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ORIGINAL ARTICLE

Physical activity patterns of school adolescents: validity, reliability and percentiles proposal for evaluation

Patrones de actividad física de adolescentes escolares: validez, confiabilidad y propuesta de percentiles para su evaluación

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Abstract

Introduction: Regular physical activity (PA) during childhood and adolescence is important for the prevention of non-communicable diseases and their risk factors. **Objectives:** To validate a questionnaire that measures PA patterns, to verify its reliability, compare the levels of PA aligned with chronological and biological age, and develop percentile curves to assess PA levels, depending on biological maturation. **Subjects and Method:** Descriptive cross-sectional study was performed on a non-probabilistic quota sample of 3,176 Chilean adolescents (1685 males and 1491 females), with a mean age range from 10.0 to 18.9 years. An analysis was performed on, weight, standing and sitting height. The biological age through the years of peak growth rate and chronological age in years was determined. Body Mass Index was calculated and a survey of PA was applied. The LMS method was used to develop percentiles. **Results:** The values for the confirmatory analysis showed saturations between 0.517 and 0.653. The value of adequacy of Kaiser-Meyer-Olkin (KMO) was 0.879 and with 70.8% of the variance explained. The Cronbach alpha values ranged from 0.81 to 0.86. There were PA differences between the genders when aligned by chronological age. There were no differences when aligned by biological age. Percentiles are proposed to classify the PA of adolescents of both genders according to biological age and sex.

Keywords:
Physical activity;
Questionnaire;
Validity;
Reliability;
Percentiles;
Maturation.

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Introduction

Performing regular physical activity (PA) during childhood and adolescence is important for the prevention of non-communicable diseases and at the same time for the prevention of several risk factors[1]. In this context, it is necessary for researchers and public health professionals to consider that in order to measure and monitor PA patterns, it is necessary to control some priority requirements such as validity and reliability, and also to have standardization (standards) to diagnose, classify and follow up in the short, medium and long term.

The assessment of PA is generally approached from several points of view, using quantitative and/or qualitative methods, also called direct methods (double-labeled water, direct calorimetry, motion sensors, accelerometers, PA diaries and direct observation), and/or indirect methods (VO_{2max}, heart rate, questionnaires and reports of amount of energy intake)[2].

Self-report questionnaires, despite their limitations, are often used as a qualitative method within population surveillance studies because of their practicality, low cost, low participant load, and the ability to contextualize PA[3]. Such qualitative information is important for population surveillance and exploration of many aspects[4], such as providing valuable information about physical education classes, location and circumstances of activities in which the individual engages[5], and even the possibility to identify the days of the week, approximate times and places of the daily practices.

To the best of our knowledge, there is no representative study in Chile that presents an instrument that measures the patterns of PA in a valid and reliable way, and also that presents reference standards for adolescents, except for a study recently carried out, which was developed to evaluate a school[2]; however, it lacked validity, something that can make associations with related constructs difficult, therefore, this can inhibit the validity of a questionnaire. In addition, the developed percentiles were constructed according to the chronological age, without control of biological maturation, which can bring confusion when analyzing results, since the range of variability between individuals of the same chronological age during somatic growth is large and especially accentuated throughout the adolescence[6].

In essence, this study predicts that the dimensions (type of activity, frequency, duration and intensity) of the questionnaire to be validated represent the latent structure of the PA patterns, so that the confirmatory analysis could show a clear stipulation and interpretation of the relationship between each observed variable and each latent dimension[7]. It is also estimated that reliability values could reflect high reliability values and even postulated that PA aligned with chronological age levels could be confounded by biological maturation, since female mature approximately 2 years earlier than male[8]. Therefore, this study aims to: a) validate a questionnaire that measures PA patterns; b) verify reliability; c) compare PA levels aligned by chronological and biological age; and d) develop percentile curves to assess PA levels as a function of biological maturation.

