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ORIGINAL ARTICLE

Physical inactivity, a risk factor for mental disorders in Spanish youth: a cross-sectional study

Raquel Pastor-Cisneros[1] · Damián Pereira-Payo[2] · Ángel Denche-Zamorano[3] · María Mendoza-Muñoz[4] · José Ignacio Calzada-Rodríguez[5] · Juan Manuel Franco-García[2]

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Abstract

Aim Mental health has become a major social issue, particularly following the COVID-19 pandemic, with raising levels of anxiety and depression among adolescents and young adults and the subsequent higher prescription of antidepressants and anxiolytics. In this regard, while aspects such as obesity, sedentary behaviors and substance use are recognized risk factors, physical activity has been associated with lower levels of depression and anxiety. The study aimed (1) to investigate the associations between physical activity frequency (PAF) and self-reported depression and anxiety, as well as antidepressants and anxiolytics use, in the young Spanish population; (2) to identify potential risks factors for depression, chronic anxiety and use of antidepressants and anxiolytics concerning variables such as sex, age, BMI, smoking, study level and PAF.

Subject and methods A cross-sectional study based on data from the European Health Survey in Spain (EHSS 2020) was conducted, including a final sample of 3,416 participants aged 15–34 years.

Results Associations between PAF and self-reported depression and anxiety and use of antidepressants and anxiolytics were found, with physically inactive groups showing higher prevalence. Being female, physically inactive and smoker, among others, emerged as notable risk factors for depression and anxiety. Additionally, being female, older age and smoking increase the prevalence of antidepressant and anxiolytic use. Being in secondary school is associated with increased use of anxiolytics.

Conclusion Physical inactivity is associated with a higher prevalence of depression, anxiety, and use of antidepressants and anxiolytics in the target population, with PA programs and initiatives being potential protective factors.

Keywords Psychology · Mental health · Exercise · Sedentary lifestyle · Youth · Medication

Introduction

In the process of establishing a new normal after the suffering caused by the COVID-19 pandemic, an additional phenomenon of equal magnitude, but less visible, is emerging more forcefully than ever: the deterioration of mental health in the population (Radfar et al. 2021; Vadivel et al. 2021). Beyond the immediate health and death aftermath posed

✉ José Ignacio Calzada-Rodríguez
jicalzadar@unex.es

Raquel Pastor-Cisneros
raquelpc@unex.es

Damián Pereira-Payo
dpereirapayo@unex.es

Ángel Denche-Zamorano
denchezamorano@unex.es

María Mendoza-Muñoz
mamendozam@unex.es

Juan Manuel Franco-García
jmfrancog@unex.es

[1] Physical Activity for Education, Performance and Health Research Group (PAEPH), Faculty of Sport Sciences, University of Extremadura, 10003 Cáceres, Spain

[2] Health, Economy, Motricity and Education (HEME) Research Group, Faculty of Sport Sciences, University of Extremadura, 10003 Cáceres, Spain

[3] Promoting a Healthy Society (PHeSO) Research Group, Faculty of Sport Sciences, University of Extremadura, 10003 Cáceres, Spain

[4] Department of Communication and Education, Universidad Loyola Andalucía, 41014 Seville, Spain

[5] Social Impact and Innovation in Health (InHEALTH) Research Group, University Centre of Mérida, University of Extremadura, 06800 Mérida, Spain

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by the SARS-CoV-2 infection, its repercussions on mental health as indirect consequences should be considered, with the surge of anxiety and depression standing out prominently (Brasso et al. 2022). Moreover, adolescents and young adults could be particularly susceptible to the mental health implications of this global crisis (Gruber et al. 2021), experiencing long-term difficulties, being the previously mentioned disorders highly reported among these age-groups (United Nations Children's Fund 2021). According to recent scientific literature, there has been a 48.1% increase in mental disorders in the global population over the past 30 years (GBD 2019 Mental Disorders Collaborators 2022). Regarding young European population, a prevalence of 16.98% for mental disorders was determined, with elevated rates of mental and substance use disorders in Spain (Castelpietra et al. 2022). Linked to this, previous research has highlighted the need for prevention and early intervention, as young people are at increased risk of mental disorders in adulthood (Mulraney et al. 2021). Eventually, it is stated that around 10–20% of adult population in Spain has suffered from mental issues across their life cycle (Garrido-Elustondo et al. 2016; Juliá-Sanchis et al. 2020).

The World Health Organization (WHO) latest version of the International Catalogue of Diseases (ICD-11) (WHO 2018) shows some guidelines in order to conceptualize mental issues. Regarding these guidelines, anxiety disorders are future-oriented, defined as perceived anticipated threat. Anxiety has been shown to be one of the most common health conditions, with a current estimated prevalence of 4.05% worldwide which is increasing over time, being woman and living in high-income regions potential risk factors (Javaid et al. 2023). In Spain, this disorder affects around 6.7% of the total population, with differences between women and men (9.1% vs. 4.3%) (Ministerio de Sanidad, Consumo y Bienestar Social 2018). Concerning anxiety implications, it is associated with behavioral disturbances that may trigger significant distress and affect daily functioning, regarding academic, occupational, family, social, etc., areas (Swan and Kendall 2016; Rebello et al. 2019). Likewise, it is specifically related to sleep problems, which negatively impacts individuals' quality of life (Weiner et al. 2015). Also, depression is recognized by means of the previously mentioned guidelines and the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V) (American Psychiatric Association 2013) as primarily characterized by persistent sadness, diminished interest, or loss of pleasure in most activities. Besides, depression shows a global prevalence of 5% (Institute for Health Metrics and Evaluation 2021), while concerning Spanish youth population achieves a number around 4% (Bernaras et al. 2013), and has a strong relationship with anxiety. Sex differences are presented as women are more likely than men (Eid et al. 2019) to suffer from depression and comorbid anxiety, while a high level of education has been recognized as a factor that can provide protection against the above-mentioned disorders (Bjelland et al. 2008). Thus, gender differences and study level are elements to be considered.

