <0.001 |
| Self esteem | SE_4 | 0.29 | 0.02 | 11.81 | <0.001 |
| | SE_5 | 0.45 | 0.03 | 14.67 | <0.001 |
| | SE_7 | 0.34 | 0.03 | 13.38 | <0.001 |
| | SE_8 | 0.36 | 0.04 | 9.52 | <0.001 |
| | SE_9 | 0.54 | 0.03 | 17.18 | <0.001 |

TABLE 9 Factor covariance: parenting competence, emotional intelligence, parental self-esteem.

| | | Estimate | SE | Z | p |
|------------------------|------------------------|-------------------|------|-------|--------|
| Parental competence | Parental competence | 1.00 ^a | | | |
| | Emotional intelligence | 0.44 | 0.04 | 11.39 | <0.001 |
| | Self esteem | 0.67 | 0.04 | 19.13 | <0.001 |
| Emotional intelligence | Emotional intelligence | 1.00 ^a | | | |
| | Self esteem | 0.42 | 0.04 | 10.11 | <0.001 |
| Self esteem | Self esteem | 1.00 ^a | | | |

Despite the fact that the conditions of normality and homogeneity were not met, the values of the coefficients of skewness and kurtosis were analyzed. Since the values of these coefficients fall between -1 and $+1$ (Table 14) it can be stated that the hypothesis according to which the high educational level is associated with a high level of parental competence is partially confirmed.

4.6. Correlational analysis between parents' emotional intelligence and authoritative parenting style

By calculating the average of the answers specific to the three subscales, it was found that the central tendency at the sample level is to choose the answer variants that determine an average, respectively high level of emotional intelligence.

The mean of the variable perceiving and understanding emotions is 57.83, the variable expressing and labeling emotions is 54.53 and the variable managing and regulating emotions is 62.13 (Table 15). The value of skewness varies between -0.70 and -0.28 , and the value of kurtosis varies between -0.15 and 1.67 . Both ranges of values are statistically acceptable. Therefore, after the normality of the research variables was analyzed, all skewness and kurtosis values were within an acceptable range.

Based on the descriptive statistics, it was found that the average of the responses to the three subscales of the questionnaire, parenting style authoritarian, authoritative and permissive is higher for the authoritative parenting style, 64.60, followed by the mean of the permissive parenting style, 35.64 and the mean of the authoritarian parenting style, 20.98 (Table 16). The value of skewness varies between -0.97 and 0.88 , and the value of kurtosis varies between -0.07 and 1.40 . Both ranges of values are statistically acceptable. Therefore, after the normality of the research variables was analyzed, all skewness and kurtosis values were within an acceptable range.

Most of the respondents participating in the research are followers of the authoritative parenting style.

Following the correlational analysis between the level of parents' emotional intelligence and the authoritative parenting style, the existence of a reasonable, statistically significant positive association was found ($r=0.45$, $p<0.001$), which indicated that as the level of parents' emotional intelligence increased, the preference for the authoritative parenting style increased (Table 17). Thus, parents who manage to better perceive their emotions, understand them, express them and later regulate them, tend to find a balance between authority and gentleness, flexibility shown towards the child.

Based on the statistical analyses, it was demonstrated that the hypothesis according to which as the level of parents' emotional intelligence increases, the preference for the authoritative parenting style supported by the data.

4.7. Correlational analysis between the Barnum effect experienced by parents and the level of parental competence

Before testing the hypothesis that considers the experience of the Barnum effect in the case of parents depending on their educational level, we present the distribution of the response options to the items specific to the measurement of this effect was calculated in relation to the educational level of the parents. The questions subjected to the distribution analysis were the following: Forums, groups of parents constitute a safe space to be aware of new trends in parenting; As long as the information fits my child's situation, it does not matter who wrote it or shared it; If I were to attend a parenting course, I would be more interested in the topics discussed than the professional training of the person giving the course; It is more important to want

TABLE 10 Estimated values of self esteem mediator on the relationship between emotional intelligence and parental competence.

| Effect | Estimate | SE | 95% Confidence Interval | | Z | p | % Mediation |
|----------|----------|------|-------------------------|-------|-------|--------|-------------|
| | | | Lower | Upper | | | |
| Indirect | 0.02 | 0.01 | 0.01 | 0.03 | 3.32 | <0.001 | 8.62 |
| Direct | 0.22 | 0.02 | 0.17 | 0.26 | 9.31 | <0.001 | 91.38 |
| Total | 0.24 | 0.02 | 0.19 | 0.28 | 10.21 | <0.001 | 100.00 |

TABLE 11 Mediation analysis of parental self-esteem on the relationship between emotional intelligence and parenting competence.

| | | Estimate | SE | 95% Confidence Interval | | Z | p |
|------------------------|---------------------|----------|------|-------------------------|-------|------|--------|
| | | | | Lower | Upper | | |
| Emotional intelligence | Self-esteem | 0.02 | 0.00 | 0.01 | 0.03 | 4.86 | <0.001 |
| Self-esteem | Parental competence | 1.08 | 0.24 | 0.61 | 1.54 | 4.55 | <0.001 |
| Emotional intelligence | Parental competence | 0.22 | 0.02 | 0.17 | 0.26 | 9.31 | <0.001 |

to know more about the child's education than the source of information (Table 1).

Following the analysis of the data distribution, the following answers were identified by the respondents who graduated from university, respectively post-university studies: forums, groups of parents were considered by 200 respondents to a moderate extent, respectively to a large and very large extent a safe space for to be aware of the new trends in parenting, while 256 respondents considered to a very small or a small extent that these virtual spaces are safe for valid information about parenting.

Of the 456 respondents, 178 considered to a moderate extent, respectively to a large and a very large extent that as long as the information read is suitable for their own child's situation, it is not important who wrote or spread that information, while 278 respondents they agreed with this statement very little, respectively to a small extent.

252 respondents out of the 456 stated that they are moderately, highly and very interested in the topics discussed in a parenting course and not necessarily in the professional training of the person giving the course. At the opposite pole are the 204 respondents out of a total of 456 who stated that they are interested to a very small or small extent in the topics discussed at the expense of the attention given to the professional training of the person who provides the content of the parenting topics.

It was found that the parent's desire to know information about the child's education is more important than the source of information, 245 of them affirming that they agree to a moderate extent, respectively to a great extent and to a very great extent with the previously stated statement, while 211 respondents from the 456 pay more attention to the knowledge of the information at the disadvantage of the information source to a very small or small extent.

Next, despite the high educational level, parents tend to be guided by the topics discussed in a parenting course without paying much attention to the professional training of the person providing these topics. The tendency to search for information about child education without taking into account the possibility that the documentation source may not have scientific content specific to the field was also highlighted.

To test the hypothesis that takes into account the fact that as the parent experiences a high level of the Barnum effect, the level of parental competence decreases, a correlation analysis was carried out between the independent variable the Barnum effect and the dependent variable parental competence. Following this analysis, a negative association was obtained between the two variables $r = -0.19$, $p < 0.001$. Thus, it was found that as the level of the Barnum effect increases, an effect according to which parents do not choose the right parenting practices from scientific sources or from specialized literature, the level of parental competence decreases, the hypothesis being supported by the data (Table 18).

5. Discussion

The purpose of the research is to provide scientific information regarding the influence of emotional intelligence on parenting style, respectively on parental competence. A second aim of the research is represented by the identification of the factors that determine the level of parental competence of the parents. The educational level of the parents becomes an important variable of the study being put in relation to both the parental competence and the Barnum effect experienced by the parents. The collected data supported a number of seven hypotheses that are summarized in Table 19.

The results obtained through the statistical interpretation of the data highlight the usefulness of parents' emotional intelligence and their level of self-esteem for the acquisition of parental competence. The research contributes with novel elements in the field of parenting by determining a factorial model, but also by carrying out a mediation analysis of parents' self-esteem on the relationship between their emotional intelligence and parental competence. The measurement of the Barnum effect, according to which parents consider true information about the education of children, is not scientifically validated, represents another element of originality of this work.

