Research Article

Factors Associated with the Risk of Eating Disorders

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Abstract

Objective: To analyze factors associated with the risk of Eating Disorders (EDs), like the Mediterranean diet adherence, physical activity and weight status, in participants between 12 and 20 years old; and to obtain data of prevalence of risk of developing an ED.

Methods: 1342 adolescents were selected from educational centers on Gran Canaria, Spain. The sampling technique was sampling by clusters, and the sample unit was the classroom. Risk of EDs was measured by EAT-40 questionnaire. Sociodemographic variables, weight status, physical activity, and adherence to Mediterranean diet were also evaluated. To evaluate the associated factors of EAT, positive test logistic regression analyses were used, controlling for confounding variables.

Results: The prevalence of risk of ED was 27.42% (33% of girls, 20.6% of boys). The following variables were associated with an increased risk of developing an ED: excess weight versus normal weight (OR = 2,32; 95% CI: 1.58- 3.41), a low adherence to the Mediterranean diet versus a high adherence (OR=1.77; 95% CI: 1.06-2.94), a good level of physical activity versus a moderate level (OR=1.790; 95% CI: 1.08-2.96), and have been on diet in the past year (OR=5.97; 95% CI: 4.12-8.66).

Conclusion: The prevalence of risk of ED in Gran Canaria is especially high compared to other national and international studies. A high adherence to Mediterranean diet and a moderate level of physical activity attenuate the risk of ED in adolescents.

Keywords: Eating disorders; Risk factors; Epidemiology; EAT-40; Cross-sectional descriptive research

Introduction

Eating Disorders (EDs) are biopsychosocial pathologies with severe physical complications [1]. They are characterized by a difficult and prolonged treatment time, risk of chronicity, relapse, anxiety related to social constraints, risk of obesity in later life, depression, suicide attempts, anxiety disorders, substance abuse, and high comorbidity [2-4]. In addition, all ED have an elevated mortality risk, anorexia the most remarkable [5,6].

Given the severe impact of these diseases, numerous epidemiological studies have been developed in recent decades that attempt to measure the extent of these disorders and inquire about risk factors that may be related to the disorders [7]. Although there are clear differences and a variety among these studies, it can be considered there is a risk of ED of between 4 and 12% (some studies indicate up to 25%), with a prevalence of ED diagnosis of between 1 and 5% [8].

Although the percentage of ED diagnosis is relatively low, many women seem to be at risk of developing it [9,10]. Moreover, in contrast to previous stereotypes, epidemiological studies have shown that EDs affect all ethnicities and socioeconomic groups [11,12].

Therefore, the risk factors associated with these problems can also vary depending on social and cultural differences [13]. In Spain, and especially in the Canary Island, the obesity prevalence among children and adolescents is very high, particularly among Canarian adolescent girls [14].

EDs are common in adolescent population [15,16]. These pathologies, together with overweight and obesity, are important health concerns in adolescents [15], because excess weight has been associated with altered dietary patterns [17,18].

Despite the existence of some longitudinal studies, there is still no consensus about the determinant factors in the development of these pathologies in adolescence. In addition, many of the studies have limitations of the sample size or the inclusion of a single class [19].

Some studies like the European ProYouth programme, focused on the promotion of mental health and the prevention of ED among young people, have concluded that those individual who had considerable concerns about their weight are at risk for developing ED [20]. Other, like the published by Morales et al. in 2014, have found that risk factors of ED were male gender, age > 14 years, body image dissatisfaction, family dysfunction, depressive symptoms and perceived stress [21]

It has been argued that it is important to identify specific risk and protective factors for the development of disturbed eating [22].

In the Canary Island, there are some studies about characteristics associated to EDs [23,24] with different results about the influence of age, gender, physical activity, previous losing diets or excess weight. None of these studies have evaluated the influence of Mediterranean diet adherence. Some studies have found an inverse association between adherence to a Mediterranean diet and the risk of depression [25]. Because of that, it would be interesting to investigate the relation between dietary patterns and EDs prevalence.

Therefore, the objectives of this paper are to analyze the association between different factors like Mediterranean diet adherence, physical activity patterns and weight status and the risk of developing an EDs, and to obtain data of prevalence of risk in a population between 12 and 20 years old from the island of Gran Canaria, Spain. This will allow us to identify those individuals most likely to have EDs, in order to design targeted programs for high-risk individuals.

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 and done in accordance with the Declaration of Helsinki [26]. All participants or (in the case of minors) their legal representatives signed an informed consent agreeing to participate in this research, following the LOPD 15/1999 [27].

