

# Healthy diet and physical activity in schoolchildren aged 10-12 years

## Alimentación saludable y actividad física en escolares de 10 a 12 años

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### ABSTRACT

Currently, obesity and overweight have become a very important problem throughout the society of developed countries. The increasing number of children who present obesity or weight problems can be influenced by the type of diet that they follow. The aim of this study was to analyse and compare the influence of the practice of physical activity and adherence to Mediterranean diet on the problem of obesity and focus on the differences regarding to gender. The study followed a descriptive, non-experimental design. It was carried out with the help of 346 schoolchildren from different schools from Granada who had to fill the KIDMED, PAQ-C and ad hoc questionnaires. As core results, it was found that boys show a greater adherence to Mediterranean diet and practice a higher level of physical activity than girls, but there is a bigger percentage of overweight boys. It was also found that there were statistically significant differences regarding to the relation of physical activity practice and Mediterranean diet adherence. As main conclusions, it is important to highlight that 5 out of 10 schoolchildren have a normal weight and almost half of the sample have a high adherence to Mediterranean diet.

### KEYWORDS

Physical Activity; Mediterranean Diet; BMI; Schoolchildren

### RESUMEN

Actualmente, la obesidad y el sobrepeso se han convertido en un problema muy importante en toda la sociedad de los países desarrollados. El número creciente de niños que presentan obesidad o problemas

de peso puede estar influenciado por el tipo de dieta que siguen. El objetivo de este estudio fue analizar y comparar la influencia de la práctica de actividad física y la adherencia a la dieta mediterránea en el problema de la obesidad, con un enfoque en las diferencias de género. Este estudio siguió un diseño descriptivo y no experimental. Se llevó a cabo con la ayuda de 346 escolares de diferentes colegios de Granada, quienes completaron los cuestionarios KIDMED, PAQ-C y ad hoc. Como resultados principales, se ha encontrado que los chicos muestran una mayor adherencia a la dieta mediterránea y practican un mayor nivel de actividad física que las chicas, pero hay un mayor porcentaje de chicos con sobrepeso. También se ha observado que existen diferencias estadísticamente significativas en la relación entre la práctica de actividad física y la adherencia a la dieta mediterránea. Como principales conclusiones, cabe destacar que 5 de cada 10 escolares tienen un peso normal y casi la mitad de la muestra tiene una alta adherencia a la dieta mediterránea.

## **PALABRAS CLAVE**

Actividad Física; Dieta Mediterránea; IMC; Escolares

## **1. INTRODUCTION**

The last three years of Primary Education are considered as the beginning of the adolescence that is a stage of transition where psychological, biological and social changes occur. These important changes can have an impact on young people's health. During this stage, young people become independent and they start making independent choices, creating new behaviour patterns that will be followed during adulthood, because childhood and adolescence are fundamental periods when people acquire eating habits whose influence will last until adulthood (Muros et al., 2017). Moreover, during adolescence, the practice of physical activity (PA) decreases notoriously because they choose another type of hobbies and they start eating unhealthy food that will be accompanied afterward by alcohol and other bad habits (Trigueros et al., 2020).

Authors as Buja et al. (2020) say that one of the most common types of unhealthy behaviours is following an unbalanced diet, considering that it is a primary risk factor for the beginning of non-contagious diseases. Furthermore, obesity during childhood and adolescence has become one of the riskiest problems that threatens longevity and health problems (Faienza et al., 2020). The last 30 years have been determining when talking about childhood obesity, because its rate has doubled and even tripled in many developed countries (de Onis, 2010). The Global Health Observatory Data 2017 by World Health Organization (WHO) stated that the number of obese children and adolescents (5-19

years old) is over 340 million people (Valerio et al., 2017). Eating healthily is important at all ages for people's well-being, because the excess of corporal fat during early-childhood can last during adolescence and cause physiological and pathological aspects of morbidity and mortality during adulthood (Dietz, 1998; Salvador-Pérez, 2015). In childhood, it becomes more important because it helps the growth, cognitive development and school performance of children, as well as it reduces the risk of early health problems related with nutrition and chronic diseases that can appear in later life.

