

Research

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Behavioural and Psychological Variables Associated with Overweight and Obesity in Gran Canaria, Spain

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ABSTRACT

Objective: To obtain data of the prevalence of overweight and obesity of adolescents from educational centers in Gran Canaria (Spain) and to analyze behavioural and psychological factors associated with weight status.

Method: 1336 participants aged 12-20 years, were randomly selected. The studied variables related to weight status were: adherence to the Mediterranean diet, physical activity, nutritional knowledge and meal frequency. All of these were assessed by validated questionnaires.

Results: The prevalence of obesity was 10.4% (8.6% girls, 12.6% boys) and overweight 22.3% (24% girls, 20.4% boys). There are no significant differences between weight status and adherence to the Mediterranean diet but we observed that participants with normal weight obtained the highest mean score in the KIDMED test and the highest frequency in the “high” group of adherence. Adolescents with normal weight spent fewer hours in sedentary activities ($p \leq 0.05$) and more hours on physical activity ($p \leq 0.05$) than those with underweight, overweight or obesity. There were no significant differences between nutritional knowledge and weight status. Participants who never or almost never had breakfast, morning break, afternoon break and dinner had a higher prevalence of obesity and overweight (respectively, $p \leq 0.001$; $p \leq 0.001$; $p \leq 0.001$; $p \leq 0.05$) than those who had these meals every day.

Conclusion: The prevalence of obesity and overweight in the adolescent population is still very high in the Canary Islands. The consideration of factors related to obesity in adolescence and learning more about the variables that predispose or prevent these problems can significantly contribute to the development of treatments and prevention programs specifically for this context or other similar contexts.

KEYWORDS: Obesity; Prevalence; Mediterranean diet; Behavioural variables.

ABBREVIATIONS: ESO: Educación Secundaria Obligatoria; WHO: World Health Organisation; HELENA: Healthy Lifestyle in Europe by Nutrition in Adolescence.

INTRODUCTION

Obesity remains a major public health problem. The potential and serious consequences that can derive from it, as well as its high prevalence in the world, justify the need to find accurate and periodic information about obesity.¹

The increase in obesity and overweight in children and adolescents in the past two decades is particularly alarming.² According to WHO, in 2013 more than 42 million children under five years old were already overweight.³

In Spain, and especially in the Canary Islands, the prevalence of obesity among children and adolescents is very high, particularly among Canarian adolescent girls.⁴ The enKid studies have shown the prevalence of obesity in Spain to be 13.9% and of overweight 12.4% (of overweight and obesity 26.3%).⁵ Geographically, the Canary Islands and Andalusia had the highest prevalence of obesity, and La Rioja, Asturias, the Basque Country, Galicia and Madrid had the lowest prevalence of obesity.^{5,6}

Regarding the etiology of obesity, it includes genetic and lifestyle factors. In relation to lifestyle, analyzing eating habits and physical activity in the population is basic. Therefore, in this work we have studied the adherence of the participants to the Mediterranean diet. This concept was proposed and developed by Keys and Grande⁷ and was defined as a dietary pattern followed in regions around the Mediterranean (mainly Crete, Greece and the south of Italy). The principal aspects of this dietary pattern include high consumption of fruit and vegetables, olive oil as a source of fat, low consumption of meat and dairy products and moderate consumption of wine.⁸

Its health benefits have been amply demonstrated by numerous epidemiological studies⁹ and are related to a lower total mortality and a lower incidence of cardiovascular disease, obesity, type 2 diabetes, metabolic syndrome and hypertension.¹⁰

In relation to eating habits we also studied the frequency of meals. Breakfast is the meal most related to obesity, and skipping it has been identified as a factor associated with excess weight.^{1,11} We have also related the morning break, lunch, afternoon break and dinner to the weight status of the participants.