Moreover, mental disorders represent a high economic burden, exceeding 4% of the Gross Domestic Product (GDP) across Europe, including direct costs (health care and social security programs) and indirect costs (impact on the labor market), which in Spain were estimated at around 2.5% and 1.7% of GDP in 2015, respectively (OECD 2018). Specifically, anxiety and depressive disorders have a total annual cost in Europe of about 74 and 92 billion euros, in that order (Olesen et al. 2012), and account for about 2.2% of Spain's GDP (Ruiz-Rodríguez et al. 2017). Total spending on anxiolytics in Spain reached €108 million in 2022, while antidepressants accounted for €626 million (OECD Data Explorer 2022), with a regional study showing an average cost of €27.10 per patient/year under the age of 25 (Gutiérrez-Abejón et al. 2023).

Individuals suffering from depression and anxiety often develop harmful behaviors linked to substance use, being adolescents at great risk (Bohnert et al. 2014; Kelly et al. 2015; Johannessen et al. 2017). Concretely, these mental health disorders have been positively associated with the use of alcohol, cannabis, and tobacco among this age group and young adults (Esmaeelzadeh et al. 2018). On the other hand, antidepressants and anxiolytics use for treating mental disorders has globally increased over the years (Chalabi 2013; Carrasco-Garrido et al. 2016; Brauer et al. 2021), particularly in higher-income or more developed countries, being Spain among the leading consumers of psychotropic drugs (Brauer et al. 2021). In young people, the prescription of antidepressants has increased significantly over the years (Bachmann et al. 2016; Schröder et al. 2017; Revet et al. 2018; Lagerberg et al. 2019; Jack et al. 2020), with overuse and off-label prescribing being pressing issues to consider. The same applies to anxiolytics, showing a growing trend of use in young people (Boyd et al. 2015; John et al. 2015; García et al. 2023; Stangeland et al. 2023; Martinez-Mendia et al. 2023), especially from the age of 15 and among adolescent females (Martinez-Mendia et al. 2023). In relation to this, gender differences may be found when analyzing antidepressant and anxiolytics consumption, as women has shown a higher prevalence of overall use (Van der Heyden et al. 2009; Lewer et al. 2015; Xu et al. 2021; Bojanic 2024).

People experiencing chronic illnesses are at higher risk of suffering depression alongside their primary ailment (National Institute of Mental Health (NIMH) 2021). For instance, obesity has been associated with anxiety (Gariepy et al. 2010) and depression (Opel et al. 2015; Herhaus et al. 2020), being BMI a potential risk factor and related to the development and severity of these mental disorders. Sedentary behavior has been linked to low quality of life

(Boberska et al. 2018) and several non-communicable diseases, including depression, anxiety and other mental health conditions in youth (Hoare et al. 2016; Logan et al. 2018; Jahrami et al. 2022). Thus, physical inactivity is directly related to mental issues with independence of sex-gender (Galper et al. 2006), as well as lower overall mental well-being and happiness among others, with regards to young people (Rodriguez-Ayllon et al. 2019). Contrary, engaging regularly in physical activity (PA) involves benefits in general health (Matsudo 2012) and improvements concerning individuals' quality of life (Zurita-Ortega et al. 2018), with a decrease in non-communicable illnesses incidence, risks and mortality (de Rezende et al. 2019). In fact, PA has been associated with lower levels of anxiety and depression and may delay their onset in non-clinical populations (Rebar et al. 2015), and is recognized as a prospective means of reducing both disorders (Bell et al. 2019) alongside exercise, which a recent systematic review and meta-analysis proposed as a treatment comparable to psychotherapy and pharmacology concerning depressive symptoms (Noetel et al. 2024).

Therefore, the objectives of this study are (1) to assess the associations between frequency of physical activity and self-reported depression and anxiety, as well as antidepressants and anxiolytics use, in the young Spanish population; and (2) to establish possible relationships between the variables mentioned above and other factors such as sex, BMI, study level and smoking.

Materials and methods

Design

This research is a cross-sectional study based on data from the 2020 European Health Interview Survey in Spain (EHISS). This survey is promoted and supervised every five years by the European Statistical Office (Eurostat) and in Spain is carried out by the Spanish National Institute of Statistics (INE) (Instituto Nacional de Estadística 2020). The main objective of the EHIS is to know the health status of the adult population of the European Union member countries. Specifically, the main objective of the EHISS was to determine the health status of the population over 15 years of age residing in Spain. The EHIS was regulated by the Commission Regulation N° 141/2013 implementing Regulation 1338/2008 of the European Parliament and the Council on Community statistics on public health and health and safety at work and, as the data were anonymized public access data, their use did not require approval by an accredited bioethics committee.