Subjects and Methods

Type of study and sample

A cross-sectional descriptive study was performed. 3,176 adolescents from 7 municipal schools in the Maule region (Chile) were studied. The size of the universe was 21,173 subjects and the sample was calculated through a non-probabilistic quota sample. A representative sample of 1685 male and 1,491 female subjects was determined. Subjects were recruited from municipal schools in the Maule region (Chile). Adolescents who were physically healthy and self-sufficient for anthropometric evaluation were considered in the study. Young people aged between 10.0 and 18.9 years were also considered. Those who did not authorize the consent with the consent forms (75 subjects) and those who did not complete the anthropometric assessments and the questionnaire filling (25 subjects) were excluded. The study was approved by the ethics committee of the Universidad Católica del Maule, Chile.

Procedures

The dates of birth (day, month and year) of the young people studied were collected from birth certificates. This information was provided by the school offices. The decimal age was calculated through tables, using the date of birth and the evaluation (day, month and year).

The study was organized in 2 phases: the first to collect the anthropometric data and the second to apply the questionnaire. Data collection was performed from Monday to Friday from 8:00 a.m. to 1:00 p.m., during the months of August, September and October of 2015. For the anthropometric evaluation, the protocol suggested by Ross and Marfell-Jones[9] was used. Body weight (kg) was evaluated using an electronic scale (Tanita UK Ltd, UK), with a scale of 0-150 kg and with a precision of 100 g. Standing height was measured with a portable stadiometer (Seca & Co. KG, Hamburg, Germany), with an accuracy of 0.1 mm and a scale of 0-2.50 m. The seated height was taken using a wooden bench (50 cm high), with a measurement scale of 0 to 150 cm, with an accuracy of 1 mm. In all cases, instruments calibrated according to the manufactur-

ers' recommendations were used. 10% of the sample (318 subjects) of both sexes were evaluated 2 times to guarantee the technical error of measurement (TEM). Values below 2% were obtained for all anthropometric variables.

To measure PA patterns, the survey technique was used. The instrument considered was the questionnaire by Gómez-Campos et al.[10], which qualitatively assesses adolescent's PA. The instrument has 4 categories (type of activity, duration, frequency and intensity). This instrument was traditionally applied in pencil and paper, and students had 15 to 20 minutes to answer 11 questions proposed by the instrument. The evaluators remained in the classroom during the survey to clear any doubts.

The entire evaluation procedure was carried out by 6 students of Physical Education. These evaluators had the necessary experience for the collection of information, and were also trained and certified in anthropometric and survey techniques.

Body mass index (BMI) was calculated using the traditional formula, BMI = weight (kg)/height (m^2). The biological age was determined for both genders through the technique proposed by Mirwald et al. [11]. This is an indicator of the somatic maturity that represents the time of maximum growth in height during adolescence. It was proposed to be used in cross-sectional studies, since sexual maturation usually brings about constraints and skeletal maturation is an expensive and invasive method. The years of peak growth rate (PGR) were calculated using multiple regression equations. These equations require standing height, sitting height, leg length (sitting height-sitting height), chronological age and their interactions. The biological age was aligned for both genders in 10 intervals: in male subject (–4, –3, –2, –1, 0, 1, 2, 3, 4, and 5 years from PGR) and in female subjects (–2, –1, 0, 1, 2, 3, 4, 5, 6, and 7 years from PGR).

The PA questionnaire was validated by construct methodologies (confirmatory analysis). By this procedure it was verified if the questionnaire really reflects the theoretical meaning of the variable PA. All 4 factors were confirmed except question 3, which did not converge within the first category (type of PA). Reliability was determined by means of internal consistency analysis.

PA patterns were plotted for each sex in percentiles. Three classifications were considered: p <15 as low PA level; ≥ p15 to p85 as moderate level of PA, and ≥ p85 as high level of PA.

Statistics

The normality of the anthropometric and survey data was verified by means of the Kolmogorov-Smirnov test. A descriptive statistical analysis of arithmetic mean, standard deviation, range, frequencies and percentages was then performed. Differences between the two genders were determined using Student's t-test for independent samples. The construct validity was calculated using multivariate analysis. Confirmatory analysis was the final choice. The Kaiser-Meyer-Olkin (KMO) and Bartlett sphericity tests were applied to verify the fit of the data, and the commonalities and percentage of the variance were also calculated. Reliability was verified by Cronbach's Alpha. Percentage standards were developed using the LMS method[12]. This technique allowed the creation of 3 smoothed curves: L(t) Box-Cox power, M(t) median and S(t) coefficient of variation, and allowed to illustrate the p15, p50 and p85 percentiles according to the age and sex range. For all cases, the significance level adopted was $p < 0.05$. Calculations were made with an Excel spreadsheets and with SPSS 18.0.

