REFERENCE VALUES OF THE BODY COMPOSITION OF YOUNG CHILEAN SOCCER PLAYERS

VALORES DE REFERÊNCIA DA COMPOSIÇÃO CORPORAL DE JOVENS FUTEBOLISTAS CHILENOS

VALORES DE REFERENCIA DE LA COMPOSICIÓN CORPORAL DE JÓVENES FUTBOLISTAS CHILENOS

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ABSTRACT

Objective: To analyze whether fat mass (FM) and fat-free mass (FFM) should be evaluated by chronological age and/or biological age and propose curves to classify the body composition of young Chilean soccer players. Methods: A cross-sectional descriptive study was developed. Six hundred and forty-two soccer players between 13.0 and 18.9 years of age were recruited. Body mass, height, trunk-cephalic height, and tricipital and subscapular skinfolds were evaluated. Biological maturation was determined using peak height velocity age (PHV) and the percentage of fat mass was estimated by regression equations. The reference percentiles were calculated using the LMS method. Results: The values of R^2 were lower for chronological age (FM = 0.07% and FFM = 0.13%) than for biological age (FM = 0.31% and FFM = 0.50%). Eleven percentiles (p3, p5, p10, p15, p25, p50, p75, p85, p90, p95 and p97) were calculated for FFM and FM. Conclusion: Biological age (PHV) is a better predictor of FFM and FM than chronological age. The references proposed can be used to monitor the body composition of young Chilean soccer players. ***Level of Evidence II; Diagnostic Study.***

Keywords: Body composition; Youth; References values; Soccer.

RESUMO

Objetivo: Analisar se a massa gorda (MG) e a massa livre de gordura (MLG) devem ser avaliadas pela idade cronológica e/ou pela idade biológica, e propor curvas para classificar a composição corporal de jovens futebolistas chilenos. Métodos: Elaborou-se um estudo descritivo transversal. Foram recrutados 642 futebolistas entre 13,0 e 18,9 anos. Massa corporal, estatura, altura tronco-cefálica, dobras cutâneas tricipital e subescapular foram medidas. A maturação biológica foi determinada pela idade de pico de velocidade de crescimento (IPVC) e o percentual de massa gorda foi estimado por equações de regressão. Os percentis de referência foram calculados pelo método LMS. Resultados: Os valores de R^2 para idade cronológica foram menores (MG = 0,07% e MLG=0,13%) em comparação com os valores para a idade biológica (MG = 0,31% e MLG = 0,50%). Foram calculados 11 percentis (p3, p5, p10, p15, p25, p50, p75, p85, p90, p95 e p97) para a MLG e MG. Conclusão: A idade biológica (IPVC) é um preditor melhor da MLG e da MG do que a idade cronológica. As referências propostas podem servir para monitorar a composição corporal de jovens futebolistas chilenos. ***Nível de evidência II; Estudo de diagnóstico.***

Descritores: *Composição corporal; Jovens; Valores de referência; Futebol.*

RESUMEN

Objetivo: Analizar si la masa grasa (MG) y la masa libre de grasa (MLG) deben ser evaluadas por la edad cronológica y/o por la edad biológica, y proponer curvas para clasificar la composición corporal de jóvenes futbolistas chilenos. Métodos: Se elaboró un estudio descriptivo transversal. Fueron reclutados 642 futbolistas entre 13,0 y 18,9 años. Fueron medidas masa corporal, estatura, altura tronco-cefálica, pliegues cutáneos tricipital y subescapular. La madurez biológica fue determinada por la edad de pico de velocidad de crecimiento (EPVC) y el porcentual de masa grasa fue estimado por ecuaciones de regresión. Los percentiles de referencia fueron calculados por el método LMS. Resultados: Los valores de R^2 para edad cronológica fueron menores (MG=0,07% y MLG=0,13%) en comparación con los valores para la edad biológica (MG=0,31% y MLG=0,50%). Fueron calculados 11 percentiles (p3, p5, p10, p15, p25, p50, p75, p85, p90, p95 y p97) para la MLG y MG. Conclusión: La edad biológica (EPVC) es un predictor mejor de la MLG y de la MG que la edad cronológica. Las referencias propuestas pueden servir para monitorizar la composición corporal de jóvenes futbolistas chilenos. ***Nivel de evidencia II; Estudio de diagnóstico.***