To obtain the final sample for the EHISS 2020, a three-stage stratified random sampling system was used. Initially, Spanish municipalities were organized by strata, municipalities were randomly selected, then a random selection of dwellings from these municipalities was made, and finally, a random selection of one resident over 15 years of age from each of the selected dwellings was made. The selected persons received a notification, being invited to participate in the EHISS 2020 (Instituto Nacional de Estadística), and were informed of the selection process, the voluntary nature of their participation, the objectives of their participation and the processing and anonymous disclosure of their responses. Personal data would be treated confidentially and would not be published. After the acceptance of the participants, they were summoned to carry out the interviews, EHISS 2020 Questionnaire, by personnel trained and accredited by the INE. The interviews were conducted between July 2019 and July 2020. All information related to sample calculation, data collection, data processing, missing data treatment and other technical data of the survey were shown in the EHISS 2020 methodology (Instituto Nacional de Estadística 2020).

Participants

For this study, the database with all the responses of the 22,072 participants of the EHISS 2020 was downloaded. These data are available on the INE website, being freely accessible and of public use. The following inclusion criteria were applied to this initial population for this study: 1) age between 15 and 34 years; 2) data on the frequency of physical activity performed in leisure time (item 112 in the EHISS 2020). Thus, 18,656 participants aged 35 years or older were not included. Therefore, the final sample of this study was 3,416 young people aged 15 to 34 years old from Spain.

Explanatory variables

Age The age of the participants was recorded in years.

Body Mass Index Group (BMI) The participants were grouped according to their body mass index, which was calculated from the weight and height of the participants with the formula kg/m2. Participants were grouped into four groups: Underweight (<18.5), Normal (≥ 18.5 and <25), Overweight (≥ 25 and <30) or Obesity (≥ 30).

Study level This variable collected the data from the item "STUDIES" of the EHISS. Participants were grouped according to the highest level of studies obtained: Primary, Secondary, Baccalaureate, Vocational training or University.

Smoking status This variable collected data from item 121 of the EHISS 2020. This item questioned participants about their relationship with smoking: "Can you tell me if you smoke? Do not consider e-cigarettes or other similar

electronic devices." Possible choices were "Yes, I smoke daily" (Smoker), "I do not currently smoke but have smoked before" (Former Smoker), "Yes, I smoke but not daily" (Occasional) or "I do not smoke and have never smoked regularly" (Non-smoker).

Physical Activity Frequency (PAF) This variable collected data from item 112 of the EHISS. This item questioned participants about the frequency of physical activity performed in their free time: "Which of these possibilities best describes how often you do some physical activity in your free time?" The possible options were: "I don't exercise. I spend my free time almost entirely sedentary: reading, watching TV, going to the movies, etc." (Inactive), "I do some occasional physical activity or sport: walking or cycling, gardening, gentle gymnastics, recreational activities that require light exertion, etc." (Occasional), "I do physical activity several times a month (sports, gymnastics, running, swimming, cycling, team games, etc." (Active) or "I do sports or physical training several times a week" (Very active).

Outcome variables

Depression status This variable collected data from item 25a.20 of the EHISS 2020. It asked participants about having or having ever had depression: "I will read you a list of diseases or health problems. Do you have or have you ever had depression?" The possible options were: Yes, No, don't know or no answer.

Anxiety status This variable collected data from item 25a.21 of the EHISS 2020. It asked participants about having or having ever had chronic anxiety: "I will read you a list of diseases or health problems. Do you have or have you ever had chronic anxiety?" The possible options were: Yes, No, don't know or no answer.

Antidepressant use This variable collected data from items 85, 86 and 87a.14. These items questioned participants about the use of medication prescribed by a physician (During the past 2 weeks, have you taken any medication prescribed by a physician?" Options: Yes or No), taken without a doctor's prescription ("During the past 2 weeks, have you taken any medications, including herbal medications or vitamins, that were not prescribed to you by a doctor?" Options: Yes or No) and about the use of antidepressants ("Next, I am going to read you a list of types of medications, please tell me which one or ones you have taken in the past 2 weeks-antidepressants, stimulants?" Options: Yes or No). Participants were grouped into two groups-Yes (Yes on item 87a.14) or No (No on items 85, 86, and 87a.14).

Anxiolytics use This variable collected data from items 85, 86 and 87a.7. These items questioned participants about the use of medications prescribed by a physician (During the past 2 weeks, have you taken any medications prescribed by a physician?" Options: Yes or No), taken without a doctor's prescription ("During the past 2 weeks, have you taken any medications, including herbal medications or vitamins, that were not prescribed to you by a doctor?" Options: Yes or No) and about the use of anti-anxiety medications ("Next, I am going to read you a list of types of medications, please tell me which one or ones you have taken in the past 2 weeks-tranquilizers, relaxants, sleeping pills?" Options: Yes or No). Participants were grouped into two groups-Yes (Yes on item 87a.7) or No (No on items 85, 86, and 87a.7).

Statistical analysis

First, the normality of the data of the categorical variable (Age) was studied with a Kolmogorov–Smirnov test.

