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Behavioral risk factors and mental health: Single and cluster associations in Spanish adolescents

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ABSTRACT

Objective. The risk factors associated with mental health in adolescents are not well known in the general population of Mediterranean countries. Therefore, this study aimed to identify individual and clustered behavioral risk factors for psychological distress.

Methods. Cross-sectional study conducted in 2008-2009 among 4054 students representative of those in the 4th year of secondary education in the region of Madrid (Spain). Mental health was assessed using the General Health Questionnaire (GHQ-12), with psychological distress defined as a score ≥3. The analyses were performed with logistic regression and adjusted for the main confounders.

Results. Psychological distress was more frequent in those who did insufficient physical activity (odds ratio 1.23; 95% confidence interval 1.03-1.47), smokers (1.30; 1.07-1.59) and users of illegal drugs (1.46; 1.21-1.76). Psychological distress also showed a positive dose-response relationship with the number of risk behaviors for eating disorders (p for linear trend <0.001). Moreover, it was associated with both thin (1.37; 1.16-1.62) or very thin body image (2.15; 1.39-3.32) and perceived overweight (1.74; 1.40-2.15) or obesity (3.12; 2.23-4.37). Compared with individuals without classic risk behaviors (low physical activity, low consumption of fruits/vegetables, smoking, high-risk alcohol consumption), frequency of psychological distress was higher in those with two risk behaviors (1.47; 1.19-1.82) and was even greater in those with three or four risk behaviors (1.56; 1.21-2.01).

Conclusions. During adolescence, psychological distress is associated with lifestyles, body image and eating behaviors. Clustering of classic risk behaviors increases the likelihood of poor mental health.

Keywords. Mental health, adolescents, health survey, risk factors, clustering.

INTRODUCTION

The prevalence of mental disorders in young people ranges between 8 and 57% according to studies from several countries representing diverse social contexts[1]. Mental health has a great impact on morbidity and mortality given that in developed countries neuropsychiatric problems are responsible for 22% of disability-adjusted life year[2], a figure which is probably higher in adolescents[3].

Various factors have been related to mental health problems in adolescence. There is consistent evidence of their association with smoking[4], illegal drugs[5], eating disorders[6], and self-perception of body image[7]. However, the role of physical exercise[8;9], alcohol consumption[10;11]and body weight remains uncertain[7].

Moreover, the relation between clustering of risk behaviors and mental health has scarcely been studied in adolescents, despite their great importance to public health. In fact, prevalence of clustered behaviors is high, and it has been suggested that certain clusters of unhealthy behaviors are associated with poorer mental health[12;13]. This comprehensive approach is in line with the multidimensional model of health and is useful for developing preventive interventions aimed at multiple rather than isolated risk factors[14].

In a Mediterranean country, such as Spain, the prevalence of adolescent mental health disorders in individuals aged 15 years is 19.1%[15], which is within the range of other developed countries. However, notable differences in the frequency of health behaviors have been found between adolescents in European Mediterranean countries and those in the United States[16]. The association of this different pattern of behavioral risks with mental health is unknown in the general adolescent population.

Accordingly, this study aimed to identify behavioral risk factors for psychological distress among Spanish adolescents and to examine the relationship between the clustering of these risk factors and mental health.

METHODS

Study design and population

The data were taken from the Risk-Factor Surveillance System for Non-communicable Diseases (Spanish acronym, SIVFRENT) in the adolescent population. This system monitors major health-related lifestyles in a representative sample of students of 4th-year secondary education in the region of Madrid (Spain). In Spain, secondary education is mandatory and it consists of four academic courses between the age of 11-12 and 15-16 years.

Schools were stratified by geographic area (the capital and all other municipalities) and type of school (public or private) with the probability of selection being proportional to the number of students enrolled. Two classrooms were selected randomly in each school. Students completed the questionnaire in the classroom in the presence of trained personnel. The average time needed to complete the questionnaire was 35 minutes. Participation of schools and students was voluntary after obtaining informed consent. Information was collected in 2008 and 2009 in 94 schools and 185 classrooms.