The positive relationship between parents and children is of great importance for children's health, well-being and resilience, and the emotional intelligence of parents largely determines this positive relationship (114). Both the process by which children will be taught

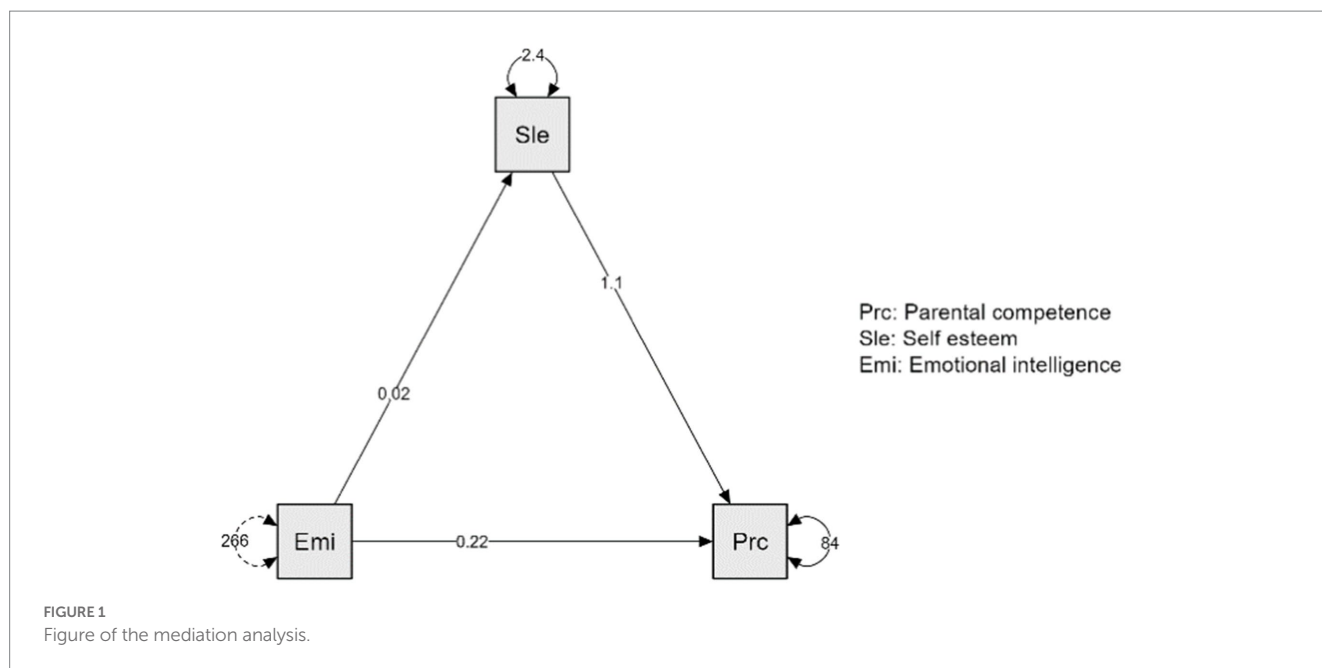


TABLE 12 Analysis of variance of the level of parental competence according to the educational level of the respondents.

| | F | df1 | df2 | p |
|---|------|-----|-------|-------|
| Parental competence | 3.68 | 4 | 66.88 | 0.009 |
| Homogeneity of variance (Levene's) test of the level of parental competence according to the educational level of the respondents | | | | |
| | F | df1 | df2 | p |
| Parental competence | 2.57 | 4 | 605 | 0.037 |

to behave appropriately and the development of their sense of security depend on the quality of this relationship, which subsequently leads them to have a solid self-perception, but also self-confidence, thus exploiting their potential (115).

Raising children is also accompanied by stressful situations caused by the uncertainty of parents to act in different contexts. Emotional intelligence, along with its skills and competencies, self-knowledge, awareness and management of one's emotions, self-evaluation and self-control, can contribute to managing stressful situations and adopting constructive thinking in the case of parents (116). Throughout the parental experience, the emotional state of adults can be accentuated as a result of the multiple challenges encountered in the process of educating children (117), which is why emotional intelligence becomes important in regulating the emotional state of parents.

Even if the adult has proven that he has the necessary skills to educate his child, when faced with stressful, confusing times, parenting skills can be affected. Parental competence is correlated with the parent's feelings of safety and protection in order to face well the challenges that may arise in the education of the child (118), but also with the observance of consequences among children for their inappropriate behaviors at the expense of the application of punishments (119). This is supported by behaviors such as: adaptation

to the child's needs, but also to the contexts that require the formulation of limits; avoiding orders, ultimatums, but adopting a firm but at the same time benevolent attitude that leads to cooperation; spending time with children to strengthen the relationship (120). Parental competence is also proven when parents choose to change their perspective on the problems that may appear in their children's lives, understand their way of acting and finally offer the right answers to make the problem-solving process more efficient (121).

One of the goals of the competent parent is to demonstrate to the child that he is genuine and sincere when he wants to understand his concerns or perspectives on certain things (122). Another goal of the competent parent is to identify what their child's abilities, preferences, beliefs, or goals are and act accordingly (123). It has been demonstrated that the choice of a profession corresponding to the level of education determines the formation of parental skills through which parental competence is formed (124). Along with parental competence, parenting style is an important aspect for acquiring this competence (125). carry out a differentiated analysis of the three concepts specific to parenting: parenting practices, parenting dimensions, parenting styles. Parenting practices are the observable behaviors of parents for children's development. For example, a parenting practice that supports children's academic success could be represented by occasional participation in documenting activities in partnership with children. Positive reinforcement, discipline or conflict management are also included in the category of parenting practices.

Along with parental practices, in the field of parenting there is also the concept of parental dimensions that can be observed in the establishment of relationships between parents and children. The parental dimensions are as follows: Parental support – denotes a parent-child relationship based on affectivity, involvement, acceptance, emotional availability, warmth and responsiveness [(126) cited in (125)]. This dimension was associated with the children's avoidance of dangerous environments, vices, but also with the externalization of emotions; Parental control – highlights how the parent manages the child's behavior using rules, disciplinary strategies,

TABLE 13 Tukey post-hoc test – parental competence.

| | | Secondary studies | High school studies | Post-secondary studies | University studies | Postgraduate studies |
|------------------------|-----------------|-------------------|---------------------|------------------------|--------------------|----------------------|
| Secondary studies | Mean difference | — | −1.13 | −2.28 | −3.79 | −5.14 |
| | <i>p</i> -value | — | 0.996 | 0.958 | 0.701 | 0.418 |
| High school studies | Mean difference | | — | −1.15 | −2.66 | −4.01 |
| | <i>p</i> -value | | — | 0.973 | 0.149 | 0.010 |
| Post-secondary studies | Mean difference | | | — | −1.51 | −2.87 |
| | <i>p</i> -value | | | — | 0.900 | 0.470 |
| University studies | Mean difference | | | | — | −1.35 |
| | <i>p</i> -value | | | | — | 0.614 |
| Postgraduate studies | Mean difference | | | | | — |
| | <i>p</i> -value | | | | | — |

**p* < 0.05.

***p* < 0.01.

****p* < 0.001.

TABLE 14 Descriptive analysis of the Skewness and Kurtosis values of the level of parental competence depending on the educational level of the parents.

| | Educational level | Parental competence |
|-----------------------|------------------------|---------------------|
| Number of respondents | Secondary studies | 12 |
| | High school studies | 102 |
| | Post-secondary studies | 40 |
| | University studies | 271 |
| | Postgraduate studies | 185 |
| Skewness | Secondary studies | 0.28 |
| | High school studies | 0.35 |
| | Post-secondary studies | 0.39 |
| | University studies | 0.31 |
| | Postgraduate studies | −0.14 |
| Kurtosis | Secondary studies | −0.25 |
| | High school studies | −0.31 |
| | Post-secondary studies | −0.20 |
| | University studies | −0.44 |
| | Postgraduate studies | −0.16 |

punishments and rewards, or supervision. When parents find a balance in controlling the child's behavior, its development is positively influenced, while inconsistent control (associated with the permissive approach) and exaggerated control (physical punishments, emotional abuse) are associated with inappropriate child behaviors that cause gaps in its development. Parental psychological control - manifests itself through the parent's attempt to manipulate the child's thoughts, emotions and feelings [(127, 128) cited in (125)] being associated with relationship difficulties, but also with depressive states.

