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# Physical self-concept in Peruvian adolescent schoolchildren: Validity, reliability, and proposal of percentiles for its evaluation

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**Introduction:** The period of adolescence is characterized by marked changes relevant to adult life. The goals of this study were (a) to analyze the psychometric properties of the physical self-concept questionnaire (PSC) in adolescents and (b) to develop percentiles for evaluation by age and sex.

**Methods:** A descriptive cross-sectional study was conducted in adolescents aged 11 to 17 years from an altitude region of Peru (3,812m above sea level). The sample size was 1,263 schoolchildren (609 males and 654 females). The PSC was measured through the survey technique. The questionnaire proposed by Fox and Corbin (1989), composed of five dimensions (totaling 30 questions), was applied. Validity was assessed by means of confirmatory factor analysis (CFA) and reliability by means of internal consistency (Cronbach's alpha). Percentiles were calculated using the LMS method (lambda: skewness, median; M and S: coefficient of variation).

**Results and Discussion:** In the CFA, factor loadings (communalities) were satisfactory for the model. Values ranged from (0.30 to 0.60), in addition, the Kaiser–Meyer–Olkin sample adequacy test was 0.89,  $X^2=3401.086$  (gl: 395,  $p<0.00$ ), CFI (0.898), RMSEA (0.078) and % variation 47%. The reliability values (Cronbach's alpha) per question evidenced values from  $r=0.80$  to  $0.81$  and the total scale  $r=0.81$ . Percentiles were calculated: p3, p5, p10, p15, p25, p50, p75, p80, p85, p90, and p95. This study concludes that the psychometric properties of the PSC questionnaire applied to adolescents living in an altitude region of Peru were valid and reliable. The proposed percentiles can be used to categorize and monitor PSC by age and sex. These results suggest their use and application in the school system.

## KEYWORDS

physical self-perception, adolescents, validity, reliability, percentiles

## Theoretical bases and conceptual foundations

Self-concept in general is a term created by convictions, which is hierarchically organized, changes over time and is influenced by other people, situations, and cultures (Pestana, 2015). It is characterized as evaluative and descriptive, and has a multifaceted and hierarchical organization (Shavelson et al., 1976). It comprises non-academic and academic subdomains.

In the first case, it refers to the emotional (how we are perceived by others), emotional (experience of states of feelings and emotions) and physical (image of one's own bodily capabilities and physical appearance). In the second case, they are represented by subject-specific facets of the self (e.g., English, mathematics) (Craven and Marsh, 2008).

According to the literature, two models that have to do with physical self-concept stand out. The first one has to do with the one proposed by Marsh et al. (1994), which presents nine subdomains (strength, physical activity, body composition, coordination, endurance, sport competence, health, physical appearance and flexibility) and secondly the model of Fox and Corbin (1989), which highlights a multidimensional and hierarchical structure with four specific subdomains (sport competence, physical condition, physical attractiveness and strength) and a domain of physical self-evaluation.

In general, physical self-concept is defined as one's perception or evaluation of one's physical ability and physical appearance (Fox and Corbin, 1989). It is intimately linked to the individual's behavior and environment. Both variables appear to drive success in school and in life (Lichner et al., 2021).

In fact, during adolescence, healthy habits and behaviors for adult life are developed (Castro et al., 2020; Vaquero-Solís et al., 2021), these play a relevant role in physical and psychological health during growth and development (Vollmer et al., 2021), in addition, this stage, is characterized by presenting marked physical, social and psychological changes (Altıntaş et al., 2014), which should be constantly evaluated and monitored. From this perspective, in order to assess physical self-concept, it is necessary to have scales and/or instruments that measure specific domains in adolescents. To this end, it is necessary to establish effective and efficient strategies to ensure the quality control of the scales in terms of validity and reliability.

In fact, the most common validity tests are content validity, criterion validity (predictive and concurrent) and construct validity (Martínez and Moreno, 2002). In addition, reliability types encompass (e.g., measures of stability, equivalence, and internal consistency) (Boateng et al., 2018).

In fact, validity and reliability tests in general serve to ensure that measurement instruments assess objectively and rigorously (Muñiz and Fonseca-Pedrero, 2019). In this context, construct validity strongly supports the multidimensionality of self-concept in its facets and hierarchical structure (O'Mara et al., 2006) and reliability by Cronbach's alpha is the one that is usually predominantly used in scales (Raykov and Marcoulides, 2011), such as that of physical self-concept.