Following the advices of Salvador-Pérez (2015), increasing the PA level and the emergence of nutritional education are recommended changes that help to reduce morbidity. Public institutions, as schools, should promote these measures to supply young people the necessary knowledges to live healthily and prevent diseases. The WHO proposed in 2004 a world-wide strategy to reduce obesity based on the diet, physical activity and health to reduce risk factors as bad nutrition habits and physical inactivity and then, the Action Plan 2008-2013 about the world-wide strategy to prevent and control non-transmissible diseases (Navarro-Solera et al., 2014). The most common risk factors of obesity are related to the reduction of time spent cooking foods and the rise of fast food consumption cooked with lots of sugar additives (Salvador-Pérez, 2015; Tur et al., 2005). For that reason, the aim of WHO is to raise awareness of how harmful the obesity is and to promote the acquisition of healthy life habits based on a proper diet, as the Mediterranean diet (MD) and the practice of PA (Navarro-Solera et al., 2014).

MD is defined by Galán-López et al. (2019) as a diet: "Based on a high intake of fruits, vegetables, legumes, and unrefined cereals, a moderate to high intake of olive oil and fish (...) a moderate intake of milk, yogurt, and cheese, and a low consumption of meat or meat products" (p. 4480).

It has been proved by Barja-Fernández et al. (2019); Williamson et al. (2019) that a greater adherence to MD has positive impacts on health and longevity and reduces the risk of diseases as metabolic syndrome, cardiovascular diseases, type II diabetes mellitus, obesity, neoplastic disease and mortality. It has also been proved that practising PA habitually contributes to primary and secondary prevention of many chronic diseases and it decreases the risk of premature death. Moreover, it helps to improve mental and social health (Chen & Lee, 2013; Muros et al., 2017). Adolescence is a stage that people start when they are between 10 or 11 years old until 19 years old, so there is a part of Primary students who are adolescents (González-Valero, 2018; WHO, 2014). Unfortunately, Spanish adolescents do not practice as much physical activity as they should (Ramos et al., 2016) and they only practise it in Physical Education lessons at school (Sevil et al., 2016). In these lessons, the teacher

should create adherence not only to physical activity, but to properly food habits. Concerning the gender, there are differences about the time adolescents use to practice physical activity, because the 82.8% of girls do not achieve the requisite of recommended physical activity in adolescents compared to the 60% of boys (Tapia-López, 2019).

Physical activity and adherence to Mediterranean-style diet are connected variables that reflect a tendency to a healthy lifestyle (Williamson et al., 2019). Although following a MD is a healthy behavior, food habits in Mediterranean countries have experienced an important deterioration in the last few years, especially in young people because of sociocultural changes. This impact combined with physical inactivity on account of sedentary hobbies as passive leisure related to screens and videogames constitute the most important risk of diseases in adolescent people (Barja-Fernández et al., 2019).

In Spain, Partearroyo et al. (2019) state that current food habits are changing leading to a westernized diet based on less varied food: “higher intake of animal instead of vegetal products such as legumes, nuts, fruits, and vegetables” (p. 2664) what is leading to a problem of adolescents showing a greater distance from the balanced diet that their parents followed.

There have been new models of positive development whose aim is to determine the factors that foster healthy development during adolescence, adopting regular practice of physical activity and healthy lifestyle habits. These two aspects are key, in the emergence of these models that are currently based on new paradigm focused on the optimal functioning of adolescents (Trigueros et al., 2020).

Gender is a current issue that is gaining importance thanks to feminism and it should be considered in every investigation. Gender differences have been found in most of the studies related to the physical activity variant of this investigation (Aibar et al., 2014; Bailey et al., 2012; Beltrán et al., 2017; Ramos et al., 2012) where it is proved that the lifestyle of boys is more active than the lifestyle of girls. However, no gender differences have been found regarding to adherence to MD (Galán-López et al., 2019).

Thus, the aims of this study are to describe the level of physical activity and adherence to Mediterranean diet in a sample of schoolchildren (10-12 years-old) and to compare the level of MD and PA regarding to gender.

## 2. METHODS

### 2.1. Design and participants

This research was done following a descriptive and non-experimental design. The collection of data has been cross-sectional because the values have been compiled at a single point. The sample is composed by 346 schoolchildren of 10-12 years old from different public Primary Education schools located in Granada. They are students of the 5th and 6th year of Primary Education and the average of their age is 11.57 (standard deviation 0.64). The 40.8% of the simple were boys (n=141) and the 59.2% were girls (n=205).