Descriptores: *Composición corporal; Jóvenes; Valores de referencia; Fútbol.*

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INTRODUCTION

In youth team soccer, variations in the stage of maturation play an important role in body dimensions, body composition, body proportions and sports performance. The combination of these variables during biological maturation combined with an advanced chronological age and their relationship with physical performance can be advantageous to young athletes.[1]

In this sense, clubs, sports associations, soccer academies and national selections should introduce evaluation of biological maturation into their

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training programs. This indicator should be continually evaluated since the chronology and intensity of puberty are specific to each adolescent and can vary considerably among them.[2]

Several studies have shown that youths in advanced stages of biological maturation are able to perform a greater diversity of physical and motor tasks.[1,3,4] This implies variations in the body composition and functional abilities among young athletes.[5]

As a consequence, studying fat mass and fat-free mass in young soccer players is important, considering that this information can be highly useful in monitoring the planning and evaluation of training programs, as well as the intake of nutrients over time.[6] It can also be used to identify young talents who are involved in sports programs[7] and to monitor changes in body composition from the effects of training during the growth and development phase.

In general, given that body composition is important for sports performance,[8] the hypothesis of this study is that the variables fat mass and fat-free mass should be analyzed according to the biological age and not the chronological age. In addition, no study exists that classifies and monitors the body composition of young athletes by means of reference curves. This fact is important because it is well known that low levels of fat mass and high levels of fat-free mass provide a good foundation for the development of the locomotor activities and technical skills specific to a particular sport.[9]

Therefore, the present study initially proposes verification of whether fat mass and fat-free mass should be analyzed by chronological age and/or by biological age, and then to propose curves to classify the body composition of young Chilean soccer players.

METHODS

Type of study and sample

A descriptive cross-sectional study was conducted. The sample selection was non-probabilistic. The players were recruited from two professional clubs and ten under-12, under-14, under-16 and under-18 national selections (participants in a national championship). The sample considered was made up of 642 soccer players between 13.0 and 18.9 years of age.

All the players selected for the study trained during the week (3-5 sessions). Each session was 90-120 minutes in duration. In addition, all athletes competed once a week (Saturday). The athletes were distributed by game position as follows: goalies (n=72), defense (n=240), midfielders (n=220) and offense (n=110).

The presidents of each club and selection involved were invited to assist in organizing the study. Subsequently, the parents were asked to give their consent for conducting anthropometric evaluations by signing the informed consent form (ICF) and the corresponding terms of assent for the young soccer players. Throughout the study the participants were informed that they could withdraw at any time. The study was approved by the Institutional Review Board of the Universidade Autónoma do Chile-238-2015 and was developed in accordance with the ethical principles for research in human beings of the Declaration of Helsinki.

Athletes who were not Chilean citizens and those with physical injuries that would limit the anthropometric evaluations were excluded from the study.

Techniques and procedures

The evaluations were conducted at club facilities and at the concentration center where the national soccer championship was held. Anthropometric assessments were performed in a specific location where the tools for this were installed. The evaluations were conducted by three experienced evaluators, always in the morning (8 am to 11 am) from Monday to Friday before any type of physical activity.

The technique described by Ross, Marfell-Jones[10] was used to evaluate five anthropometric variables. Body mass was assessed using an electronic scale (Tanita, United Kingdom, Ltd), with a scale from 0-150 Kg and precision of 100 g. Height was measured according to the Frankfurt plane using a portable stadiometer (Seca Gmbh & Co. KG, Hamburg, Germany) with 0.1 mm precision. Trunk-cephalic height was measured using the same stadiometer mentioned above and a bench with a height of 50 cm. Tricipital and subscapular skinfolds (mm) were measured with a skinfold compass (Harpendem UK, England) that exerts a constant pressure of 10 g/mm^2. The technical error of measurement (TEM) fluctuated between 0.45 and 1.0%.

Biological maturation was determined by means of the age of peak height velocity (PHV). The regression equation proposed by Mirwald et al.[11] for boys was used. The maturation intervals were organized in years in relation to the PHV, for example -1 PHV, 0 PHV, 1 PHV, 2 PHV and 3 PHV.

The percentage of fat mass was calculated by the equation proposed by Boileau et al.:[12] Boys %F = 1.35(*TR*+*SS*) – 0.012 (*TR*+*SS*)^2 – 4.4. Fat-free mass and fat mass values were obtained through the estimated body fat percentage and body mass.