## Background on the study and measurement of the physical self-concept

The first measures of physical self-concept date back to unidimensional and global conceptions that included items related to physical abilities and physical appearance (Marsh and Shavelson, 1985). It is now widely known that self-concept is multidimensional, so studies in recent years have been interested in validating physical self-perception scales in various geographic regions of the world (Kolovelonis et al., 2013; McGrane et al., 2016; Estevan et al., 2018; Navarro Patón et al., 2020). However, to our knowledge, no physical self-perception scales for adolescents have been proposed or validated in Peru, so it is possible that the scale proposed by Fox and Corbin (1989) could demonstrate a valid and reliable factor structure in adolescents living in a high-altitude region.

It is widely known that the validation and adaptation of scales from one culture to another has increased in various areas of the world (Muñiz et al., 2013). Therefore, the scores obtained in these scales have very important implications for the final result of any research using self-reports. As well as in professional activity when testing theories and in decision making in intervention programs (Padilla et al., 2007).

In fact, we currently live in an increasingly multicultural and multilingual environment, in which scales are used as supports in decision making (Muñiz et al., 2013), so research in a multilingual country like Peru, is relevant, because it has marked geographical variations (coast, highlands and jungle), where the adolescents to be studied live in the department of Puno (Peru) located at 3812 m. a.s.l. (it is located on the shores of Lake Titicaca in the southeast of the country, on the Collao plateau and within the limits of La Paz, Bolivia).

In this context, Smith et al. (1999) warned more than 24 years ago that the way in which adolescents perceive themselves physically may vary from one geographic region to another within the same country, so that aspects such as climate, history, sociopolitical circumstances, health, economy and ethnicity (Markus and Kitayama, 1998) could be relevant factors when measuring the physical self-perception of adolescents.

Therefore, the objectives of the study are: (a) to analyze the psychometric properties of the physical self-concept questionnaire (PSC) in adolescents living in a high altitude region of Peru and (b) to develop assessment percentiles by age and sex.

## Materials and methods

### Type of study and sample

A descriptive cross-sectional study was conducted in adolescents aged 11 to 17 years. The sample selection was probabilistic (random). The population consisted of four public secondary schools, totaling 9,150 students (4,500 males and 4,650 females). The sample size was 1,263 schoolchildren, corresponding to 13.8% [609 males (6.7%) and 654 females (7.1%)] of the total population, with a confidence interval of 95%.

All the schoolchildren studied attended public schools in the urban area of the city of Puno (Peru). This region is located at 3,812 m above sea level, on the shores of Lake Titicaca (southeast of the country on the Collao plateau) and within the limits of La Paz (Bolivia), its economy is based on mining, agriculture, livestock, and tourism (Cossio-Bolaños et al., 2020).

In general, these students belonged to the emerging lower middle class, whose daily economic income of a Peruvian family ranges from US\$8.0 to US\$19.0 (López-Calva and Ortiz-Juarez, 2011). The 2019 Human Development Index (HDI) in Peru was 0.777 points, an improvement over 2018, when it stood at 0.771.

Adolescents who were enrolled at the secondary level (aged 12 to 17 years) and those who completed the survey were included in the study. Schoolchildren who did not attend on the day of the evaluation and those who presented some type of physical disability were withdrawn from the study. The parents and/or guardians of the students signed the informed consent form, as well as the students themselves signed the informed consent form. All procedures were carried out in accordance with the Local Ethics Committee and the Declaration of Helsinki for human beings.

TABLE 1 Operationalization of the variable studied.

