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The relationship between life satisfaction and risk preferences of couch potatoes, recreational and elite athletes: the impact of mental dispositions and attitudes

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Introduction: This study examines the relationship between physical activity and mental wellbeing among students not playing any sport ("couch potatoes"), recreational athletes and "dual career students", i.e., students who are at the same time elite athletes. It addresses three closely related, yet different questions: (i) Do couch potatoes, recreational and elite athletes differ in their level of affective well-being or happiness? (ii) Are there any differences in cognitive wellbeing or life satisfaction between these groups? and (iii) Are there any differences in risk preferences and attitudes?

Methods: In our empirical analysis, we use a large cross-section dataset with detailed information on nearly 4,700 students enrolled at 24 different universities and universities of applied sciences all over Germany to identify the relationship between the individuals' personalities and their life satisfaction and risk preferences using standard regression models.

Results: Our findings indicate that, first, elite athletes report higher levels of happiness and life satisfaction than recreational athletes and couch potatoes. Second, both groups of athletes display higher levels of risk tolerance than couch potatoes. Third, and most important, we find significant personality differences between elite athletes and the other two groups of students that drive most, yet not all of our results.

Discussion: Since dual career students are often role models for other students, universities should consider investing in their sports facilities and offering sports classes on campus to increase the athletic involvement of the general student body.

KEYWORDS

life satisfaction, risk preferences, elite athletes, mental attitudes, personality differences

1 Introduction

It is now a stylized fact in the health and sports economics literature that physical activity has a positive impact on an individual's mental health and subjective wellbeing (Frey and Gullo, 2021; Di Domizio and Fabrizi, 2024; Buecker et al., 2020). Social sciences—whether economics, sociology or psychology—distinguish between two dimensions of subjective wellbeing, the experiential and the evaluative one. The former comprises transient states, such as positive and negative emotions while the latter comprises global cognitive judgments on one's own life (Kahneman and Riis, 2005). Although these two models of wellbeing are theoretically different, they partly overlap (Ryan and Deci, 2001). Recently, these concepts have been adapted to analyze the perceptions and mental dispositions of elite athletes (Lundqvist, 2011; Wicker et al., 2020).

Elite sports can be challenging and rewarding, providing unique opportunities that are not available to non-athletes (Filbay et al., 2019; Giles et al., 2020). On the one hand, athletes can connect with peers and have stimulating interactions that improve self-confidence and control of their environment (Jones et al., 1994). On the other hand, athletes not only experience success but also failure, and have to train hard, accept nutritional restrictions as well as the risk of incurring overtraining, injury, and even burnout (Rice et al., 2016; Hilpisch et al., 2024). Thus, it is not yet clear whether the positive association between physical activity and mental wellbeing that has been documented for recreational athletes also exists among elite athletes.[1]

Previous studies on the association between physical activity and mental health very often fail to address the problem of self-selection into physical activity, i.e., because individuals who play sports likely differ in their personality characteristics from those that do not. These differences in mental attitudes and dispositions, in turn, can lead to differences in important life outcomes such as life satisfaction, happiness, and risk preferences. Due to the cross-sectional nature of our data, we cannot identify a causal impact of sport participation on happiness, life satisfaction and risk tolerance either.[2] What we are instead interested in is the extent to which differences in individuals' mental attitudes and dispositions (openness, conscientiousness, extraversion, agreeableness, neuroticism) moderate the correlation between physical activity and happiness, life satisfaction and risk tolerance. Therefore, we use detailed self-reported information on individuals' mental attitudes and dispositions to control (as far as is possible with our observational data) for these self-selection effects as suggested by Henderson et al. (2006).[3] In a first step, we estimate the correlation between two different measures of physical activity (self-declared activity status, i.e., couch potato, recreational athlete, elite athlete) and weekly training hours. In a second step, we include in the estimation variables reflecting differences in the individuals' personalities to see whether these differences reduce the impact of sport participation on happiness, life satisfaction and risk tolerance. We use a large sample with detailed information on more than 4,600 students attending 24 German universities and universities of applied sciences to answer three different, yet closely related research questions.

- Do couch potatoes, recreational and elite athletes differ in their levels of affective wellbeing or happiness (that is their moods and motivations that can be either positive or negative and can fluctuate significantly)?
- Do these three types of students differ in their levels of cognitive wellbeing or life satisfaction (that is their cognitive evaluation of how satisfied one is with his/her life)?
- Finally, do these three groups of students differ in their risk preferences and attitudes?