Subsequently, a descriptive analysis was performed in which the sample was characterized in terms of all the study variables. This presentation was carried out both with data from the total sample and by sex. The continuous variables were characterized through the median and the interquartile range. Possible differences between sexes were analyzed with the Mann–Whitney U test. The categorical variables (BMI Group, Study Level, Smoking Status, PAF, Depression Status, Anxiety Status, Antidepressants Use and Anxiolytics Use) were characterized by the absolute and relative frequencies presented by the sample, both in the general population and by sex. The relationships between sex and the rest of the categorical variables were analyzed with the Chi-square test. To evaluate the strength of these associations, Cramer's V and the Phi coefficient were calculated. To analyze possible differences in proportions between sexes, a post-hoc test was performed: pairwise z test for independent proportions. These same statistical tests were used to analyze the relationships between PAF and: Depression Status, Anxiety Status, Antidepressants Use and Anxiolytics Use.

Finally, four multiple binary logistic regression models were performed to evaluate the risk factors of: 1) Depression; 2) Anxiety; 3) Antidepressants Use; 4) Anxiolytics Use. These were the dependent variables of each of the models. The remaining variables of this study were included as independent variables: Age, Sex, BMI Group, Study Level, Smoking Status and PAF.

All analyses were performed with IBM SPSS Statistics v.25 statistical software. The value of $p < 0.05$ was set as the level of significance.

Results

The Kolmogorov–Smirnov test found that the data of the continuous variables (Age) did not follow a normal distribution ($p < 0.001$).

The sample had a median age of 25 years (10), with no differences by sex ($p < 0.129$). Dependence relationships were found between sex and the sociodemographic variables: BMI ($X2 = 86.1$, $df = 3$, $p < 0.001$, $V = 0.161$), Study Level ($X2 = 67.1$, $df = 4$, $p < 0.001$, $V = 0.140$), Smoking ($X2 = 26.7$, $df = 3$, $p < 0.001$, $V = 0.089$) and PAF ($X2 = 106.0$, $df = 3$, $p < 0.001$, $V = 0.176$). Sex-dependent relationships were also found between depression ($X2 = 5.9$, $df = 1$, $p < 0.001$, $\varphi = 0.042$) and anxiety ($X2 = 13.3$, $df = 1$, $p < 0.001$, $\varphi = 0.062$). Women had a higher prevalence of self-reported depression (3.6% vs 2.2%, $p < 0.05$) and anxiety (5.7% vs 3.1%, $p < 0.05$) than men. Something similar was found between sex and self-reported use of antidepressants ($X2 = 6.3$, $df = 1$, $p = 0.012$, $\varphi = 0.043$) and anxiolytics ($X2 = 4.9$, $df = 1$, $p = 0.027$, $\varphi = 0.038$). Females also had higher prevalence of antidepressant (2.1% vs 1.0%, $p < 0.05$)

Table 1 Descriptive analysis

Variables	Total = 3,416		Men = 1,652		Women = 1,764		X^2	df	p	V
	Median	IQR	Median	IQR	Median	IQR				
Age (Years)	25	(10)	25	(11)	26	(10)	n.a	n.a	0.129	n.a
BMI Group	**n**	**%**	**n**	**%**	**n**	**%**	**X^2**	**df**	**p***	**V**
Underweight	157	4.8	39	2.4	118	7.0*	86.1	3	< 0.001	0.161
Normal	2,126	64.4	984	61.3	1,142	67.3*				
Overweight	786	23.8	476	29.7	310	18.3*				
Obesity	232	7.0	105	6.5	127	7.5				
Study Level										
Primary	293	8.4	138	8.4	155	8.8	67.1	4	< 0.001	0.140
Secondary	1,108	36.6	604	36.6	504	28.6*				
Baccalaureate	658	18	298	18	360	20.4				
Vocational training	695	22.6	373	22.6	322	18.3*				
University	662	36.1	239	14.5	423	24.0*				
Smoking										
Smoker	716	21.0	395	22.2	321	18.2*	26.7	3	< 0.001	0.089
Ex-Smoker	118	3.5	64	28	54	3.1				
Occasional	297	8.7	158	18.2	139	7.9				
No Smoker	2,278	66.8	1,030	31.6	1,248	70.8*				
PAF										
Inactive	976	28.6	366	22.2	610	34.6*	106.0	3	< 0.001	0.176
Occasional	1,021	29.9	463	28	558	31.7*				
Various/Month	546	16.0	301	18.2	245	13.9*				
Various/Week	872	25.5	522	31.6	350	19.9*				
Depression							**X^2**	**df**	**p***	**φ**
Yes	99	2.9	36	2.2	63	3.6*	5.9	1	< 0.001	0.042
No	3,316	97.1	1,616	97.8	1,700	96.4*				
Anxiety										
Yes	153	4.5	52	3.1	101	5.7*	13.3	1	< 0.001	0.062
No	3,261	95.5	1,600	96.9	1,661	94.3*				
Antidepressant										
Yes	54	1.6	17	1.0	37	2.1*	6.3	1	0.012	0.043
No	3,362	98.4	1,635	99.0	1,727	97.9*				
Anxiolytics										
Yes	115	3.4	44	2.7	71	4.0*	4.9	1	0.027	0.038
No	3,301	96.6	1,608	97.3	1,693	96.0*				

IQR (Interquartile range); n (participants); % (Percentage); p (p-value from Mann–Whitney U test); p* (p-value from Chi-square test); * (Significant differences of proportions between gender with $p < 0.05$ from post hoc pairwise z-test for independent proportions); X^2 (Chi-square statistic); df (degree freedom); V (Cramer's V coefficients); φ (Phi coefficients); n.a. (not application)