Statistical Analysis

The normal distribution of the data was verified using the Kolmogorov-Smirnov test. Descriptive analysis was performed (mean, standard deviation and amplitude). The relationship between the variables was determined using Pearson's correlation coefficient. Multiple regression (step wise) analysis was performed. A significance level of $p<0.05$ was adopted. The analyses were performed in SPSS 16.0 for Windows. Smoothed percentile curves were created for fat mass and fat-free mass based on the LMS method,[13] using LMS Chart Maker Pro version 2.3 program, which calculated the following percentiles: p3, p5, p10, p15, p25, p50, p75, p85, p90, p95 and p97.

RESULTS

The anthropometric and body composition variables can be seen in Table 1. The peak height velocity age (PHV) of the soccer players studied was 15.01±09 years.

The relationships between biological and chronological age and the body composition of the soccer players are shown in Table 2. According to the Pearson's correlation coefficient values, fat mass and non-fat mass must be analyzed by biological age. The values (R^2=13-50%) improved substantially in both cases as compared to chronological age. In general, the sum of the tricipital and subscapular skinfolds, as well as the percentage of fat yielded very low R^2s.

Table 1. Descriptive characteristics of the study sample.

Variables	X	SD	Minimum	Maximum
Chronological Age (years)	16.5	1.5	12.9	20.0
PHV age (years)	15.1	1.0	13.18	18.80
Anthropometry				
Body Mass (kg)	64.7	8.8	38.0	91.2
Height (cm)	170.6	7.1	135.9	193.0
Trunk-Cephalic Height (cm)	89.1	4.2	74.1	101.5
Skinfolds				
Tricipital (mm)	8.3	2.7	1.0	21.0
Subscapular (mm)	8.1	2.6	1.0	26.0
∑(Tr+Ss) (mm)	16.4	4.5	7.0	41.0
Body Composition				
Percentage of fat (%F)	14.0	4.7	-4.4	30.8
Fat Mass (kg)	9.2	3.9	-3.4	28.1
Fat-free Mass (kg)	55.5	6.8	31.9	80.4

PHV: peak height velocity, Tr: Triceps, Ss: Subscapular, X: Mean, SD: standard deviation.

The percentile values of fat mass and fat-free mass by biological age can be seen in Table 3. In both cases, the median value increases as the PHV age increases. Figure 1 shows the fat mass and fat-free mass graphs of the young Chilean soccer players.

DISCUSSION

This study demonstrates that biological maturation (PHV age) is a good indicator for evaluating the FM and FFM of young soccer players, while the chronological age seems to have limited use for these compartments.

These data show that body composition is closely related to the period of biological maturation in adolescents,[14] so its use and application to youth soccer players is essential.

Table 2. Values from the multiple linear regression between chronical and biological ages and the body composition variables.

Variables	Chronological Age (years)				Biological Age (PHV)			
	R	R^2	SEE	P	R	R^2	SEE	P
Skinfolds (mm)								
Tricipital	0.070	0.005	1.533	0.001	0.028	0.004	1.082	0.001
Subscapular	0.204	0.041	1.504	0.001	0.241	0.058	1.051	0.001
Σ Skinfolds (Tr + Ss)	0.077	0.006	1.53	0.001	0.123	0.015	1.074	0.001
Percentage of fat (% F)	0.123	0.015	1.529	0.001	0.179	0.032	1.076	0.001
Fat Mass (kg)	0.270	0.071	1.480	0.001	0.362	0.131	1.020	0.001
Fat-free Mass (kg)	0.560	0.313	1.277	0.001	0.708	0.502	0.772	0.001

PHV: Age of Peak Height Velocity, Tr: Triceps, Ss: Subscapular, SEE: Standard Error of Estimate.

Regardless of the type of technique used, PHV ages serve to identify different maturation periods of a group of athletes in the same age group and/or training group and/or competitive category.[15] This helps to reduce favoritism in the selection of young soccer players solely by chronological age.

Having obtained this information, it is possible to avoid favoring early maturing players, favoritism that also discourages players who mature later and/or who have possibilities for excellence in the future.[16] Several national studies[17,18] and other international ones[19-21] have demonstrated the usefulness of biological maturation in young soccer players with related variables, not only with body size and composition, but also with aerobic power, muscle strength and speed, respectively.