Thus, we estimate the covariate-adjusted gaps in the different outcomes between the three groups of students. Although our approach avoids some of the shortcomings associated with cross-section data, we do not claim that we can identify a causal effect running from athletic participation to happiness, life satisfaction and risk tolerance. However, we are confident that the findings reported below add to the already existing body of knowledge on the positive impact of sports on important intermediate life outcomes of young people. Our findings suggest that "dual career students" (students who are at the same time elite athletes) are significantly happier than observationally similar couch potatoes and recreational athletes even after controlling for differences in mental attitudes and dispositions. Moreover, dual career students are willing to take more risks and can act, therefore, as role models for their fellow students. Thus, universities should consider investing in their sports facilities and offering sports classes on campus to increase the athletic involvement of the general student body.

In the next section, we provide an overview of the existing evidence on the impact of sport participation on individual life satisfaction, happiness, and risk tolerance.[4] We then describe our dataset and present our empirical results. Concluding our analysis, we summarize our major findings and derive practical implications.

2 Related literature

Engaging in sport or, more general, in physical activity has a positive impact on overall wellbeing by satisfying needs such as physical health, achievement, social interaction, affiliation, and competition (Balish et al., 2016; Biddle and Ekkekakis, 2005; McDonald et al., 2002). Therefore, playing a sport regularly may result in desirable long-term effects (Kim and James, 2019), impacting overall life satisfaction, self-esteem (Sato et al., 2015), the sensation of a good lifestyle, and a positive perception of one's subjective health (Ross et al., 2019). Thus, the dedication and perseverance required to practice sport—be it at the recreational or the elite level—can positively impact various aspects of life (Sherman and Shavit, 2023).

Previous research has assessed the relationship between sport participation and happiness using different approaches that vary in their appropriateness to tackle the issues of reverse causality and endogeneity. While most of the early studies did not address these problems at all, more recent papers are of one of the following types. Some use instrumental variables, i.e., factors that are associated with an increased probability to exercise but that are at the same

1 Wicker and Frick (2015) for example show that the number of days per week people practice at moderate intensity have a significant and positive effect on subjective wellbeing while the number of days with vigorous-intensity activity has a significant and negative impact. Moreover, the number of minutes spent on moderate-intensity activity significantly add to subjective wellbeing, while the minutes spent on vigorous-intensity activity significantly reduce the level of social wellbeing.

2 Although less likely, it is possible that reverse causality drives the results in the sense that happy and satisfied individuals are more likely to practice sports.

3 Cappelen et al. (2024) and Fricke et al. (2018) employ an experimental design to isolate the impact of physical activity on academic performance and find a statistically significant and positive causal effect.

4 We emphasize that this literature review is not exhaustive. There are numerous further studies that can (and probably should) be cited. For the sake of brevity, we decided to include only those studies that we consider representative for the respective body of literature.

time assumed to be uncorrelated with mental wellbeing, such as the proximity to the next swimming pool or running track, to solve these problems (Wicker and Frick, 2015). Others use longitudinal data to estimate the impact of sport participation on happiness as well as the impact of happiness on the probability to exercise, finding that the impact of regular training on happiness is about three times as large as vice versa (Frey and Gullo, 2021). Moreover, a small number of studies use controlled field experiments (Cappelen et al., 2024), sometimes finding surprisingly strong effects of regular physical activity on various life outcomes. Finally, a completely different approach employs the "experience sampling method" to analyse whether and to what extent a large portfolio of daily activities, including playing sports contributes to individuals' happiness (Bryson and MacKerron, 2017).

In an early study, Miller and Hoffman (2009) found that young adults' identification as an athlete can have a positive impact on wellbeing, reducing the likelihood of self-harm, depression, and suicide attempts. Downward and Rasciute (2011) show that sport participation is positively associated with happiness as it increases social interaction, which is typically highly valued by individuals. Using panel data from the UK, Wheatley and Bickerton (2019) examine the effects of various leisure activities, arts consumption, and sport participation on subjective wellbeing and find, inter alia, a positive impact of moderate or mild intensity of physical activity on health, job, and leisure time satisfaction. Huang and Humphreys (2012) as well as Ruseski et al. (2014) demonstrate that sport participation increases individual happiness among men and women to the same extent, highlighting its benefits regardless of gender. Using panel data from Germany, Frey and Gullo (2021) find this positive relationship to be stronger at younger and older ages. Moreover, various papers demonstrate that the intensity as well as the duration of physical activity determine whether sport participation is experienced as beneficial or detrimental to individual wellbeing (Downward and Dawson, 2016; Mutz et al., 2021; Wicker and Frick, 2015).

