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Life style and sports practice in peripubertal boys and girls on bone mineral density and body composition – preleminary study

(S) Estilo de vida y práctica deportiva en niños y niñas peripubertales sobre la densidad mineral de hueso y la composición del cuerpo: estudio preleminar

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Resumen

Introducción: Hay varios estudios publicados en los últimos veinte años que intentan establecer la relación entre las reacciones esqueléticas a diferentes cargas, en particular en los deportes de los jóvenes. ***Objetivos:*** The aim of this research is to study the impact of regular physical activity (basketball, soccer and swimming) on peri-puberal subjects by bone mineral density (BMD) and body composition. ***Métodos:*** Este es un estudio seccional, descriptivo y correlacional que incluye nadadores (n = 17 hembras y 10 varones), futbolistas (n = 13 hembras y 19 varones), jugadores de baloncesto (n = 14 hembras y 15 varones) y un grupo de control (n = 20 mujeres y 12 hombres) en un total de 120 sujetos. Se aplicó un cuestionario sobre actividad física e ingesta de alimentos y estatura, masa corporal y circunferencia abdominal. La DMO se evaluó mediante ultrasonido cuantitativo del calcáneo. La prueba de Kruskal-Wallis se utilizó para estudiar el efecto de los deportes en las variables de estudio. ***Resultados y discusión:*** La DMO para el grupo de control es más baja que para todos los demás grupos para ambos sexos (nadadores (f: 0.521; m: 0.533), fútbol (f: 0.634; m: 0.639), baloncesto (f: 0.688; m: 0.657), Grupo de control (f: 0.462; m: 0.472). Los jugadores de baloncesto tienen los valores más altos de BMD para ambos sexos, seguidos por los jugadores de fútbol y los nadadores. La prueba de Kruskal-Wallis muestra que hay efectos de los deportes por encima de la BMD [X^2 (3)=82.796; p<0.001]. ***Conclusiones:*** La actividad física regular en sujetos peripúberes promueve un aumento en la DMO, los deportes de confrontación son los que tienen valores más altos en el esqueleto para ambos sexos.

Palabras clave: Actividad física; composición corporal; osteoporosis; reabsorción ósea; remodelación ósea

Abstract

Introduction: There are several studies published in the last twenty years that try to stablish the relationship between skeleton reactions to different loads particular in sports youth.

Aim: The aim of this research is to study the impact of regular physical activity (basketball, soccer and swimming) on peri-puberal subjects by bone mineral density (BMD) and body composition.

Methods: This is sectional, descriptive and correlational study involving swimmers (n=17 females and 10 males), soccer players (n=13 females and 19 males), basketball players (n=14 females and 15 males) and a control group (n=20 females and 12 males) in a total of 120 subjects. A questionnaire on physical activity and food intake was applied and stature, body mass and abdominal girth. BMD was assessed using quantitative ultrasound of the calcaneus. Kruskal-Wallis test was used to study the effect of sports in the study variables.

Results & discussion: BMD for the control group is lower than for all other groups for both genders, (Swimmers (f: 0.521; m: 0.533), Soccer (f: 0.634; m: 0.639), Basketball (f: 0.688; m: 0.657), Control Group (f: 0.462; m: 0.472). Basketball players have the higher values for BMD for both genders followed by soccer players and swimmers. The Kruskal-Wallis test show there is effect of sports above the BMD [X^2 (3)=82.796; p<0.001].

Conclusions: Regular physical activity on peripubertal subjects promotes increase on BMD, the confrontation sports are the ones that have higher values on the skeleton is for both sexes.