Regarding physical activity, scientific studies have evidenced its association with obesity in adolescents, as well as with metabolic and cardiovascular diseases. Therefore, it is important to pay attention to the amount of physical activity performed by adolescents in order to consider the development of effective obesity prevention and treatment programs.¹²

Other sociodemographic variables such as educational level of parents have been related to weight status, so we have included them in this study. We also found interesting the assessment of adolescents nutritional knowledge level and its association with their weight status. Children are conditioned by their family dietary practices, while adolescents are cognitively more able to choose what they eat and to think about the dietary habits that they follow.¹³ There are many studies that have shown the association between variables like eating habits and obesity in childhood and adolescence. However, there is a lack of inves-

tigations focused on Spanish adolescents.^{11,14-16} Therefore, the aim of this research was to find overall data of prevalence of overweight and obesity in the Canarian adolescents and associate them with different behavioural variables.

MATERIAL AND METHODS

Participants and Procedure

This study was reviewed and approved by the Ethics Committee of the University of Las Palmas de Gran Canaria. All participants or (in the case of minors) their legal representatives signed an informed consent agreeing to participate in this research.

The sample of this cross-sectional study was representative and consisted of 1336 participants with a mean age of 15.0 (SD = 2.1 years). All adolescents who participated were from compulsory secondary education (aged 12 to 16; known in Spain as Educación Secundaria Obligatoria - ESO) to post-compulsory education at high school (aged 16 to 18; known in Spain as Bachillerato) or vocational training enrolled in various schools on the island of Gran Canaria.

The different educational centers and classrooms (one per level) were randomly selected. We contacted the centers and met with heads or school counselors to explain what the work was to consist of, to distribute the informed consent and to coordinate the activity. Once the date was specified, the team moved to the participating centers for the implementation of the different tests. The time required for conducting these tests was approximately 40 minutes, and they were at all times supervised by a team member. Later, the students were weighed and measured without shoes, jackets or heavy coats. The anthropometric study was conducted by experienced professionals.

Instruments

An ad hoc sociodemographic questionnaire was used, which collected information such as gender, age, educational level of parents, family illnesses reported by participants, being on diets, meal frequency and so on.

The Mediterranean Diet Quality Index (KIDMED) questionnaire¹⁷ was used to determine the level of adherence to the Mediterranean diet. It consists of 16 items that are related to Mediterranean dietary patterns. Each of the 12 items that denoted positive connotation with respect to the Mediterranean diet were scored as a +1, while questions that had a negative connotation to the Mediterranean diet (there are four) were scored as a -1. Then, all the items were summed to produce a total score. Based on this score, participants' adherence was classified as high (score ≥ 8), medium (4–7) or low (score ≤ 3).

To assess physical activity habits of adolescents the

Krece Plus questionnaire was used.¹⁸ This test consisted of two questions that assessed the number of hours per day dedicated to sedentary activities like watching TV or playing video games and the number of hours per week dedicated to physical activity. So, it allowed us to obtain an easy index for screening the level of activity or inactivity of the adolescents.

Each question offered six possible answers and scored ranges from 0 to 5. The maximum total value of the test was 10 and the minimum 0. According to this overall score individuals were classified into three categories corresponding to their level of physical activity:

- Good: score ≥ 9 for boys; ≥ 8 for girls
- Regular: 6–8 points in boys; 5–7 in girls
- Bad: score ≤ 5 in boys; ≤ 4 in girls

The NKT questionnaire was used to study the nutritional knowledge of participants in a formal way. This test was previously validated in children and adolescents.^{19,20} The NKT questionnaire was designed for students who had not received any special education on “nutrition”.¹⁹ The questionnaire included a total of 23 multiple choice questions categorized in specific scales: knowledge of concepts (e.g. subscales “energy intake and energy metabolism” or “physical activity”), instrumental knowledge (e.g. subscale “nutrient contents”) and knowledge of causal relationships (e.g. subscales “sweeteners” or “oral health”). Each multiple-choice question offered three possible answers and the “don’t know” category, and only one was correct. To calculate the total score, correct answers scored 1 and the rest 0. Finally, all correct answers were summed up and calculated as a percentage of the total.