The response rate was 81.3% in the schools and 91.6% among students. A total of 8.3% of students did not participate because they were absent from class on the day of the survey, and 0.1% refused to participate. The overall study response (schools and students) was 74.5%.

Information was initially obtained from 4244 students. When the participants did not report the educational level or occupation of their parents, or their own weight and height to calculate the body mass index (BMI), these missing values were coded as a "no response" category, which was used in the analyses (Tables 1 and 2). For the remaining variables, information was lacking for up to 3.7% of subjects, who were excluded from the analysis; also 0.8% of questionnaires were invalidated due to inconsistent replies. Thus, the final sample for analysis included 4054 individuals.

Study variables.

Mental health was assessed with the General Health Questionnaire (GHQ-12), which has been validated in Spain[17]. Furthermore, this questionnaire has shown good psychometric properties in our study sample[18].

The GHQ-12, as described by Goldberg et al.[19], consists of 12 questions about the following issues: losing concentration, losing sleep, playing a useful part in things, making decisions, feeling under strain, overcoming difficulties, enjoying activities, facing problems, feeling depressed, losing confidence, feeling worthless and feeling happy.

Each question has four response categories. The replies were classified using a binary (also known as "classical") scoring method in which the categories "much less than usual" and "same as usual" score 0 points, while "more than usual" and "much more than usual" score 1 point. The total score ranges from 0 to 12 points. We used a cut-off point of ≥ 3 to identify individuals with possible psychological distress[19].

The sociodemographic variables collected were age, gender, place of birth, living with parents and/or siblings, and parents' employment status and educational level.

With respect to behavioral factors, we asked about performance of 19 types of physical activity and identified persons who did vigorous physical activity (>5 METs) three or more times per week. Using a brief food frequency questionnaire, we estimated fruit and vegetable consumption, classifying subjects according to whether they consumed three or more servings of fruits or vegetables per day. Students also reported smoking status, which was classified as current smoking (any frequency of smoking) or non-smoking.

Alcohol intake was assessed with a quantity-frequency questionnaire on the consumption of eight types of alcoholic beverages, separately for weekdays and weekends. The alcoholic beverages were converted into total alcohol intake in gram per day (g/day) Individuals meeting at least one of the following criteria were considered to be high-risk drinkers: a) regular intake of ≥40 g/day (in males) or ≥24 g/day (in females); b) having a binge drinking episode (consumption of ≥6 standard drink units in a single drinking session) in the last 30 days; and c) having been drunk in the last 12 months. Drug users were considered to be those who had used any type of illegal substance in the last 12 months.

Information was also collected on three behavioral risk factors for eating disorders in the last 12 months: a) not eating for 24 or more hours to lose weight or uphold their figure; b) induced vomiting for weight-loss or upholding their figure; and c) use of laxatives, diuretics or diet pills to lose weight or uphold their figure. Subjects were classified into three categories according to whether they had 0, 1, or 2-3 of these behaviors. Based on self-reported data, body mass index (BMI) was calculated as

weight in kilograms divided by squared height in meters. Subjects were then classified as normal weight, thin/severe thin, overweight and obese, according to the WHO growth reference chart for school-aged children and adolescents[20]. Finally, students reported on their body image: whether they perceived themselves as very thin, thin, normal weight, or overweight/obese.

An aggregate variable was created for the following four risk behaviors: insufficient vigorous activity, low fruit/vegetable intake, smoking, and high-risk alcohol consumption. Since all four risk factors were present in only 158 individuals, we decided to combine categories 3 and 4.

Statistical analysis.

We calculated the prevalence of subjects with psychological distress (GHQ-12 score ≥3) and its 95% confidence interval (CI). Logistic regression models were then used to calculate odds ratios (OR) and their 95% CI for psychological distress according to sociodemographic variables and risk behaviors. The regression models were adjusted for all the variables simultaneously.