Results

Anthropometric variables and mean PA scores are shown in Table 1. The male subjects showed higher weight, standing height, sitting height and PA compared to the female subjects ($p < 0.05$). In addition, the female subjects showed PGR (12.43 ± 1.12) versus male (15.1 ± 0.96). There were no differences in both genders between chronological age and BMI ($p > 0.05$)

The values of the confirmatory analysis are expressed in common factors (saturation values) and can be observed in Figure 1. Afterwards, using Varimax rotation with Kaiser Normalization it was possible to identify that question number 3 (type factor) with a saturation variables (0.138) was not relevant, so it was decided to eliminate this item. In general, acceptable saturation values ranged from 0.517 to 0.653; The KMO adequacy value was 0.879 and the sphericity test

Table 1.

Variables	Hombres		Mujeres	
	X	DE	X	DE
Edad cronológica (años)	15,2	2,6	14,5	3,0
Edad biológica (APVC)	15,1	0,9	12,4	1,1*
Peso (kg)	65,6	15,5	57,5	12,7*
Estatura de pie (m)	167,0	10,3	156,9	6,8*
Estatura sentado (cm)	87,7	7,4	81,5	7,9*
IMC (kg/m^2)	23,3	4,4	23,2	4,3
Actividad física (puntos)	31,87	7,21	28,45	7,23*

APVC: años de pico de velocidad de crecimiento; DE: desviación estándar; IMC: índice de masa corporal; X: media. *p < 0,05.