To weigh students we used a scale ranging from 0 to 150 kg with a precision of 200 g. For the measurement of body height a Holtain stadiometer (Holtain Ltd., Dyfed, UK) with an accuracy of 1 mm was used. Waist circumference was measured with a metal, flexible but inextensible tape (Holtain Ltd., Dyfed, UK) on a 0.1 cm scale.

Growth references from the WHO^{21,22} were used to establish the weight status of the adolescents, following this criteria:

Weight state	Criteria
Overweight	IMC > +2 SD
Obesity	IMC > +1 SD
Thinness	IMC < -2 SD
Severe thinness	IMC < -3 SD

Data Analysis

The SPSS statistical package (version 19.0. for Windows) was used throughout for the analysis. Descriptive analyses of the variables used the test of proportions for qualitative

variables, measurements of central tendency (mean or median) and measures of dispersion (Standard Deviation - SD) for quantitative variables. Bivariate analyses of the proportionality of distribution of categorical variables were estimated using the χ^2 test.

For continuous variables, we used the Kolmogorov-Smirnov test to check that the variables were normally distributed. Normality was accepted as $p > 0.05$. For comparisons of continuous variables in which the distributions were normal, the comparisons of absolute means between groups were assessed with Student’s t-test. For comparisons of variables in which the distributions were non-normal, the comparisons of absolute means between groups were made with the nonparametric Wilcoxon test of the sum of the ranges.

RESULTS

Obesity Prevalence

The overall prevalence of obesity was 10.4% (n=139), of overweight 22.3% (n=299), of normal weight 65.1% (n=873) and of underweight 1.9% (n=25). Six participants of the total initial sample (N=1342) would not be weighed (because they would not let us to do it), representing a 0.4% of missing subjects. So the final sample was of 1336 adolescents.

Table 1 shows prevalence data of weight status in relation to sociodemographic characteristics. By sex, the prevalence of obesity in boys was of 12.6% (n=76) and in girls it was of 8.6% (n=63). Regarding age groups, we found a higher prevalence among participants of 13 years old or less (16.3%) and of 18 years old or more (11.6%) than in the other groups. Moreover, the prevalence of obesity was higher among adolescents with a father and/or mother with a medium-low level of education, family history of obesity (self-referential) and among those participants who had been on diets in the last year. We did not find significant differences in weight status among participants of public and private schools or among those who reported having relatives with anorexia or bulimia.

Adherence to the Mediterranean diet

In relation to the questionnaire of adherence to the Mediterranean diet (KIDMED), the mean score of the population was 5.83 ± 2.52 . A total of 19.2% of the population belonged to the group of “low adherence”, 53.7% to the group “medium adherence” and the 26.9% belonged to the “high adherence” group. Table 2 shows lower scores in girls (5.56 ± 2.47) than in boys (6.15 ± 2.54) ($p < 0.001$).

There were no significant differences between weight status and adherence to the Mediterranean diet between the participants (Table 3). However, we observed that participants with normal weight obtained the highest mean score in the KIDMED