The sample consisted of 1342 adolescents with a mean age of 15.0 (SD = 2.1 years). All the participants 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 15 educational centers on the island of Gran Canaria (11 public educational centers and 4 private educational centers).

We started with a pilot study in an educational center to ensure that all participants understood and did correctly all the tests in the stipulated time.

The sampling technique was sampling by clusters, the sample unit was the classroom; then, 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 adolescents were weighed and measured without shoes, jackets, or heavy coats.

Instruments

Sociodemograhic questionnaire:

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, and so on.

Risk of Eating Disorder (EAT-40):

As a screening tool to determine whether or not there was risk of developing an eating disorder, the EAT-40 (Eating Attitudes Test) of Garner and Garfinkel was used [28]. The EAT-40 has been a commonly used screening instrument for EDs in epidemiological research. It measures the characteristic symptoms and concerns of EDs, such as the attitudes, feelings, and behaviors related to food, weight, and exercise. It is suitable for application from the age of 12, or from the first period in women. The cutoff proposed by the original authors is 30 (Sensivity: 100%, Specificity: 97%) [28]. With this same cutoff, in the Spanish validation study, sensitivity drops to 67.9 %. Therefore, Castro, Toro, Salamero, and Guimerá [29] proposed an alternative cutoff of 20 to be used in the Spanish environment, bringing the sensitivity up to 91%.

Moreover, they identified three factors. Factor I, significantly loaded, contains almost all items and can be identified as diet and food preoccupation. Factor II contains most of the items related to the perception of experiencing social pressure and eating distress. Factor III mainly contains issues related to psychobiological disorders. This was the version used in our study.

The EAT-40 questionnaire consists of 40 items, which distinguish between ED patients and the normal population. Responses are rated on a 1 (Always) to 6 (Never) spectrum. Items 1,18,19,23 and 39 are scored: 6=3 points; 5=2 points; 4=1 point; 3, 2, or 1=0 points. The remaining items are scored: 1 = 2 points; 2=2 points; 3=1 point, and 4, 5, or 6=0 points. Therefore, the total possible scores of the questionnaire ranges from 0 to 120 points.

Physical Activity (Krece Plus):

The Krece Plus [30] questionnaire was used to evaluate the physical activity habits of the adolescents. This validated [30] test consists of 2 questions that assess the number of hours per day that the subjects performed sedentary activities like watching TV or playing video games, and the number of hours per week dedicated to physical activity. So, it is an index that allows a fast screening of the level of activity or inactivity of the participants. Each question has 6 possible answers and the scores range from 0 to 5. The maximum total value of the test is 10 and the minimum is 0. According to this, overall score are classified into 3 categories corresponding to their level of physical activity:

Good: score ≥ 9 for boys, ≥ 8 for girls

Moderate: 6–8 points for boys, 5–7 for girls

Poor: values ≤ 5 for boys, ≤ 4 for girls.

Adherence of Mediterranean diet (Kidmed):

The Kidmed Questionnaire [31] was used to measure the degree of adherence to the Mediterranean diet. It consists of 16 items. Each question is answered in the affirmative or negative (yes/no). It includes 12 items showing a positive attitude to the Mediterranean diet, which added 1 point if the subject responds positively; while 1 point is subtracted if the subject responds positively in those questions that have a negative connotation for the Mediterranean diet. From the total scored, three categories are obtained:

High adherence: scores ≥ 8 (and optimal adherence to the Mediterranean diet)

Intermediate adherence: scores between 4–7 (need to improve eating patterns to fit the Mediterranean model)

Low adherence: scores ≤ 3 (a very low quality diet where adherence is poor).

Anthropometric measures:

To weigh the participants 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.

Table 1: Sociodemographic characteristics of the studied population.