Self-esteem develops as a result of the experiences that a person lives throughout his life, but also as a result of deep self-reflections on these experiences (129). For a better understanding of the dynamics

TABLE 15 Mean of responses to the questionnaire to measure the level of emotional intelligence.

| | Perceiving and understanding emotions | Expressing and labeling emotions | Management and Regulation of emotions |
|---------------------|---------------------------------------|----------------------------------|---------------------------------------|
| N | 610 | 610 | 610 |
| Missing | 0 | 0 | 0 |
| Mean | 57.78 | 54.53 | 62.13 |
| Median | 59.00 | 55.00 | 62.00 |
| Standard deviation | 7.15 | 6.81 | 5.89 |
| Minimum | 35.00 | 18 | 43 |
| Maximum | 75.00 | 70 | 79 |
| Skewness | −0.38 | −0.70 | −0.28 |
| Std. error skewness | 0.10 | 0.10 | 0.10 |
| Kurtosis | 0.21 | 1.67 | 0.15 |
| Std. error kurtosis | 0.20 | 0.20 | 0.20 |
| Shapiro–Wilk W | 0.99 | 0.97 | 0.99 |
| Shapiro–Wilk p | < 0.001 | < 0.001 | < 0.001 |

of self-esteem it is necessary to make a distinction between self-esteem as a trait of the parent and self-esteem as a state of the parent. Self-esteem as a state of the individual represents the totality of his feelings about himself that fluctuate also under the influence of external factors, while self-esteem as a trait refers to the individual's general assessment of his own worth (130). Parents' self-esteem is translated into their overall opinion of themselves, reflecting how they feel about their abilities and limitations, as opposed to self-image, which highlights how parents perceive themselves in terms of how they show

TABLE 16 The average of the answers for measuring the variables: authoritative, authoritarian and permissive parenting style.

| | Authoritative parenting style | The authoritarian parenting style | Permissive parenting style |
|---------------------|-------------------------------|-----------------------------------|----------------------------|
| N | 610 | 610 | 610 |
| Missing | 0 | 0 | 0 |
| Mean | 64.60 | 20.98 | 35.64 |
| Median | 66.00 | 20.00 | 36.00 |
| Standard deviation | 6.91 | 6.23 | 6.16 |
| Minimum | 30 | 12 | 18 |
| Maximum | 75 | 51 | 54 |
| Skewness | −0.97 | 0.88 | 0.10 |
| Std. error skewness | 0.10 | 0.10 | 0.10 |
| Kurtosis | 1.40 | 0.91 | −0.07 |
| Std. error kurtosis | 0.20 | 0.20 | 0.20 |
| Shapiro–Wilk W | 0.94 | 0.94 | 1.00 |
| Shapiro–Wilk p | <0.001 | <0.001 | 0.118 |

TABLE 17 Correlational analysis between the emotional intelligence total score variable and the authoritative style score variable.

| | | Emotional intelligence | Authoritative parenting style |
|-------------------------------|-------------|------------------------|-------------------------------|
| Emotional intelligence | Pearson's r | — | |
| | p-value | — | |
| Authoritative parenting style | Pearson's r | 0.45 | — |
| | p-value | <0.001 | — |

or opinion of who and what they are. Both aspects are particularly important: a negative self-image affects self-esteem and self-confidence (131), but an optimal level of self-esteem indicates the balanced development of internal comfort and security (132).

A differentiation between parent self-esteem and self-compassion is necessary to establish balance. Self-esteem tends to increase when the parent experiences success in various areas of his life, while self-compassion emphasizes how the parent relates to himself in situations where he experiences failure. Self-esteem needs to be counterbalanced by self-compassion in order for the parent to realize that his human value does not necessarily lie in the success and failure experienced over time, but rather in how he capitalized on successes and handled failures (133).

The limit of the study is represented by a low level of heterogeneity, the majority of respondents being female. As a result of this limitation, hypotheses regarding the role of gender as a moderator of the relationship between emotional intelligence and parenting

TABLE 18 Correlational analysis between the Barnum effect experienced by parents and the level of parental competence.

| | | Barnum effect | Parental competence |
|---------------------|-------------|---------------|---------------------|
| Barnum effect | Pearson's r | — | |
| | p-value | — | |
| Parental competence | Pearson's r | −0.19 | — |
| | p-value | <0.001 | — |

TABLE 19 Hypothesis testing summary.

| Code | Hypothesis short description | p-value | Result |
|------|------------------------------|---------|---------------------|
| H1 | EI → PC | <0.001 | Supported |
| H2 | PSE → PC | <0.001 | Supported |
| H3 | PC → EI + PSE | <0.001 | Supported |
| H4 | PSE → EI + PC | <0.001 | Supported |
| H5 | PC → EL | <0.05 | Partially confirmed |
| H6 | EI → APS | <0.001 | Supported |
| H7 | BE → PC | <0.001 | Supported |

The variable codes are as follows: EI, emotional intelligence; PC, parental competence; PSE, parental self-esteem, EL, educational level, APS, authoritative parenting style, BE, Barnum effect.

competence, or the relationship between emotional intelligence and parenting style, could not be tested. In the future, this problem could be solved by choosing a more efficient sampling strategy, which would contribute to the collection of data from more male respondents.

6. Conclusion

As a result of the tested hypotheses, the following aspects are concluded:

Parents with a high level of emotional intelligence demonstrate a high level of parental competence as a result of the specific emotional intelligence strategies they use in the parenting process.

The level of parental competence varies with parental self-esteem by 6% as a result of the self-confidence and effectiveness of parents with high levels of self-esteem.

Parental competence is determined by factors such as the emotional intelligence and self-esteem of parents, a confirmatory factor analysis being carried out in this regard. At the same time, self-esteem plays a mediating role in the relationship between parents' emotional intelligence and parenting competence.

The level of education of the parents partially influences the level of parental competence, additional measures being necessary to formulate a conclusion.

The high level of emotional intelligence of parents is associated with the adoption of the authoritative parenting style that is in agreement with specific elements of this intelligence.

Even if the high educational level of the parents would ensure them access to valid information from a scientific point of view, the

Barnum effect is also felt in the case of parents with university and postgraduate studies, which draws attention to the training of adults in terms of parental education regardless of their status or educational level.

As a result of the Barnum effect experienced by the participants of this study, it is noted that the level of parental competence decreases as the Barnum effect increases. Thus, the necessity of training adults in the field of parenting is found once again in order to reduce the adoption of inappropriate educational practices for the education of children.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

This study was conducted in accordance with the Helsinki Declaration and approved by the Ethics Commission of the University of Bucharest—Registration number: (100/22.03.2022). The patients/participants provided their written informed consent to participate in this study.

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Author contributions

AŞ and GP: conceptualization, methodology, validation, writing – original draft preparation, and writing – review and editing. GP: supervision. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The birthplace and relative age effects in Brazilian olympic athletes: a cross-national comparison

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Purpose: Our purpose was to verify the existence of birthplace and relative age effect (RAE), as well as the association between birthplace effect and RAE among Brazilian athletes competing in the Olympic Games.

Methods: Data included information about Brazilian Summer Olympic athletes from 1920 to 2021. To investigate RAE, athletes' birthdate was distributed into birth quartiles (Q1: Jan–Mar; Q2: Apr–Jun; Q3: Jul–Sep; Q4: Oct–Dec), while birthplace effect was assessed considering the state and the region (Southeast; Northeast; South; North; and Midwest) of birth. The Chi-square test (χ^2) was used to verify differences between the birthplace effect and RAE.