	Underweight n (%)	Normal weight n (%)	Overweight n (%)	Obesity n (%)	Total n (%)	p
Gender						0.063
Boys	10 (1.7%)	393 (65.3%)	123 (20.4%)	76 (12.6%)	602 (100%)	
Girls	15 (2%)	480 (65.4%)	176 (24%)	63 (8.6%)	734 (100%)	
Age (years)						<0.001
≤13	7 (2.3%)	161 (52.4%)	89 (29%)	50 (16.3%)	307 (100%)	
14-15	7 (1.5%)	319 (67.7%)	102 (21.7%)	43 (9.1%)	471 (100%)	
16-17	7 (1.7%)	295 (73.2%)	73 (18.1%)	28 (6.9%)	403 (100%)	
≥18	4 (2.6%)	98 (63.2%)	35 (22.6%)	18 (11.6%)	155 (100%)	
Center type						NS
Public	19 (1.9%)	642 (64.1%)	228 (22.8%)	113 (11.3%)	1002 (100%)	
Private	6 (1.8%)	231 (69.2%)	71 (21.3%)	26 (7.8%)	334 (100%)	
Father's educational level						0.027
High	4 (1.5%)	198 (73.1%)	52 (19.2%)	17 (6.3%)	271 (100%)	
Medium-Low	17 (2.4%)	448 (63.6%)	162 (23%)	77 (10.9%)	704 (100%)	
Mather's educational level						0.016
High	5 (1.7%)	217 (72.8%)	59 (19.8%)	17 (5.7%)	298 (100%)	
Medium-Low	17 (2.2%)	480 (63.4%)	179 (23.6%)	81 (10.7%)	757 (100%)	
Family diseases						
Alcoholism						NS
YES	1 (1.8%)	36 (65.5%)	13 (23.6%)	5 (9.1%)	55 (100%)	
NO	24 (1.9%)	835 (65.3%)	286 (22.4%)	134 (10.5%)	1279 (100%)	
Family obesity						
YES	0 (0%)	65 (51.2%)	28 (22%)	34 (26.8%)	127 (100%)	
NO	25 (2.1%)	806 (66.8%)	271 (22.5%)	105 (8.7%)	1207 (100%)	
Family anorexia						NS
YES	0 (0%)	9 (52.9%)	5 (29.4%)	3 (17.6%)	17 (100%)	
NO	25 (1.9%)	862 (65.5%)	294 (22.3%)	136 (10.3%)	1317 (100%)	
Family bulimia						NS
YES	0 (0%)	7 (50%)	4 (28.6%)	3 (21.4%)	14 (100%)	
NO	25 (1.9%)	864 (65.5%)	295 (22.3%)	136 (10.3%)	1320 (100%)	
Dieted in past year						<0.001
YES	1 (0.3%)	131 (41.3%)	115 (36.3%)	70 (22.1%)	317 (100%)	
NO	24 (2.4%)	740 (72.8%)	184 (18.1%)	68 (6.7%)	1016 (100%)	

Table 1: Weight status (WHO) and socio demographic characteristics.

	BOYS Media (DT)	GIRLS Media (DT)	TOTAL Media (DT)	p
KIDMED	6.15 (2.54)	5.56 (2.47)	5.83 (2.52)	<0.001
Krece Plus	6.05 (2.17)	5.06 (2.31)	5.51 (2.30)	<0.001
Hours TV, etc.	2.33 (1.27)	2.21 (1.26)	2.26 (1.26)	NS
Hours physical activity	3.37 (1.72)	2.28 (1.77)	2.77 (1.84)	<0.001

Table 2: KIDMED and Krece Plus distributed by gender.

test and the highest frequency in the “high” group of adhesion.

	Normal weight	Overweight	Obesity	p
Mediterranean diet adherence				NS
Total M (DT)	5.89 (2.55)	5.76 (2.50)	5.64 (2.31)	
Groups n(%)				NS
Low	166 (19%)	56 (18.7%)	8 (32%)	
Intermediate	463 (53%)	166 (55.5%)	11 (44%)	
High	244(27.9%)	77 (25.8%)	6 (24%)	

Table 3: Mediterranean diet adherence (KIDMED) and weight status

Physical Activity

A total of 55.1% of the adolescents belonged to the group of “bad physical activity”, 29.8% to the “regular physical activity” group and 14.8% of the population belonged to the “good physical activity” group. The overall mean of hours of sedentary activities of the population was 2.26±1.26. The mean of hours that the adolescents practice physical activity was 2.77±1.84.

Table 2 shows a higher score in boys (6.05±2.17) than in girls (5.06±2.31) (p< 0.001) in the Krece Plus (physical activity). Participants with normal weight spent fewer hours in sedentary activities such as watching television or playing video games (p< 0.05) and more hours of physical activity (p< 0.05) than those with underweight, overweight or obesity (Table 4).