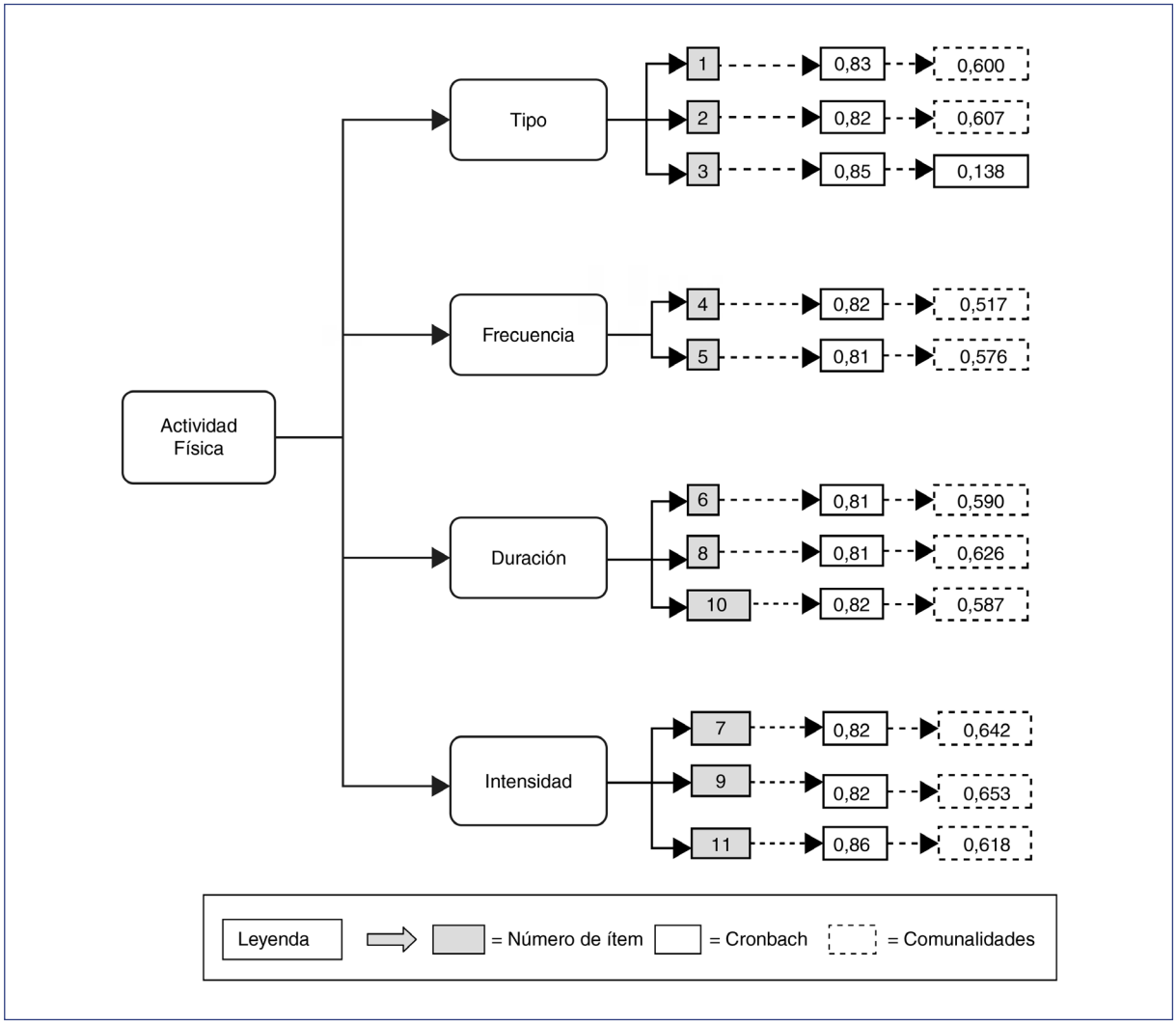

Figure 1.

was X^2 = 17,060.243, with p <0.05. Cronbach's alpha values showed acceptable values ranging from 0.81 to 0.86. Therefore, the applied instrument shows validity and reliability for a set of 10 questions distributed in 4 dimensions (categories), which explain 70.8% of the variance.

PA values according to chronological age and biological age are shown in Table 2. Regarding the chronological age, there were differences between both genders in the type of PA, from 15 to 18 years, in the frequency in 16 and 17 year olds, and in the duration from 16 to 18 years. There was no difference in intensity between the sexes. As for the biological age, only differences in the type of PA were observed, where the male subjects showed values higher than the female subjects ranging from the 2 to 5 years from PGR. In the other categories there were no significant differences. In general, when male are classified by chronological age, they present higher PA than female, from 11 to 18 years; however, by biological age, there were no significant differences, except for 3 years from PGR. Figure 2 clearly shows that when they are classified by biological age, the adolescents of both genders ostensibly decrease the levels of PA. For example, female decreased PA levels from 12.4 ± 1.1 years old and male from 15.1 ± 0.9 years old.

The percentiles (p15, p50 and p85) calculated through the LMS method are shown in Table 3. In both genders the proposed percentiles were constructed by controlling biological maturation from the year of PGR. In male it ranges from -4 years to 5 years from PGR and in female from -2 years to 7 years from PGR.