Results: The sample consisted of 388 Brazilian athletes of both sexes, distributed in 38 sports modalities from 23 Brazilian states (Southeast=66.5%; South=14.4%; Northeast=12.1%; North=1.5%; Midwest=5.4%). For both sexes, most of the athletes were from the São Paulo state (37.4%), followed by Rio de Janeiro (18.3%), both from the Southeast region. For birthdate distribution according to birthplace, it was observed that the North region presented the highest frequency of athletes born in Q1 (50%), followed by the Northeast and Southeast regions. No significant differences were found for the birthplace effect ($\chi^2=5.69$, value of $p=0.128$) and RAE between sexes ($\chi^2=0.530$, value of $p=0.912$), nor was shown an association between the birthplace effect and RAE.

Conclusion: Most Brazilian Olympic athletes are from the Southeast region, but no RAE was established regarding their birthplace. Results from the present study can guide sports public policies in Brazilian regions, especially in the Midwest, North, and Northeast regions, which are underrepresented in Brazilian high-performance sports.

KEYWORDS

birthplace effect, relative age effect, olympic games, athletes, country

1. Introduction

The interest in understanding the role of contextual variables in athletes' development and performance has increased in the last few years (Yan et al., 2016). The birthplace effect is the term used to characterize the role played by the place where an individual was born and grew up during his early development to their success (Cote et al., 2006; Hancock et al., 2018). The birthplace effect has been associated with the likelihood of an athlete achieving high levels of proficiency in sports (Rossing et al., 2018; Smith and Weir, 2020). Previous studies have highlighted the birthplace effect in different contexts (Smith and Weir, 2020; Leite et al., 2021), such as soccer (Teoldo and Cardoso, 2021), the Olympic Summer Games (Tozetto et al., 2017), and basketball (Faria et al., 2021). However, only few studies investigated the impact of the birthplace among Brazilian Olympic athletes over the years and, nonetheless the relevance, most of them are time-limited (Tozetto et al., 2017; Thuanly et al., 2021b).

When the birthplace effect was studied in the Brazilian context, results present some differences. For example, studying athletes competing in Rio de Janeiro Olympic Games 2016, Tozetto et al. (2017), showed that most of the Brazilian athletes were from the Southeast and South regions. Further, among those competing in Tokyo Olympic Games 2020, athletes from the Southeast and Northeast regions presented a higher chance of being a medalist (Thuanly et al., 2021b). Notwithstanding the Southeast and South regions present the best economic index among Brazilian regions (OECD, 2011), higher participation of athletes from the Northeast region can be related to public policy programs and the legacy of the Rio de Janeiro 2016 Summer Olympics, which lead to the development of the Northeast Olympic Training Center (*Centro de Formação Olímpica do Nordeste*; Fortaleza—Ceará) to support 26 Olympics sports disciplines (Ceará, 2017).

In addition to the birthplace effect, the relative age effect (RAE) has also been associated with the likelihood to become an elite athlete in different sports disciplines (Brázo-Sayavera et al., 2018; Gil et al., 2021). In summary, the RAE refers to the association between performance and the calendar month in which an athlete has been born (Roberts et al., 2021). If RAE is documented in a sport, the athletes born in given months outnumber those born in the other months (the comparisons are usually made between the first versus last months). This phenomenon explains that “early-born” athletes—at the beginning of their athletic career—are older than their “late-born” peers (Gil et al., 2021). An extreme example is that an athlete born on 1st January is almost 1 year older than an athlete born on 31st December of the same calendar year, though both compete in the same age group. Such age difference during the stage of sports development may provide an advantage to “early-born” athletes who usually outscore their peers in terms of anthropometric and physiological characteristics, which in turn reinforces their psychological characteristics and a mentality of a “winner” (Drenowatz et al., 2021; van Aalst and van Tubergen, 2021).

Considering the differences between the Brazilian macro-regions, it is expected a different distribution for both birthplace and RAE phenomena. For example, despite the Southeast region being pointed out as the economic center of the country, the region presents the best indicators of human development and is the most populous in the country. More people competing for specific positions within clubs and sports programs can create a competitive atmosphere among the

states from this region. In addition, this selective pressure can be associated with the feeling of “victory at all costs,” and also reflect in the selection of the athletes, or the odds to provide resources for specific groups. No information is available about the connection between the birthplace effect and RAE in Brazilian Olympic athletes. The following research questions were put forward: (1) What is the birthdate distribution of the Brazilian Olympic athletes according to birthplace? and (2) What are the associations between birthplace and RAE in Brazilian athletes competing in the Olympic Games?

2. Methods

2.1. Design and sample

This is a retrospective study where secondary data from the official website of the Brazilian Olympic Committee¹ was used. Considering missing information (e.g., no information about the place of residence or birthdate), as well as the exclusion of foreign athletes, the sample size was composed of 388 Brazilian athletes of both sexes (33.8% women), competing in the Summer Olympic Games editions from 1920 to 2020/21. Participants were distributed in 38 sports modalities, and they were born in 23 Brazilian states (Southeast=66.5%; South=14.4%; Northeast=12.1%; North=1.5%; and Midwest=5.4%). Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the participants was not required to participate in this study in accordance with the national legislation and the institutional requirements.

2.2. Data collection procedures

We downloaded all the data from the official website of the Brazilian Olympic Committee for athletes competing in Summer Olympic Games (1920 to 2020/21). Data comprised information about sex (female; male), birthdate (mm/dd/yyyy), birthplace (city, state), year of the Olympic Games, medals (gold, silver, bronze, or none), and/or the ranking position (i.e., classification in the competition), and sports modality participation. Sports modalities were categorized into three groups, i.e., team sports, individual sports, and mixed sports (when the competition can be performed individually and/or in teams, such as gymnastics, tennis, and badminton).

2.3. Birthplace effect and relative age effect

For analysis regarding the birthplace effect, we have considered the state and the region (Southeast; Northeast; South; North; and Midwest) of birth. To investigate RAE, the birth date of athletes was distributed into birth quartiles. The first quartile (Q1) comprises the months January, February, and March; the second quartile (Q2) comprises the months April, May, and June; the third quartile (Q3) comprises the months July, August, and September; and the fourth

¹ www.cob.org.br/pt/cob/time-brasil/atletas/

quartile (Q4) comprises the months October, November, and December.

2.4. Statistical analysis

Mean and standard deviation (SD) and frequency (%) were used to express the descriptive information. The Chi-square test (χ^2) was used to present the association between birthplace and RAE between sexes. Similarly, we used the Chi-square test (χ^2) to verify the association between the birthplace effect and RAE. All analyses were performed considering the total sample and both sexes. These analyses were performed in the SPSS software version 26.0, adopting a significance value of 5%.