### 2.2. Instruments

The instruments used to develop this study were:

Self-register form: self-made register composed by socio-demographic questions, where gender, age, height, weight and physical activity practice are considered.

Test KIDMED: test proposed by Serrá-Majem et al. (2004) which is composed by a 16-questions-survey that should be answered using yes or no. The affirmative answers of the questions that have a negative connotation in relation to MD (4 of the questions) count -1 point, and the affirmative answers of the questions that have a positive connotation in relation to MD (12 questions) count +1 point. The negative answers do not count. Therefore, the index can vary from -4 (minimum adherence) to 12 (maximum adherence).

Physical Activity Questionnaire for Children (PAQ-C): It is a questionnaire translated by Manchola-González et al. (2017) that issued to assess the level of physical activity of children from 8 to 14 years old, concerning the 7 days before the compilation. It is composed by 10 questions regarding to the frequency of the physical practice activity carried out and the scores range from 1 to 5.

### 2.3. Procedure

To compile the data, the research team developed a self-made questionnaire and then, contacted with the Primary Schools who participate during a formal letter provided by the University of Granada. The letter asked the head-teachers of the different schools to collaborate with the students to compile the needed data and it mentioned the anonymity of the data that would only be used by the research team. Another formal letter was provided by the University of Granada to be given to the parents of the schoolchildren.

Once the schools accepted to participate, the data was collected during school timetable, with the help of standardized questionnaires where one of the members of the research team was there to help and answer any doubts and, afterwards, analysed and connected to the investigation by the research team. The anonymity of the information collected was guaranteed following the Declaration of Helsinki.

## 2.4. Data analysis

To analyse the data, the computer statistic program SPSS 22.0 was used. First of all, a descriptive analysis was done, using frequency tables and percentages and calculating the standard deviation. To relate the variables, contingency tables has been used, focusing on the statistical differences and on if they were significant or not. It depends on the value of chi-square that would show a significant statistical difference if the value is as close as possible of 0.000.

## 3. RESULTS

This study was conducted, as shown in Table 1, with data collected from 346 students, 205 girls (59.25%) and 141 boys (40.75%). The minority of the students, a 23.4% (n=81) has a low-quality MD adherence, and the 37.9% (n=131) has an improbable MD adherence and the 38.7% (n=134) has an optimal MD adherence. Referring to BMI, it can be clearly seen that the majority of the population has underweight (49.1%, n=170), some others have a normal weight (47.4%, n=164) and only a 3.5% has overweight (n=12).

About physical activity practice, most of the students practice a medium level of PA (64.7%, n=224), some others practice a high level of PA (22.8%, n=79) and just 12.4% practices a low level of PA (n=43).

**Table 1.** Descriptive analysis of the sample

<b>Gender</b>		<b>Mediterranean diet</b>	
<b>Masculine</b>	N= 141 (40.74%)	<b>Low Quality</b>	N= 81 (23.4%)
<b>Feminine</b>	N= 205 (59.25%)	<b>Improbable</b>	N= 131 (37.9%)
<b>Total</b>	N= 346 (100%)	<b>Optimal</b>	N= 134 (38.7%)
<b>Body Mass Index</b>		<b>Physical Activity</b>	
<b>Underweight</b>	N= 170 (49.1%)	<b>Low Level</b>	43 (12.4%)
<b>Normal Weight</b>	N= 164 (47.4%)	<b>Medium Level</b>	224 (64.7%)
<b>Overweight</b>	N= 12 (3.5%)	<b>High Level</b>	79 (22.8%)
<b>Total</b>	N= 346 (100%)	<b>Total</b>	346 (100%)

No statistically significant differences were found between physical activity practice and gender ( $p= 0.186$ ), Mediterranean diet adherence ( $p= 0.165$ ) and BMI ( $p= 0.103$ ) (Table 2).