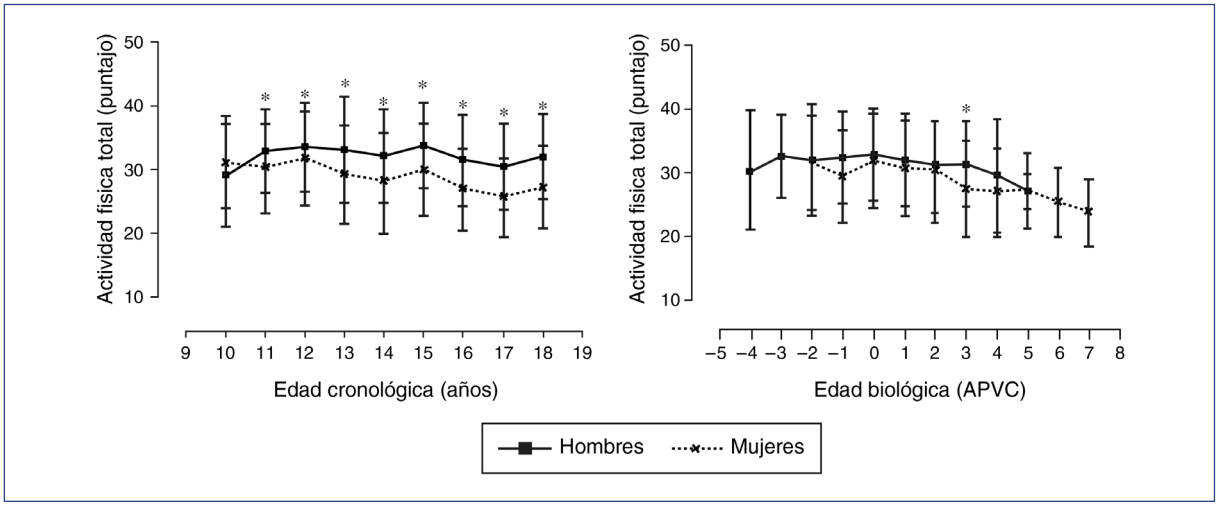

Figure 2.

Note that percentiles p <15 specifies a low PA level, ≥ p15 to p85 for a moderate PA level, and ≥ p85 indicates a high PA level.

Discussion

Regarding the validity of the questionnaire, the results of the study showed that the 4 categories proposed were valid. In fact, the saturation values obtained in this study are considered as significant (0.517 to 0.653), as described by Figueiredo-Filho and Sila-Junior[13]; in addition, the adequacy values (KMO = 0.879) are very good, since they are within the range of 0.8 to 0.9[14]. These results suggest a clear stipulation and interpretation of the relationship between each observed variable and each latent dimension[7], except for one question that showed saturation of 0.138, since this value within the latent structure did not allow to validate the instrument in its entirety; consequently, the 10 questions accurately represented the initial structure of this tool.

In essence, the results described here are consistent with several previous studies, especially with instruments that measure physical activity and fitness[15-17], and with instruments that were constructed to assess eating habits[18,19] and attitude toward obesity in adolescent girls[20]; therefore, including the explanatory percentage of the study variance, which explained 70.8% of the variance, this is a clear indication that the confirmatory factor analysis allowed to contrast the substantive theories of the PA questionnaire, although the development of new studies is necessary, including samples of adolescents from other regions of Chile, as this information could help confirm these findings, and thus achieve external validity.

Regarding the reliability of the instrument, the values of internal consistency obtained in this study show values between 0.81 and 0.86. These values are evidently consistent with other studies with similar characteristics[2,20,21], in which had used Cronbach's alpha to verify the reliability of their instruments. In fact, since the values observed in this study are considered acceptable[22,23], the instrument is reliable, at least in terms of internal consistency. Although, it is necessary to explore other possibilities of reliability, for example, through the use of measures of test-retest stability.

In essence, within the internal consistency procedure, Cronbach's alpha is undoubtedly the method most widely used by researchers, especially when it comes to verifying survey reliability. Thus, reliability compliance, as one of the requirements of quality control, regardless of method, means achieving greater accuracy and reproducibility of the instruments[24].

Regarding the comparison of the levels of PA, when aligned by chronological age, the results show a slight decline as the age advances, and male present higher levels of PA in relation to female; however, when PA scores were aligned by biological age, note that there was no difference between the two genders, and the decline was more pronounced, especially after PGR occurred in both genders.

In both genders, the levels of PA start to decrease ostensibly from the level (zero), for example, in male at 15.1 ± 0.9 years old and in female at 12.4 ± 1.1 years old, respectively.

These results show that gender differences in the

Table 2.