To assess the association between clustering of risk behaviors and psychological distress we constructed three sequential logistic regression models. First, a crude model (model A); second, a model adjusting for sociodemographic variables, including age, gender, place of birth, living with parents and/or siblings, parents' employment status and parents' educational level (model B); and third, a model additionally adjusted for illegal drug use, behaviors related to eating disorders, reported BMI and body image (model C). We examined whether the associations of interest varied with age and

gender using likelihood ratio tests which compare models with and without interaction terms (the products of sex and age times risk behaviors). The p for linear trend was calculated for the variables eating disorders and clustering of behavioral risk factors.

The analyses were performed using the "Survey Data" procedures of Stata v.11.0 for Windows (1984-2010 StataCorp, Texas, USA), which takes account of the complex sampling design in the study.

RESULTS.

In the total sample, 37.0% of participants (45.4% of girls and 28.1% of boys) had psychological distress (GHQ-12 ≥3). The frequency of psychological distress was higher in immigrants (44.9%, 95% CI: 40.5-49.3) than in those born in Spain (35.7%, 95% CI: 33.8-37.7) (Table 1).

In the multivariate analyses, the frequency of psychological distress was higher in girls, in persons born outside of Spain, and in those who did not live in a two-parent family (Table 1). It was also higher in those who did insufficient physical activity, smokers, and illegal drug users. Furthermore, psychological distress showed a positive dose-response relationship with the number of risk behaviors for eating disorders (p for linear trend <0.001). It was also associated with having a thin or very thin body image and with perceived overweight or obesity (Table 2). Comparing with adolescents with normal weight, psychological distress was less frequent in adolescents with overweight after controlling for the main confounders (OR 0.65; 95% CI: 0.50-0.84) (Table 2).

Smoking showed a strong association with psychological distress in younger individuals, with an OR of 1.80 (95% CI: 1.28-2.52) at 15 years of age, 0.99 (95% CI:

0.73-1.35) (p for interaction=0.003) at age 16, and 1.37 (95% CI: 0.94-2.02) at age 17; moreover, physical inactivity showed a stronger association with psychological distress in boys than in girls (p for interaction=0.044), with an OR of 1.61 (95% CI: 1.17-2.20) for boys and 1.09 (95% CI: 0.88-1.36) for girls.

Psychological distress was associated with clustering of classic behavioral risk factors (insufficient physical activity, low intake of fruits and vegetables, smoking and high-risk alcohol consumption). Table 3 shows that, in the crude model, the frequency of psychological distress was higher in adolescents with two risk behaviors simultaneously (OR 1.75; 95% CI: 1.45-2.12) and was even greater in those who had three or four risk behaviors (OR 2.22; 95% CI: 1.82-2.71). After adjusting for sociodemographic variables, the ORs decreased to 1.67 and 1.99, respectively. Lastly, after additional adjustment for illegal drug use, eating disorders, body image and reported BMI, the OR decreased to 1.47 (95% CI: 1.19-1.82) in those with two risk behaviors, and to 1.56 (95% CI: 1.21-2.01) in those with three or four risk behaviors, (p for linear trend <0.001).

DISCUSSION.

Adolescent mental health is related with certain sociodemographic variables, and particularly with health behaviors. Female gender, immigrant status, not living in two-parent households, having insufficient physical activity, smoking, illegal drug use, eating disorders and negative perception of body image are related with psychological distress. In addition, the clustering of classic risk behaviors shows an increasing gradient with frequency of psychological distress.

The association of female gender with psychological distress is consistent with most previous research[21;22]. Apparently the differences in mental health between the two genders develop during adolescence. At 13-15 years of age a slight excess in the frequency of depression is seen in girls, and after that age the differences become very evident[22]. This could be related to the fact that adolescent girls are more concerned with their social relationships and experience greater stress[21], and that the effect of the two variables on depressive symptoms is higher in girls[23].

It is interesting that adolescents born outside of Spain show more psychological distress. Studies show mixed results in first-generation immigrant adolescents[24]. This may be due to heterogeneity in their places of origin and in personal characteristics of the subjects studied, although it might be expected that emigration could hinder academic performance and increase the perception of discrimination[24]. The immigrant population has grown considerably in recent years, and currently one of every seven adolescents was born outside of Spain. Thus, further research should be done in this area.