3. Results

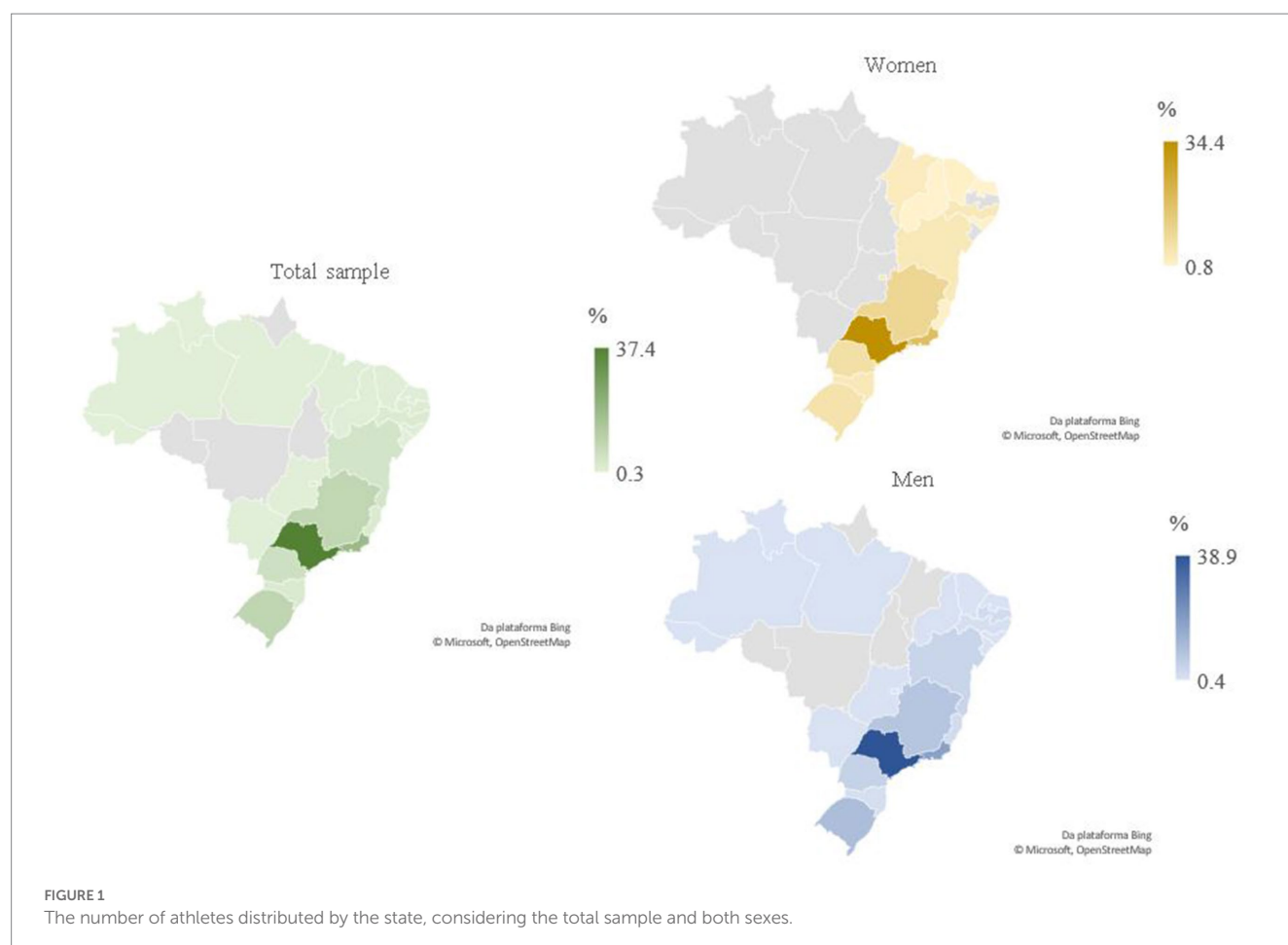
The total sample was composed of 388 athletes (woman: 131; men: 257), mean age of 25.5 ± 5.5 years (women: 25.8 ± 5.4 years; men: 25.3 ± 5.6 years), from 23 Brazilian states. Most of the participants competed in team sports, such as soccer (33.5%), volleyball (19.8%), and basketball (10.8%). For both sexes, most of the athletes were from São Paulo state (37.4%), followed by Rio de Janeiro (18.3%), both from the Southeast region (Figure 1). The lowest representativeness was observed for athletes from Acre, Roraima, and Sergipe states.

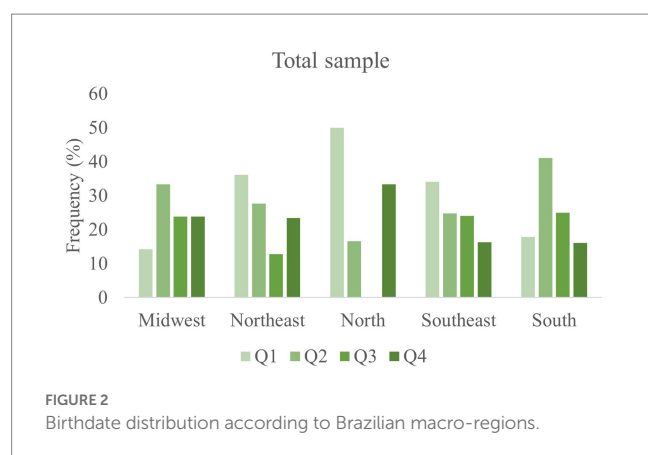
Considering macro-regions of birth, the chi-square test results did not show significant differences between sexes ($\chi^2 = 5.69$, $p = 0.128$).

Regarding the RAE, a higher frequency of athletes was born in the first (31.2%) and second (27.8%) quartiles, while a small frequency was born in the fourth quartile, for both sexes (Figure 2). The birthdate distribution according to birthplace (South; Southeast; North; Northeast; Midwest) showed that the North region presented the highest frequency of athletes born in Q1 (50%), followed by the Northeast and Southeast regions. Most of the athletes from the South were born in Q2 (41.1%), while a similar distribution between the quartiles was found for those from Midwest. The association between birthplace and RAE was tested through the chi-square test. No significant differences for birth quartile and birthplace were verified ($\chi^2 = 14.7$, value of $p = 0.09$). Similar results were founded for RAE, in which significant differences were not observed between sexes ($\chi^2 = 0.530$, $p = 0.912$).

4. Discussion

The purpose of this study was to verify the existence of birthplace and RAE, as well as the association between birthplace effect and RAE among Brazilian athletes competing in the Olympic Games. The results showed that the highest frequency of athletes was from the Southeast region, especially São Paulo state. These results are following previous studies that investigated Summer Olympic Games (Tozetto





et al., 2017; Thuany et al., 2021b), individual sports, such as running and swimming (Gomes-Sentone et al., 2019; Thuany et al., 2021a), soccer (Teoldo and Cardoso, 2021), and public policies programs (Reverdito et al., 2016). Factors explaining these results include demographic characteristics, economic indicators, sports public policies, and financial support (Galatti, 2017). Population and wealth were two of the leading indicators for international countries' sports success (Bohme and Bastos, 2016). Similarly, the Southeast region has more than half of the Brazilian population and the highest gross domestic product in the country. In addition, these results can be related to the fact that this is the region with the highest concentration of professional teams, sports federations, and hosting major sports events (Junior and Borin, 2017).

A higher frequency of athletes born in the first and second quartile was shown for both sexes, but no significant association was found between regions. RAE was previously demonstrated in basketball, soccer, and ice hockey (Cobley et al., 2009), especially for young athletes. When sports categories are divided according to chronological age, athletes born in the first months (Q1 and Q2) can present an advantage compared to those born in the last months regarding anthropometric and physical fitness variables, for example. A comparison between athletes born in January and December highlighted the differences resulting from the time gap of almost 1 year (physical, morphological, training background differences, and an initial advantage). Those differences can be associated with the higher expectation in January-born athletes as proposed by the Pygmalion effect (Hancock et al., 2013).

In summary, several factors are related to the presence of RAE in sports, such as cognitive, emotional, motivational, and morphological characteristics (Musch and Grondin, 2001). The absence of RAE in the present study can be related to methodological limitations. The statistical analysis was performed on the whole sample and was not stratified by sports modalities. Differences in RAE patterns among Rugby players from different nationalities were previously shown (Kearney, 2017), as well as among Olympic athletes around the world (1896–1996), regardless of sex and type of sports (Joyner et al., 2020).

Although without significant differences, we observed a higher frequency of athletes born in the first semester (Q1 and Q2). Previous studies propose some strategies to mitigate RAE, such as (i) improving selection criteria by changing the dates/ages of cutoff points, (ii) using selection systems based on biological age; (iii) in team sports, holding championships by similar age; and (iv) train scouts so that they can

identify and avoid RAE during selection processes (Gil et al., 2021). Although there are many strategies proposed to mitigate this effect, the implementation must be done carefully by testing its possible outcomes, as they can significantly affect the athlete's life (Webdale et al., 2020). Social issues had already been identified as a decisive factor in this process. Therefore, government agencies, team managers, and coaches also play a crucial role in mitigating these effects (Baker et al., 2010). We did not identify any significant differences for RAE according to sex, although previous research suggested a more significant effect among men, while current studies corroborate our findings (Kelly et al., 2020). Most of the research are conducted in the context of male athletes (Parma and Penna, 2018), but results among female athletes also identified the presence of RAE in different modalities (Smith et al., 2018).