Exploring the causal relationship between delayed gratification, an intrinsic characteristic of regular physical activity, and wellbeing, Gschwandtner et al. (2022) find that playing sport is associated with the ability to delay instant gratification and to put extra effort into obtaining the desired result, i.e., a higher level of satisfaction, in the longer run. The short-run benefits of sport participation notwithstanding (such as the release of endorphins, interaction with equally minded individuals, or simply a sense of achievement), playing a particular sport regularly requires additional personal investment, sacrifice, and effort for future wellbeing (Pummell et al., 2008). Irrespective of its investment character, playing sport is considered by individuals one of the most pleasurable activities that they can engage in. Bryson and MacKerron (2017) find that when people are called randomly on their smartphones and are asked how happy they are at that particular moment, followed by the question what they are currently doing, the highest level of happiness is reported by people making love with their partner, closely followed by leisure activities such as going to a museum or a theater or playing sport.[5]

Another relevant factor affecting individuals' subjective wellbeing is how they perceive their social status. Thus, individual wellbeing not only depends on the income of a reference group (however defined), but also on the difference between an individual's own income and the average income of the respective reference group (Ferrer-i-Carbonell, 2005; D'Ambrosio and Frick, 2012). In line with this reference group argument, it can be inferred that students practicing sports—be it at the recreational or even professional level—feel happier due to their superior physical conditions than their peers who do not exercise (i.e., couch potatoes) which, in turn, strengthens their self- as well as their social-esteem.

When examining the effects of sport on life satisfaction and happiness it is, nevertheless, important to distinguish between recreational and elite athletes. While practicing recreational sports contributes to subjective wellbeing via exercise as well as proximity with equally minded people (Wicker et al., 2015), elite athletes are motivated by additional factors such as the thrill of competition and have qualities such as discipline and perseverance that are necessary for a professional career. Moreover, participation in high-stakes sports events allow athletes to experience positive emotions such as confidence and trust. These events also come with the opportunity to simulate managerial behavior with respect to goal setting and strategy development (Edwards et al., 2004; Sato et al., 2015; Kim et al., 2021; Rice et al., 2016). Finally, practicing sports can positively impact how we regulate our emotions, leading us to explore various aspects that shape our decision-making process, such as risk-taking (Ross et al., 2019; Figner and Weber, 2011).

Individuals who engage in sports usually perceive risks as lower and experience less anxiety when confronted with new or uncertain situations. These individuals are often categorized as "sensation seekers" (Zuckerman and Kuhlman, 2000). With high levels of life satisfaction and happiness, they feel more in control of their environment, leading them to take higher risks and explore uncertain opportunities. Standard economic models assume that rational utility-maximizing individuals constantly compare the (expected) costs of and the (expected) returns to the activities they engage in. As soon as the marginal costs exceed the marginal returns, the individual withdraws. Thus, the utility functions of elite and recreational athletes are different in the sense that their appraisal of costs and benefits of a particular activity differs considerably. Elite athletes differ from recreational athletes, first, in that the former tend to estimate risks even in activities they have not experienced to any extent as lower and that, second, their overall level of anxiety is lower. The result is that elite athletes are more likely to enter into risky situations while recreational athletes are more likely to avoid them (Zuckerman 2007, p. 65–67). Thus, the often non-monetary rewards of elite sport are perceived as benefits only by some individuals, either because they underestimate the risks associated with a particular activity or because they are willing to accept them because the expected benefits are judged to outweigh the expected costs. However, since elite athletes typically prepare very well for the activities they engage in, underestimation of risk is an unlikely explanation for the observable differences in behavior (Zuckerman, 2007, p. 55–57).[6]

5 Paid work comes close to the bottom of the happiness ranking. It is the second worst activity for happiness (on a list of 40 different ones) after being sick in bed.

6 Frick (2020) uses data from two extreme sports—cliff diving and free diving—to compare the risk preferences of male and female "sensation

3 Description of variables

In our empirical analysis, we use a large cross-section dataset with detailed information on nearly 4,700 students enrolled at 24 different universities and universities of applied sciences all over Germany.[7] The data from couch potatoes and recreational athletes was collected in the summer of 2016 via an online survey[8] while the subsample of elite athletes was recruited for participation during the same period using the same questionnaire through the "German University Sports Federation".[9] Our final dataset with 4,682 individuals includes 19.2% couch potatoes,[10] that is students indicating that they do no sports at all, and 72.9% recreational athletes, that is students indicating that they do sports but compete—if at all—only at the local or regional level. Finally, 7.9% of our student population consider themselves "elite athletes" competing in their respective sports at the national or even international level. Since very little is known about elite athletes who are at the same time enrolled as university students, they are deliberately oversampled in our data to enable us to make meaningful comparisons across the three groups of students.