Like in previous studies[25], not living with both parents is related with a greater likelihood of psychological distress. This is notable for two reasons. First, the increasing number of families different from the two-parent model, and second, the high prevalence of poorer mental health, as almost one of every two adolescents who do not live with both parents has a General Health Questionnaire-12 (GHQ-12) score ≥ 3.

It is known that physical exercise increases self-esteem in adolescents[9], but its possible benefits on anxiety and depression have not been established conclusively[8]. Our results support the beneficial effect of physical exercise on mental health, especially in

males[26]. This may be explained by the fact that boys have more opportunity to develop social skills because they participate in group activities more often than girls, who show greater preference for individual activities[26].

The relation between smoking and psychological distress is also consistent with what has been reported in literature. Some longitudinal studies have shown that the relation is bidirectional, that is, that depression predicts smoking and smoking predicts depression[4]. In our study, the relation between the two variables was stronger in younger adolescents, which suggests greater vulnerability in early adolescence when depressive symptoms increase rapidly[27].

Adolescents who abuse alcohol frequently suffer disorders related to consumption of other substances and have mental comorbidity[28]. Alcohol abuse is also associated with other behavioral risk factors, which makes it difficult to isolate its independent contribution on mental health. This may be why the few studies on this relation have major methodological differences that make it difficult to compare them, and have yielded inconsistent results. Boys et al. reported that regular alcohol consumption does not increase the risk of psychiatric problems unless it is associated with the use of other substances[10]. Verdurmen et al. observed an association between weekly alcohol consumption and poorer mental health in younger adolescents[29]. In the same line, an association between binge drinking and mental health disorders has been reported in Dutch adolescents, but only in those aged 12-15 years, as the association was inverse in those aged 16-18[11]. Strandheim et al. observed an association in Norwegian adolescents between the number of alcohol intoxications and behavioral and attention problems, but the relation was not adjusted for other covariates[30]. This is noteworthy since we found that high-risk alcohol consumption was associated with psychological distress in the

bivariate analysis, but the association was not observed after adjusting for other variables (mainly smoking and illegal drug use).

Consistent with our results, drug use coexists with mood disorders, anxiety and depression in adolescence[5].

In adolescents eating disorders are associated with depressive symptoms even after controlling for perceived body image[6]. In our study, perceived body image showed a J-shaped association with psychological distress, in which both thin body image and perceived overweight or obesity were accompanied by poorer mental health. Previous studies have shown that perceived weight has a stronger influence on mental health than BMI[7], and our results support that perceived body image mediates or confounds the relationship between reported BMI and psychological distress[31] (the OR of overweight without controlling for body image was 1.08 (95% CI: 0.66-1.76) and after controlling for this variable was 0.65 (95% CI: 0.50-0.84)).

Only a few studies have looked at the relation between clustering of classic risk behaviors and adolescent mental health; although they have found significant associations[12;13;32], major methodological differences make their results very difficult to compare. Of these studies, the one most similar to ours was conducted by Pronk et al., who observed that the absence of depression was associated with a larger number of healthy lifestyles like physical exercise, balanced diet, healthy weight, and not smoking[32]. Of note is the high frequency of clustered risk behaviors in our population, where almost half of the adolescents had two or more of these behaviors, and of these around 50% had psychological distress. This relation was robust since it was maintained after controlling for possible confounders, especially eating behaviors and

illegal drug use. These findings may facilitate the development of preventive interventions focusing on multiple risk factors[14].

Our study has several limitations. Since it was a cross-sectional study, it is not possible to establish causal relationships. Also, student absence on the day of the survey might has been related to some mental health problem; however, given that the percentage of absence was not high (8.3%), this is unlikely to have had a substantial impact on the results. Another limitation is that the information was self-reported, so that we cannot rule out some recall bias, especially for variables such as parents´ educational level, parents´ occupation, and adolescents' reported BMI. This recall bias would underestimate the actual associations. Nonetheless, it should be recalled that the GHQ-12 has good psychometric characteristics[18]. Finally, the variable for clustering of behavioral risks was constructed by summing the number of risk factors, several studies have reported that weighted indices are not better than those that are purely additive[33]. Moreover, additive indices have been shown to be independently associated with health status[33].