The findings in this study may help professionals who work directly with soccer or researchers who work with sports sciences. Using biological maturation determination methods (invasive and non-invasive) can optimize and strengthen the structure of training programs, since FM and FFM are significant variables that serve to identify the nutritional state of children and adolescents[22] and can even prevent injuries.[23]

Consequently, once it determined that the PHV age is a better predictor of the body composition of young football players, this second objective of this study was to propose curves to estimate the fat mass and fat-free mass for the biological age (PHV age).

The curves developed can establish new guidelines or reinforce the existing ones in sports clubs and organizations that work with young soccer players and even act as a tool for professionals who work with

Table 3. Reference values for fat mass and fat-free mass of young soccer players by biological age.

PHV	n	L	M	S	P3	P5	P10	P15	P25	P50	P75	P85	P90	P95	P97
Fat Mass (kg)															
-1	54	-0.24	6.12	0.32	3.5	3.7	4.1	4.4	5.0	6.1	7.6	8.6	9.4	10.7	11.7
0	113	-0.09	7.35	0.35	3.9	4.2	4.7	5.1	5.8	7.4	9.3	10.6	11.6	13.3	14.5
1	218	0.12	8.43	0.38	4.0	4.4	5.1	5.6	6.5	8.4	10.8	12.3	13.5	15.3	16.6
2	201	0.46	9.31	0.38	3.9	4.4	5.4	6.0	7.1	9.3	11.9	13.4	14.5	16.1	17.3
3	56	0.75	10.48	0.35	4.2	4.9	6.0	6.8	8.1	10.5	13.1	14.5	15.5	17.0	18.0
Fat-Free Mass (kg)															
-1	54	-0.79	44.26	0.11	36.4	37.3	38.6	39.6	41.1	44.3	47.8	50.0	51.5	54.0	55.7
0	113	-0.51	50.19	0.10	42.1	43.0	44.5	45.5	47.0	50.2	53.7	55.7	57.1	59.3	60.8
1	218	-0.27	54.62	0.08	46.8	47.7	49.1	50.1	51.6	54.6	57.8	59.7	61.0	62.9	64.2
2	201	0.01	58.02	0.08	50.3	51.2	52.6	53.6	55.1	58.0	61.1	62.8	64.0	65.8	67.0
3	56	0.30	62.17	0.07	54.6	55.5	57.0	57.9	59.4	62.2	65.0	66.6	67.7	69.3	70.4

PHV: Age of Peak Height Velocity.

