Journal of Sport and Health Research 2019, 11(1):91-106

Carvalho, A.S.; Fernandes, A.P.; Gallego, A.B.; Vaz, J.A.; Vega, M.S. (2019). The relation of sports with sleep quality and anthropometric measures at secondary schools. *Journal of Sport and Health Research. 11*(1):91-106.

Original

LA RELACIÓN DE LOS DEPORTES CON LA CALIDAD DEL SUEÑO Y LAS MEDIDAS ANTROPOMÉTRICAS EN LAS ESCUELAS SECUNDARIAS

THE RELATION OF SPORTS WITH SLEEP QUALITY AND ANTHROPOMETRIC MEASURES AT SECONDARY SCHOOLS

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Edited by: D.A.A. Scientific Section Martos (Spain)

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Received: 23/05/2018
Accepted:16/06/2018

Journal of Sport and Health Research 2019, 11(1):91-106

RESUMEN

El objetivo de este estudio es evaluar la relación de la práctica deportiva con la calidad del sueño y los hábitos nutricionales de los adolescentes y su implicación en el peso y forma corporal. Se llevó a cabo el estudio en una población de 345 estudiantes de la enseñanza Secundaria del Ayuntamiento de Bragança, Portugal. Los datos se recopilaron en mayo de 2017 a través de un cuestionario que incluía el Índice de Calidad del sueño de Pittsburgh (PSQI) y un cuestionario auto informado sobre los hábitos nutricionales y la práctica de actividad física extra-curricular, su tipología, su frecuencia y duración en adolescentes. La evaluación antropométrica y la composición se realizaron con una báscula de escala electrónica, con métodos de bioimpedancia eléctrica bipolar. Se procedió a la validación del percentil/ IMC (WHO, 2007). Se verificó que el 58% de los adolescentes en estudio practicaba deporte fuera de la actividad escolar. La mayoría de los adolescentes, el 75,1%, presentaban percentil normoponderado, el 14,5% pre-obesidad y el 5,5% obesidad, siendo que el 36,0% presentaba grasa corporal por encima de lo sano. En cuanto a la evaluación de la calidad del sueño, se llegó a la conclusión de que el 39,71% de los participantes mostró pobre calidad de sueño (PSQI > 5 puntos). Se constató que el percentil de IMC y el porcentaje de grasa corporal estaban significativamente asociados al hecho de que los adolescentes practican deporte y la calidad del sueño, verificándose que la práctica deportiva y la buena calidad del sueño son factores positivos en la obtención del percentil y de la masa grasa normoponderales. Se observó también que el número de hábitos diarios correctos es superior en los alumnos que practican actividad deportiva extra-curricular, en los alumnos con percentil sano y/o grasa corporal adecuada. Estos resultados muestran la importancia de fomentar la actividad física, las opciones nutricionales saludables y también la calidad del sueño en la niñez y adolescencia, con el objetivo de maximizar un ambiente promotor de salud y mejorar el nivel de salud actual y en la edad adulta.

Palabras clave: Calidad del Sueño, Actividad física, Medidas Antropométricas, Hábitos Nutricionales, Adolescentes, Salud

ABSTRACT

The objective of this study is to assess the relationship between sports practice, sleep quality and eating habits of adolescents and its implication in weight and body composition. The study was carried out in a population of 345 high school students of the county of Bragança, Portugal. The data was collected in May 2017 through a questionnaire that included the Pittsburgh Sleep Quality Index (PSQI), and a self-report questionnaire about food habits and practice of extracurricular physical activity, regarding its typology, frequency and duration in adolescents. The anthropometric and composition evaluation was performed using an electronic scale and using a bipolar electric bioimpedance method (Tanita BC-545®). The equivalent percentile was validated using the percentile / IMC tables (WHO, 2007). The results showed that 58% of the adolescents were practising sports outside school activities. The majority of adolescents, 75.1%, had a normoponderal percentile, 14.5% preobesity and 5.5% obesity. 36.0% of the students showed body weight above healthy. Regarding the quality of sleep, it was concluded that 39.71% of the participants showed poor quality of sleep (PSQI >5 points). The BMI percentile and body fat percentage were significantly correlated with sports practice and quality of sleep, which shows that both factors are positive factors to obtain percentile of BMI and normoponderal fat mass. It was also observed that the number of healthy daily habits is higher in students who practice extra-curricular sports, in students with a healthy percentile and / or adequate body fat. The results showed the importance of promoting physical activity, healthy eating choices and also sleep quality in childhood and adolescence. The maintenance of a healthy environment can be crucial not only to improve their actual lifestyles but also their future adult life.

Keywords: Sleep quality, Physical activity, Anthropometric measures, Eating habits, Adolescents, Health.

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INTRODUCTION

Among the main changes in the behaviour patterns of today's society, an increase in sedentary levels and hyper caloric diets can be seen (Crespo, 2001; DGS 2016). The global decline in physical activity levels has become a major 21st century public health problem (Blair, 2009; Ding et al., 2016). Insufficient physical activity is one of the leading risk factors of death worldwide and it is also a key risk factor for non-communicable diseases such as cardiovascular diseases, cancer and diabetes (WHO, 2016).

Globally, 1 in 4 adults is not active enough, and more than 80% of the world's adolescent population is insufficiently physically active (WHO, 2016). Although children are intrinsically active, studies have shown that the infant population of contemporary societies presents low levels of participation in regular physical activity (Baptista et al., 2012).