The main strength of this study is that it was based on a large sample representative of the adolescent population, with a high participation rate. As far as we know, this is the first research study done in Mediterranean countries that identifies health behaviors and sociodemographic determinants for adolescent mental health adjusting for all the variables simultaneously, making possible to assess the independent contribution of each of them. It should also be noted that the characteristics of the sampling design were taken into account in the data analysis.

We conclude that, in adolescence, psychological distress is related with lifestyles, body image and eating behavior. Likewise, the clustering of classic risk behaviors is related

with poor mental health. This lays the groundwork for the formulation of preventive interventions to improve mental health focusing simultaneously on various risk behaviors.

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Table 1. Prevalence and odds ratios (OR) of psychological distress, by sociodemographic variables.

Variables	N	% (95% CI [a])	OR[b] (95% CI)	P value
Total	4054	37.0 (35.1-39.0)	NA[c]	NA
Gender				
Male	1951	28.1 (25.7-30.4)	1 (ref)	
Female	2103	45.4 (43.0-47.8)	1.70 (1.43-2.02)	<0.001
Age, years				
15	1515	35.6 (33.1-38.8)	1 (ref)	
16	1700	35.6 (32.9-38.4)	0.91 (0.78-1.06)	0.205
17	839	42.6 (38.7-46.4)	0.99 (0.82-1.20)	0.940
Country of birth				
Spain	3470	35.7 (33.8-37.7)	1 (ref)	
Other country	584	44.9 (40.5-49.3)	1.35 (1.11-1.65)	0.003
Living with parents				
Two-parent family	3320	35.1 (33.0-37.2)	1 (ref)	
No two-parent family	734	45.8 (42.4-49.2)	1.30 (1.08-1.57)	0.007
Living with siblings				
Yes	3205	36.2 (34.2-38.1)	1 (ref)	
No	849	40.4 (36.4-44.4)	1.04 (0.88-1.24)	0.623
Father's employment				
Employed	3650	36.0 (34.0-38.0)	1 (ref)	
Unemployed	300	47.3 (41.8-52.8)	1.23 (0.98-1.54)	0.076
No response	104	44.2 (35.5-52.9)	0.87 (0.59-1.27)	0.459
Mother's employment				
Employed	2914	37.4 (35.2-39.7)	1 (ref)	
Unemployed	1113	36.0 (33.1-39.0)	0.97 (0.82-1.15)	0.741
No response	27	37.0 (18.4-55.6)	0.73 (0.30-1.76)	0.481
Father's education				
University	1242	34.8 (31.4-38.2)	1 (ref)	
Secondary	999	35.7 (32.5-38.9)	1.32 (0.94-1.85)	0.107
Primary	1086	36.7 (33.5-39.9)	0.93 (0.76-1.15)	0.525
No formal education	236	47.5 (40.3-54.6)	0.97 (0.79-1.18)	0.759
No response	491	41.1 (36.7-45.6)	1.10 (0.79-1.53)	0.581
Mother's education				
University	1161	35.0 (31.5-38.5)	1 (ref)	
Secondary	1129	35.3 (32.3-38.4)	1.12 (0.78-1.61)	0.524
Primary	1230	38.7 (35.9-41.5)	1.02 (0.83-1.26)	0.847
No formal education	197	46.2 (38.5-53.9)	0.89 (0.72-1.11)	0.315
No response	337	38.6 (33.2-44.0)	0.95 (0.67-1.34)	0.763

[a] CI: Confidence interval.

[b] OR calculated by logistic regression adjusting for the rest of the variables in tables 1 and 2.

[c] NA: Not applicable.

Table 2. Prevalence and odds ratios (OR) of psychological distress, by behavioral and other health risk factors.