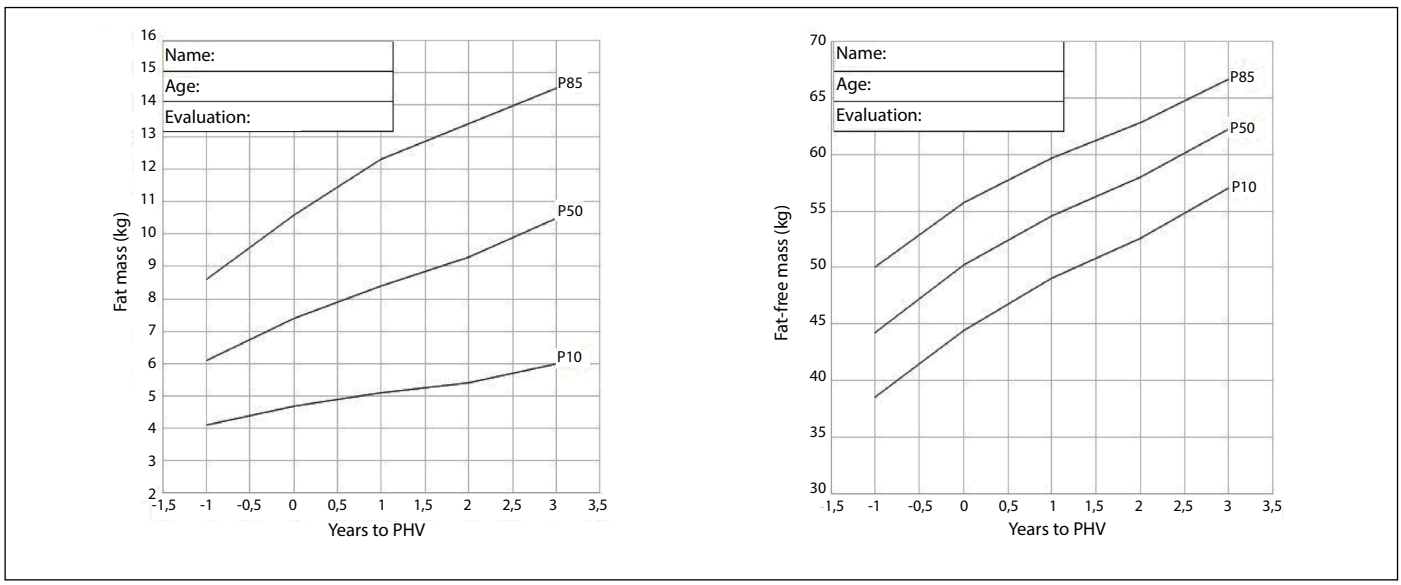

Figure 1. Curves of fat mass and fat-free mass of young soccer players by biological age (PHV age).

youth soccer. In this way, trainers could focus more on the sports performance of each athlete and less on body size.[24]

This percentile-based classification system can assist traditional classification, since it can help to reduce injuries[25] and improve the issue of classification of youths by strength and body composition characteristics, even though there is no universal classification system that guarantees equitable participation of young sportspeople in general.

All the references, whether national or international, are subject to biases,[26] however, it is useful in identifying the characteristics of acceleration, normality and/or delay of growth and body composition. For example, values between p15 and p85 could be related to normal maturation and the values at the extreme limits classified as early or late. Even so, there is a risk in applying the established limits critically,[27] because more studies need to be conducted in order to point out how to identify the cutoff points more accurately.

In general, the FM and FFM indicators are significant measures of the nutritional state.[28] This means that a higher level of fat-free mass should be interpreted as an important indicator of physical performance,[29] while a higher level of fat mass tends to influence the physical performance of athletes negatively.

Therefore, there is no doubt that both body compartments mentioned above must be analyzed by biological age. However, many times the athlete selection process, the analysis of their body composition, and monitoring over time may vary among clubs and may depend on the club policies, the level of information of the professionals and the sports policies of the federations.[24]

In summary, the potential of this study must be recognized. For example, it is the first study conducted in the South American sphere and the large size of the sample ensures its possible use, at least for Chilean soccer players, even though the technique used to estimate the PHV ages may include some bias for this sample of soccer players and the proposed percentiles may not be specific for other sociocultural realities and contexts.

We conclude that biological age as defined by PHV is a better predictor of FM and FFM than chronological age and the proposed reference can be used to monitor the body composition of young Chilean soccer players. The results suggest using it in clubs, selections and federations that deal with youth soccer. The calculations can be performed at http://www.reidebihu.net/body_composition_soccer.php.