The positive energy balance, excessive calorie consumption and low energy expenditure has contributed alarmingly to an increase in overweight and obesity rates in the world population, with a particular focus on young children (De Onis, Onyango, Borghi, Siyam, Nishida, & Siekmann, 2007; Lakshman, Elks, & Ong, 2012; Herman, Sabiston, Mathieu, Tremblay, & Paradis, 2015; Kowaleski-Jones & Wen, 2013).

Identifying the main causes of this epidemic evidence is complex, however it is consensual that low levels of physical activity, combined with hyper caloric diets are considered the main factors that lead to altered body composition in children and young people. It is also appropriate to analyse the impact of sleep quality on this phenomenon. Teenagers may have a particularly high-risk for weight gain due to an increase independence in dietary choices, a decrease in physical activity and also a decrease in sleep duration (Dumith et al., 2011; Van Dyk, Krietsch, Saelens, Whitacre, McAlister, & Beebe, 2018).

Poor sleep quality is associated with increased food intake and poor diet quality. Sleep influences on eating habits and consequently on the energy balance and body weight regulation. People with lack of sleep show a positive correlation between free time and food intake and also experience hormonal and brain changes that drive the intake of food with a high calorific value (Chaput, 2014; Dewald, Meijer, Oort, Kerkhof, & Bogels, 2010; Hart et al., 2013; McNeil, Doucet, & Chaput, 2013; Paiva, 2008; Quist, Sjödin, Chaput, & Hjorth, 2016). In addition, scientific research has shown a healthy and balanced diet to positively influence the quality of sleep (McNeil, Doucet, & Chaput, 2013).

Despite controversial results, recent investigations provide conclusions regarding the relationship between sleep duration and physical activity in teenagers and suggests that when short-sleeping teens sleep longer, they engage in less sedentary activities (Van Dyk et al., 2018).

Furthermore, it is essential to increase the practice of exercise and to decrease the sedentary lifestyle. It is fundamental to develop concerted actions, promoting the practice of physical activity, but also its connection with standard diets and sleep quality should be included as an essential part of community empowerment for health-promoting lifestyles (Chaput, 2014; Cuervo, Cachón, González, & Zagalaz, 2017, DGS, 2016; DGS, 2015; López, Nicolás, & Díaz, 2016; Muros, Cofre-Bolados, Salvador-Pérez, Castro-Sánchez, Valdivia-Moral, & Pérez-Cortés, 2016; Rebelo-Pinto, Pinto, Rebelo-Pinto, & Paiva, 2014; WHO, 2010).

One of the main goals of this research is to assess the relationship between exercising and sleep quality and eating habits of teenagers and its implication in weight and body composition. This would help to create a concrete and accessible instrument that work teams within school health could use to coordinate interventions to promote healthy behaviours in children and young people.

METHODS

The study used non-experimental, analytical and transversal methodology, of epidemiological character and with a quantitative approach.

Participants

It was intended to carry out the study in a population of 862 high school students. However, due to consent being required from both legal guardians and students, a smaller sample of 345 students was obtained.

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Of the 345 participants, 59.1% (204) were females and 40.9% (141) were males. Regarding age, it was observed that the mean value was identical between girls and boys, as well as the dispersion values.

Table 1. Characterization of age by gender

Gender	n	%	Min	Max	Mean	Standard desviation
Female	204	59.1%	15	20	16.63	1.10
Male	141	40.9%	15	20	16.74	1.06
Total	345	100%	15	20	16.68	1.08

Regarding the place of residence, 83.2% (287) of the students surveyed lived in urban areas and 16.8% (58) in rural areas. Considering the type of education, 89.9% (310) of the students attended regular education and the remaining 10.1% (35) attended professional/vocational education. As for the school year, 29.9% (103) of the respondents attended the 10th grade, 42.6% (147) the 11th grade and 27.5% (95) were in the 12th grade.

Instruments

To collect data, a questionnaire consisting of four parts was used: sociodemographic data, lifestyle and clinical data, academic data and finally the characterization of sleep and assess of sleep quality.

The questionnaire included a self-report questionnaire about teenagers' food habits, consisting of 13 questions addressing the daily food habits of students, with a likert-scale response (never, rarely, 1 time per week, 4-6 times per week, every day). The main target were the most important aspects of the teenagers eating patterns (DGS, 2016; Graça & Gregório, 2015), focusing not only on the number of meals/day, the consumption of vegetables, fruit and water, but also the consumption of sugary products, snacks, fast-food and ready meals. Based on the 13 food pattern answers and on what is considered a good eating habit in each behaviour, a variable was defined attempting to count the number of good eating habits of each respondent. The number of good habits can range from zero to thirteen.

For the evaluation of physical activity, a self-report questionnaire was also used to determine the practice of extracurricular physical activity, its typology, frequency and duration (Instituto Nacional de Estatística, 2016).

The quality of sleep was assessed using the Pittsburgh Sleep Quality Index (PSQI), validated for the Portuguese population by Ramalho (2008). The PSQI, an instrument created by Buysse, Reynolds, Monk, Berman and Kupfer (1989), is a self-rated questionnaire which assesses sleep quality and disturbances over a 1-month time interval. Nineteen individual items generating seven component scores: sleep quality sleep, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The sum of scores for these seven components yields one overall score - the total of sleep quality. The final quote is done by assigning a score on a 3-point scale to each of the subscales, and the higher the result, the worse the quality of sleep, to a maximum of 21 points. A score above 5 is considered poor sleep quality (Buysse et al., 1989).