Table 1 displays the descriptive statistics of our dataset.[11] Admittedly, the use of cross-section data to identify the impact of athletic participation on life satisfaction, happiness, and risk tolerance is problematic, because particularly satisfied, happy, and/or risk-tolerant students may be more likely to become athletes. To reduce the potential bias, we include personality characteristics in the estimated models to hold constant the motivation and discipline that inspires athletes but also raises life satisfaction and happiness as well as risk tolerance. Our data includes a validated short version of the "Big 5-Personality Inventory" with 17 different statements (Rammstedt and John, 2005; our results are displayed in Tables A1, A2). Using the principal factor command in Stata, we were able to perfectly reproduce the Big 5 personality dimensions known as extraversion, openness, conscientiousness, neuroticism, and agreeableness.[12] It also appears from Table 1 that not only elite athletes but also women are slightly overrepresented in our sample. This is primarily due to the fact that technical universities with their traditionally large share of male students enrolled in degree programs such as mechanical and electrical engineering are underrepresented in our sample.

The average age in our sample is around 24, with the youngest students aged 18 and the oldest ones aged 50. Around 6% of the respondents report a migration background.[13] Roughly one fifth of our student population have spent at least one academic semester abroad and 39% are delayed in the sense that—given their year of study—they have not assembled all the credit points required for graduation. On average, the students in our sample invest 31 h per week to study and 5 h per week to play sport.[14] Figures A2–A6 document the statistically significant differences in the personalities, that is, the mental attitudes and dispositions of couch potatoes, recreational and elite athletes. The latter score significantly higher on extraversion, openness, and conscientiousness than the former and significantly lower on neuroticism, suggesting that the personalities of elite athletes are indeed fundamentally different from those of both, couch potatoes and recreational athletes. In our estimations (the results of which are presented below), we include these personality measures to check whether they have an impact on life satisfaction, happiness

seekers". While the number of women self-selecting in these sports is lower than the corresponding figure for men, female athletes appear to be as risk-tolerant as their male counterparts.

7 Figure A1 displays the regional distribution of the universities and universities of applied sciences.

8 One of the authors of this study—Nikolaus Risch (former president of Paderborn University)—presented the idea for this project at one of the regular meetings of the "German Rectors' Conference", the association representing the institutional center of the German higher education and research system. During that meeting in early 2016, he was able to convince 23 of his colleagues to place a link to our survey tool at the website of their respective institution, inviting their students to participate in the survey.

9 As a member of the executive board of the "German University Sports Federation" (ADH) Nikolaus Risch was also able to convince his fellow board members to place our survey tool at the website of the organization, inviting student athletes to participate in the survey. The ADH is the umbrella organization of the German university sports institutions. More than 200 universities with 2.5 million students are members of the ADH. The ADH represents their interests and is committed to the development of university sport. Moreover, the ADH is actively involved in organized sport at the national and international level (for more information see https://www.adh.de/en/).

10 Around 28% of the 20–25 year olds in Germany are either overweight (BMI between 25 and 30) or even obese (BMI over 30). https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Gesund-heit/Gesundheitszustand-Relevantes-Verhalten/Tabellen/liste-koerpermasse.html#104708. Overweight and life satisfaction/happiness have been found to be negatively correlated (Oswald and Powdthavee, 2007). The question whether inactivity leads to obesity or obesity to inactivity has not yet been convincingly answered. However, the available evidence shows that physical activity in general and sport in particular play an important role in reducing obesity (Raiman et al., 2023).

11 Table A3 displays the descriptive statistics for the three different groups of students. It appears that they differ—as expected—significantly in their mental attitudes and dispositions.

12 The detailed results of the factor analysis are, of course, available from the corresponding author upon request. McCrae and Costa (1994), Cobb-Clark and Schurer (2012) as well as Anger et al. (2017) show that individuals' personalities are rather stable over time. Boyce et al. (2013) confirm these findings and argue that personality changes are usually the result of an exogenous shock, such as long-term sickness or unemployment.

13 Students with a migration background are slightly underrepresented in our sample, because men are underrepresented (men with a migration background often study technical disciplines, such as technical or mechanical engineering) (https://www.destatis.de/DE/Service/Statistik-Campus/Datenreport/Downloads/datenreport-2021-kap-3.pdf?__blob=publicationFile).