Dimensions	Items
Physical condition	2. I am always in excellent physical condition and shape. 5. I am very proud of who I am and what I can do physically. 6 I am very proud of what I can do. 7. I always organize myself so that I can do intense physical exercise on a regular and continuous basis. 12. I always maintain a high level of endurance and physical fitness. 22. I feel very confident to practice on an ongoing basis and to maintain my physical fitness. 27. I feel that, compared to most people, my level of fitness is not that high.
Appearance	3. Compared to most, my body is not that attractive. 8. I have difficulty maintaining an attractive body 10. I am always satisfied with the way I am physically 13. I feel ashamed of my body when it comes to wearing skimpy clothes. 18. I think that I am often admired because my physique or my type of figure is considered attractive 25. I wish I had more respect for my physical "me." 28. I do not feel confident about the appearance of my body. 30. I feel very satisfied with the way I am physically.
Sports competition	1. I am very good at almost all sports. 14. When it comes to situations that require strength, I am the first to volunteer 16. I consider that I am always among the best when it comes to participating in sporting activities 20. I always have a really positive feeling about my physical appearance. 21. I tend to be among the fastest when it comes to learning new sporting skills. 26. When the opportunity arises, I am always among the first to participate in sports.
Force	4. Compared to most people of the same sex, I think I lack physical strength. 9. My muscles are as strong as those of most people of the same sex. 23. I think that, compared to most people, my body does not seem to be in the best shape. 24. I think that, compared to most people, I am very strong and have well-developed muscles. 29. I think that I am not as good as most when it comes to situations that require strength.
Self-esteem	6. I believe I am not among the most capable when it comes to sporting ability. 11. I do not feel confident when it comes to participating in sporting activities 15. When it comes to physical appearance, I do not feel very confident in myself 17. I tend to feel a bit uncomfortable in places where physical exercise and sports are practiced. 19. I have little confidence when it comes to my physical strength

## Techniques and procedures

The survey was carried out in each of the four secondary schools. It was surveyed during 2019 (April to July) and during school hours from 8:00 to 13:00 h and from Monday to Friday. Table 1 shows the dimensions and items assessed to measure physical self-perception.

The survey technique was used to measure the physical self-concept (PSC). The questionnaire proposed by Fox and Corbin (1989) implemented in Spanish. This instrument comprises two parts, one of demographic variables (age, sex) and a second part which is composed of five dimensions (totaling 30 questions, each with alternatives on a scale of 1–5 points). Previously this questionnaire was validated by other studies in Greek adolescents (Kolovelonis et al., 2013) Spanish (Navarro Patón et al., 2020) and in Peruvian university youth (Gomez-Campos et al., 2018).

The procedure consisted of applying the instrument in a traditional pencil-and-paper manner. One enumerator per school was arranged, totaling five evaluators. Each interviewer explained and cleared doubts about the filling out of the instrument. This procedure was carried out at each school during school hours and lasted approximately 20 min. Validity was assessed by means of confirmatory factor analysis (CFA) and reliability by means of internal consistency (Cronbach's alpha).

## Statistics

The normality of the data was verified by means of the Kolmogorov–Smirnov test. Descriptive statistical analysis of frequencies, percentages, arithmetic mean, standard deviation, skewness, and kurtosis was performed. The model fit for the Confirmatory factor analysis (CFA) provided the following calculations: Kaiser–Meyer–Olkin sample adequacy test (KMO), Chi-square ( $X^2$ ), Bartlett's test of sphericity, comparative fit index (CFI), root mean square error of approximation (RMSEA), and % variance. Cronbach's alpha was used for internal consistency. In all cases,  $p < 0.05$  was adopted. The results were initially processed and analyzed in Excel spreadsheets, then in SPSS 18.0. The LMS method (Cole et al., 2000) was used to develop the percentiles. The L, M and S curves represented skewness ( $\lambda$ ), median ( $\mu$ ) and coefficient of variation ( $\sigma$ ). The LMS method uses the Box–Cox transformation to fit the distribution of the physical self-concept scale data to a normal distribution by minimizing the effects of skewness. The L, M and S parameters were calculated according to the maximum penalty method (Cole and Green, 1992). The cut-off points of the scale can be interpreted in three categories:  $<p10$  is low,  $p15$  to  $p85$  moderate, and  $>p85$  high perception.

## Results

Table 2 shows the mean values and standard deviation of the five dimensions of the physical self-perception scale by age and sex. There were no significant differences between ages, both in males and females ( $p > 0.05$ ). In addition, when the five dimensions were compared between both sexes, no significant differences were observed ( $p > 0.05$ ), however, when the values of the total questionnaire were compared, males presented higher values than females ( $p < 0.05$ ).

In relation to the CFA factor loadings ranged from 0.41 to 0.75 and communalities from 0.30 and 0.60. In both cases they were satisfactory for the model. The descriptive values (mean,  $\pm$  SD, skewness, and kurtosis) and validity and reliability of the physical self-perception scale are shown in Table 2. Skewness showed values ranging from  $-1.06$  to  $0.18$  while kurtosis ranged from  $-0.95$  to  $0.22$ . In relation to the CFA, the factor loadings (communalities) were satisfactory for the model. Values ranged from 0.30 to 0.60. In addition, the KMO sample adequacy test was 0.89,  $X^2 = 3401.086$ , (gl: 395,  $p < 0.00$ ), CFI (0.898), RMSEA (0.078) and % variation 47%. The reliability values (Cronbach's alpha) per question evidenced values from  $r = 0.80$  to  $0.81$  and the total scale  $r = 0.81$  (Table 3).