A pre-test of the data collection instrument was performed before its application. This was carried out in February 2017 in a sample with similar characteristics to the target population.

Procedure

The research "Evaluation of the Quality of Sleep in secondary school students in Bragança county" is part of the PhD programme of the author, aiming a detailed knowledge regarding quality of sleep in secondary school students of the county. It is also aimed to assess the relationship between exercising and sleep quality and eating habits of adolescents and its implication in weight and body composition.

The study includes students who attend secondary education in the county of Bragança, located in the northeast of Portugal. The population includes a total of 862 individuals (Parque Escolar data, 2016_2017), integrated into the regular and professional education of the three School Groups of the county. All students and their legal guardians were contacted in person or by letter. The research methodology was explained to them and their informed consent to participate in the study was obtained.

To be a school student in the county of Bragança who agrees to informed and voluntary participate in the study was the criteria to be part of this research. A final sample of 345 students was obtained, with the informed consent of the students and their legal guardians. An overall sampling error of 4.5%, with a

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representative sample of 36% of the population can be seen in the sample under study.

Data collection was carried out between May 15 to May 31, 2017, in the three high schools of Bragança county. After correct explanation by the investigator, the questionnaire was performed face-to-face, with individual completion on an average time of 30 minutes.

At the same time, an anthropometric evaluation and body composition evaluation were performed by bioimpedance by a team of three trained health professionals, uniformed and supervised by the researcher. All subjects were evaluated in the morning, barefoot and only with the indispensable clothing. For stature evaluation, a SECA® stationary stadiometer (Seca-217®, Hamburg, Germany) was used to validate the mean value of two measurements, with an accuracy of 1mm (INSA, DGS, 2010). A 100 g precision electronic scale was used for to assess weight and body composition (percentage of fat mass) using a bipolar electric bioimpedance method (Tanita InnerScan Body Composition Monitor® model BC-545®, precision 0.1%, Netherlands). The BMI (Body Mass Index (kg) / height2 (m)) and the validation of the equivalent percentile were calculated using the percentile / BMI tables taking into consideration that the population had, in average, less than 19 years, (WHO, 2007, DGS 2013). Subpopulations were then classified as low-weight (<percentile 15) normoponderal (percentile> = 15 and <85), pre-obesity (percentil >= 85 e < 97) or obesity (percentil >=97), according to WHO classification (2007). Regarding body fat, the percentage of fat mass recorded on the scale was considered as being below, above or within healthy range, according to Healthy Body Fat Rangers for Children, Tanita (Jebb, McCarthy, Fry & Prentice, 2004).

The anonymity and confidentiality of the students were respected by questionnaire coding and ethical rigor in the collection and processing of data.

Subsequently the data was analyzed by statistical software - SPSS for Windows, version 21.0

Statiscal analysis

Statistical analysis of the data related to the study was carried out using the software Statistical Package for the Social Sciences - SPSS for Windows, version 21.0.

In order to describe and characterize the study sample, a data descriptive analysis was performed according to the nature of the variables under study. Statistical measures were used: absolute frequencies, relative frequencies, mean, standard deviation, median, interquartile range, bar graphs and end and Boxplot. The statistical analysis of the results was performed through cross-tables of variables with the application of the chi-square test in order to evaluate the independence of the variables. When the conditions for the application of the chi-square test independence (sample greater than 20 elements, expected frequency greater than 1 and 80% of expected frequency greater than 5) were not present the exact test of Fisher was used. Subsequently, for situations of significant association between variables, the *odds ratio* and respective intervals were calculated in order to specify, regarding the independent variables, the teenagers with the highest probability of anthropometric worse results. A parametric test was also used to compare independent groups regarding the number of correct eating habits per day.

A level of statistical significance was assumed at $p < 0.05$.

Ethical considerations

Permission to conduct the study was obtained by the National Data Protection Commission (authorization no. 2164/2017) and by the General Direction of Education, Ministry of Education (request no. 0567300001) who found that all procedures and ethical considerations were taken in the research There was also a positive assessment by the Ethics Committee of the Local Health Unit of the Northeast and approval by the boards of Bragança School Groups. Furthermore, it was ensured that all researchers involved in the project rigorously followed the ethical considerations associated with the data collection, processing and analysis

RESULTS

An initial descriptive analysis was performed to acknowledge the participants' extracurricular physical activity practice, their food patters and their sleep quality.

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As seen in table II, the majority of participants, 58% (200) exercise outside of school activity, with more expressive physical activity in males, with 63.1% of boys and 54.4% of the girls assuming they had an extra-curricular sports practice habit. The frequency of the most common sports activity was 2/3 times a week, with 36% (72) of the students under these circumstances. Regarding the duration of the practice session, it was observed that the majority of the boys, 69.7% (62), exercise over 60 minutes, while 37.8% (42) of the girls also claimed to practice more than 60 minutes and 33.3% (37) stating that the practice session lasted between 40 and 60 minutes. Most students were not federated athletes, regardless their gender. It was concluded by applying the chi-square test, that at a significance level of 5%, the practice of sports and the frequency of practice was statistically independent of the student gender. On the other hand, it was concluded, at a significance level of 5%, that the duration of the practice session was statistically associated with the gender of the interviewed student.