14 Elite athletes devote about 3 h per week less to attending classes, studying, and preparing for exams than couch potatoes and recreational athletes. On the other hand, elite athletes train, on average, nearly 12 h per week whereas recreational athletes spend 5 h playing sports. Thus, the weekly "workload" of elite athletes is about 28% higher than that of couch potatoes and 8% higher than that of recreational athletes (all these differences are statistically highly significant).

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TABLE 1 Overview of variables.

Variable	Description	Mean	Std. dev.	Min.	Max.
Couch potato	Dummy (1 = yes)	0.19	–	0	1
Recreational athlete	Dummy (1 = yes)	0.73	–	0	1
Elite athlete	Dummy (1 = yes)	0.08	–	0	1
Extraversion	Personality dimension	0	0.88	−2.45	1.77
Openness	Personality dimension	0	0.83	−2.15	2.38
Conscientiousness	Personality dimension	0	0.78	−3.11	1.73
Neuroticism	Personality dimension	0	0.76	−2.97	1.80
Agreeableness	Personality dimension	0	0.75	−3.01	1.58
Gender	Dummy (1 = female)	0.66	–	0	1
Delay	Dummy (1 = yes)	0.39	–	0	1
Study hours	Studying hours per week	30.9	13.8	0	70
Training hours	Training hours per week	4.8	4.8	0	35
Stay abroad	Dummy (1 = yes)	0.19	–	0	1
Age	Age (in years)	23.9	4.1	18	50
Married	Dummy (1 = yes)	0.05	–	0	1
Single with partner	Dummy (1 = yes)	0.50	–	0	1
Single, no partner	Dummy (1 = yes)	0.44	–	0	1
Widowed, divorced	Dummy (1 = yes)	0.01	–	0	1
Migration background	Dummy (1 = yes)	0.06	–	0	1
Field of study		11 Dummies			
Degree		5 Dummies			
Education father		9 Dummies			
Education mother		9 Dummies			

and risk tolerance over and above the effect of being a recreational or an elite athlete.

The questions that were used to elicit the respondents' happiness, life satisfaction, and risk tolerance are as follows:

- "Taking all things together, how happy would you say you are?"
- "All things considered, how satisfied are you with your life as a whole nowadays?"
- "How do you see yourself: are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?"[15]

The following request complemented each question: "Please tick a box on the scale, where the value 0 means: 'not at all happy/satisfied/willing to take risks' and the value 10 means: 'very happy/satisfied/willing to take risks'."

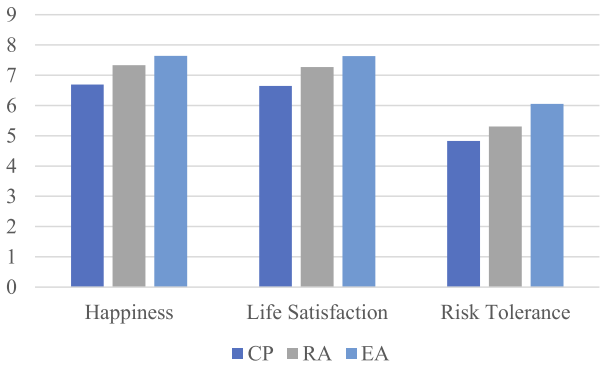

FIGURE 1
Happiness, life satisfaction, and risk tolerance among students.

Figure 1 shows that elite athletes (EA) report 14% higher levels of happiness than couch potatoes (CP) and 4% higher levels than recreational athletes (RA). Moreover, these differences are virtually the same when it comes to life satisfaction (+15% compared to CP and +5% compared to RA). Finally, elite athletes are much

15 While the use of single-item statements to measure happiness and life satisfaction is generally accepted, this is often not the case when it comes to risk tolerance. However, Charness et al. (2013) and Menkhoff and Sakha (2017) show that different measures of risk tolerance or risk aversion are highly correlated, justifying the use of a single-item statement.

TABLE 2 Estimation results.