	Normal weight	Overweight	Obesity	p
Physical activity				
Total hours sedentary activities M (DT)	2.20 (1.24)	2.33 (1.34)	2.45 (1.18)	0.007
Total hours physical activity M (DT)	2.86 (1.84)	2.64 (1.82)	2.68 (1.81)	0.034
Groups n (%)				0.008
Poor	457 (52.4)	175 (58.5)	84 (60.4)	
Regular	266 (30.5)	87 (29.1)	46 (33.1)	
Good	149 (17.1)	37 (12.4)	9 (6.5)	
TOTAL n (%)	873 (100%)	299 (100%)	139 (100%)	

Table 4: Physical activity (Krece Plus) and weight status.

Nutritional Knowledge

Ten out of twenty-three questions were answered correctly by more than 50% of respondents. The overall percentage of correct answers in the population was 47.2. In the total

sample girls had similar scores as boys (respectively, 46.9% and 47.5%). By sex, there were significant differences only in subscale C (sweeteners and oral health; p< 0.000) and subscale E (special terms and definitions; p= 0.01). In both subscales, boys had higher scores. There were no significant differences between nutritional knowledge and weight status.

Meal Frequency

A total of 18.6% of the adolescent population never or almost never had breakfast (11.9% boys, 24.1% girls). There were significant differences between girls and boys in breakfast (p<0.001), afternoon break (p= 0.007), dinner (p<0.001) and snacking between meals (p= 0.005). In all of them, girls never or almost never ate.

Table 5 shows that participants who never or almost never had breakfast, morning break, afternoon break and dinner had a higher prevalence of obesity and overweight (respectively, p= 0.001; p= 0.001; p= 0.001; p= 0.028) than those who had these meals every day or almost every day. The only meal in which there were no significant differences was lunch.

DISCUSSION

The objective of this study was to calculate the prevalence of obesity and overweight in adolescents in Gran Canaria (Canary Islands, Spain) and to analyze the relation between excess weight and different variables. Results showed a prevalence of obesity of 10.4% (12.6% of boys and 8.6% of girls) and of overweight of 22.3% (boys 20.4%, girls 24%). We observed a relation between obesity and the educational level of the parents, having a relative with obesity, hours of sedentary activities and frequency of meals.

The serious physical and psychological consequences resulting from overweight and obesity highlight the importance of addressing these issues from an early age.²³ Epidemiological studies have shown that the prevalence of overweight has surpassed the prevalence of malnutrition in all ages and social and demographic strata. This represents a short and long term risk factor for the increase of Non-communicable chronic diseases (NCCD).²⁴⁻²⁶

The prevalence rates of overweight and obesity vary depending on the geographical area where the studies were conducted, as well as age groups, tables or classification systems used, etc. However, there is a consensus that marks a worldwide increase of child and adolescent obesity, which constitutes an important public health problem.¹

The enKid study 5, conducted in Spain with children and youths, found a prevalence of obesity (13.9%) higher than in our work (10.4%). However, in our study, the data of the prevalence of overweight were much higher (22.3%) than in the en-

	Normal weight	Overweight	Obesity	Total
Breakfast**				
Never/almost never	137 (15.7%)	71 (23.7%)	39 (28.1%)	247 (18.8%)
Always/almost always	736 (84.3%)	228 (76.3%)	100 (71.9%)	1064 (81.2%)
Morning break**				
Never/almost never	192 (22%)	93 (31.1%)	48 (34.5%)	333 (25.4%)
Always/almost always	681 (78%)	206 (68.9%)	91 (65.5%)	978 (74.6%)
Lunch				
Never/almost never	11 (1.3%)	4 (1.3%)	1 (0.7%)	16 (1.2%)
Always/almost always	862 (98.7%)	295 (98.7%)	138 (99.3%)	1295 (98.8%)
Afternoon break **				
Never/almost never	244 (27.9%)	134 (44.8%)	72 (51.8%)	450 (34.3%)
Always/almost always	629 (72.1%)	165 (55.2%)	67 (48.2%)	861 (65.7%)
Dinner*				
Never/almost never	58 (6.6%)	34 (11.4%)	13 (9.4%)	105 (8%)
Always/almost always	815 (93.4%)	265 (88.6%)	126 (90.6%)	1206 (92%)
Snacking between meals**				
Never/almost never	543 (62.2%)	235 (78.6%)	111 (79.9%)	889 (67.8%)
Always/almost always	330 (37.8%)	64 (21.4%)	28 (20.1%)	422 (32.2%)

**p< 0.001

*p< 0.05

Table 5: Frequency of meals and weight status.