Table 2 Associations between frequency of physical activity and: depression, anxiety, antidepressants use, and anxiolytics use

Variables	Inactive		Occasional		Various/Month		Various/Week		X^2	df	*p*	V
Depression	*n*	%	*n*	%	*n*	%	*n*	%				
Yes	52a	5.3	27b	2.6	6b	1.1	14b	1.6	32.2	3	< 0.001	0.097
No	923a	97.7	994b	97.4	540b	98.9	858b	98.4				
Anxiety												
Yes	66a	6.8	44ab	4.3	11b	2.0	32b	3.7	21.2	3	< 0.001	0.079
No	908a	93.2	977ab	95.7	535b	98.0	840b	96.3				
Antidepressants												
Yes	27a	2.8	11b	1.1	7ab	1.3	9b	1.0	12.5	3	0.006	0.060
No	949a	97.2	1,010b	98.9	539ab	98.7	863b	99.0				
Anxiolytics												
Yes	47a	4.8	35ab	3.4	7b	1.3	26ab	3.0	14.0	3	0.003	0.064
No	929a	95.2	986ab	96.6	539b	98.7	846ab	97.0				

n (participants); % (percentages); X^2 (Chi-square statistics); df (degree freedom); p (p-value from Chi-square test); V (Cramer's V coefficients), ab (Different letters mean significant differences of proportions between physical activity frequency groups with $p < 0.05$ from post hoc pairwise z-test for independent proportions)

and anxiolytics (4.0% vs 2.7%, $p < 0.05$) than men (Tables 1 and 2).

PAF was found to be associated with self-reported depression (X2 = 32.2, df = 3, $p < 0.001$, V = 0.097) and anxiety (X2 = 21.2, df = 3, $p < 0.001$, V = 0.079), as well as with the use of antidepressants (X2 = 12.5, df = 3, $p < 0.001$, V = 0.060) and anxiolytics (X2 = 14.0, df = 3, $p < 0.001$, V = 0.064).

Figure 1 shows the prevalence of depression, anxiety, antidepressant use and anxiolytic use in the young Spanish population according to PAF.

Models for depression and anxiety

The regression model identified as main risk factors for self-reported depression: smoking (OR: 4.10, 95% C.I.: 2.62–6.43), physical inactivity (OR: 2.33, 95% C.I.: 1.25–4.32), being female (OR: 1.76, 95% C.I.: 1.13–2.76). Conversely, being of normal weight appeared to be a reduced risk of depression (OR: 0.40, 95% C.I.: 0.19–0.83). The model explained 11.6% of the variance (R2). These same risk factors were identified for anxiety. This model explained 10.4% of the variance (R2). All model parameters were presented in Table 3.

Models for antidepressants and anxiolytics use

The regression model identified as main risk factors for antidepressants use smoking (OR: 2.25, 95% C.I.: 1.22–4.17) and being female (OR: 2.54, 95% C.I.: 1.39–4.64). The model explained 8.6% of the variance (R2). Daily smoking (OR: 2.52, 95% C.I.: 1.62–3.92), being in secondary education (OR: 2.29, 95% C.I.: 1.01–5.19) and being female (OR: 1.73, 95% C.I.: 1.15–2.58) were the main risk factors for anxiolytic use. The model explained 9.3% of the variance (R2). All model parameters were presented in Table 4.

Discussion

The main objectives of the study were to analyze the relationships between the level of physical activity and the prevalence of depression, chronic anxiety, use of antidepressants and anxiolytics in young Spanish adults, as well as to evaluate risk factors for depression, chronic anxiety, use of antidepressants and anxiolytics according to the established socio-demographic variables: Sex, Age, BMI Group, Smoking, Study Level and PAF. The main findings of this study were the associations found between PAF and self-reported prevalence of depression, chronic anxiety, antidepressant use and anxiolytic use in young Spanish adults. These were more prevalent in physically inactive groups. In addition, physical inactivity was identified as a risk factor for self-reported depression, anxiety and anxiolytic use.

The main results of this research on the mental health of Spanish young adults aged 15–34 years were 1) the relationship of the physical activity frequency with the variables of depression, anxiety, antidepressant use and anxiolytic use and 2) the significant association of physical inactivity with a higher prevalence of depression, anxiety, antidepressant use and anxiolytic use. Regarding the assessment of risk factors, physically inactive individuals were at higher risk of depression and anxiety in young Spanish adults. On the other hand, insufficient evidence was found to consider