Model	(1)	(2)	(3)	(4)	(5)	(6)
	Happiness	Happiness	Life satisfaction	Life satisfaction	Risk tolerance	Risk tolerance
Couch potato	Reference group					
Recreational athlete	**0.464*** **	**0.278*** **	**0.452*** **	**0.274*** **	**0.209** **	**0.0808**
	(0.0812)	**(0.0716)**	**(0.0780)**	**(0.0684)**	**(0.0895)**	**(0.0822)**
Elite athlete	**0.731*** **	**0.298** **	**0.776*** **	**0.368*** **	**0.509*** **	**0.171**
	(0.143)	**(0.127)**	**(0.138)**	**(0.121)**	**(0.158)**	**(0.145)**
Extraversion	–	0.452***	–	0.390***	–	0.552***
		(0.0286)		(0.0273)		(0.0328)
Openness	–	0.876***	–	0.853***	–	0.697***
		(0.0305)		(0.0292)		(0.0351)
Conscientiousness	–	0.240***	–	0.390***	–	−0.141***
		(0.0325)		(0.0311)		(0.0373)
Neuroticism	–	0.0953***	–	0.0594*	–	0.366***
		(0.0322)		(0.0308)		(0.0370)
Agreeableness	–	0.299***	–	0.218***	–	−0.173***
		(0.0326)		(0.0312)		(0.0374)
Gender (1 = female)	0.00930	0.269***	−0.0603	0.176***	−0.349***	−0.0392
	(0.0636)	(0.0581)	(0.0611)	(0.0556)	(0.0701)	(0.0667)
Delay	−0.534***	−0.302***	−0.629***	−0.367***	−0.0405	0.0550
	(0.0587)	(0.0524)	(0.0564)	(0.0501)	(0.0647)	(0.0601)
Study hours	−0.00613***	−0.00537***	−0.00311*	−0.00377**	−0.00598***	−0.00300
	(0.00189)	(0.00169)	(0.00182)	(0.00161)	(0.00208)	(0.00194)
Training hours	0.00684	−0.00878	0.00257	−0.0144**	0.0574***	0.0458***
	(0.00732)	(0.00645)	(0.00703)	(0.00617)	(0.00807)	(0.00741)
Stay abroad (1 = yes)	0.0542	−0.113*	0.168**	0.0152	0.698***	0.532***
	(0.0708)	(0.0624)	(0.0680)	(0.0597)	(0.0781)	(0.0717)
Age	−0.0726*	−0.0567*	−0.0775**	−0.0684**	−0.0904**	−0.0754**
	(0.0375)	(0.0330)	(0.0361)	(0.0315)	(0.0414)	(0.0379)
Age^2	0.000769	0.000357	0.000949	0.000616	0.00187***	0.00149**
	(0.000651)	(0.000572)	(0.000626)	(0.000547)	(0.000718)	(0.000657)
Family status	Reference group: married					
Single with partner	−0.568***	−0.505***	−0.463***	−0.393***	0.0114	0.0771
	(0.135)	(0.118)	(0.129)	(0.113)	(0.148)	(0.136)
Single, no partner	−1.363***	−1.176***	−0.998***	−0.815***	−0.0138	0.156
	(0.137)	(0.120)	(0.132)	(0.115)	(0.151)	(0.138)
Widowed, divorced	−1.275***	−1.288***	−0.965***	−1.016***	0.882**	0.831**
	(0.386)	(0.338)	(0.370)	(0.324)	(0.425)	(0.389)
Migrant (1 = yes)	−0.0870	−0.121	−0.152	−0.171*	0.434***	0.350***
	(0.122)	(0.107)	(0.117)	(0.102)	(0.134)	(0.123)

(Continued)

TABLE 2 (Continued)

Model	(1) Happiness	(2) Happiness	(3) Life satisfaction	(4) Life satisfaction	(5) Risk tolerance	(6) Risk tolerance
Field of study			11 Dummies included			
Degree			5 Dummies included			
Education father			9 Dummies included			
Education mother			9 Dummies included			
Constant	8.906***	8.780***	8.560***	8.605***	6.267***	5.912***
	(0.556)	(0.490)	(0.534)	(0.468)	(0.613)	(0.562)
N	4,682	4,682	4,682	4,682	4,682	4,682

Standard errors in parentheses.
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$. The bold values indicate the coefficients that we are particularly interested in.

TABLE 3 Treatment effects estimation.

Model	(2) Happiness	(4) Life satisfaction	(6) Risk tolerance
Couch potato		Reference group	
Recreational athlete	0.240***	0.226***	0.319***
	(0.067)	(0.064)	(0.074)
Elite athlete	0.251**	0.298***	0.661***
	(0.112)	(0.107)	(0.127)
Potential outcome mean	7.049***	7.007***	4.994***
	(0.0631)	0.059	0.067
N	4,682	4,682	4,682

Standard errors in parentheses.
**$p < 0.05$; ***$p < 0.01$.

more risk tolerant than the other two groups of students. All these differences are statistically highly significant ($p < 0.01$).[16]