Table 2. Characterization of sports according to gender

Variables		Gender		Total
		Female N (%row) %column	Male N (%row) %column	N (%row) %column
Play sports	Yes	111(55.5%) 54.4%	89(44.5%) 63.1%	200(100%) 58.0%
	No	93(64.1%) 45.6%	52(35.9%) 36.9%	145(100%) 42.0%
	Total	204(59.1%) 100%	141(40.9%) 100%	345(100%) 100%
Frequency of sport	Daily	15(50.0%) 13.5%	15(50.0%) 16.9%	30(100%) 15.0%
	More than 3 times week	35(59.3%) 31.5%	24(40.7%) 27.0%	59(100%) 29.5%
	2-3 times week	37(51.4%) 33.3%	35(48.6%) 39.3%	72(100%) 36.0%
	Weekly	18(54.5%) 16.2%	15(45.5%) 16.9%	33(100%) 16.5%
	Sporadically	6(100%) 5.4%	0(0.0%) 0.0%	6(100%) 3.0%
	Total	111(55.5%) 100%	89(44.5%) 100%	200(100%) 100%
Duration of the session of sports	< 20m	6(85.7%) 5.4%	1(14.3%) 1.1%	7(100%) 3.5%
	20-40m	26(66.7%) 23.4%	13(33.3%) 14.6%	39(100%) 19.5%
	40-60m	37(74.0%) 33.3%	13(26.0%) 14.6%	50(100%) 25.0%
	> 60m	42(40.4%) 37.8%	62(59.6%) 69.7%	104(100%) 52.0%
	Total	111(55.5%) 100%	89(44.5%) 100%	200(100%) 100%
É atleta federado	Sim	29(50.0%) 26.1%	29(50.0%) 32.6%	58(100%) 29.0%
	Não	82(57.7%) 73.9%	60(42.3%) 67.4%	142(100%) 71.0%
	Total	111(55.5%) 100%	89(44.5%) 100%	200(100%) 100%

The practice of sport is statistically independent of gender: X^2=2.595; p=0.121.
The frequency of the practice of sport is statistically independent of gender: X^2=6.103; p=0.188.
The duration of the practice of sport is statistically dependent on gender: X^2=20.949; p=0.000.
Federated is statistically independent of athlete sex: X^2=1.003; p=0.349.

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From the graph of Figure 1, it can be concluded that boys practiced essentially team sports (soccer, basketball, handball, volleyball) and gym. In the case of girls walking, gym and dance were the activities of choice.

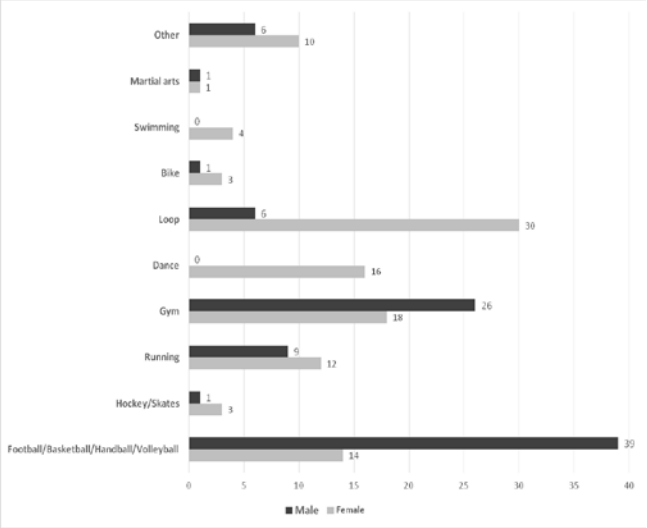

Figure 1. Sports practiced by gender

Regarding the adolescent eating pattern, the mean value of 7.33 correct eating habits per day was obtained, with a standard deviation of 2,647 from a minimum of 0 and a maximum of 13 correct eating behaviours. It can be seen in table III that girls present mean and median results of higher eating habits and lower dispersion (7.56 ± 2.608 and 8 ± 3) compared to boys (7.00 ± 2.678 and 7 ± 4. By the application of the t test it was concluded that the observed differences are not statistically significant (t = 1,935; p = 0.054).

Table 3. Number of correct eating habits by gender

	Female	**Male**	***t*- test statistics** (p value)
Mean (Std. Deviation)	7.56 (2.608)	7.00 (2.678)	1.935 (0.054)
Median (interquartile range)	8.00 (3.00)	7.00 (4.00)	

In the boxplot of figure 2 the distribution of correct eating habits of the students according to gender can be seen. It was observed that the results obtained by girls present a higher concentration between the first and third quartile than the results of boys. The mean values are statistically close between females and males; however, it was concluded that girls obtained less disparate results between them.