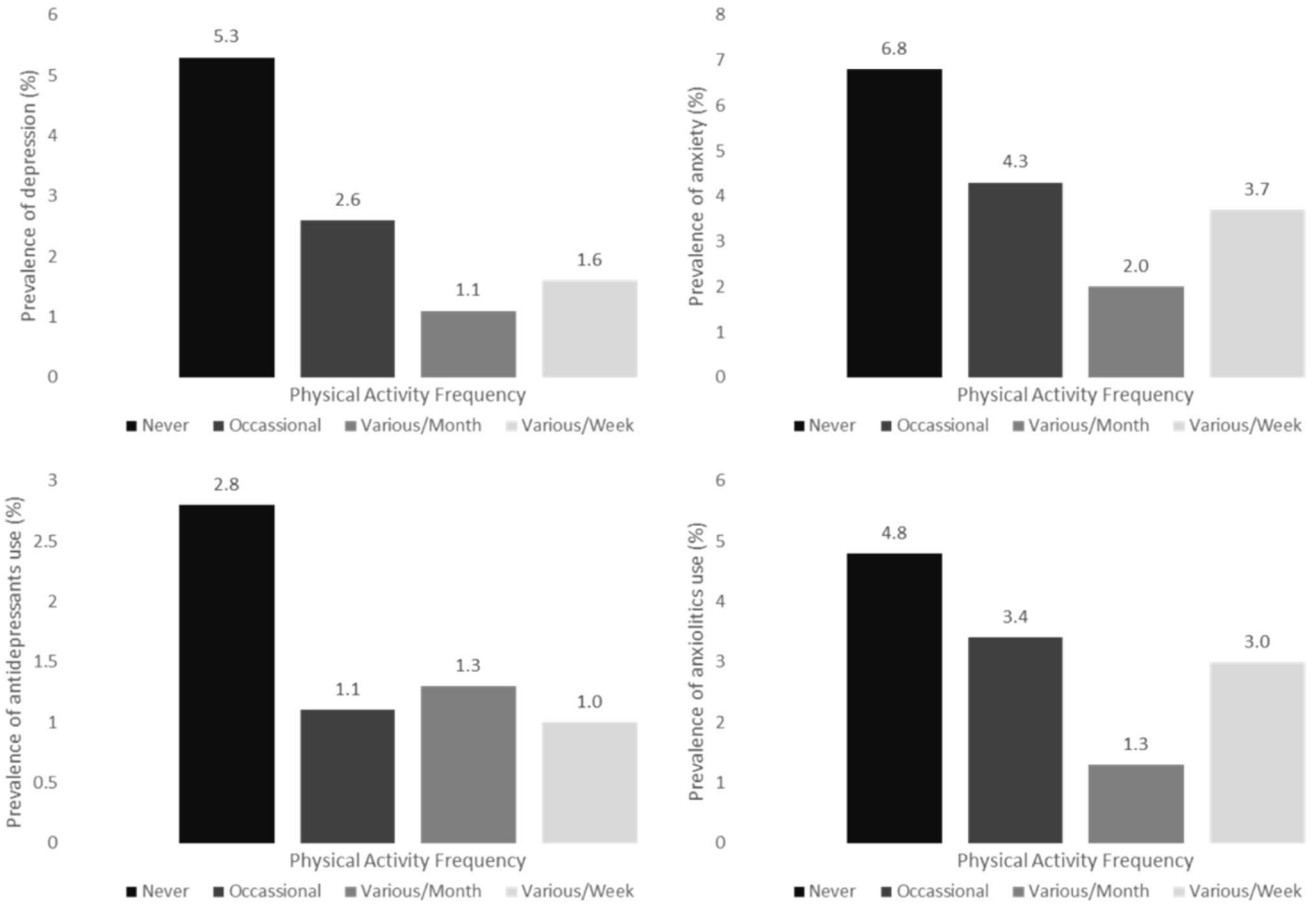

Fig. 1 Prevalence of depression, anxiety, antidepressants use and anxiolytics use, according to physical activity frequency

physical inactivity as a risk factor for antidepressant and anxiolytics use.

When characterizing the sample, it was found that young Spanish women had a higher self-reported prevalence of depression (3.6% vs. 2.2%) and anxiety than young Spanish men (5.7% vs. 3.1%), thus confirming a sex-dependent relationship between depression and anxiety ($p < 0.05$). Previous similar studies have found this same dependency relationship in their results, reporting a higher prevalence of depression and anxiety in females than in males (Bekhbat and Neigh 2018; Labaka et al. 2018; Eid et al. 2019).This is mainly due to biological and hormonal differences between the sexes (Labaka et al. 2018) as well as that women are more likely to have a more negative self-reporting of health than men (Lindemann et al. 2019), which may translate into a greater tendency to externalize and share their emotions (Wingenbach et al. 2018), and consequently leads to more prevalent self-reporting of depression and anxiety than in men.

At the same time, in line with these results, this study shows associations between higher use of antidepressants in women compared to men (2.1% vs 1.0%, $p < 0.05$) and anxiolytics (4.0% vs 2.7%, $p < 0.05$), consistent with the findings as they are commonly used by a profile of people suffering from depression and/or anxiety. Other previous studies also reported the same results, again finding a dependency relationship between the female sex with respect to the use of antidepressants and anxiolytics (Thapliyal et al. 2018; Marasine et al. 2021).

Furthermore, previous research on mental health in young people in Spain (ENSE) published in 2017 reported a gender difference in the prevalence of depression (4.0% vs. 2.2%. $p < 0.05$) and diagnosed chronic anxiety (6.1% vs. 3.1%. $p < 0.05$), also being higher in females (Denche-Zamorano et al. 2022). Taking into account the results of our current study, it can be seen that the differences between the sexes have been maintained, with very similar percentages of prevalence.

In addition to the above justifications for the differences found between the sexes, it should be added the greater predisposition of boys to engage in physical activity, as numerous studies indicate a higher frequency of PA among boys than among women (Armstrong et al. 2018; Kellstedt et al. 2021), whose inactivity rates are higher (Guthold et al.