Keywords: Physical activity; body composition; osteoporosis; bone reabsorption; bone remodeling

Tipe: Essay

Section: Sports science

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(P) Estilo de vida e prática esportiva em crianças e adolescentes, peripubertales sobre a densidade mineral de hueso e composição do cuerpo: estudio preleminar

Resumo

Introdução: Existem vários estudos publicados nos últimos vinte anos que tentam estabelecer a relação entre as reações do esqueleto para diferentes cargas específicas em jovens desportistas ***Objectivos:*** O objetivo desta pesquisa é estudar o impacto da atividade física regular (basquetebol, futebol e natação) em sujeitos peri-puberais através da densidade mineral óssea (DMO) e composição corporal.***Métodos:*** Trata-se de um estudo seccional, descritivo e correlacional envolvendo nadadores (n = 17 mulheres e 10 homens), jogadores de futebol (n = 13 mulheres e 19 homens), jogadores de basquetebol (n = 14 e 15 homens) e grupo controle (n = 20 fêmeas e 12 machos) num total de 120 indivíduos. Foi aplicado um questionário sobre a atividade física e ingestão alimentar e estatura, massa corporal e circunferência abdominal. A DMO foi avaliada usando ultrassonografia quantitativa do calcâneo. O teste de Kruskal-Wallis foi utilizado para estudar o efeito do esporte nas variáveis do estudo. ***Resultados e discussão:*** A DMO para o grupo controle é menor do que para todos os outros grupos para ambos os sexos, (Nadadores (f: 0,521; m: 0,533), Futebol (f: 0,634; m: 0,639), Basquetebol (f: 0,688; m: 0,657) Grupo Controle (f: 0,462; m: 0,472) Os jogadores de basquete têm os maiores valores de DMO para ambos os sexos, seguidos por jogadores de futebol e nadadores, e o teste de Kruskal-Wallis mostra que há esportes acima da DMO [X^2 (3)=82.796; p<0.001]. ***Conclusões:*** A atividade física regular em sujeitos peripubertais promove aumento na DMO, os esportes de confronto são os que apresentam maiores valores no esqueleto para ambos os sexos.

Palavras-chave: Atividade física; composição do corpo; osteoporose; reabsorção óssea; remodelação óssea

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I. Introduction / Introducción

There are several studies published in the last twenty years that try to stablish the relationship between skeleton reactions to diferent loads particular in sports youth (Chilibeck, Sale & Webber, 1995; American Academy of Pediatrics, 2001; Guy & Micheli, 2001; Gracia-Marco, Moreno LA, Ortega FB, *et al.*, 2011; Vlachopoulos *et al*., 2017).

The benefits of physical activity are known and the adaptations associated with the stimuli of the same in the morphology of the individuals, with different responses in the different stages of life, associated with other factors, such as the hormonal and alimentary, can help us to understand the different responses to the practice of physical activity, preventing the reduction of bone loss (Warden & Fuchs, 2018; Rusley, Cueto & Donaldson, 2018).

Bone mineral density (BMD) loss as we age is aggravated when bone skeletons in the first decades of life are not stimulated enough to promote gains in bone remodeling and remodeling mechanisms capable of preparing the increased risk of fractures associated with the turn of half a century of life and consequent impact on public health (Tan, Macdonald, Kim, *et al.* (2014).

The purpose of this study is to know the impact of regular and prolonged sports activity (basketball, soccer, swimming, control group) in peripubertal in the values of bone mineral density (BMD) and body composition.

I.1.Aims / Objetivos:

The aim of this research is to study the impact of regular physical activity (basketball, soccer and swimming) on peri-puberal subjects by bone mineral density (BMD) and body composition.

II. Methods / Material y métodos

This is a cross-sectional study, descriptive and correlational involving swimmers (n=17 females and 10 males), soccer players (n=13 females and 19 males), basketball players (n=14 females and 15 males) and a control group (n=20 females and 12 males) in a total of 112 subjects. A questionnaire on physical activity and food intake was applied and stature, body mass and abdominal girth. BMD was assessed using quantitative ultrasound of the calcaneus (QUS), the instrument used was the Sahara Hologic Bone Densitometer. Later, an International Lifestyles Questionnaire was delivered to the entire sample, as well as the acquisition of anthropometric data through a Tanita CS601 digital scale that provided various values such as weight, height, body mass index, percentage of lean mass and weight of muscle mass. Regarding the descriptive statistics, data was analyzed in the form of tables and graphs, done through the

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software Statistical Package for the Social Sciences (SPSS), such as descriptive statistics, mean, standard deviation and some correlational tests, namely Kruskall Wallis. A p-values < 0,05 was considered statistically significant. SPSS version 20 was used for statistical analyses.