The present study has some limitations. Firstly, we decided to provide a general view of the birthplace effect and RAE among Brazilian Olympic athletes, but differences can be shown considering sports modalities. The differences between states' characteristics can be associated with sports practices. Secondly, the birthplace can be different from the place where the athlete grew up, but this information is not available to be used. Information about populational birthdate was not considered, since we used data from different years, which impaired the use of 1 year as parameter. In addition, a limited number of data was available to be used in this study. This is an important limitation since important differences can be shown in a more representative sample. However, no previous studies have investigated RAE in the Brazilian regions to the best of our knowledge. The five regions present economic, social, cultural, and demographic differences, influencing sports access and practice, training facilities, and financial support. Investigating the association between the birthplace effect and RAE with sports performance according to the medals won at the Olympics Games (gold, silver, and bronze) or the position in the competition ranking may be a relevant issue for future research, as well as a higher sample size for each branch of sport investigated.

5. Conclusion

Most of the Brazilian Olympic athletes were from the Southeast region, especially São Paulo and Rio de Janeiro states. Taking into account the quartiles in which athletes were born, the highest frequency of them were born in Q1 and Q2, and significant differences for RAE according to sex were not identified. Results from the present study can guide public policies in Brazilian regions, especially for the Midwest, North, and Northeast regions, which are underrepresented in Brazilian high-performance sports.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation

and institutional requirements. Written informed consent from the patients/ participants or patients/participants legal guardian/ next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

MT: conceptualization and formal analysis. MT, ML, JC, and TA: methodology. MT and DV: writing—original draft preparation. PN, BK, KW, and TG: writing—review and editing. All authors contributed to the article and approved the submitted version.

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The subject-environment interplay between runners from different Brazilian macro-regions

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Purpose: Our purpose was to investigate the interplay between runners and their environment using a network approach.

Methods: This cross-sectional study sampled Brazilian runners of both sexes, from the five macro-regions of the country. An electronic questionnaire was used to obtain information regarding age, sex, training volume, socio-economic level, place of residence, and running pace. Environmental indicators (public illumination, pavement, sidewalk, and green areas) were collected from available public information. Descriptive statistics were presented in mean (SD), and frequency (%). A network analysis was performed to evaluate the association between individual and environmental characteristics. Statistical analyses were performed in the JASP, considering $p < 0.05$.

Results: At North and Mid-West regions, public illumination presents the highest values for the expected influence (1.74 and 1.56), while in Northeast and Southeast, sidewalks present the highest values (2.13; 0.91). For betweenness centrality, in North, Northeast, and Mid-West regions, residency in the capital of a state presented a hub. In contrast, pavement, and training volume present higher values in the South and Southeast. Network topologies are different.

Conclusion: Public illumination (North and Mid-West) and sidewalk (Northeast, Southeast) were the most important variables for runners. Continental size countries need specific approaches to improve physical activity levels and health outcomes that consider the cultural, historical, and environmental background.

KEYWORDS

complex systems, endurance, exercise, network analysis, amateur athletes

1. Introduction

Complex systems comprise the dynamic and non-linear relationships established between variables (Hristovski et al., 2012). From this relationship, a non-deterministic and irreducible behavior emerges (IPEA, 2015). Complex systems can be studied in different fields, including—but not limited to—biology (Cohen et al., 2022), physics (Robinson et al., 2022), psychology (Medin, 2017; Hayes and Andrews, 2020), and sports science

(Pereira et al., 2018; Renfree and Casado, 2018). In the sports context, the complex systems approach was previously used to understand the subject-environment-task relationship in soccer players (Pol et al., 2020), performance predictors (Pereira et al., 2018; Renfree and Casado, 2018), and physical activity behaviors (PA) (Orr et al., 2016).

The association between the subject and environment has been highlighted as an important attribute of increasing physical activity levels (Smith et al., 2017; Tcymbal et al., 2020). In addition, the outdoor environment, comprising both the built and natural environments, has also been related to physical activities and health outcomes (Coon et al., 2011; Deelen et al., 2019). Individuals regularly engaged in outdoor physical activity presented lower values for somatic anxiety than those participating in indoor activities (Lawton et al., 2017). Moreover, green spaces were positively related to sports practice in high-income countries (i.e., China) (Wang et al., 2019). Despite the results of the studies being summarized at countries level, the generalization of results found in specific contexts is limited. These challenges are related to the cross-national differences experienced within countries.

For example, based on its territorial dimension, Brazil is a large country, with a political-geographical division into five macro-regions (i.e., North, Northeast, South, Southeast, and Mid-West) (Pokshishevskiy, 1960). The five macro-regions present specific characteristics regarding weather, economic development (Pokshishevskiy, 1960), cultural and lifestyle habits (Torres and Dessen, 2008), physical activity preferences (Brasil, 2015), and physical environment for outdoor activities (Hino et al., 2018). At a national level, the physical environment related to physical activity differs. Hino et al. (2018), reported that access spaces to leisure and sports practice, road structures for physical activity (sidewalks, illumination, and pavement), and tree-lined streets can influence the population involvement in physical activity. The authors also showed that South (i.e., Curitiba) and Southeast regions (i.e., São Paulo, Minas Gerais, Espírito Santo) presented better indicators related to the built environment, as well as a friendlier environment for physical activity compared to other regions (Hino et al., 2018), due to the higher indicators for green spaces, illumination, training facilities, and paved streets (Galatti, 2017; Hino et al., 2018). These results highlight the relevance of the physical environment to outdoor activities (Haug et al., 2008), but also reinforce the urge to understand the phenomenon using a more holistic approach (Bauman et al., 2012).

Outdoor activities are related to positive benefits to physical and mental health (Coventry et al., 2021). Among the activities performed in outdoor spaces, running has been pointed out as one of the most practiced and also has been contextualized as an important strategy to improve physical activity at a population level (WHO, 2019). Running is considered a sustainable activity, in which the costs associated with the training are relatively low, as well as non-expensive equipment is required. Despite these positive factors, more information is necessary about the interplay runner-environment in Brazilian macro-regions.

Since the relationship between the subject and environment is non-linear by nature, we used a network model to offer insights regarding the relative importance of individual and environmental variables to the running commitment (training volume and running pace) among different Brazilian contexts. It is a second step of a previous research study, in which we found that green

spaces are positively related to a higher training volume among female runners (Thuany et al., 2022). Despite these results, the previous publication was focused on women runners and did not address the complex association between environmental factors. Considering the within-country differences, it is also important to understand the specificities of each region, what was not previously addressed. We hypothesized that the network topology will present different configurations between Brazilian macro-regions; and that regions with the best environmental indicators (i.e., higher green spaces, higher public illumination, percentage of the sidewalk, and pavement) will present a stronger influence on running commitment.

2. Materials and methods

2.1. Design and sample

The study presents a cross-sectional design in which data from the InTrack Project is used (InTrack, 2021). The project was developed with amateur Brazilian runners of both sexes, and data were collected between November 2019 and March 2020. Eligibility criteria included: self-classification as a runner, confirmation of participation in the study, and answering all mandatory questions in the questionnaire. The present study did not consider runners below 18 years and participants who did not answer all mandatory questions. All the participants were informed about the study's purpose, risks, and ethical aspects. The study was performed following the Declaration of Helsinki and was approved by the Ethics Committee of the Federal University of Sergipe, Brazil (protocol no 3558630).