Characteristics		EAT-40						
		Risk (n = 368)		No Risk (n =974)		Total (N = 1342)		p
		n	%	n	%	N	%	
Gender	Boys	125	20.6%	481	79.4%	606	100%	.000
	Girls	243	33%	493	67%	736	100%	
Age (years)	≤13	101	32.8%	207	67.2%	308	100%	.095
	14–15	127	26.8%	346	73.2%	473	100%	
	16–17	99	24.6%	304	75.4%	403	100%	
	≥18	41	25.9%	117	74.1%	158	100%	
School year	ESO	270	29.6%	643	70.4%	913	100%	.008
	Bachillerato	87	21.8%	312	78.2%	399	100%	
	Ciclo	11	36.7%	19	63.3%	30	100%	
Center type	Public	292	29%	716	71%	1008	100%	.027
	Private	76	22.8%	258	77.2%	334	100%	
Weight status	Underweight	31	15.3%	171	84.7%	202	100%	.000
	Normal weight	184	23.3%	607	76.7%	791	100%	
	Overweight and obese	153	44.6%	190	55.4%	343	100%	
Father's educational level	Low	122	29.7%	289	70.3%	411	100%	.071
	Medium–High	139	24.5%	428	75.5%	567	100%	
Mother's educational level	Low	123	28.9%	302	71.1%	425	100%	.368
	Medium–High	167	26.4%	465	73.6%	632	100%	
Obesity: parent		52	40.6%	76	59.4%	128	100%	.000
Alcoholism: parent		24	43.6%	31	56.4%	55	100%	.006
Kidmed	Low	85	33.1%	172	66.9%	257	100%	.078
	Intermediate	191	26.5%	530	73.5%	721	100%	
	High	92	25.5%	269	74.5%	361	100%	
Physical Activity	Poor	209	28.3%	530	71.7%	739	100%	.110
	Moderate	96	24%	304	76%	400	100%	
	Good	63	31.7%	136	68.3%	199	100%	
Dieted past year		185	58%	134	42%	319	100%	.000

Growth reference of the WHO [32,33] were used to establish the weight status of the adolescents, following this criteria:

Data Analysis

The SPSS statistical package (version 19.0. for Windows) was

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

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 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.

To evaluate the factors associated with the EAT, positive test logistic regression analyses was used. The studied independent variables were: gender, age, being on a diet in the past year, weight status, physical activity, obesity in parents, alcoholism in parents, mother educational level and father educational level. Significance was set at p < 0.05.

Results

The final sample consisted of 1342 participants, of which 45.2% (n = 606) were boys and 54.8% (n = 736) were girls; 98.5 % (n = 1322) were aged between 12 and 20 years and the level of education received ranged from ESO to bachillerato and vocational training. A total of 913 participants (68%) were in ESO, 399 (29.8%) were at bachillerato, and 30 (2.2%) were enrolled at vocational training institutions. With reference to the educational level of parents of adolescents, we found that 58% (n = 567) of the fathers and 59.8% (n = 632) of the mothers had secondary or higher education, compared to 42% (n = 411) of fathers and 40.2% of mothers (n = 425) who had a low educational level.

Regarding the level of adherence to the Mediterranean diet by participants, the mean score for the total population was 5.83 (SD = 2.52), and the mean for girls was 5.56 (SD = 2.47) and that for boys was 6.15 (SD = 2.54) (p < 0.001). In the case of Krece Plus (physical activity), we found an average of 6.05 for boys (SD = 2.17) and 5.06 (SD = 2.31) for girls, and the difference was also significant (p <

Table 2: Means and standard deviation of different variables distributed by gender and risk.

	Girls			Boys		
	EAT ≥ 20 (n = 243)	EAT < 20 (n = 493)	p	EAT ≥ 20 (n = 125)	EAT < 20 (n = 481)	p
Age (years)	15.18 (2.03)	15.19 (2.01)	.951	14.54 (2.52)	15.26 (2.16)	.001
BMI	23.30 (4.70)	21.39 (3.90)	.000	23.16 (4.85)	21.32 (4.92)	.000
EAT	31.23 (10.77)	11.39 (4.40)	.000	28.28 (7.65)	11.10 (4.32)	.000
Physical act hours/week	2.23 (1.88)	2.30 (1.72)	.665	3.36 (1.72)	3.38 (1.72)	.918
Sedentary hours/day	2.28 (1.35)	2.18 (1.21)	.315	2.28 (1.34)	2.34 (1.26)	.657
Kidmed	5.24 (2.66)	5.72(2.36)	.018	6.17 (2.66)	6.14 (2.51)	.912

Table 3: Risk of Eating Disorders by weight status, Mediterranean diet adherence, Level of Physical Activity and Previous diet[&].