The percentile values of the physical self-concept by dimension, total questionnaire, age and sex are shown in Tables 4, 5. The percentiles are distributed from p3, p5, p10, p15, p25, p50, p75, p80, p85, p90, and p95.

## Discussion

The results of the study have shown that the physical self-concept questionnaire in adolescents evidenced valid and reliable psychometric properties. This questionnaire presents 30 questions and five dimensions (physical condition, physical appearance, sports competence, strength,

self-esteem, and total questionnaire), which were developed to assess the physical self-concept of college students (Fox and Corbin, 1989; Fox, 1990).

The values of the CFA model revealed an adequate internal structure according to the adjustment used. The CFI was 0.898 and the RMSEA was 0.078, which are in line with literature recommendations (Schermelleh-Engel et al., 2003). Even, the KMO value was 0.754, considered reasonable (Dini et al., 2014).

Moreover, the communalities ranged from 0.30 to 0.60, whose values should be around  $\sim 0.50$  (Knehta et al., 2019) and are consistent with other studies that sought similar objectives to the present study (Eklund et al., 1997).

In fact, reliability values were high ( $r = 0.80-0.81$ ), demonstrating high internal consistency for the questionnaire. The Cronbach's alpha values observed in this study demonstrate that they exceeded the minimum values recommended in the literature (Streiner, 2003) and consequently are consistent with several studies reported in recent years (Goñi and Infante, 2010; Kolovelonis et al., 2013; Navarro Patón et al., 2020).

In general, the scale validated in this study has robust dimensional properties and adequate reliability values, so it can be used to acquire information on physical self-concept in adolescents living in an altitude region of Peru. Scales with these quality control characteristics are considered optimal and essential tools for collecting information (Palenzuela-Luis et al., 2022) in various areas of human knowledge. For example, in health, social and behavioral sciences (Boateng et al., 2018). In addition, in recent years, the physical self-concept questionnaire in adolescents has been widely used to relate to multiple variables, such as self-esteem, depressive symptoms, cardiorespiratory fitness and body fatness (Dishman et al., 2006; Balsalobre et al., 2014; Palenzuela-Luis et al., 2022).

In fact, based on the premises described above, this study developed percentiles for the assessment of the physical self-concept of adolescent

TABLE 2 Descriptive values ( $X \pm SD$ ) of the dimensions of the Physical self-concept scale by age and sex of the sample studied.

	12years		13years		14years		15years		16years		17years		Diff
	X	SD	X	SD	X	SD	X	SD	X	SD	X	SD	
<b>Males</b>													
n	72		206		131		85		72		36		
PC	21.1	3.8	20.8	3.7	20.7	3.8	20.5	3.5	20.8	3.6	20.1	3.7	ns
PA	25.5	4.4	25.5	4	25.2	3.9	25.7	2.7	25.7	3.8	26	3.8	ns
SC	20.3	4.2	20.4	4.6	19.7	4.6	20.1	3.8	20	3.5	19.7	4.2	ns
S	14.9	2.8	14.6	2.4	14.4	2.2	14.7	2.4	15.1	2.2	15.5	2.2	ns
SE	14.7	4	14.8	4	14.7	3.6	15.1	3	14.9	2.9	15	3.3	ns
TS	96.4	13	96.1	12.7	94.7	12	96	8.8	96.5	10	95.4	12	ns
<b>Females</b>													
n	42		101		102		179		178		47		
PC	20.5	3.3	19.6	4	20.2	3.3	19.5	4.2	19.4	3.9	19.2	4.1	ns
PA	26.7	3.6	25.5	4	24.8	2.9	24.9	5	25.4	5.2	25.3	5.2	ns
SC	20.6	4.4	19.2	4.6	19.2	4.3	19.1	4.5	18.9	4.4	19.6	5.2	ns
S	14.1	2.4	14.5	2.5	14	2.6	14.2	2.7	14.5	2.6	14.4	2.8	ns
SE	15.5	3.8	14.1	4.1	14	3.7	15.4	4	15.4	4.1	15.4	4.6	ns
TS	94.1*	11	93.0*	12.4	92.2*	8.6	93.2*	15	93.6*	15	93.8*	15	ns

PC: physical condition, PA: physical appearance, SC: sports competence, S: strength, SE: self-esteem, TS: total scale, ns: not significant, \*: significant difference.