Table 3 Logistic binary regression model for depression and anxiety risk factor

Model for Depression					
	β	Adjusted OR	95% C.I		*p*-value
Sex					
Men		Reference			
Women	0.567	1.76	1.13	2.76	0.013*
PAF					
Various/Week		Reference			0.001**
Inactive	0.844	2.33	1.25	4.32	0.008**
Occasional	0.239	1.27	0.65	2.47	0.481
Various/Month	−0.885	0.41	0.13	1.27	0.122
Smoking					
No Smoker		Reference			< 0.001***
Smoker	1.411	4.10	2.62	6.43	< 0.001***
Occasional	0.114	1.12	0.26	4.75	0.877
Ex-Smoker	0.659	1.93	0.91	4.08	0.085
BMI Group					
Underweight		Reference			0.008**
Normal	−0.922	0.40	0.19	0.83	0.014*
Overweight	−0.261	0.77	0.35	1.68	0.512
Obesity	−0.219	0.80	0.33	1.98	0.634
Constant	−4.102	0.02			< 0.001***
Model for Anxiety 10.4 R2					
		Adjusted OR	95% C.I		p-value
Sex					
Men		Reference			
Women	0.706	2.03	1.41	2.91	< 0.001***
PAF					
Various/Week		Reference			0.025*
Inactive	0.248	1.28	0.81	2.02	0.288
Occasional	−0.130	0.88	0.54	1.42	0.594
Various/Month	−0.710	0.49	0.24	0.99	0.047*
Smoking					
No Smoker		Reference			< 0.001***
Smoker	1.436	4.21	2.88	6.14	< 0.001***
Occasional	1.413	4.11	2.01	8.37	< 0.001***
Ex-Smoker	1.135	3.11	1.82	5.31	< 0.001***
BMI Group					
Underweight		Reference			0.002**
Normal	−0.908	0.40	0.22	0.73	0.003**
Overweight	−0.560	0.57	0.30	1.09	0.089
Obesity	−0.166	0.85	0.41	1.76	0.656
Constant	−3.373	0.03			< 0.001

β (Beta); OR (Odds ratio); CI (Confidence Interval).; * (p value < 0.05); ** (p-value < 0.01); *** (p-value < 0.001)

2020), thus also favoring a higher prevalence of mental illness in women (Riecher-Rössler 2017). In this sense, our study also confirms this fact as it reports a dependency relationship between sex and PAF, finding a lower frequency of PA in women than in men, as well as a higher percentage of inactive women than inactive men. This finding is consistent with our results whose relationship is consistent with other research on BMI and sex, reporting a higher prevalence of high BMI (Rundle et al. 2019), usually associated with a high percentage of body fat, and low BMI (Valenzuela et al. 2020), usually associated with a low level of muscle mass, in women than in men. Taking into account the studies that have found an association between a BMI below or above the established standard and PA (Kesavachandran et al. 2009;

Table 4 Logistic binary regression model for antidepressants uses and anxiolytics use risk factor

Model for Antidepressants Use					
	β	Adjusted OR	95% C.I		*p*-value
Age	0.054	1.06	1.00	1.11	0.043*
Sex					
Men		Reference			
Women	0.932	2.54	1.39	4.64	0.002**
Smoking					
No Smoker		Reference			0.050
Smoker	0.812	2.25	1.22	4.17	0.010*
Occasional	−0.273	0.76	0.10	5.73	0.791
Ex-Smoker	−0.065	0.94	0.32	2.78	0.907
Study Level					
Primary		Reference			0.040*
Secondary	0.318	1.37	0.51	3.70	0.529
Baccalaureate	−2.352	0.10	0.01	0.82	0.033*
Vocational training	−0.159	1.17	0.42	3.29	0.763
University	−0.561	0.57	0.18	1.79	0.336
Constant	−6.214	0.00			<0.001***
Model for Anxiolytics Use					
		Adjusted OR	95% C.I		*p*-value
Age	0.081	1.09	1.05	1.13	<0.001***
Sex					
Men		Reference			
Women	0.546	1.73	1.15	2.58	0.008**
PAF					
Various/Week		Reference			0.059
Inactive	0.097	1.10	0.65	1.86	0.715
Occasional	−0.066	0.94	0.55	1.60	0.808
Various/Month	−1.107	0.33	0.13	0.82	0.016*
Smoking					
No Smoker		Reference			0.001**
Smoker	0.924	2.52	1.62	3.92	<0.001***
Occasional	0.717	2.05	0.79	5.33	0.142
Ex-Smoker	0.601	1.82	0.97	3.44	0.064
Study Level					
Primary		Reference			0.012*
Secondary	0.829	2.29	1.01	5.19	0.047*
Baccalaureate	0.109	1.12	0.44	2.84	0.820
Vocational training	0.314	1.37	0.58	3.25	0.478
University	−0.066	0.94	0.38	2.34	0.887
Constant	−6.467	0.00			<0.001

β (Beta); OR (Odds ratio); CI (Confidence Interval); * (*p* value < 0.05); ** (*p*-value < 0.01); *** (*p*-value < 0.001)

Pandey et al. 2017), this explains the relationship found in women, who have a higher prevalence than men of having a high BMI or a low BMI with respect to the established standard. It could be suggested that this association of the prevalence of a BMI above or below the standard in young women may influence a poorer self-concept and self-esteem (Kucharska 2018; Wang et al. 2020), and accordingly, as our results indicate, women self-report greater depression and anxiety.