**Table 2.** Relation between gender and study variables

Gender	Physical Activity			Mediterranean diet			Body Mass Index			
	Low	Medium	High	Low	Improvable	Optimal	Underweight	Normal weight	Overweight	
Males	N	12	95	34	29	49	63	63	70	8
	Gen.	8.5%	67.4%	24.1%	20.6%	34.8%	44.7%	44.7%	49.6%	5.7%
	PA	27.9%	42.4%	43.0%	35.8%	37.4%	47.0%	37.1%	42.7%	66.7%
Females	N	31	129	45	52	82	71	107	94	4
	Gen.	15.1%	62.9%	22.0%	25.4%	40.0%	34.6%	52.2%	45.9%	2.0%
	PA	72.1%	57.6%	57.0%	64.2%	62.6%	53.0%	62.9%	57.3%	33.3%
<b>Sig.</b>	$p = 0.186$			$p = 0.165$			$p = 0.103$			

With regard to the analysis of MD adherence and PA practice (Table 3), some statistically significant differences have been found ( $p = 0.001$ ). These differences have been caused by the fact that focusing on people whose adherence to MD is low-quality, it can be found that the 32.6% are people who practice a low level of PA, the 24.6% are people who practice a medium level of PA and the 15.2% are people who practice a high level of PA. Focusing on people whose adherence to MD is improvable, the results are that people who practice a low level of PA represent a 37.2%, people who practice a medium level of PA represent a 42% and people who practice a high level of PA, represent a 26.6%. Finally, focusing on people whose adherence to MD is optimal, the 30.2% of these people practice a low level of PA, the 33.5% practice a medium level of PA and the 58.2% practice a high level of PA. Finally, there are more people who practice a medium level of PA (64.7%) than people who practice a low (12.4%) or medium (22.8%) level of PA.

**Table 3.** Relation between PA practice, MD adherence and BMI

Physical Activity	Mediterranean diet			Body Mass Index			
	Low	Improvable	Optimal	Underweight	Normal weight	Overweight	
Low	N	14	16	13	20	21	2
	PA	32.6%	37.2%	30.2%	46.5%	48.8%	4.7%
	MD	17.3%	12.2%	9.7%	11.8%	12.8%	16.7%
Medium	N	55	94	75	115	100	9
	PA	24.6%	42.0%	33.5%	51.3%	44.6%	4.0%
	MD	67.9%	71.8%	56.0%	67.6%	61.0%	75.0%
High	N	12	21	46	35	43	1
	PA	15.2%	26.6%	58.2%	44.3%	54.4%	1.3%
	MD	14.8%	16.0%	34.3%	20.6%	26.2%	8.3%
<b>Sig.</b>	$p = 0.001$			$p = 0.504$			

#### 4. DISCUSSION

The purpose of this study was to analyse and compare the relations between the body composition and the practice of PA and adherence to MD focusing on gender differences. It has been done with the aid of 346 participants (10-12 years-old). The importance of this study at this stage is vital because habits that are learnt by children in their early years are mostly acquired by them for the rest of their life. Because of that, as the aim of this study is to help combating obesity, the variables related to PA practice and MD adherence should be learnt by children to achieve a healthy life. The abovementioned variables from each participant have been analysed considering their life quality and health as it has been done in other similar investigations studied by Buja et al. (2020); Galán-López et al. (2019); Salvador-Pérez (2015).

Buja's study sample was composed by 6-7 years old schoolchildren from Padua, Italy and the studied variables were adherence to the MD, family setting, social sphere and demographics, behavioural traits and lifestyles. The second study's aim (Galán-López et al., 2019) was to analyse the physical fitness, physical activity and MD and it was carried out with information compiled from 13- to 16-years-old students from Seville, Spain. The last study from Salvador-Pérez (2015) whose variables were the physical fitness, physical activity, MD, self-esteem and academic achievement used a sample of 5 to 8 and 9 to 12 years old schoolchildren from Granada.

Healthy lifestyle factors that characterised a Mediterranean lifestyle involve a high level of PA practice, a high level of adherence to MD and a BMI that reveal the normal weight of the children and these factors tend to cluster together as in other studies about the same subject (Buja et al., 2020; Gubbels et al., 2012).