TABLE 3 Descriptive analysis (skewness and kurtosis) and validity and reliability values of the physical self-concept scale.

Dimensions	Items	Mean	SD	Asymmetry	Kurtosis	Factor loadings	Communalities	Cronbach's
FC	2	3.31	0.95	-0.16	-0.23	0.608	0.41	0.8
	5	4.02	1.07	-1.06	0.58	0.578	0.41	0.8
	7	3.19	1.08	-0.11	-0.63	0.623	0.35	0.8
	12	3.25	1.01	-0.12	-0.38	0.603	0.43	0.8
	22	3.46	1.02	-0.33	-0.27	0.688	0.43	0.8
	27	2.98	1.06	-0.1	-0.5	0.453	0.44	0.8
PA	3	3.03	0.99	-0.08	-0.19	0.726	0.31	0.8
	8	3	1.05	-0.02	-0.4	0.678	0.36	0.8
	10	3.66	1.12	-0.56	-0.4	0.721	0.6	0.8
	13	2.97	1.23	0.04	-0.87	0.504	0.38	0.81
	18	2.75	0.98	-0.07	-0.29	0.517	0.33	0.8
	25	3.14	1.21	-0.13	-0.86	0.754	0.38	0.82
	28	2.94	1.16	0.03	-0.74	0.469	0.39	0.8
	30	3.9	1.12	-0.79	-0.2	0.737	0.55	0.8
SC	1	3.44	0.97	-0.38	0.06	0.745	0.49	0.8
	14	2.85	1.04	0.1	-0.34	0.626	0.3	0.8
	16	3.12	1.06	-0.11	-0.38	0.736	0.58	0.8
	20	3.56	1.05	-0.45	-0.23	0.632	0.45	0.8
	21	3.38	1.11	-0.28	-0.57	0.704	0.47	0.8
	26	3.27	1.1	-0.13	-0.57	0.757	0.52	0.8
S	4	2.83	1.15	0.09	-0.82	0.515	0.31	0.82
	9	3.01	1.08	-0.04	-0.53	0.626	0.39	0.81
	23	2.98	1.04	-0.01	-0.41	0.416	0.38	0.8
	24	2.73	0.97	0.18	-0.2	0.745	0.45	0.8
	29	2.95	1.05	-0.02	-0.47	0.527	0.28	0.81
SE	6	2.99	1.17	-0.03	-0.77	0.544	0.3	0.81
	11	3.04	1.24	-0.06	-0.95	0.640	0.3	0.81
	15	3	1.13	-0.01	-0.64	0.536	0.34	0.8
	17	2.95	1.2	0.02	-0.84	0.668	0.53	0.8
	19	2.94	1.11	-0.05	-0.62	0.648	0.35	0.8

FC: physical condition, PA: physical appearance, SC: sports competence, S: strength, SE: self-esteem.

schoolchildren. Percentile ranks are useful for quickly understanding how a particular score compares to the other scores in a distribution of scores. In that sense, the percentile values proposed in this study can be used to categorize adolescents into <p10 (low self-perception), p15 to p85 (moderate self-perception), and >p85 (high self-perception) by age and gender.

This tool allows monitoring the progress and/or decline of physical self-concept, during adolescence, since it plays an important role during this period, especially in promoting individual well-being and an active and healthy lifestyle (Mañano et al., 2004; Marsh et al., 2006; Carraro et al., 2010). Moreover, it is essential and necessary to the extent that it is used for adolescent health care and contributes to rapid detection of the problem, especially within epidemiological contexts (Bolaños et al., 2016).

In essence, from a quantitative perspective, the use of this questionnaire can serve physical education teachers to become aware of

physical self-concept when obtaining values below the 10<sup>th</sup> percentile among adolescents. Even, it can help to promote participation in intervention programs, which aim to improve their general self-concept, body perceptions and self-esteem among adolescents (Altıntaş et al., 2014).