Edad cronológica (años)		Tipo		Frecuencia		Duración		Intensidad		Total		Edad biológica (APVC)		Tipo		Frecuencia		Duración		Intensidad		Total	
	n	X	DE	X	DE	X	DE	X	DE	X	DE		n	X	DE	X	DE	X	DE	X	DE	X	DE
Hombres																							
10,0-10,9	64	9,5	3,2	5,1	1,7	7,9	2,6	6,4	2,0	29,2	7,9	–4	48	10,1	3,4	5,3	2,0	8,5	3,0	6,4	1,9	30,4	9,5
11,0-11,9	69	10,6	2,5	6,0	1,6	8,7	2,6	7,3	2,0	32,9	6,5*	–3	78	10,5	2,8	5,8	1,6	8,6	2,5	7,2	1,8	32,6	6,4
12,0-12,9	81	10,7	3,0	5,9	1,6	9,2	2,6	7,5	1,7	33,6	6,9*	–2	119	10,1	3,0	5,8	1,7	8,8	3,2	7,4	2,7	32,0	8,4
13,0-13,9	145	10,4	3,1	6,0	1,7	9,3	2,9	7,5	2,6	33,1	8,4*	–1	186	9,9	3,0	5,9	1,6	9,1	2,4	7,4	1,8	32,4	7,1
14,0-14,9	242	9,9	3,0	5,9	1,5	8,8	2,8	7,3	2,0	32,1	7,2*	0	297	10,1	3,0	5,9	1,5	9,2	2,5	7,5	1,9	32,8	7,1
15,0-15,9	228	10,3	2,84*	6,2	1,6	9,4	2,4	7,7	1,8	33,8	6,9*	1	367	9,8	2,9	5,8	1,6	8,9	2,6	7,3	1,8	32,0	7,2
16,0-16,9	290	9,6	3,06*	5,7	1,5*	8,8	2,47*	7,2	1,7	31,5	7,1*	2	329	9,6	2,98*	5,6	1,5	8,6	2,5	7,0	1,8	31,0	7,1
17,0-17,9	356	9,3	3,04*	5,5	1,55*	8,4	2,48*	7,0	1,7	30,5	6,9*	3	197	10,0	3,42*	5,9	1,5	8,7	2,1	7,4	1,7	31,3	6,6*
18,0-18,9	210	9,8	3,13*	5,7	1,5	9,0	2,26*	7,2	1,7	32,0	6,7*	4	41	9,5	6,24*	4,7	1,6	8,0	1,6	7,3	1,6	29,6	8,9
												5	23	9,2	1,17*	4,9	1,4	7,5	1,2	7,0	0,9	27,1	2,7
Mujeres																							
10,0-10,9	76	9,9	2,9	5,8	1,7	8,3	2,7	7,2	1,8	31,1	7,2	–2	59	10,1	3,0	5,8	1,6	8,3	2,5	7,4	2,2	31,5	7,3
11,0-11,9	123	9,8	2,6	5,8	1,6	7,9	2,9	6,9	1,8	30,3	7,0	–1	99	9,6	2,8	5,4	1,7	8,1	2,8	6,9	1,8	29,5	7,1
12,0-12,9	158	9,8	2,8	5,6	1,7	9,3	2,6	7,3	1,8	31,8	7,3	0	148	10,0	2,7	5,9	1,6	9,2	2,8	7,1	1,8	32,0	7,2
13,0-13,9	109	9,1	3,0	5,2	1,6	8,1	2,8	6,7	1,8	29,3	7,6	1	150	9,4	2,8	5,4	1,8	8,7	2,7	7,1	1,9	30,7	7,5
14,0-14,9	188	8,2	3,0	5,3	1,8	7,5	2,7	6,6	2,0	28,0	7,8	2	195	8,5	3,0	5,3	1,7	8,1	2,7	6,7	1,9	30,1	7,8
15,0-15,9	173	8,6	2,8	5,5	1,5	8,5	2,7	7,0	1,7	30,1	7,2	3	244	8,2	2,6	5,1	1,6	7,6	2,7	6,4	1,7	27,6	7,2
16,0-16,9	221	7,9	2,5	4,8	1,5	7,6	2,6	6,2	1,6	27,0	6,4	4	309	7,9	2,6	4,8	1,4	7,5	2,6	6,3	1,7	26,9	6,9
17,0-17,9	311	7,5	2,3	4,6	1,3	7,2	2,4	6,1	1,6	25,6	6,1	5	144	7,8	2,2	4,9	1,3	7,7	2,5	6,5	1,6	27,3	5,7
18,0-18,9	122	8,3	2,5	5,0	1,3	7,7	2,9	6,5	1,5	27,3	6,5	6	82	7,7	2,4	4,9	1,1	6,9	2,5	6,2	1,4	25,5	5,1
												7	51	7,0	2,2	4,4	1,2	6,6	2,0	5,7	1,4	24,0	5,1

APVC: años de pico de velocidad de crecimiento; DE: desviación estándar; X: promedio.* $p < 0,001$, diferencia significativa en relación con las mujeres.