Referring to PA practice, most of the children practice a medium level of PA and almost one of every four children practice a high level of PA. The results obtained are similar to those found in a cross-sectional study of European adolescents (Grosso et al., 2013) and in a cross-sectional study of Sevillian adolescents (Galán-López et al., 2019) where boys were more active than girls, as in the present study where there is a bigger percentage of girls who practice a low level of PA than the percentage of boys who practice a low level of PA. This fact can be due to the stereotypes that shape the society, because children are supposed to take the roles usually applied to their gender. Boys would practice sports and would be brave, while girls would be cooking and would be very bad when playing football and other sports. However, the majority of the sample practice a medium level of PA. It can also be observed that children with lower level of practice of PA tend to show a lower or improvable



adherence to MD (López-Gil et al., 2020). In this study, statistically significant differences were found when comparing adherence to MD and PA practice as in the research done by Salvador-Pérez (2015), where children who practice a low level of PA, have an improbable level of MD and in the study carried out by Muros et al (2017), where correlations between PA practice and adherence to MD were found. Moreover, higher adherence to MD is associated with healthier body composition as Schröder et al. (2010) studied.

The results found about dietary patterns related to MD differ from those found by Benítez-Benítez et al. (2016); Galán-López et al. (2019); González-Valero (2018) where the majority of the sample shows a medium or low level of adherence to MD. In the present research, the majority of the participants show a high adherence to MD, so it can be on account of the decreasing of adherence to MD with the increase of the age. Authors like Galán-López et al. (2019) and Grosso et al. (2013) found that there is no significant difference in adherence to MD according to gender. By contrast, other studies about the same subject and methodology have found different results because their sample was from non-Mediterranean countries (Novak et al., 2017).

The data found about BMI in the present study shows that 5 out of 10 children are underweight and 4 out of 10 have a normal weight. This result varies from those obtained by Grosso et al. (2013) because in this study nearly half of the sample was overweight or in the study carried out by Arriscado et al. (2014) where more than a 25% of the sample was overweight. In the present study, as in the researches conducted by Galán-López et al. (2019); Ortega et al. (2011), there is a very small percentage of overweight people. The reason of this fact can be due to size of the sample, because in the first mentioned investigations, the sample was bigger than the sample of the rest of the studies or to the date where the information was compiled, because as years passed, nutrition becomes a more important concern. Moreover, it can be a result of the socioeconomic level of the participant families. If they have a low socioeconomic level, they waste their money on low-quality food, usually ultra-processed food, that tends to be cheaper, fact that entails the poor nutrition of the children.

When only gender is considered, there were no statistically significant differences when comparing any of the variables as in studies as those carried out by López-Gil et al. (2020); Rosa et al. (2017); Serra-Majem et al. (2004). When comparing BMI, the majority of the sample were underweighted or had a normal weight. However, there are more overweight boys than girls, fact that can be due to the stigmatization of obesity and the exaltation of the body or gender stereotypes that are mainly problematic for women as in the study of Galán-López et al. (2019); Rosa et al. (2017).

It is worth to highlight that those participants who practice a high level of PA, are those who have a high level of adherence to MD, as it is also found in the study carried out by Galán-López et al. (2018). Maybe, this fact can reach the conclusion that children who practice a high level of PA, are aware that they have to eat better instead of eating more and that they have to focus on the quality of the food rather than on the quantity. In conclusion, as MD is composed by high-quality food, diet from children with a high level of practice of PA can be closer to the characteristics of the MD than the diet of those children who do not need high-quality food because they do not practice any PA.

## 5. CONCLUSIONS

The present study has helped to reach some important conclusions. 4 out of 10 children present a high adherence of MD and half of the sample does not show problems with their weight, because they have a normal weight. Regarding to the PA, only 2 out of 10 schoolchildren show a high level of PA practice, but luckily, only 1 out of 10 children presents a low level of PA practice.

Focusing on children who practice a medium level of PA, the majority of them shows an improbable adherence to MD; and focusing on those who practice a high level of PA, the majority of them shows a high adherence to MD (optimal diet).

Regarding to gender, there is a higher percentage of boys who have an optimal adherence to MD, while there is a bigger percentage of girls who present low adherence to MD. About the BMI, there is a greater percentage of boys who have a normal weight, but there is also a bigger percentage of boys who are overweight. Finally, there is a bigger percentage of boys who practice a high level of PA, while there is a larger percentage of girls who have a low level of practice of PA.

This study has a number of limitations as its cross-sectional design shows data from a single point in time, with no follow-up over time. Also, the population chosen does not allow us to generalise the results obtained as it is a very specific sample, both in terms of the type of student body and geographically.