Variables	N	% (95% CI[a])	OR[b] (95% CI)	P value
Vigorous physical activity				
3 or more days/week	2882	33.7 (31.5-35.9)	1 (ref)	
Less than 3 days/week	1172	45.4 (42.5-48.3)	1.23 (1.03-1.47)	0.021
Fruit and vegetable consumption				
3 or more/day	2324	36.8 (34.6-38.9)	1 (ref)	
Less than 3/day	1730	37.4 (34.8-40.0)	1.09 (0.96-1.23)	0.193
Smoking				
Non smoker	2841	33.0 (31.0-35.0)	1 (ref)	
Smoker	1213	46.5 (43.1-49.9)	1.30 (1.07-1.59)	0.009
A**lcohol**				
Non or low-risk drinker	2537	34.0 (31.7-36.3)	1 (ref)	
High-risk drinker	1517	42.1 (39.3-44.9)	1.05 (0.87-1.26)	0.633
Illegal drugs				
Never or some lifetime use	3203	34.2 (32.2-36.1)	1 (ref)	
In the last 12 months	851	47.8 (44.2-51.5)	1.46 (1.21-1.76)	<0.001
Eating disorders[c]				
No risk behavior	3646	33.7 (31.8-35.6)	1 (ref)	
1	301	63.8 (58.2-69.4)	2.34 (1.80-3.06)	<0.001
2-3	107	75.7 (67.1-84.3)	3.25 (1.98-5.33)	<0.001
P for linear trend			<0.001	
Body image				
Appropriate weight	2324	31.4 (29.2-33.6)	1 (ref)	
Very thin	84	48.8 (38.8-58.8)	2.15 (1.39-3.32)	0.001
Somewhat thin	602	36.0 (32.0-40.1)	1.37 (1.16-1.62)	<0.001
Overweight	831	44.6 (41.0-48.3)	1.74 (1.40-2.15)	<0.001
Obese	213	67.1 (61.0-73.3)	3.12 (2.23-4.37)	<0.001
Reported Body Mass Index				
Normal weight	3216	37.3 (35.2-39.3)	1 (ref)	
Thin/Severe thin	75	32.0 (22.8-41.2)	0.69 (0.44-1.09)	0.107
Overweight.	492	30.9 (26.7-35.1)	0.65 (0.50-0.84)	0.002
Obese	100	44.0 (32.3-55.7)	0.89 (0.56-1.42)	0.627
No response	171	49.1 (41.4-56.9)	1.17 (0.82-1.68)	0.389

[a] CI: Confidence interval.

[b] OR calculated by logistic regression adjusting for the rest of the variables in tables 1 and 2.

[c] Eating disorders. Number of risk behaviors (0-3).

Table 3. Association between clustering of risk behaviors and psychological distress.

Number of risk behaviors[d]	N	Prevalence of psychological distress %	Model A[a]		Model B[b]		Model C[c]	
			OR[e] (95% CI[f])	P value	OR (95% CI)	P value	OR (95% CI)	P value
0	961	29.7	1 (ref)		1 (ref)		1 (ref)	
1	1383	32.6	1.15 (0.96-1.38)	0.133	1.14 (0.95-1.38)	0.155	1.10 (0.91-1.33)	0.307
2	1038	42.5	1.75 (1.45-2.12)	<0.001	1.67 (1.37-2.03)	<0.001	1.47 (1.19-1.82)	0.001
3-4	672	48.4	2.22 (1.82-2.71)	<0.001	1.99 (1.60-2.46)	<0.001	1.56 (1.21-2.01)	0.001
P for linear trend				<0.001		<0.001		<0.001

[a] Model A: Univariate logistic regression model.

[b] Model B: Adjusted for age, gender, place of birth, living with parents, living with siblings, parents' employment and parents' education.

[c] Model C: Model B additionally adjusted for drug use, eating disorders, body image and reported body mass index.

[d] Risk behaviors: insufficient physical activity, low fruit and vegetable intake, smoking and high-risk alcohol consumption.

[e] OR: Odds ratio.

[f] CI: Confidence interval.