All authors declare no potential conflict of interest related to this article

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REFERENCES

1. Deprez D, Coutts AJ, Fransen J, Deconinck F, Lenoir M, Vaeyens R, et al. Relative Age, Biological Maturation and Anaerobic Characteristics in Elite Youth Soccer Players. Int J Sports Med. 2013;34(10):897-903.
2. Malina RM, Bouchard C, Bar-Or O. Growth Maturation and Physical Activity. Champaign: Human Kinetics; 2004a.
3. Malina RM, Ribeiro B, Aroso J, Cumming SP. Characteristics of youth soccer players aged 13-15 years classified by skill level. Br J Sports Med. 2007;41(5):290–5.
4. Hirose N. Relationships among birth-month distribution, skeletal age and anthropometric characteristics in adolescent elite soccer players. J Sports Sci. 2009;27(11):1159–66.
5. Knechtle B, Wirth A, Knechtle P, Rosemann T, Rüst CA, Bescós R. A comparison of fat mass and skeletal muscle mass estimation in male ultra-endurance athletes using bioelectrical impedance analysis and different anthropometric methods. Nutr Hosp. 2011;26(6):1420-7.
6. Turnagöl H. Body Composition and Bone Mineral Density of Collegiate American Football Players. J Hum Kinet. 2016;(51):103-12.
7. Güllich A, Emrich E. Individualistic and collectivistic approach in athlete support programmes in the German highperformance sport system. European Journal for Sport and Society. 2012;9(4):243–68.
8. Oliver JM, Lambert BS, Martin SE, Green JS, Crouse SF. Predicting football players' dual-energy x-ray absorptiometry body composition using standard anthropometric Measures. J Athl Train. 2012;47(3):257-63.
9. Reilly T, Maughan RJ, Hardy L. Body fat consensus statement of the steering groups of the British Olympic Association. Sports Exerc Injury. 1996;2:46-9.
10. Ross WD, Marfell-Jones MJ. Kinanthropometry. In: MacDougall JD, Wenger HA, Geeny HJ (eds).
11. . Physiological Testing of Elite Athlete. London: Human Kinetics; 1991. pp 223– 308.
12. Mirwald RL, Baxter-Jones AD, Bailey DA, Beunen GP. An assessment of maturity from anthropometric measurements. Med Sci Sports Exerc. 2002;34(4):689–94.
13. Boileau RA, Lohman TG, Slaughter MH. Exercise and body composition in children and youth. Scan J Sports Sci. 1985;7:17-27.
14. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ. 2000;320 (7244):1240-3.
15. Perroni F, Vetrano M, Rainoldi A, Guidetti L, Baldari C. Relationship among explosive power, body fat, fat free mass and pubertal development in youth soccer players: a preliminary study. Sport Sci Health. 2014;10:67–73
16. Gómez-Campos R, Arruda M, Hobold E, Abella CP, Camargo C, Martínez Salazar C, et al. Assessment of biological maturation: Uses and applications in schools. Rev Andal Med Deporte. 2013;6(4):151-60.
17. Ré AHN, Bojikian LP, Teixeira PT, Bohme MTS. Relação entre crescimento, desempenho motor, maturação biológica e idade cronológica de jovens do sexo masculino. Rev Bras Educ Fís Esporte. 2005;19(2):153-62.
18. **Gómez-Campos R, Urra-Albornoz C, Andruske C, Almonacid-Fierro A, Pacheco-Carrillo J, Cossio--Bolaños MA. Equations to Predict Body Fat Percentage in Young Chilean Soccer Players. J Exerc Physiol. 2017;20(4):96-107.**
19. Urra C, Gutierrez M. Composición corporal de jóvenes futbolistas alineados por edad cronológica y biológica. Rev Peru Cienc Act Fis Deporte. 2016;3(1):293-8.
20. Malina MR, Eisenmann JC, Cumming SP, Ribeiro B, Baros J. Maturity associated variation in the growth and functional capacities of youth football (soccer) players 13–15 years. Eur J Appl Physiol. 2004b;91(5–6):555–62.
21. Vaeyens R, Malina RM, Janssens M, Van Renterghem R, Bourgois J, Vrijens J, et al. A multidisciplinary selection model for youth soccer: the Ghent Youth Soccer Project. Br J Sports Med. 2006;40(11):928–34.
22. Figueiredo AJ, Goncalves CE, Coelho E, Silva MJ, Malina MR. Youth soccer layers, 11–14 years: maturity, size, function, skill and goal orientation. Ann Hum Biol. 2009;36(1):60–73.
23. Lang PO, Trivalle C, Vogel T, Proust J, Papazian JP. Markers of metabolic and cardiovascular health in adults: Comparative analysis of DEXA-based body composition components and BMI categories. J Cardiol. 2015;65(1):42-9.
24. Donatelli R, Dimond D, Holland M. Sport-specific biomechanics of spinal injuries in the athlete (throwing athletes, rotational sports, and contact-collision sports). Clin Sports Med. 2012;31(3):381-96.
25. Kirkendall DT. The relative age effect has no influence on match outcome in youth soccer. J Sport Health Sci. 2014;3(4):273-8.
26. Caine DJ, Broekhoff J. Maturation assessment: a viable preventive measure against physical and psychological insult to the young athlete? Phys Sportsmed. 1987;15(3):67-80.
27. Campos RG, de Arruda M, Hespanhol JE, Camargo C, Briton RM, Cossio-Bolanos MA. Referencial values for the physical growth of school children and adolescents in Campinas, Brazil. Ann Hum Biol. 2015;42(1):62-9.
28. **Portella D, Arruda M, Gómez-Campos R, Checkin Portella G, Andruske C, Cossio-Bolaños MA. Physical Growth and Biological Maturation of Children and Adolescents: Proposed Reference Curves. Ann Nutr Metab. 2017;70(4):329–37.**
29. Lang PO, Trivalle C, Vogel T, Proust J, Papazian JP. Markers of metabolic and cardiovascular health in adults: Comparative analysis of DEXA-based body composition components and BMI categories. J Cardiol. 2015;65(1):42-9.
30. Malina R, Geithner C. Body Composition of Young Athletes. Am J Lifestyle Med. 2011;5(3):262-78.