## 6. REFERENCES

1. Aibar, A., Bois, J. E., Zaragoza, J., Generelo, E., Paillard, E., & Fairclough, S. (2014). Weekday and weekend physical activity patterns of French and Spanish adolescents. *European Journal of Sport Science*, 14(5), 500-509. <https://doi.org/10.1080/17461391.2013.829127>

2. Arriscado, D., Muros, J. J., Zabala, M., & Dalmau, J. M. (2014). Relationship between physical fitness and body composition in Primary School children in Northern Spain (Logroño). *Nutrición Hospitalaria*, 30(2), 385-394. <https://doi.org/10.3305/nh.2014.30.2.7217>
3. Bailey, D. P., Fairclough S. J., Savory, L. A., Denton, S. J., Pang, D., Deane, C. C., & Kerr, C. J. (2012). Accelerometry-assessed sedentary behaviour and physical activity levels during the segmented school day in 10-14-years-old children: The HAPPY study. *European Journal of Pediatrics*, 171(12), 1805-1813. <https://doi.org/10.1007/s00431-012-1827-0>
4. Barja-Fernández, S., Pino, M., Portela, I., & Leis, R. (2019). Evaluation of food habits and physical activity in galician students. *Nutrición Hospitalaria*, 37(1), 93-100. <https://10.20960/nh.02668>
5. Beltrán, V. J., Sierra, A. C., Jiménez, A., González-Cutre, D., Martínez, C., & Cervelló, E. (2017). Diferencias según género en el tiempo empleado por adolescentes en actividad sedentaria y actividad física en diferentes segmentos horarios del día. *Retos*, 31, 3-7. <https://doi.org/10.47197/retos.v0i31.36207>
6. Benítez-Benítez, A. M., Sánchez, S., Franco-Reynolds, L., Bermejo, M. L., & Cubero, J. (2016). Compliance with a Mediterranean diet in students at the University of Extremadura: a resource in health education. *Revista de la Fundación Educación Médica*, 19(6), 287-289. [https://scielo.isciii.es/scielo.php?pid=S2014-98322016000600004&script=sci\\_arttext](https://scielo.isciii.es/scielo.php?pid=S2014-98322016000600004&script=sci_arttext)
7. Buja, A., Grotto, G., Brocadello, F., Sperotto, M., & Baldo, V. (2020). Primary school children and nutrition: lifestyles and behavioral traits associated with a poor-to-moderate adherence to the Mediterranean diet. A cross-sectional study. *European Journal of Pediatrics*, 179(5), 827-834. <https://doi.org/10.1007/s00431-020-03577-9>
8. Chen, J. J., & Lee, Y. (2013). Physical Activity for Health: Evidence, theory and practice. *Journal of Preventive Medicine and Public Health*, 46(1), 1-2. <https://doi.org/10.3961/jpmph.2013.46.S.S1>
9. Dietz, W. H. (1998). Health consequences of obesity in youth: Childhood predictors of adult disease. *Pediatrics*, 101, 518-525. <https://doi.org/10.1542/peds.101.S2.518>
10. Faienza, M. F., Chiarito, M., Molina-Molina, E., Shanmugam, H., Lammert, F., Krawczyk, M., D'Amato, G., and Portincasa, P. (2020). Childhood obesity, cardiovascular and liver health: a growing epidemic with age. *World Journal of Pediatrics*, 16(5), 438-445. <https://doi.org/10.1007/s12519-020-00341-9>
11. Galán-López, P., Ríes, F., Gísladottir, T., Domínguez, R., & Sánchez-Oliver, A. J. (2018). Healthy Lifestyle: Relationship between Mediterranean Diet, Body Composition and Physical Fitness in 13 to 16-Years Old Icelandic Students. *International Journal of Environmental Research and Public Health*, 15(5), 1-15. <https://doi.org/10.3390/ijerph15122632>