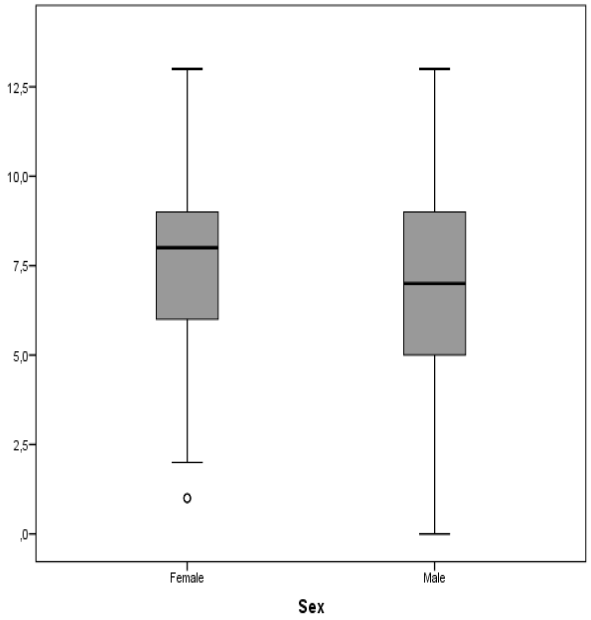

Figure 2. Boxplot - correct eating habits versus gender

Regarding the results of the anthropometric measurements and body composition (percentile, metabolic age and body fat), was observed in table IV that in the study sample the majority of adolescents, 75.1% (259), had a normoponderal percentile. On the other hand, 14.5% (50) of the students were pre-obese, 26 girls and 24 boys. Obesity was presented in 5.5% (19) of the students, 13 girls and 6 boys. Regarding metabolic age (recorded for students with at least 18 years of age, 75 records), 46.5% (35) of the students showed results above healthy, 21 girls and 14 boys. As for body fat, it was observed that 36.0% (124) of the adolescents in the study were above healthy, 77 girls and 47 boys. It was concluded that the percentile, metabolic age and body fat were statistically independent of gender.

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Table 4. Characterization of anthropometric measurements and body composition by gender

Variables		Gender		Total
		Female N (%row) %column	Male N (%row) %column	N (%row) %column
Percentile	Low	10(58.8%) 4.9%	7(41.2%) 5.0%	17(100%) 4.9%
	Normal	155(59.8%) 76.0%	104(40.2%) 73.8%	259(100%) 75.1%
	Preobesity	26(52.0%) 12.7%	24(48.0%) 17.0%	50(100%) 14.5%
	Obesity	13(68.4%) 6.4%	6(31.6%) 4.3%	19(100%) 5.5%
	Total	204(59.1%) 100%	141(40.9%) 100%	345(100%) 100%
Metabolic age (age≥18)	Normal	22(55.0%) 51.2%	18(45.0%) 56.3%	40(100%) 53.3%
	Above normal	21(60.0%) 48.8%	14(40.0%) 43.8%	35(100%) 46.7%
	Total	43(57.3%) 100%	32(42.7%) 100%	75(100%) 100%
Body fat	Below normal	2(66.7%) 1.0%	1(33.3%) 0.7%	3(100%) 0.9%
	Normal	124(57.1%) 61.1%	93(42.9%) 66.0%	217(100%) 63.1%
	Above normal	77(62.1%) 37.9%	47(37.9%) 33.3%	124(100%) 36.0%
	Total	203(59.0%) 100%	141(41.0%) 100%	3444(100%) 100%

The Percentile is statistically independent of sex: X^2=1.786; p=0.625.
The metabolic age is statistically independent of sex: X^2=0.191; p=0.815.
Body fat is statistically independent of gender:X^2=0.973; p=0.698.

It was also concluded through the sum of the components of the PSQI, that 39.71% (n = 137) of participants showed poor quality of sleep (PSQI> 5 points).

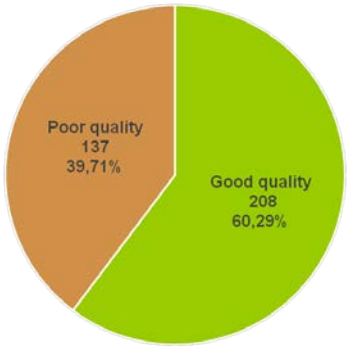

Figure 3. Participants sleep quality (PSQI)

Subsequently we proceeded to cross the variables of sports practice, sleep quality, percentile and body composition (% of fat mass) of teenagers. It was found that the percentile was significantly associated with the practice of sports (X^2 = 5.767, p = 0.016) and also with sleep quality (X^2 = 5.453, p = 0.020). It was concluded that the risk of pre-obesity / obesity is about 1,918 times higher in adolescents who do not practice sports compared to those who practice. It was also concluded that the risk of pre-obesity / obesity is about 1,883 times higher in adolescents with poor quality of sleep when compared to adolescents with good quality of sleep (Table V).

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Table 5. Crossing the percentile with sport, while the sports practice and sleep quality, independence test results

Variables		Percentile: Normal N (%row) %column	Percentile: Preobesity/ Obesity N (%row) %column	Total N (%row) %column	Test statistic (p-value)	*Odds ratio* (p-value)
Play sports	**Yes**	158(83.6%) 61.0%	31(16.4%) 44.9%	189(100%) 57.6%		1†
	No	101(72.7%) 39.0%	38(27.3%) 55.1%	139(100%) 42.4%	5.767* (0.016)	1.918* (0.017)
	Total	259(79.0%) 100%	69(21.0%) 100%	328(100%) 100%		
Duration of the practice of sport/week	**More than 300 minutes**	62(87.3%) 39.2%	9(12.7%) 29.0%	71(100%) 37.6%		
	Up to 300 minutes	96(81.4%) 60.8%	22(18.6%) 71.0%	118(100%) 62.4%	1.151 (0.283)	-------
	Total	158(83.6%) 100%	31(16.4%) 100%	189(100%) 100%		
Sleep quality	**Good**	164(83.2%) 63.3%	33(16.8%) 47.8%	197(100%) 60.1%		1†
	Bad	95(72.5%) 36.7%	36(27.5%) 52.2%	131(100%) 39.9%	5.453* (0.020)	1.883* (0.021)
	Total	259(79.0%) 100%	69(21.0%) 100%	328(100%) 100%		

*-p<0.1; **-p<0.01; ***- p<0.001

Analyzing the metabolic age, it was found that it was significantly associated with the practice of sports (X^2=4.688, p= 0.030), but did not shown a significant association with sports practice duration per week (X^2 = 2.347, p = 0.177), nor with sleep quality (X^2= 3.543, p = 0.060). It can be concluded that the risk of having a metabolic age above the chronological age is about 2,786 times higher in adolescents who do not practice sports compared to those practicing extra-curricular sports (table VI).