2.2. Data collection

The questionnaire "Profile characterization and associated factors for runner's performance" (Thuany et al., 2020) was used. The questionnaire was transcribed to the Google Forms platform and sent as a link to the runners. This strategy covered all Brazilian states and did not aim to obtain a representative sample. Additionally, the questionnaire was disseminated through social media (Instagram, Facebook, and WhatsApp), and participants were encouraged to invite other runners to participate. The questionnaire's validity information can be checked in Thuany et al. (2020). For the present study, the following information was used:

2.2.1. Individual characteristics

Age (years), sex (male; female), socio-economic level-SES-(1 minimum wage; > 1 to 3 wages; > 3 to 5 wages), perception about the influence of weather characteristics and built environment in training commitment (yes; no), place of residence (capital of the state; not residence in the capital of the state), running training volume (km/week), and running pace (s/km). Information about socioeconomic level was based on minimum values of 2019-R\$998,00; 193,22US) (Brasil, 2019).

2.2.2. Environmental indicators

Information regarding environmental characteristics were obtained from the Brazilian Institute of Geography and Statistics,

based on the Census 2010–Urban households’ characteristics and surroundings (IBGE, 2012). The total percentage of these characteristics was computed based on the total number of domiciles where these characteristics were reported and the total population [(number of residents which provided all parameters/total residents) \times 100]. For the present study, we used information about public illumination (presence of at least one public light point, such as a streetlight, or lamps near the residence); pavement (presence of paved surfaces in public venues/streets); sidewalk (presence of paved sidewalks for pedestrians) and percentage of green areas (presence of trees along the sidewalks or tree beds that split lanes).

2.3. Statistical analysis

Descriptive statistic was presented as mean (SD) and frequency (%). Network analysis was performed to evaluate the association between individual and environmental characteristics. The EBICglasso parameter (Extended Bayesian Information Criterion) was used for network estimation. Centrality indicators (closeness, betweenness, and expected influence) were reported. Closeness values show the average distance between nodes, whereas those with higher closeness scores are more dependent on the network. The betweenness indicates the frequency to which a node lies on the shortest path connecting everyone else in a network. High values indicate that these nodes are important connection points between others in the network. For the expected values, variables with the highest values are more sensitive to change and can act as a hub by connecting other pairs of variables on the network (Hevey, 2018). Entropy values were calculated to verify the organization of the systems, for each macro-region. Color intensity is proportional to the strength of the association, while dashed lines show negative correlations. Statistical analyses were performed in JASP (Jeffrey’s Amazing Statistics Program), considering $p < 0.05$.

3. Results

Descriptive information is presented in Table 1 for the five Brazilian macro-regions. Most of the athletes are male and aged between 30 to 40 years. The highest frequency of participants reports an economic status between “1 and 3 minimum wages,” except for runners from the Mid-West, in which most of the participants reported “>3 and 5 minimum wages.” Most of the participants reported that weather and the built environment were factors that influenced training and practice commitment. For the environmental characteristics, sidewalks and green spaces are indicators with higher differences between regions. For both variables, the Southeast region presented the highest values.

The network plot, for each Brazilian macro-region, is presented in Figure 1. In a visual inspection, different network topologies are seen. Variables are sparser in panels d (Southeast) and c (South). For the Northeastern region (panel b), a positive and strong association between environmental indicators (illumination and sidewalks; pavement and sidewalks), as well as a negative relationship between the illumination and pavement. Therefore, for Northeast and Mid-West networks (panels b, e), individual

and environmental characteristics are better linked. At the same time, for Southeast (panel d), these variables were less connected. For the North (panel a) and South regions (panel c), sidewalk and pavement variables were hubs between individuals and their environment.

Centrality results showed that illumination presented the highest values for expected influence in runners from the North and Mid-West regions (1.74 and 1.56). Similar results were shown for the Northeast and Southeast, in which sidewalks present higher values for expected influence (2.13; 0.91). For the South, to reside in the capital of the state presented a higher expected influence (1.67). Betweenness centrality results indicated similar results in North, Northeast, and Mid-West, where to reside in the capital presented higher values, indicating that this variable acts as a hub between variables. For the South and Southeast, pavement and training volume presented higher values. Entropy data suggested that the Northeast network was the most organized system (−6.8), followed by the Mid-West (−5.8), Southeast (−5.4), South (−5.3), and North (−5.1).

4. Discussion

The purpose of this study was to investigate the interplay between runners and their environment using a network approach. Our main findings showed that for the North and Mid-West regions, public illumination presents the highest values for the expected influence. In contrast, sidewalks present the highest values for the Northeast and Southeast. For betweenness centrality, in North, Northeast, and Mid-west, to reside in the capital of a state presents a hub, while pavement and training volume were important variables for South and Southeast.

The differences in the network topologies between the macro-regions confirm our first hypothesis. These results suggest that in continental size countries, such as Brazil, India, and China, where geographical, political, and cultural divisions exist, a more appropriate approach includes considering these differences but also considering sexes differences. A previous study using data from the InTrack project showed that for Brazilian women, green spaces were an important variable for training commitment (Thuan et al., 2022). These results differ from the current findings. Despite using the same project, the current study presents some advances compared to the previous publication, especially considering the theoretical bases. In this study, we embrace the complex systems approach as our guiding theory, complemented by network analysis to visually represent the interplay between individual and environmental variables. Although prior findings hold valuable practical implications within the Brazilian context, it is now crucial to shift focus towards comprehending the intricate relationships among variables, and not only the direct association between some factors, as usually considered in the scientific context. In addition, the substantial variability observed among the five macro-regions accentuates the importance to address these differences.

Especially for the environmental characteristics, a previous study showed that illumination, pavement, and cycle lanes were associated with physical activity patterns in adolescents from Rio Grande do Sul (South region) (da Silva et al., 2017). A national report showed that the North and Northeast regions presented the

TABLE 1 Participants' descriptive information based on the macro-region of residence [mean \pm SD; frequency (%)].

| | North (n = 7.3%) | Northeast (n = 35.7%) | South (n = 12.4%) | Southeast (n = 36.3%) | Mid-west (n = 8.3%) |
|---|---------------------|--------------------------|----------------------|--------------------------|------------------------|
| Individual characteristics | | | | | |
| Sex | | | | | |
| Female | 39 (46.4%) | 147 (35.8%) | 62 (43.4%) | 152 (36.4%) | 40 (42.1%) |
| Male | 45 (53.6%) | 264 (64.2%) | 81 (56.6%) | 266 (63.3%) | 55 (57.9%) |
| Age, years | 35.6 (10.5) | 37.40 (9.7) | 36.87 (8.6) | 38.99 (8.90) | 39.50 (9.7) |
| SES | | | | | |
| Until 1 minimum wage | 8 (9.5%) | 33 (8%) | 4 (2.8%) | 19 (4.5%) | 1 (1.1%) |
| > 1 and 3 wage | 45 (53.6%) | 181 (44%) | 64 (44.8%) | 221 (52.9%) | 31 (32.6%) |
| > 3 and 5 wage | 30 (35.7%) | 189 (46%) | 71 (49.7%) | 174 (41.6%) | 62 (65.3%) |
| > 5 wage | 0 (0%) | 4 (1.0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Missing | 1 (1.2%) | 4 (1.0%) | 4 (2.8%) | 4 (1.0%) | 1 (1.1%) |
| Perception about weather | | | | | |
| No | 27 (32.1%) | 126 (30.7%) | 30 (21.0%) | 158 (37.8%) | 30 (31.6%) |
| Yes | 57 (67.9%) | 284 (69.1%) | 113 (79.0%) | 260 (62.2%) | 65 (68.4%) |
| Missing | 0 (0%) | 1 (0.2%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Perception about built environment | | | | | |
| No | 26 (31.0%) | 124 (30.2%) | 27 (18.9%) | 106 (25.4%) | 16 (16.8%) |
| Yes | 58 (69.0%) | 287 (69.8%) | 116 (81.1%) | 312 (74.6%) | 79 (83.2%) |
| Training volume | 33.9 (21.9) | 30.31 (23.1) | 34.06 (24.5) | 40.76 (36.16) | 38.28 (30.7) |
| Running pace | 325.1 (69.8) | 329.10 (56.3) | 310.55 (52.0) | 322.62 (56.41) | 329.01 (63.2) |
| Environmental characteristics | | | | | |
| Illumination | 93.4 (3.8) | 96.75 (0.7) | 94.97 (1.6) | 96.77 (1.9) | 97.02 (2.1) |
| Pavement | 74.9 (12.7) | 84.37 (6.7) | 89.90 (3.8) | 95.88 (2.4) | 84.61 (12.8) |
| Sidewalk | 38.5 (14.2) | 79.43 (9.2) | 65.47 (4.6) | 89.76 (3.9) | 74.03 (9.5) |
| Green spaces | 57.0 (21.5) | 55.89 (9.8) | 68.36 (17.7) | 73.32 (5.7) | 53.46 (25.6) |