III. Results / Resultados

The sample characterization involving the 120 participants from all groups is presented in Table 1 represents information about age and body composition variables, and sports activity information is also included according sex. The BMI values for both sexes differs by only one tenth. The values of BMD are very close.

In the Table 2 the sample is presented by sport modality groups separed by sex considering information about age and body composition variables.

The anthropometric variables in both sexes present higher values in the basketball players comparing with the other modalities, only the control group have slight increase in the BMI. On the other hand the control group presents considerably poorer BMD values when compared with the other groups.

Not being a normal distribution we had to adopt by non-parametric tests know the efect of sports. The Kruskal-wallis test show there is efecte of sports above the BMD [X^2 (3)=82.796; p<0.001], Qui_STIFF [X^2 (3)=77.126; p<0.001] and Waste [X^2 (3)=8.299; p<0.05].

In the Graphs bellow is represented the box plot for each variable whom p<.05, is possible to observe the differences for the subgroup of sports in the BMD, BMI and Qui_STIFF varibles.

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Table 1 - Descriptive characteristics of the sample (mean ± standard deviation, percentages by subgroup) according sex, age, BMI, BMD, QUI STIFF and sports modality percentage.

Variables	**n**	**Mean ± SD/Percentage**			
	120	**Female (n=64)**		**Male (n=56)**	
		53.3%		46,7%	
Weight (kg)		56.9	± 11.58	61.8	± 13.81
Heigth (m)		162.1	± 8.35	168.96	± 9.76
Waist Circunference (cm)		69.8	± 7.59	72.71	± 9.76
BMI (kg/m^2)		21.5	± 3.49	21.4	± 3.46
BMD (g/cm^2)		0.562	± 0.112	0.589	± 0.962
QUI STIFF		101.2	± 18.66	72.71	± 9.76
Age (years)		15.25	± 1.50	15.16	± 17.72
Sport Modality	**n**			**%**	
Swimmers	27		26.6%		17.9%
Soccer	32		20.3%		33.9%
Basketball	29		21.9%		26.8%
Control Group	12		31.2%		21.4%

Table 2 - Descriptive characteristics (M ± SD) for the total sample (n=112) by sex, for extern morphology and bone mass density variables by subgroup sports modality.

		Swimmers (F:17;M:10)		Soccer (F:13;M:19)		Baskteball (F:14;M:15)		Control Group (F:20;M:12)	
	Sex	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Weight (kg)	F	53.16	9.36	54.18	10.59	60.08	12.65	59.60	12.56
	M	60.20	15.34	60.24	9.789	66.54	16.18	59.63	15.14
Heigth (m)	F	161.07	8.83	159.34	5.09	164.20	9.64	163.36	8.62
	M	163.9	12.48	169.98	7.89	170.44	9.94	169.67	9.64
Waist circunference (cm)	F	68.18	4.82	66.01	8.46	72.51	6.64	71.94	8.58
	M	73.52	7.26	70.86	4.85	75.52	7.93	71.45	9.11
BMI (kg/m^2)	F	20.34	2.06	21.29	3.75	22.08	3.05	22.28	4.40
	M	22.00	3.15	20.74	2.20	22.73	4.68	20.45	3.39
BMD (g/cm^2)	F	0.521	0.045	0.634	0.065	0.688	0.111	0.462	0.044
	M	0.533	0.072	0.639	0.044	0.657	0.078	0.472	0.048
QUI STIFF	F	94.50	7.24	112.38	10.39	122.12	20.13	85.25	7.00
	M	96.47	11.48	113.24	6.97	110.71	24.05	86.70	7.71
Age (years)	F	14.71	1.75	15.46	1.05	15.93	1.54	15.10	1.373
	M	14.60	1.43	15.32	1.21	15.07	1.71	15.50	1.732