Table 6. Crossing of metabolic age with sport, while the sports practice and sleep quality, independence test results

Variables		Metabolic age: Normal N (%row) %column	Metabolic age: Above normal N (%row) %column	Total N (%row) %column	Test statistic (p-value)	*Odds ratio* (p-value)
Play sports	**Yes**	26(65.0%) 65.0%	14(35.0%) 40.0%	40(100%) 53.3%		1†
	No	14(40.0%) 35.0%	21(60.0%) 60.0%	35(100%) 46.7%	4.688* (0.030)	2.786* (0.032)
	Total	40(53.3%) 100%	35(46.7%) 100%	75(100%) 100%		
Duration of the practice of sport/week	**More than 300 minutes**	12(80.0%) 46.2%	3(20.0%) 21.4%	15(100%) 37.5%		
	Up to 300 minutes	14(56.0%) 53.8%	11(44.0%) 78.6%	25(100%) 62.5%	2.374 (0.177)	-------
	Total	26(65.0%) 100%	14(35.0%) 100%	40(100%) 100%		

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Sleep quality	**Good**	29(61.7%) 72.5%	18(38.3%) 51.4%	47(100%) 62.7%	3.543 (0.060)	1†
	Bad	11(39.3%) 27.5%	17(60.7%) 48.6%	28(100%) 37.3%		2.490 (0.062)
	Total	40(53.3%) 100%	35(46.7%) 100%	75(100%) 100%		

*-p<0.05; **-p<0.01; ***- p<0.001

As regards body fat (5 fat mass), it was confirmed that it was significantly associated with the practice of sports (X^2 = 6,734, p = 0.009) and also with sleep quality (X^2 = 8,390, p = 0.004), but had no significant association with sports practice duration per week (X^2 = 0.439, p = 0.527).

It can be concluded that the risk of over-healthy body fat is about 1,804 times higher in adolescents who do not practice sports outside school activities compared to those who practice. The risk of body fat above normal is about 1,932 times higher in adolescents with poor sleep quality compared to adolescents with good sleep quality (table VII).

Table 7. Crossing of body fat (% FAT) with sport, while the sports practice and sleep quality, independence test results

Variables		**Body fat**		**Total**	**Test statistic**	***Odds ratio***
		Normal	**Above normal**			
		N (%row) %column	**N (%row) %column**	**N (%row) %column**	**(p-value)**	**(p-value)**
Play sports	**Yes**	138(69.3%) 63.6%	61(30.7%) 49.2%	199(100%) 58.4%	6.734** (0.009)	1†
	No	79(55.6%) 36.4%	63(44.4%) 50.8%	142(100%) 41.6%		1.804* (0.010)
	Total	217(63.6%) 100%	124(36.4%) 100%	341(100%) 100%		
Duration of the practice of sport/week	**More than 300 minutes**	52(72.2%) 37.7%	20(27.8%) 32.8%	72(100%) 36.2%	0.439 (0.527)	-------
	Up to 300 minutes	86(67.7%) 62.3%	41(32.3%) 67.2%	127(100%) 63.8%		
	Total	138(69.3%) 100%	61(30.7%) 100%	199(100%) 100%		
Sleep quality	**Good**	143(69.8%) 65.9%	62(30.2%) 50.0%	205(100%) 60.1%	8.319** (0.004)	1†
	Bad	74(54.4%) 34.1%	62(45.6%) 50.0%	136(100%) 39.9%		1.932** (0.004)
	Total	217(63.6%) 100%	124(36.4%) 100%	341(100%) 100%		

*-p<0.05; **-p<0.01; ***- p<0.001

The number of correct daily eating habits was also compared with sports practice, percentile and body fat (table VIII). The number of correct daily habits is higher in students who practice extra-curricular sports (7.89 ± 2.562 and 8 ± 4) compared to students who did not practice sports (6.57 ± 2.579 and 7 ± 3). It is also higher in students with a healthy percentile (7.59 ± 2.537 and 8 ± 3) compared to students with pre-obesity / obesity (6.32 ± 2.867 and 7 ± 4) and finally in students with adequate body fat values (7.62 ± 2.545 and 8 ± 3) comparatively with students with excess fat mass (6.81 ± 2.764 and 7 ± 4).

In the boxplot of Figure 4, it can be seen that 50% of students who practice sports have at least 8 correct eating habits per day, while 75% of students who do not practice sports have a maximum of 8 correct eating habits. The t test results showed statistically significant differences (t = 4.709, p = 0.000).