Kid study (12.4%). The National Health Survey 2006-2007 6 obtained a prevalence of obesity in Spanish children of 10.3% and of overweight of 18.8%. Another work in Castilla y León (Spain) showed a prevalence of obesity of 5.8% and of 16.7% of overweight.²⁷ These data are much lower than ours.

We observed similar results in other studies such as the one of Garcia-Continente et al.¹¹ In this work they found a lower prevalence than in our study. However, they also found more obese boys (6.2%) than obese girls (3.7%) and more overweight boys (19.9%) than overweight girls (17%). The prevalence of overweight boys was similar to ours. The AVENA study²⁸ obtained similar data of prevalence to the study of Garcia-Continente.¹¹ In boys they found 5.7% obese and 20% overweight. In girls obesity and overweight prevalence were lower than ours: 3.8% and 16%, respectively. These works found higher rates of obesity prevalence among boys than among girls. However, Henríquez et al.² found higher obesity prevalence among girls than boys in Gran Canaria. They obtained a prevalence of 14.8%: 17.6% of girls and 12% of boys. In a more recent study, Sánchez-Cruz²⁹ found a prevalence of obesity of 12.9% among boys and of 12.3% among girls, and a prevalence of overweight of 28.6% and 23.5% among boys and girls, respectively. Obesity prevalence of boys and overweight prevalence of girls were similar to ours. Comparing age groups, as in the enKid study 5, we found the highest prevalence of obesity in participant's ≤ 13 years old.

There is some controversy among studies that exam-

ine the relationship between weight and the Mediterranean diet. Numerous prospective studies that investigate the relationship between diet quality and the risk of obesity found that the Mediterranean diet was inversely associated with the risk of obesity or weight gain.³⁰ However, other studies such as the SUN cohort study, found no such relationship, observing that participants increased their average weight during the follow-up period.³¹ In our study, the highest average KIDMED score was observed in adolescents with normal weight. Nevertheless, there were no significant differences in the level of adherence to the Mediterranean diet and the weight status.

According to the scientific literature, breakfast represents a clear protector factor of obesity.³² Other specific eating habits have also been related to the increase of weight such as the frequency of meals or the intake of snacks. However, the results of the studies in relation to eating habits are inconsistent.³³ In our research we found significant differences in meal frequency and weight status. We observed that skipping meals (breakfast, morning break, afternoon break and dinner) was associated to obesity.

However, most interventions focused on obesity prevention consider not only a dietary change component but also a physical activity component or a combination of both. A number of interventions are focused on increasing frequency and duration of physical exercise, while others on decreasing time devoted to sedentary activity.³⁴ In our research, we observed that participants with normal weight had the lowest number of hours

of sedentary activities and the most hours of physical activity.

Another variable studied in this research was the nutritional knowledge level, using the validated test NKT. As in the HELENA study (Healthy Lifestyle in Europe by Nutrition in Adolescence), in our study there was no correlation between BMI values and total NKT score. However, they found gender differences that we did not find. Their results showed a higher knowledge level among girls than among boys. Obesity and overweight have also been linked with lower educational levels.^{1,35} This paper also found a higher prevalence in adolescents whose fathers and/or mothers had low-medium educational level *versus* those with a higher educational level.

Overall prevalence of overweight and obesity continue to be very high, especially in the Canary Islands. Therefore it is necessary to search for more effective prevention programs and treatments specifically for adolescents, which might consider the variables analyzed in this research.

CONFLICTS OF INTEREST: None.

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