4 Empirical findings

Using the couch potatoes as our reference group, we first estimate the impact of being a recreational or an elite athlete on happiness, life satisfaction, and risk tolerance while controlling for a large number of potentially confounding factors (models 1, 3 and 5). In a second step, we include the Big 5 personality dimensions—extraversion, openness, conscientiousness, neuroticism, and agreeableness—in our estimations to assess the extent to which personality differences affect the dependent variables (models 2, 4, and 6). Our models are of the following general form[17]:

$$\begin{aligned} DV = {} & \alpha_0 + \alpha_1 \text{ Student Type (RA, EA)} \\ & + \alpha_2 \sum \text{Personality Dimensions} + \alpha_3 \text{ Gender} + \alpha_4 \text{ Delay} \\ & + \alpha_5 \text{ Study Hours} + \alpha_6 \text{ Training Hours} + \alpha_7 \text{ Stay Abroad} \\ & + \alpha_8 \text{ Age} + \alpha_9 \text{ Age}^2 + \alpha_{10} \sum \text{Family Status} \\ & + \alpha_{11} \sum \text{Field of Study} + \alpha_{12} \sum \text{Final Degree} \\ & + \alpha_{13} \sum \text{Education Father} + \alpha_{14} \text{ Education Mother} + \varepsilon \end{aligned} \quad (1)$$

where DV is the dependent variable (either happiness, life satisfaction or risk tolerance).

Table 2 presents our estimation results for the six alternative models derived from Equation 1. Controlling for several potential confounders, such as gender, delay, weekly study and training hours, age, family status, migration background, field of study, academic degree, and parents' education, models (1) to (3) corroborate that both, recreational and elite athletes report significantly higher levels of happiness and life satisfaction than couch potatoes, suggesting that practicing sports is crucial for individuals' mental wellbeing. The respective difference between recreational and elite athletes is also statistically significant for both variables in models 1 and 3, but not in models 2 and 4, suggesting that the differences in the mental attitudes and dispositions of recreational and elite athlete are not as large as between couch potatoes and the two groups of athletes. With respect to risk

16 According to the most recent edition of the "World Happiness Report", average life satisfaction in Germany is 6.89 (the respective value in our sample is 7.18). Average risk tolerance is 5.07 in the entire population (Brooks and William, 2023) and 5.27 in our sample. The slightly higher figures in our sample are not surprising as our population is younger than the German average and younger people tend to be happier and more risk-tolerant than older people. Wicker et al. (2020) compare life satisfaction of German elite athletes in less commercialized sports with residents of similar age (18–30 years) and find that the former score slightly lower than the latter (7.46 vs. 7.55 on an 11 point Likert scale). Since the authors use different samples to calculate the means, the reported figures are not comparable due to the differences in the framing of the two surveys of which one addressed only elite athletes while the other one addressed the entire population living in Germany. Moreover, the authors do not distinguish between recreational athletes and couch potatoes.

17 Not surprisingly, happiness and life satisfaction are highly correlated at +0.82. The correlation between happiness and risk tolerance is +0.19 and the one between life satisfaction and risk tolerance is +0.20, suggesting that happy and satisfied people tend to be slightly more risk tolerant (the latter two correlation coefficients are also statistically significant).

tolerance, a different picture emerges. Recreational and elite athletes are indeed more risk-tolerant than couch potatoes, that is both, recreational and elite athletes show a significantly higher willingness to take risks than couch potatoes. However, when personality traits are included in the estimations, the coefficients of the respective dummies lose their statistical significance. This suggests that personality traits are more important for risk tolerance than any level of physical activity. Finally, a statistically significant difference in risk-taking tendencies between recreational and elite athletes is also evident, suggesting that elite athletes are less risk-averse than observationally similar recreational athletes (model 5).

When including the five variables representing different mental attitudes and dispositions, the magnitude of the coefficients of the two sports dummies in the happiness and life satisfaction models is considerably reduced, yet they retain their statistical significance. This suggests that the unexplained differences (covariate adjusted) in the outcomes between the different groups are attenuated substantially when the mental attitudes and disposition variables are added to the models. This is not the case with respect to risk tolerance, as the two sports dummies now fail to reach conventional levels of statistical significance (model 6). This suggests that differences in personality traits are the main determinants of risk tolerance. In this context, it is worth emphasizing that individuals' responses to the general risk question have been found to be a reliable predictor of actual risky behavior such as being self-employed and investing in stocks (Dohmen et al., 2011).[18]