Table 3.

	Hombres							Mujeres					
APVC	L	M	S	p15	p50	p85	APVC	L	M	S	p15	p50	p85
Tipo AF													
–4	1,42	7,75	0,30	5	8	10	–2	1,47	7,57	0,29	5	8	10
–3	1,40	7,58	0,30	5	8	10	–1	1,35	7,43	0,30	5	7	10
–2	1,39	7,49	0,30	5	8	10	0	1,21	7,29	0,32	5	7	10
–1	1,38	7,50	0,31	5	8	10	1	1,07	6,99	0,34	5	7	10
0	1,36	7,56	0,31	5	8	10	2	0,92	6,56	0,36	4	7	9
1	1,27	7,51	0,32	5	8	10	3	0,78	6,17	0,37	4	6	9
2	1,09	7,35	0,33	5	7	10	4	0,66	5,91	0,38	4	6	8
3	0,82	7,06	0,34	5	7	10	5	0,56	5,68	0,38	4	6	8
4	0,52	6,44	0,36	4	6	9	6	0,46	5,38	0,38	4	5	8
5	0,22	5,69	0,37	4	6	8	7	0,37	5,01	0,38	3	5	7
Frecuencia AF													
–4	1,46	5,71	0,28	4	6	7	–2	1,20	5,73	0,29	4	6	7
–3	1,39	5,82	0,28	4	6	7	–1	1,09	5,68	0,30	4	6	7
–2	1,32	5,91	0,27	4	6	8	0	0,97	5,63	0,31	4	6	7
–1	1,26	5,96	0,27	4	6	8	1	0,87	5,48	0,31	4	6	7
0	1,19	5,92	0,26	4	6	8	2	0,79	5,26	0,31	4	5	7
1	1,14	5,80	0,27	4	6	7	3	0,73	5,02	0,31	4	5	7
2	1,10	5,65	0,27	4	6	7	4	0,70	4,83	0,30	3	5	6
3	1,09	5,56	0,27	4	6	7	5	0,69	4,76	0,28	3	5	6
4	1,10	5,37	0,28	4	5	7	6	0,71	4,67	0,27	3	5	6
5	1,12	5,13	0,28	4	5	7	7	0,72	4,50	0,25	3	5	6
Duración AF													
–4	1,04	8,39	0,33	6	8	11	–2	1,33	8,26	0,31	6	8	11
–3	1,02	8,63	0,32	6	9	12	–1	1,28	8,53	0,31	6	9	11
–2	1,02	8,88	0,31	6	9	12	0	1,21	8,74	0,32	6	9	12
–1	1,10	9,04	0,29	6	9	12	1	1,13	8,57	0,33	6	9	11
0	1,23	9,11	0,28	6	9	12	2	1,03	8,14	0,34	5	8	11
1	1,40	9,04	0,27	6	9	12	3	0,92	7,72	0,34	5	8	11
2	1,53	8,92	0,26	6	9	11	4	0,81	7,45	0,35	5	8	10
3	1,63	8,75	0,24	6	9	11	5	0,71	7,25	0,35	5	7	10
4	1,72	8,32	0,22	6	8	10	6	0,62	6,89	0,35	5	7	10
5	1,80	7,73	0,20	6	8	9	7	0,54	6,44	0,35	4	6	9
Intensidad AF													
–4	0,37	6,54	0,31	5	7	9	–2	0,98	7,23	0,28	5	7	9
–3	0,23	6,85	0,29	5	7	9	–1	0,81	7,05	0,27	5	7	9
–2	0,13	7,07	0,28	5	7	9	0	0,65	6,95	0,27	5	7	9
–1	0,12	7,21	0,26	6	7	9	1	0,49	6,82	0,27	5	7	9
0	0,18	7,27	0,25	6	7	9	2	0,34	6,56	0,27	5	7	9
1	0,30	7,15	0,25	6	7	9	3	0,25	6,31	0,27	5	6	8
2	0,45	6,99	0,24	5	7	9	4	0,22	6,22	0,26	5	6	8
3	0,58	7,05	0,24	5	7	9	5	0,24	6,19	0,25	5	6	8
4	0,70	7,10	0,23	6	7	9	6	0,29	6,03	0,24	5	6	8
5	0,83	7,10	0,22	6	7	9	7	0,36	5,75	0,23	5	6	7
Total de AF													
–4	1,26	28,99	0,25	21	29	36	–2	1,15	28,43	0,24	21	28	35
–3	1,14	29,27	0,24	22	29	37	–1	1,11	28,42	0,24	21	28	36
–2	1,06	29,57	0,24	22	30	37	0	1,05	28,57	0,25	21	29	36
–1	1,05	29,82	0,23	23	30	37	1	0,96	28,06	0,26	21	28	36
0	1,11	29,94	0,23	23	30	37	2	0,84	26,90	0,26	20	27	34
1	1,19	29,65	0,22	23	30	36	3	0,70	25,69	0,26	19	26	33
2	1,23	29,16	0,22	22	29	36	4	0,57	24,90	0,25	19	25	32
3	1,22	28,71	0,22	22	29	35	5	0,45	24,30	0,24	19	24	31
4	1,21	27,54	0,21	21	28	34	6	0,35	23,24	0,23	18	23	29
5	1,19	26,01	0,21	20	26	31	7	0,26	21,95	0,21	18	22	27