Weight Status (OMS definition) n (100%)	Normoweight n (%)	Excess weight (Overweight and Obesity) n (%) OR (95%CI)	Underweight n (%) OR (95%CI)
1342 (100)	791 (59.2) 1 (ref)	343 (25.6) 2,326 (1.585- 3.414)**	202 (15.1) 1,118 (0.652-1.919)
Mediterranean Diet Adherence (Kidmed) n (100%)	High adherence n (%)	Intermediate adherence n (%) OR (95%CI)	Low adherence n (%) OR (95%CI)
1339 (100)	361 (27.0) 1(ref)	721 (53.8) 1.017 (0.686- 1.508)	257 (19.2) 1.775 (1.069-2.945)*
Level of Physical Activity n (100%)	Moderate n (%)	Good level n (%) OR (95%CI)	Poor level n (%) OR (95%CI)
1338 (100)	400 (29,9) 1 (ref)	199 (14.9) 1.790 (1.082-2.962)`	739 (55.2) 1.155 (0.783-1.705)
Dieted in the past year n (100%)	No n (%)	Yes n (%) OR (95%CI)	
1337 (100)	1018 (73.1) 1 (ref)	319 (23.9) 5.977 (4.121-8.669)**	

[&]Adjusted by age, gender, father's educational level, Mother's educational level, Obesity parent, Alcoholism parent
**p<0.001.
`p< 0.05.

0.001). The average score for the total population in this test was 5.51 (SD = 2.30).

For the EAT-40 test, of the 1342 participants, 368 (27.4 %) scored above the cutoff set at 20 (18.11% of girls, 9.31% of boys), and were therefore considered at risk of developing an ED. Table 1 shows the distribution of the sample according to the risk of ED and their socio-demographic characteristics. Regarding gender, girls were at a significantly higher risk than boys (33% versus 20.6%; p < 0.001). In relation to age, the younger group (≤ 13 years) had the highest percentage of risk at 32.8% (n = 101).

Table 2 shows the different means distributed by gender and risk, based on the results of the EAT, defined here as either EAT+ (EAT ≥ 20) or EAT− (EAT <20). Regarding age, the participants at risk had a lower average age compared with those without risk (14.54 vs. 15.26 years old; p < 0.001). BMI was superior in girls and boys with EAT+ scores versus those with EAT− (p < 0.001). In the Kidmed, girls who scored above the cutoff (EAT ≥ 20) had a mean score of 5.24 (SD = 2.66) versus a mean of 5.72 (SD = 2.36; p = 0.018) for boys who did not exceed it.

The results of the multivariate analysis are presented in Table 3. This shows, after adjusting for confounding variables, that: excess weight versus normal weight (OR = 2,32; 95% CI: 1.58- 3.41), a low adherence to Mediterranean diet versus a high adherence (OR=1.77; 95% CI: 1.06-2.94), a good level of physical activity versus a moderate level (OR=1.790; 95% CI: 1.08-2.96) and had been on some type of diet in the past year (OR=5.97; 95% CI: 4.12-8.66), is associated with an increased risk of developing an ED. We also observed that as age increases, the chances of having an ED risk decreases (OR= 1.34; 95% CI: 0.83-0.97).

Discussion

This work has focused on finding factors associated with the risk of developing an ED, like the level of adherence to the Mediterranean diet, physical activity patterns or weight status, and on analyzing data of risk of EDs in a population between 12 and 20 years old from the island of Gran Canaria. The main findings of this research indicate that adolescents who had a low adherence to the Mediterranean diet, had a higher risk of developing EDs than those with a high adherence. We also found that a good level of physical activity increased the risk of ED versus a moderate level of physical activity. In addition, we observed that excess weight increased the risk of developing an ED too.

In our study, the prevalence of risk of ED, measured by the EAT-40 screening test, was 27.42% (33% of girls, 20.6% of boys).

EDs are mental diseases that can lead to very serious physical health problems, and are closely linked with eating habits. The Mediterranean diet refers to a type of diet characterized by high consumption of vegetables, legumes, fruit, nuts, grains, and especially olive oil. It stands out also because it includes moderate consumption of fish, eggs, and dairy products, and lower consumption of meat and animal fats [34,35]. This diet therefore ensures an adequate caloric and nutrient intake, and contributes to disease prevention and increased life expectancy and quality of life [36-38]. In addition, some degree of protection attributed to the Mediterranean diet with respect to cognitive impairment, dementia or major depression incidence has been reported [39]. Hence our interest in analyzing the relation between this type of diet and the risk of ED, founding that adolescents with a low level of adherence to Mediterranean diet had a higher risk of developing an ED than adolescents with a high level of adherence (OR=1.77; 95% CI: 1.06-2.94).

Physical activity habits were evaluated by the Krece Plus questionnaire, which was used in the enKid national study conducted between 1998 and 2000 with more than 3500 participants of both sexes aged from 2 to 24 years [30]. In the case of physical activity boys had a higher mean than girls (mean 6.05 vs. 5.05, p < 0.001). However,

both were within the moderate physical activity level (6–8 points for boys, 5–7 for girls).