SES—Socioeconomic level: Based on value for 2019 (998,00R\$; 193,22US); training volume (km/week); running pace (s/km).

highest values for physical activity in leisure time (Brasil, 2015). Both regions present the highest average annual temperatures within-country (Kaplan and Chalfin, 2021). These characteristics can be related to network centralities. For the North and Mid-West, public illumination presented the highest values for expectable influence, which can be related to the security perception of physical activity in outdoor spaces (Kaplan and Chalfin, 2021). For betweenness results, residing in the capital of the state was the main variable for the North, Northeast, and Mid-West regions, indicating a relationship with the physical environment. Although Brazilian capital cities present better infrastructure than other cities from the states (IBGE, 2012), and most of the participants of the study reported residing in the capital of the state, these results should be considered carefully and face some limitations. Environmental information is related to the state's capital, which does not represent the reality of all Brazilian cities. Most of the participants self-reported that weather and built environment are factors that influence training and practice commitment. Despite the relevance of the physical structure, weather characteristics are not controlled by participants, and can also affect the activities in outdoor spaces.

The environmental aspects that showed greater relationship strength in the networks have a close connection with the investment and development of the urban centers physical structure. Concerning public illumination (North and Mid-West),

the arrangement of brighter environments can bring positive impacts such as a greater sense of security and more space for the practice of early morning (5 h 3 a.m. to 7 a.m.) and late evening physical activity since these tend to be part of the day when most people are available to get engaged in leisure physical activity due to the working hours. Sidewalks, besides being a service of the infrastructure of pedestrian circulation in the routine displacement of the cities, can be a safe space for sports, as in the case of running. Allocating spaces for sidewalks, as well as preserving their extension (i.e., corrective hole maintenance and unevenness, obstruction inspection), can provide a more appropriate and attractive built environment for outdoor physical activities. As previously stated, Brazilian territorial dimensions and regions specificity suggest a contextual evaluation to promote changes in the physical environment and availability of sports practice (Brasil, 2016). Large-scale changes in the built environment—such as improving public illumination and sidewalks' quality—depend on public resources, public policies, and policymakers. However, since physical activity practice has an important relationship with health outcomes (Kapoor et al., 2022; Stevinson et al., 2022), this becomes a fundamental investment at individual and population levels.

This study is not free of limitations. Firstly, there is an important temporal gap between the subjects and the environmental information used. However, data about environmental characteristics were the most updated available

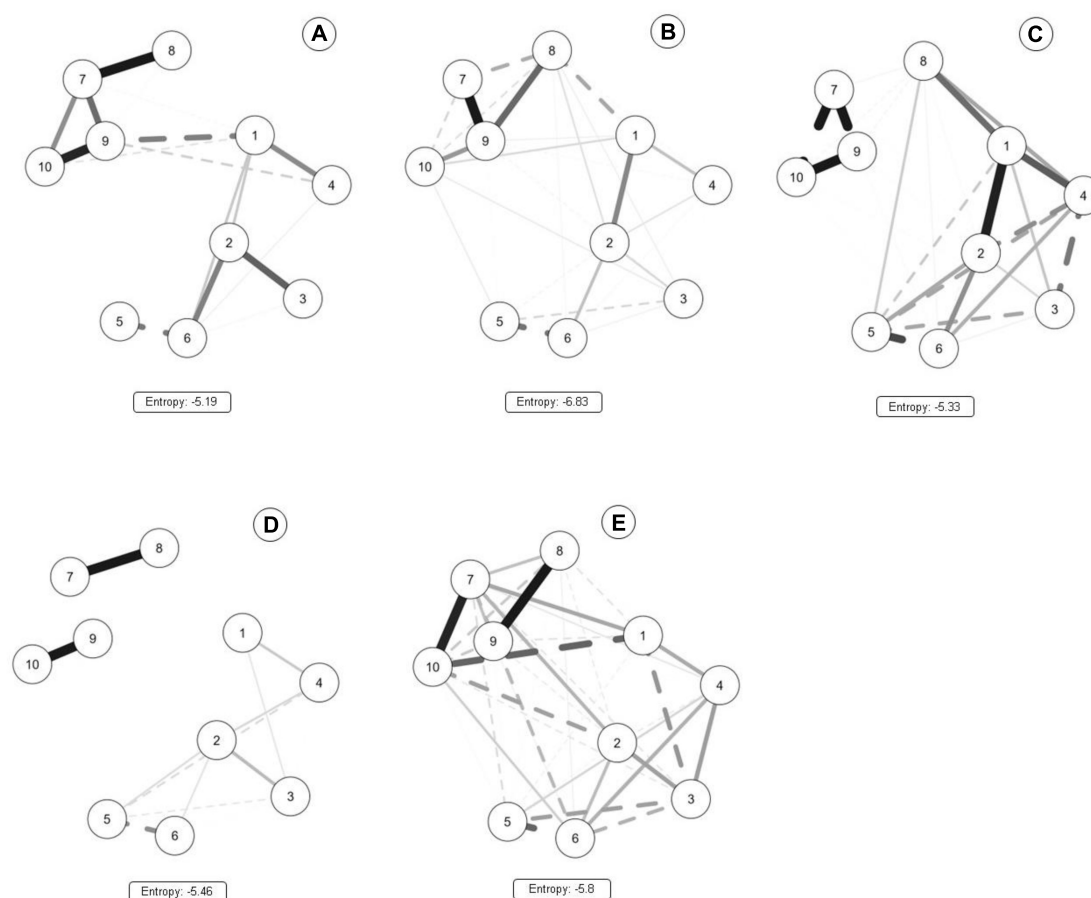


FIGURE 1

Network analysis results for Brazilian runners by region [(A) North; (B) Northeast; (C) South; (D) Southeast; (E) Mid-west]. 1: Capital residence; 2: SES; 3: Perception about the weather; 4: Perception about the built environment; 5: Running volume/week; 6: Running pace; 7: Illumination; 8: Pavement; 9: Sidewalk; 10: Green spaces.

at the moment. Sample size differences between the five macro-regions are related to data collection procedures. This is an important limitation, given that Brazil is a large country, with an estimated 2 million runners. Since our data collection procedures were based on a web survey, the results are based on data from runners that friendly decided to take part in this project, which can bias the results and impair the generalization of these findings. Third, information regarding the place of training is lacking. Our suggestion for future studies is to include the use of qualitative approaches to better understand how the physical environment of the cities influences activities in outdoor spaces, as well as what runners consider the most important changes that must be done in the physical environment.

5. Conclusion

As shown, public illumination (North and Mid-West) and sidewalks (Northeast and Southeast) are the most important variables to the runners' network. In the South and Southeast regions, the running volume was important for the networks' topology, while in the other regions to reside in the capital of the state was important to link variables within the network.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

All the participants were informed about the study's purpose, risks, and ethical aspects. The study was performed following the Declaration of Helsinki and was approved by the Ethics Committee of the Federal University of Sergipe, Brazil (protocol no. 3558630). The patients/participants provided their written informed consent to participate in this study.

Author contributions

MT: conceptualization. MT and TG: methodology. MT and PB: formal analysis. MT and DV: writing—original draft preparation. KW, BK, and TG: writing—review and editing. All authors have read and agreed to the published version of the manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships

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