AF: actividad física; APVC: años de pico de velocidad de crecimiento; L: coeficiente Box-Cox; M: mediana; S: coeficiente de variación.

subjective perception of PA levels disappeared when they were aligned for biological age, which evidently contrasts with some studies[25,26]. Therefore, biological maturation plays an important role in the decline of PA levels during adolescence. These findings support the idea that the assessment of PA should be performed according to biological age rather than chronological age, since the literature argues that the onset of PA decline is associated with puberty[27], being in the female around 12 years old and male at 14 years, although in this study it was verified in female at 12.4 ± 1.1 years old and in male 3 years later (15.1 ± 0.9 years old).

In summary, percentiles have been constructed based on biological maturation to assess the levels of PA of the young adolescents of the Maule region; this information as transcendental norms can then be used to standardize the scores of the levels of PA according to category, gender and biological age.

The use of these norms within the school environment can help the individual and collective interpretation of adolescent students, whose results can contribute efficiently to the diagnosis, monitoring and control of PA patterns[17]. It is also possible to follow their progress and/or decline during adolescence, which is essential and necessary to the extent that it is used for health care and contributes to a rapid detection of the problem, especially within epidemiological contexts.

The use and application of standards may be limited within the scope of the health sciences and education, since the evaluation and interpretation process is easy to carry out and the calculations can be carried out in the following link: http://reidebihu.net/cuesaptfisado.php.

Some limitations and strengths can be recognized in this study since, for example, it was not possible to control feeding habits and it is possible that the method of the survey technique may limit the results, being part of a qualitative method, although future studies may test these results using quantitative methods. Despite this, the study presents great strengths, such as the control of somatic maturation in the studied subjects. The practical applicability of the study is that the calculations can be carried out on-line, obtaining the result in real time by biological age and gender.

Conclusion

In conclusion, the questionnaire used to qualitatively measure PA patterns was valid and reliable; it has also been shown that PA should be evaluated by biological age and not by chronological age. These findings led to the development of percentiles to assess PA according to biological age and gender. The results suggest the use of percentages tables in the field of health sciences and education.

Ethical Responsibilities

Protection of people and animals: The authors state that the procedures followed conformed to the ethical standards of the responsible human experimentation committee and in agreement with the World Medical Association and the Declaration of Helsinki.

Confidentiality of data: The authors state that they have followed the protocols of their work center on the publication of patient data.

Privacy rights and informed consent: The authors have obtained the informed consent of the patients and/or subjects referred to in the article. This document is in the possession of the correspondence author.

Conflict of interest

The authors declare that they have no conflict of interest.

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