Although its health benefits are clear, its role in ED is more controversial. Exercise is an effective tool for many physical and psychological disorders, and recently some studies have recommended thoroughly analyzing its relationship with ED [40]. In addition, the role of moderate exercise as a strategy for prevention of ED is considered for several reasons. In this work we found that a good level of physical activity predicts a higher risk of ED than a moderate level (OR=1.790; 95% CI: 1.08-2.96). These findings are consistent with other studies that have concluded that an appropriate level of physical activity helps to prevent the onset of these disorders [41].

As for the weight status of participants, it was found that 44.6% of overweight adolescents were at risk according to the EAT-40. In agreement with other authors [42], this study found that overweight and obesity a risk factor associated with ED (OR = 2.32; 95% CI: 1.58-3.41). Recently, many studies have shown high rates of psychiatric symptoms in children and youths with obesity and overweight [43]. Studies like that by Pauli-Pott et al. [43] have suggested that if this excess weight is added to psychiatric symptoms such as depression in young girls, the risk of developing an eating disorder increases.

In relation to other prevalence studies, researches such as that of Austin [44] in North America found a prevalence of risk of 14.5% among women, and of 3.6% among men. Other researches in Europe, such as that Isomaa et al. [45], conducted in Finland, obtained lower percentages: 6.7% risk in women and 0.6% in men. Recent studies in Spain by authors such as Pamies-Aubalat [46] have valued the risk at 11.2% (7.79% women, 3.34% men), while Veses et al. [15] found that 18% of the subjects in the AVENA study and 25% of the subjects in the AFINOS study had significant scores in the screening questionnaire (SCOFF). This data of prevalence of risk (25%) is close to ours but lower (27.42%). Martínez-González et al. [47], obtained a prevalence of risk of 19.5% among young Spanish university, being higher in women and using the SCOFF as screening tool too. Almost no risk studies have been done in the Canary Islands. Herrero and Viña [48] found the prevalence of risk to be 18.1% in females and 5.4% in males in Tenerife Island. In Lanzarote Island, in 2004, Cabrera, Toledo and Báez [49] found a prevalence of risk of 18.2%, superior in woman: 21.9% vs 13.8%. In Gran Canaria Island there is also a study carried out by Roy, López, Galán and Del Castillo [23]. They found a prevalence of risk of 9% (13.3% girls and 3.8% boys), much lower than the prevalence of risk of our study (27.42%).

All of the studies emphasize a high percentage of individuals at risk of developing an ED, women being especially vulnerable.

Other factors associated with an increased risk of ED are age and dieting in the past year.

Adolescence is also an important risk factor associated with the development of ED [50], and many studies have focused on this stage of development. In this stage, psychological and physical changes make adolescents more vulnerable to EDs. In this paper, results showed that an increase of the age decreased the risk of these pathologies (OR= 1.34; 95% CI: 0.83-0.97). Therefore, the youngest (13 years or less) in this study are more likely to be at risk. This finding

is particularly interesting in view of the organization of resources when performing, for example, prevention.

Dieting is associated with weight concern and the desire to lose weight, and is largely related to the factors prevalent among women for the risk of developing eating disorders. However, dissatisfaction with weight and the use of control strategies are common among teenagers, and it is only a minority who eventually develop these disorders. This highlights once again that there is currently no single factor that explains EDs and reveals the need to analyze which variables are related to the development of these diseases and which characteristics shared individuals who develop an ED [7]. The data in this study show that 50.3% (n = 185) of participants that exceeded the cutoff had been on some kind of diet in the past year ,constituting a risk factor for ED (OR = 5.97; 95% CI: 4.12-8.66).

The complexity of these disorders requires a multifactorial approach to their study. Therefore, family factors were also considered in this work, because the family is the first group that transmits beliefs, attitudes, and behavior patterns related to food [51]. This study found that obesity and alcoholism in the families of the participants, referred by the adolescents, were present in 14.1% and 6.5% of adolescents at risk, respectively (p < 0.001).

The present findings support the role of the adherence to the Mediterranean diet, physical activity and weight status in preventing the development of EDs in adolescents. Hence, it would be interested to continue taking forward researches that analyze the relation between these factors and EDs, especially the Mediterranean diet, in larger samples and different populations. This can contribute to the development of treatments and prevention programs that are more effective.

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