A defining characteristic of our observational data is that an individual's status (i.e., being a couch potato, a recreational or an elite athlete) is not randomized. Moreover, the outcome (i.e., the reported levels of happiness, life satisfaction and risk tolerance) and the individual's status are not necessarily independent. Thus, we have to ask what the potential outcome for a specific couch potato would be in terms of happiness, life satisfaction and risk tolerance if that person would be either a recreational or an elite athlete. Therefore, we now present our estimations of the potential outcome or counterfactual for these individuals (Table 3). It appears that couch potatoes would be much better off in terms of happiness, life satisfaction and risk tolerance if they decided to become physically active.[19] According to our estimations, a limited amount of time devoted to sport is already associated with significantly higher scores in all these important life outcomes.[20]

Further analyses show that female elite athletes display the same level of happiness, life satisfaction, and risk tolerance as male elite athletes. Thus, their level of risk tolerance is significantly higher than that of male couch potatoes as well as male recreational athletes (this is in line with Comeig et al., 2016; Willinger et al., 2023). Moreover, the coefficients and level of significance of most of our control variables are as expected: Students who are (for whatever reason) behind their academic schedule are significantly less happy and satisfied with their lives. Once we control for differences in personal attitudes and dispositions, women report higher levels of happiness and life satisfaction, but no lower risk tolerance, suggesting that studies documenting a significantly lower risk tolerance of women suffer from an omitted variable bias. Weekly study hours reduce happiness and life satisfaction but have no impact on risk tolerance. Weekly training hours are positively associated with risk tolerance, suggesting that those who train more anticipate higher risks of fatigue and injury, but are willing to accept these risks. Students who have encountered challenging situations, such as studying abroad or having a migration background, display higher levels of risk tolerance. This is consistent with the notion that these students have been confronted with different challenges in environments they were not familiar with yet and have been successful in developing confidence in their decision-making. Finally, the relationships between age and happiness, life satisfaction, and risk tolerance are u-shaped, suggesting that middle-aged people display the lowest levels of happiness, life satisfaction and risk tolerance. These findings are in line with previous evidence as is the finding that married people are happier and more satisfied than cohabitating people, singles or divorced and widowed individuals.

5 Conclusions

To the best of our knowledge, our study is the first to analyze the impact of different levels of physical activity and personality traits on happiness, life satisfaction, and risk tolerance of young individuals using a large sample of students enrolled at 24 different universities and universities of applied sciences all over Germany.

Our findings can be summarized as follows: First, irrespective of the challenges and risks they experience in their daily lives, elite athletes are happier, more satisfied and more risk tolerant than both, couch potatoes and recreational athletes. Second, the personalities of elite athletes are significantly different from those of their fellow students—whether couch potatoes or recreational athletes. They are more communicative, more relaxed, more accurate, less imaginative, and as friendly as their fellow students. Third, these differences in mental attitudes and dispositions explain most, yet not all of the observable differences in happiness, life satisfaction, and risk tolerance. Thus, previous studies may suffer from an omitted variable bias, because once we control for differences in personality, the effect of physical activity on happiness, life satisfaction and risk tolerance is considerably reduced, yet still statistically significant. Due to the nature of our data, we cannot claim to identify a causal effect running from athletic participation to happiness, life satisfaction and risk tolerance. However, we are confident that controlling for differences in the mental attitudes and dispositions of couch potatoes, recreational and elite athletes helps to avoid some of

18 Since we use three different dependent variables and the same set of explanatory variables, the error terms of the models are likely to be correlated. However, the results of a seemingly unrelated regression model (Zellner, 1962, 1963) are virtually identical with the ones presented here and are, of course, available from the corresponding author upon request.

19 As additional controls we use the variables representing mental attitudes and dispositions (extraversion, openness, conscientiousness, neuroticism, and agreeableness) as well as age, gender and migration background.

20 The percentage of couch potatoes who are behind their regular academic schedule is 47 while only 38% of the recreational and 37% of the elite athletes report being behind. Thus, it may well be that couch potatoes expect to lose even more time when practicing sport.

the shortcomings of previous studies that fail to control for self-selection into different levels of physical activity.

Thus, since "dual career students" (students who are at the same time elite athletes) are often considered role models for other students, universities should consider investing in their sports facilities and offer sports classes on campus to encourage students to increase athletic involvement. This includes not only investing in sports facilities and promoting appealing sports programs irrespective of the individuals' skill level, but also fostering an active lifestyle on campus by encouraging community involvement in various activities or clubs.

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 participants was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

BF: Conceptualization, Data curation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing. AA-N: Conceptualization, Data curation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing. NR: Conceptualization, Data curation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing.

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Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/frbhe.2024.1472427/full#supplementary-material

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