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Table 8. Number of correct eating habits by gender, sport, and body fat percentile

Variable	Options	n	Mean (Std. Deviation)	Median (interquartile range)	T - test statistics (p value)
Gender	Female	204	7.56 (2.608)	8.00 (3.00)	1.935 (0.054)
	Male	141	7.00 (2.678)	7.00 (4.00)	
Sports	Yes	200	7.89 (2.562)	8.00 (4.00)	4.709*** (0.000)
	No	145	6.57 (2.579)	7.00 (3.00)	
Percentile	Normal	259	7.59 (2.537)	8.00 (3.00)	3.609*** (0.000)
	Pre obesity/Obesity	69	6.32 (2.867)	7.00 (4.00)	
Body fat	Normal	217	7.62 (2.545)	8.00 (3.00)	2.743** (0.006)
	Above normal	124	6.81 (2.764)	7.00 (4.00)	

-p<0.01; *- p<0.001

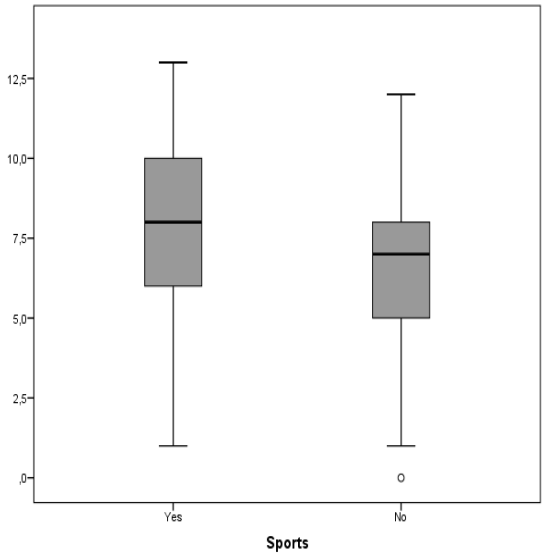

Figure 4. Boxplot - correct eating habits versus sports practice

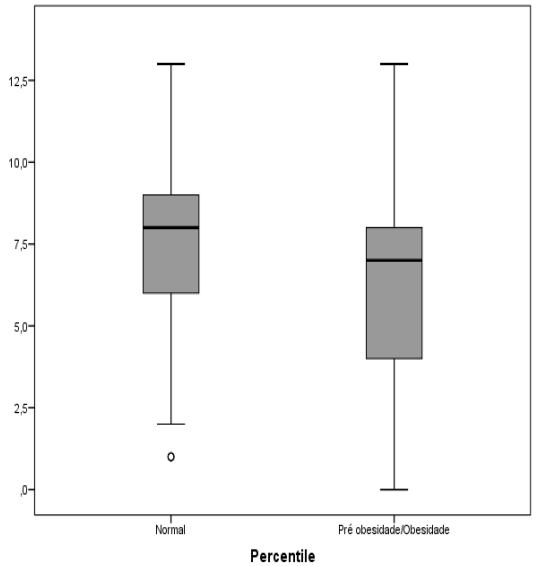

Figure 5. Boxplot - correct eating habits versus BM percentil

Regarding the BMI percentile, it can be seen in the boxplot of Figure 5 that 50% of students with normoponderal percentile have at least 8 correct eating habits while 75% of students with pre-obesity / obesity have a maximum of 8. The *t* test results showed statistically significant differences (t = 3.609, p = 0.000).

Also, regarding body fat, findings show that 50% of students with healthy body fat have at least 8 correct eating habits per day, while 75% of students with high body fat have a maximum of 9 correct eating habits. The *t* test results showed statistically significant differences (t = 2,743; p = 0.006).

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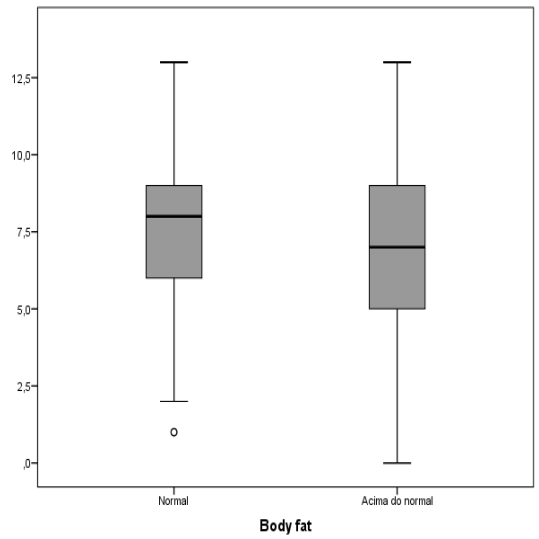

Figura 6. Boxplot-correct eating habits versus body fat

DISCUSSION

After analysing the results, it was verified that 58% of the adolescents under study practiced sports outside school activity, with higher expression in males, 63.1% of the boys against 54.4% of the girls. The data found is in accordance with the National Health Survey of 2014 (Instituto Nacional de Estatística, 2016), which reported that 68.9% of Portuguese males and 52.9% of Portuguese women aged 15-24 years practiced physical activity outside school activity at least once a week.

There is also congruence with data obtained by Pereira (2016), which found that the practice of extracurricular physical exercise was performed by 53.9% of adolescents in the county of Bragança. Correia (2013) obtained higher values of physical activity in adolescents within Bragança county, with 80% of boys and 60% of girls claiming to practice sports regularly.