There are some limitations that should be acknowledged in this research: First, the study was limited to investigate in a regionally representative sample (3,812 m above sea level), so it was not possible to cover a nationwide sample, including the three geographical areas of Peru (altitude, sea level and Amazon). In addition, the schoolchildren investigated were limited to public schools in urban areas, so future studies should investigate schoolchildren in private schools and rural areas.

Some strengths can also be recognized, for example, it is the first study carried out at national level and the surveys can be carried out in a traditional way with pencil and paper and on-line (in spanish and

TABLE 4 Percentiles for assessing physical self-concept by dimension, age, and sex in men.

Age	Males													
	L	M	S	P3	P5	P10	P15	P25	P50	P75	P80	P85	P90	P95
<b>Physical condition</b>														
12	1.3	21.12	0.17	14	15	16	17	19	21	24	25	26	27	28
13	1.54	20.99	0.17	13	14	16	17	18	21	23	25	25	27	27
14	1.57	20.87	0.17	13	14	16	17	18	21	23	24	25	26	27
15	1.43	20.67	0.17	13	14	16	17	18	21	23	24	25	26	27
16	1.16	20.61	0.17	14	15	16	17	18	21	23	24	25	26	27
17	0.8	20.39	0.18	14	15	16	17	18	20	23	24	25	26	27
<b>Physical appearance</b>														
12	0.89	25.48	0.16	18	19	20	21	23	25	28	30	31	32	34
13	1.04	25.48	0.16	18	19	20	21	23	25	28	30	31	32	33
14	1.08	25.38	0.15	18	19	21	22	23	25	28	29	30	31	32
15	1.14	25.52	0.14	19	20	21	22	23	26	28	29	30	31	32
16	1.13	25.79	0.13	19	20	21	22	23	26	28	29	30	31	32
17	0.99	26.1	0.13	19	20	22	22	24	26	28	30	31	32	33
<b>Sports competence</b>														
12	0.92	20.24	0.21	12	13	15	16	17	20	23	25	26	27	28
13	1.3	20.52	0.21	12	13	15	16	18	21	23	25	26	27	28
14	1.39	20.2	0.21	11	13	14	16	17	20	23	24	25	27	28
15	1.2	19.97	0.2	12	13	15	16	17	20	23	24	25	26	27
16	0.85	19.62	0.2	13	13	15	16	17	20	22	24	25	26	27
17	0.47	19.11	0.2	13	13	15	15	17	19	22	23	24	26	27
<b>Strength</b>														
12	0.44	14.71	0.17	10	11	12	12	13	15	16	18	18	19	20
13	0.77	14.49	0.17	10	11	12	12	13	14	16	17	18	19	19
14	0.84	14.36	0.16	10	11	12	12	13	14	16	17	17	18	19
15	0.64	14.58	0.15	11	11	12	12	13	15	16	17	18	18	19
16	0.39	14.95	0.15	11	12	12	13	14	15	16	17	18	19	19
17	0.26	15.47	0.14	12	12	13	13	14	15	17	18	18	19	20
<b>Self-esteem</b>														
12	1.19	14.93	0.28	7	8	9	11	12	15	18	19	20	21	22
13	1.09	14.88	0.26	7	8	10	11	12	15	17	19	20	21	22
14	1.04	14.83	0.24	8	9	10	11	12	15	17	18	19	21	21
15	0.94	14.88	0.22	9	10	11	12	13	15	17	18	19	20	21
16	0.77	14.85	0.2	9	10	11	12	13	15	17	18	19	20	21
17	0.5	15.13	0.19	10	11	12	12	13	15	17	18	19	20	21
<b>Full scale</b>														
12	-0.42	94.86	0.15	73	75	79	82	86	95	105	111	115	122	127
13	-0.15	94.86	0.14	73	76	80	82	86	95	104	110	114	120	124
14	0.07	94.47	0.13	74	77	80	83	87	94	103	108	111	116	120
15	0.18	94.91	0.11	76	78	82	84	88	95	102	107	110	114	117
16	0.32	95.6	0.11	77	80	83	85	89	96	103	107	110	114	116
17	0.56	96.16	0.11	78	80	83	86	89	96	103	107	110	114	117

TABLE 5 Percentiles to evaluate physical self-concept by dimension, age and sex in women.