12. Galán-López, P., Domínguez, R., Pihu, M., Gísladóttir, T., Sánchez-Oliver, A., & Ries, F. (2019). Evaluation of physical fitness, body composition and adherence to Mediterranean diet in adolescents from Estonia: The Adoles Health study. *International Journal of Environmental Research and Public Health*, *16*, 4479-4492. <https://doi:10.3390/ijerph16224479>
13. Galán-López, P., Sánchez-Oliver, A., Ries, F., & González-Jurado, J. A. (2019). Mediterranean Diet, Physical Fitness and Body Composition in Sevillian adolescent: A healthy lifestyle. *Nutrients*, *11*(9), 1-14. <https://doi.org/10.3390/nu11092009>
14. González-Valero, G. (2018). *El perfil del alumnado universitario de Primaria con mención en Educación Física desde la perspectiva físico-saludable, psicosocial y académica* [Tesis Doctoral. Universidad de Granada].
15. Grosso, G., Marventano, S., Buscemi, S., Scuderi, A., Matalone, M., Platania, A., Giorgianni, G., Rametta, S., Nolfo, F., Galvano, F., & Mistretta, A. (2013). Factors associated with adherence to a Mediterranean diet among living in Sicily, southern Italy. *Nutrients*, *5*(12), 4908-4923. <https://doi.org/10.3390/nu5124908>
16. Gubbels, J. S., Kremers, S. P., Goldbohm, R. A., Stafleu, A., & Thijs, C. (2012). Energy balance-related behavioural patterns in 5-year-old children and the longitudinal association with weight status development in early childhood. *Public Health Nutrition*, *15*(8), 1402-1410. <https://doi.org/10.1017/S1368980011003089>
17. López-Gil J. F., Brazo-Sayavera, J., García-Hermoso, A., & Yuste, J. L. (2020). Adherence to Mediterranean Diet Related with Physical Fitness and Physical Activity in Schoolchildren Aged 6-13. *Nutrients*, *12*(567), 3-13. <https://doi.org/10.3390/nu12020567>
18. Manchola-González, J., Bagur-Calafat, C., & Girabent-Farrés, M. (2017). Reliability Spanish Version of Questionnaire of Physical Activity PAQ-C. *Revista Internacional de Medicina y Ciencias de la Actividad Física y el Deporte*, *17*(65), 139-152.
19. Muros, J. J., Cofre-Bolados, C., Arriscado, D., Zurita, F., & Knox, E. (2017). Mediterranean diet adherence is associated with lifestyle, physical fitness, and mental wellness among 10-y-olds in Chile. *Nutrition*, *35*, 87-92. <https://doi.org/10.1016/j.nut.2016.11.002>
20. Navarro-Solera, M., González-Carrascosa, R., & Soriano, J. M. (2014). Estudio del estado nutricional de estudiantes de educación primaria y secundaria de la provincia de Valencia y su relación con la adherencia a la dieta mediterránea. *Revista Española de Nutrición Humana y Dietética*, *18*(2), 81-88. <https://doi.org/10.14306/renhyd.18.2.65>
21. Novak, D., Stefan, L., Prosoli, R., Emeljanovas, A., Mieziene, B., Milanovic, L., & Radisavljevic-Janic, S. (2017). Mediterranean Diet and its correlates among adolescents in Non-Mediterranean