Compared to international data was found that students under the present study presented a more sedentary pattern. Cuervo et al. (2007) found that 77% of adolescents aged between 12 and 18 years of age in Northern Spain claimed to practice extracurricular physical activity, similar to those obtained by other authors (García, Rodríguez, Sánchez & López, 2012; Muñoz, 2015), where physical activity levels were higher than 75%. This decrease in the values of physical activity practice can be related with the students' age, as the sample of our study included adolescents with ages higher than the other researches. Recent research confirms that in the 12-19-year age group physical activity decreases with age increase (Cuervo et al., 2007; DGS, 2016).

Regarding gender, results confirm those obtained in other previous studies, in which sports practice is higher in males (Correia, 2013, Cuervo et al., 2017, Pereira, 2016, WHO, 2016).

Physical activity data reveal low levels of physical activity among the youngest, in congruence with the World Health Organization, which reinforces that the world's adolescent population is insufficiently physically active (WHO, 2016).

Regular physical activity – such as walking, cycling, or doing sports – has significant benefits for health (WHO, 2016) and its closely related to healthy global lifestyles, increase in quality of life and reduction of many chronic diseases (CDC, 2011; Ruiz-Ariza, Ruiz, de la Torre-Cruz, Latorre-Román, & Martínez-López, 2015). It is fundamental in teenagers to establish regular physical activity habits, which are likely to determine the active lifestyle in adulthood.

Analysing the weight and body composition of the students under this research, was found that the majority of adolescents (75.1%) had a normoponderal percentile, 14.5% preobesity, 5.5% obesity, and 36.0% presented body fat above healthy.

Comparing the data from COSI Portugal 2016 (INSA, 2016), which showed prevalence rates of 30.7% of overweight and 11.7% of childhood obesity, was found that the sample under study had a lower prevalence of overweight and obesity. However, it has to be considered that the COSI assess children in the age group 6 to 10 years old, which may justify the observed differences. Also, in the study by Venâncio, Aguilar and Pinto (2012) the prevalence rates of overweight / obesity were much higher.

When comparing the data with those presented in the National Food and Physical Activity Survey - IAN-AF, 2015-2016, 23.6% prevalence of pre-obesity and 8.7% obesity in the age group 10-17 years) more similar prevalence values were found (Lopes et al., 2017).

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It was observed in this study that the BMI percentile and percentage of body fat were significantly associated with the fact that adolescents practice sports and also with the quality of sleep. Sports practice and good quality of sleep are positive factors to obtain a normoponderal percentile of BMI and fat mass. These results have also been observed in other studies where higher values of BMI and higher percentage of fat mass were found in sedentary adolescents (Blaes, Baquet, Fabre, Van Praagh & Berthoin, 2011; Muros et al., 2016; Padez, Fernandes, Mourão, Moreira, & Rosado, 2004).

Despite some controversial results, the most recent investigations provide more definitive conclusions regarding the relationship between sleep duration and physical activity in adolescents and suggest that when short-sleeping teens sleep longer, they engage in less sedentary activity (Van Dyk et al., 2018). Kredlow's meta-analysis, reinforces the existence of convincing evidence that physical activity has not only immediate benefits in sleep quality, but also the potential of improving sleep quality when sports practice is constant (Kredlow, Capozzoli, Hearon, & Calkins, 2015).

It was also observed that the number of correct daily eating habits is higher in students who practice extracurricular sports (7.89 ± 2.562 and 8 ± 4) compared to students who did not practice sports (6.57 ± 2.579 and 7 ± 3). It is also higher in students with a healthy percentile (7.59 ± 2.537 and 8 ± 3) comparatively to students with pre-obesity / obesity (6.32 ± 2.867 and 7 ± 4) and in students with adequate body fat values (7.62 ± 2.545 and 8 ± 3) comparatively to students with excess fat mass (6.81 ± 2.764 and 7 ± 4).

The evidences are consistent with several scientific research studies that show an association between poor eating habits and sedentary habits as well as worse sleep quality (Chaput, 2014; Dewald et al., 2010, Hart et al., 2013, McNeil, Doucet & Chaput, 2013, Muros et al, 2016, Paiva, 2008, Pearson & Biddle, 2011, Quist et al., 2016). In contrast, children with healthy eating habits are more likely to be physically active and consequently to benefit from better sleep quality (McNeil, Doucet & Chaput, 2013; Shi, Tubb, Fingers, Chen & Caffrey, 2013).

CONCLUSIONS

The majority of the adolescents (58%) under study practiced sports outside school activity, with higher expression of physical activity in males. However, values of physical activity practice below the WHO recommendations were found (WHO, 2016). 75.1% of the students presented a normoponderal percentile, however, 14.5% of those were pre-obese, 5.5% obese, and 36.0% presented over-healthy body fat.

It was concluded that the risk of pre-obesity / obesity and over-healthy body fat is higher in adolescents who do not play sports and in those with poor sleep quality. The findings show that sports practice and good quality of sleep are positive factors in the achievement of BMI percentile and normoponderal fat mass percentage.

It was also observed that the number of correct daily eating habits is higher in students who practice extracurricular sports, in students with a healthy percentile and in students with adequate body fat values. It reinforces the importance of healthy food choices in weight balance and body composition, but also in the promotion of active and healthy lifestyles.

The results showed the importance of promoting physical activity, healthy eating choices and also sleep quality in childhood and adolescence. The maintenance of a healthy environment can be crucial not only to improve their actual lifestyles but also their future adult life. It is also essential to develop actions with the different stakeholders, investing in health literacy improvement, promoting active and healthy behaviour environments, and empowering young people to make health-promoting choices.

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