Age	Females													
	L	M	S	P3	P5	P10	P15	P25	P50	P75	P80	P85	P90	P95
<b>Physical condition</b>														
12	1.62	21.25	0.16	14	15	17	18	19	21	23	25	25	26	27
13	1.49	20.2	0.18	13	14	15	16	18	20	23	24	25	26	26
14	1.27	19.88	0.19	12	13	15	16	17	20	22	24	25	26	27
15	1.08	19.68	0.2	12	13	15	16	17	20	22	24	25	26	27
16	1.14	19.47	0.2	12	13	14	15	17	19	22	24	24	26	27
17	1.38	19.44	0.2	11	12	14	15	17	19	22	23	24	26	26
<b>Physical appearance</b>														
12	0.83	26.31	0.13	20	21	22	23	24	26	29	30	31	32	33
13	0.98	25.51	0.14	19	20	21	22	23	26	28	29	30	32	32
14	1.16	24.75	0.16	17	18	20	21	22	25	27	29	30	31	32
15	1.33	25.2	0.18	16	17	19	20	22	25	28	30	31	32	33
16	1.47	25.63	0.19	15	17	19	20	22	26	29	31	32	33	34
17	1.58	25.58	0.21	14	16	18	20	22	26	29	31	32	34	35
<b>Sports competence</b>														
12	1.21	20.45	0.21	12	13	15	16	18	20	23	25	26	27	28
13	1.19	19.55	0.22	11	12	14	15	17	20	22	24	25	26	27
14	1.18	19.24	0.23	11	12	13	15	16	19	22	24	25	26	27
15	1.13	19.13	0.23	10	12	13	14	16	19	22	24	25	26	27
16	1.07	18.96	0.24	10	11	13	14	16	19	22	24	25	26	27
17	0.91	19.41	0.25	11	12	13	15	16	19	23	24	26	27	29
<b>Strength</b>														
12	1.49	14.23	0.16	10	10	11	12	13	14	16	17	17	18	18
13	1.46	14.48	0.17	9	10	11	12	13	14	16	17	17	18	19
14	1.35	14.25	0.18	9	10	11	12	13	14	16	17	17	18	19
15	1.14	14.28	0.18	9	10	11	12	13	14	16	17	18	18	19
16	1.12	14.43	0.18	9	10	11	12	13	14	16	17	18	19	19
17	1.35	14.63	0.18	9	10	11	12	13	15	16	17	18	19	19
<b>Self-esteem</b>														
12	1.04	15	0.26	8	8	10	11	12	15	18	19	20	21	22
13	1.03	14.33	0.27	7	8	9	10	12	14	17	18	19	21	22
14	1	14.23	0.27	7	8	9	10	12	14	17	18	19	20	21
15	0.94	15.12	0.27	8	9	10	11	12	15	18	19	20	22	23
16	0.92	15.42	0.27	8	9	10	11	13	15	18	20	21	22	23
17	0.92	15.38	0.28	8	8	10	11	13	15	18	20	21	23	24
<b>Full scale</b>														
12	1.35	97.41	0.11	77	80	84	86	90	97	104	108	110	114	116
13	1.25	93.77	0.12	72	75	79	82	86	94	101	105	108	112	114
14	1.05	91.92	0.13	69	72	77	79	84	92	100	104	107	111	114
15	1.01	93.23	0.15	68	71	76	79	84	93	102	107	111	116	119
16	1.19	93.93	0.16	65	69	74	78	84	94	104	109	113	118	121
17	1.34	94.01	0.17	63	67	73	77	83	94	104	110	113	119	122

english), whose results can be obtained in real time through the following link: [http://reidebihu.net/auto\\_adoles\\_puno.php](http://reidebihu.net/auto_adoles_puno.php).

## Conclusion

This study concludes that after application of the CFA and internal consistency reliability, the physical self-concept questionnaire for adolescents living in an altitude region of Peru reflected adequate psychometric properties. Furthermore, the proposed percentiles can be used to categorize and monitor physical self-concept by age and sex. These results suggest their use and application for educational and psychological testing. Future studies could include other types of validity tests to confirm our findings.

## Data availability statement

The datasets generated for this study are available on request from the corresponding author.

## Ethics statement

The studies involving human participants were reviewed and approved by Universidad Nacional del Altiplano de Puno. Written

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## Author contributions

JF-L, ML-F, ZC-G, and HQ-C collected the data. MC-B, RG-C, RV-E, and JF-L participated on the conception and design of the study. MC-B, JF-L, and RG-C analyzed the data. 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 or financial relationships that could be construed as a potential conflict of interest.

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