- European Countries: A population-based study. *Nutrients*, 9(2), 1-11. <https://doi.org/10.3390/nu9020177>
22. deOnis, M., Blossner, M., & Borghi, E. (2010). Global prevalence and trends of overweight and obesity among preschool children. *American Journal of Clinical Nutrition*, 92(5), 1257-1264. <https://doi.org/10.3945/ajcn.2010.29786>
23. Ortega, F., Artero, E., Ruiz, J., España-Romero, V., Jiménez-Pavón, D., Vicente-Rodríguez, G., Moreno, L., Manios, Y., Béghin, L., Ottevaere, C., Ciarapica, D., Sarri, K., Dietrich, S., Blair, S., Kersting, M., Molnar, D., González-Gross, M., Gutiérrez, A., Sjöström, M., & Castillo, M. J. (2011). Physical fitness levels among European adolescents: The HELENA study. *British Journal of Sports Medicine*, 45, 20-29. <http://dx.doi.org/10.1136/bjism.2009.062679>
24. Partearroyo, T., Samaniego-Vaesken, M., Ruiz, E. Aranceta-Bartrina, J., Gil, A., González-Gross, M., Ortega, R., Serra-Manjem, L., & Varea-Moreiras, G. (2029). Current foot consumption amongst the Spanish ANIBES study population. *Nutrients*, 11(11), 2663-2678. <https://doi.org/10.3390/nu11112663>
25. Ramos, P., Rivera, F., Moreno, C., & Jiménez-Iglesias, A. (2012). Análisis de clúster de la actividad física y las conductas sedentarias de los adolescentes españoles, correlación con la salud biopsicosocial. *Revista de Psicología del Deporte*, 21(1), 99-106.
26. Ramos, P., Jiménez-Iglesias, A., Rivera, F., & Moreno, C. (2016). Evolución de la práctica de la actividad física en los adolescentes españoles. *Revista Internacional de Medicina y Ciencias de la Actividad Física y del Deporte*, 16(62), 335-353. <https://doi.org/10.15366/rimcafd2016.62.010>
27. Rosa, A., García-Cantó, E., Rodríguez, P. L., Pérez-Soto, J., Tárrega L., & Tárrega P. J. (2017). Physical activity, physical fitness and nutritional status in schoolchildren from 8 to 12 years. *Nutrición Hospitalaria*, 34(6), 1292-1298. <https://doi.org/10.20960/nh.813>
28. Salvador-Pérez, F. (2015). Relación entre actividad física, hábitos de vida saludables y rendimiento académico en escolares granadinos [Tesis Doctoral. Universidad de Granada]. <http://0-hera.ugr.es.adrastea.ugr.es/tesisugr/25642935.pdf>
29. Schröder, H., Mendez, M. A., Ribas-Barba, L., Covas, M. I., & Serra-Majem, L. (2010). Mediterranean diet and waist circumference in a representative national simple of Young Spaniards. *International Journal of Pediatrics Obesity*, 5, 516-519. <https://doi.org/10.3109/17477161003777417>
30. Serrá-Majem, L., Ribas, L., Ngo, J., Ortega, R. M., García, A., Pérez-Rodrigo, C., & Aranceta, J. (2004). Food, youth and the Mediterranean diet in Spain. Development of KIDMED. Mediterranean diet quality index in children and adolescents. *Public Health Nutrition*, 7(7), 931-935. <https://doi.org/10.1079/phn2004556>

31. Sevil, J., Abós, Á., Generelo, E., Aibar, A., & García-González, L. (2016). Importancia del apoyo a las necesidades psicológicas básicas en la predisposición hacia diferentes contenidos en Educación Física. *Retos*, 29, 3-8. <https://doi.org/10.47197/retos.v0i29.34855>
32. Tapia-López, A. (2019). Diferencias en los niveles de actividad física, grado de adherencia a la dieta mediterránea y autoconcepto físico en adolescentes en función del sexo. *Retos*, 36, 185-192. <https://doi.org/10.47197/retos.v36i36.67130>
33. Trigueros, R., Mínguez, L., González-Bernal, J., Aguilar-Parra, J., Soto-Cámara, R., Álvarez, J., & Rocamora, P. (2020). Physical Education classes as a precursor to the Mediterranean Diet and the practice of physical activity. *Nutrients*, 12(1), 239-251. <https://doi:10.3390/nu12010239>
34. Tur, J. A., Serra-Majem, L., Romaguera, D., & Pons, A. (2005). Does the diet of the balearic population, a Mediterranean type diet, still provide adequate antioxidant nutrient intakes? *European Journal of Nutrition*, 44(4), 204-213. <https://doi.org/10.1007/s00394-004-0512-0>
35. Valerio, G., Balsamo, A., Baroni M. G., Brufani, C., Forziato, C., Grugni, G., Licenziati, M. R., Maffei, C., Miraglia, E., Morandi, A., Pacifico, L. Sartorio, A., & Manco, M. (2017). Childhood obesity classification systems and cardiometabolic risk factors: a comparison on the Italian, World Health Organization and International Obesity Task Force references. *Italian Journal of Pediatrics*, 43(19), 1-7. <https://doi.org/10.1186/s13052-017-0338-z>
36. Williamson, E., Polak, J., Simpson, J., Giles, G., English, D., Hodge, A., Gurrin, L., & Forbes, A. (2019). Sustained adherence to a Mediterranean diet and physical activity on all-cause mortality in the Melbourne Collaborative Cohort Study: application of the g-formula. *BMC Public Health*, 19(1), 1733-1743. <https://doi.org/10.1186/s12889-019-7919-2>
37. World Health Organization. (2014). *La salud de los adolescentes*. Available at: <https://apps.who.int/iris/handle/10665/141455>
38. World Health Organization. (2016). *Informe de la Comisión para acabar con la obesidad infantil*. Available at: <https://apps.who.int/iris/handle/10665/206450>

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The authors declare no conflict of interest.

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