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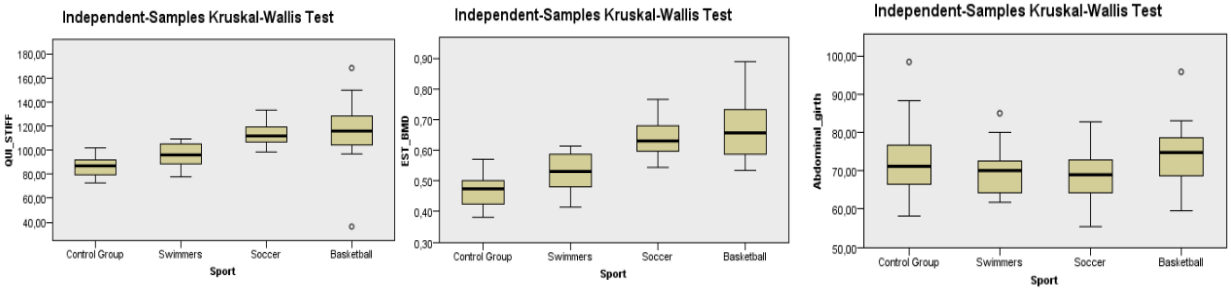
Table 3 - Kruskal-wallis test for the total sample (n=112) by sex, for extern morfology and bone mass density variables by subgrupo sports modality.

	Weight (kg)	Heigth (m)	Waist circunference (cm)	BMI (kg/m^2)	BMD (g/cm^2)	QUI STIFF	Age (years)
Chi-Square	4.279	3.342	8.299	3.960	82.79	77.126	4.074
df	3						
Asymp. Sig.	.233	.342	.040	.266	.000	.000	0.253



IV. Discussion / Discusión

In a study with a sample of 821 subjects, including children (n = 217), adults (n = 235) and the elderly (n = 369), Magkos, Magios, Babaroutsi, Manios and Sidossis (2004) concluded that age, height and diet variables affect the quantitative ultrasound indices of the calcaneus. These values were higher in adults, in overweight and obese individuals, as well as in those who practice physical activity.

According to Saadi, Reed, Carter, Dunn, Qazaq and Al-Suhaili (2003), in a study with a random sample of about 183 families with only females included, the QUS parameters are influenced by anthropometric, reproductive and lifestyle factors. This information was also confirmed by the present study, especially when the Kruskall Wallis test was performed, where it was verified that the practice of physical activity and the waist circumference influence BMD. Additionally, BMI is also a good indicator, considering that includes weight and height that are related to lifestyle and diet.

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The most relevant finding of this study was the similarity related to bone mass between active peripubertal in different sports activities have higher BMD for both sexes then the control group. The basketball subgroup present higher values overall, with a with a slight advance on the girls, with the possibility of being explained by the maturational advance (Malina, Bouchard & Oded Bar-Or, 2004). If we consider the height they are around to the Portuguese national median (163cm), while boys are still below the national average for men (172,9 cm) because had not reached Peak Height Velocity and therefore, it can be said that the bone mass (density and mineral content) will increase further more (at the moment lower than girls) (Greene, Courteix, & Baxter-Jones, 2017). Size and quantity of bone tissue are strongly affected by biological maturation that causes hypertrophy and hyperplasia in different human tissues (Rizzoli, Bonjour, & Ferrari, 2001; Loud & Gordon, 2006).

Several research demonstrated that high-impact sports in early life can be a beneficial factor for bone growth (directly or mediated by muscle levers), boosting natural development, and improving bone health in adulthood (Barbieri & Zaccagni, 2013; Tan, Macdonald, Kim, Nettlefold, Gabel, Ashe, *et al.*, 2014; Goolsby, & Boniquit, 2016).

Although this finding the biological explanation to support then are few (Ducher, Courteix, Meme et al, 2005), adults engaged in sports from early life have increased osteocalcin production and vascularization of bone tissue when compared to adults that were sedentary.

The limitations of this study should be recognized. The cross-sectional design does not allow to conclude if peripubertal whom have sport practice had higher bone mass than the control group ones prior to their engagement in sports. Finally, the bone geometry should be considered in future studies.

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V. Conclusions / Conclusiones

In summary, peripubertal engaged in high-impact sports presented higher bone mass then those who are sedentary. Efforts should be made to encourage modification of all risk factors for osteoporosis early on life such as government policies to promote the sports practice.

VI. Acknowledgements / Agradecimientos

VII. Conflict of interests / Conflicto de intereses

The autor claim there are no conflicto of interests

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