Regarding physical activity, this study shows that PA is related to self-reported conditions of depression, anxiety and use of antidepressant and/or anxiolytic medication, finding a higher prevalence of these conditions in physically inactive people. More specifically, a positive correlation is found

between PAF and self-reported conditions of depression, anxiety ($p < 0.001$) and use of anxiolytics ($p < 0.005$), i.e. the higher physical activity frequency, the lower the prevalence of depression, anxiety and use of medication. Several studies report results similar to ours, finding such associations between variables (McMahon et al. 2017; Fernandez-Navarro et al. 2018). Furthermore, it should be noted that physical activity could be considered a protective mechanism against anxiety, which could translate into a lower use of anxiolytics to alleviate psychological distress (Schuch et al. 2019; Violant-Holz et al. 2020).

However, regarding physical inactivity and the use of antidepressants or anxiolytics, there is no conclusive evidence in our study as this is a very specific variable. Although physical inactivity is related to a greater use of medication according to our study and other previous research (Fernandez-Navarro et al. 2018; Carmona-Torres et al. 2021; Santos et al. 2023), the main justification for not finding a relationship with the use of antidepressants and anxiolytics probably lies in the heterogeneity of the supply of this type of medication in patients suffering from anxiety or depression (Gadad et al. 2018; Hetrick et al. 2021).

With regard to the risk of depression, physically inactive people are found to have a higher risk of depression, anxiety and anxiolytic use. Previous studies have found significant associations between more inactive subjects with a higher risk of depression (Achttien et al. 2019), anxiety (Silva et al. 2020) and use of anxiolytics (Denche-Zamorano et al. 2023). At the same time, increasing the level of physical activity is associated with a lower risk of depression, anxiety and anxiolytic use. Previous studies have found significant associations between more active subjects with a lower risk of depression (Pearce et al. 2022), anxiety (McDowell et al. 2019) and anxiolytic use (Ramos-Sanchez et al. 2021).

Finally, regarding adjusted risk factors, it should be noted that the greatest risk factor found for depression was being a smoker, followed by physical inactivity and being female. In contrast, normal weight was found to be a reduced risk factor. In this sense, significant associations have been found in previous research linking depression with being a smoker (Wu et al. 2023), being inactive (Achttien et al. 2019), being underweight (Jung et al. 2017) or obese (Tyrrell et al. 2019), as well as being female (Eid et al. 2019). Similarly, for anxiety, the greatest risk factor was also being a smoker, noting other determinants such as being female and physical inactivity. Normal weight also appeared as a reduced risk factor. Previous research has found significant associations between anxiety and being a smoker (Zimmermann et al. 2020), being underweight or obese (Moradi et al. 2022), being female (Farhane-Medina et al. 2022) and being physically inactive (Denche-Zamorano et al. 2022).

Regarding the use of antidepressants, the greatest risk was being a woman, followed by being a smoker and being older. Being in baccalaureate appeared as a reduced risk factor. Previous research has found significant associations linking antidepressant use with female gender (Thapliyal et al. 2018), with smoking (Oliveira et al. 2017), with a basic educational level (Bjelland et al. 2008) and with older age (Stangeland et al. 2023). Regarding the use of anxiolytics, the highest risk was being a smoker, a high school student, followed by being female and older. Also, being physically active several times a month was found to be a reduced risk factor compared with being physically inactive and other frequencies of physical activity.

Limitations

This study had all the limitations characteristic of cross-sectional studies. Cross-sectional studies are a powerful tool for identifying relationships between variables and are very useful for establishing new research hypotheses that can be contrasted in subsequent studies with other types of design. However, they have important limitations. They do not allow causal relationships between variables to be established. The order of appearance of the conditions and which variables have been cause and effect in the associations found are unknown. The data came from questionnaires and the conditions were self-reported, which was another important limitation as objective data were not available.

Future line research

In future research, it would be advisable to include objective data on participants' PA, as well as to conduct studies to determine the minimum and optimal activity for the improvement of young people's mental health.

Practical implications

This study represents the reality of mental health in young adults referring to the 2020 survey, and taking into account its data and its comparison with those obtained in the 2017 health survey, it is observed that neither the prevalence of depression nor the differences between sexes have decreased, so this research should serve as justification for the need to reduce the risk of depression, with a special focus on women, so that governments can promote new policies to improve this situation. Furthermore, thanks to the adjusted risk factors provided through this study, a description of the profile of the person with depression is obtained and therefore the factors that represent a greater risk are known, allowing policies to be focused more specifically and thus being able to eliminate them or at least reduce them in a large part of the Spanish population. It should be noted that this study also establishes an order

of importance for the risk factors found and can focus the allocation of greater economic and human resources on the basis of this order, i.e. from greater to lesser localized risk.

Conclusions

PAF is associated with self-reported depression and anxiety, as well as with the use of antidepressants and anxiolytics, among adolescents and young adults in the Spanish population in the post-pandemic period.

Being female, physically inactive and smoking are considered, among other factors, to be significant risk factors for depression and anxiety. Being female, older age and smoking increase the prevalence of antidepressant and anxiolytic use. Being in secondary school is associated with increased use of anxiolytics. This study demonstrates the necessity to reinforce programs designed to encourage physical activity as a preventive measure against mental health problems in young people in Spain.

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Data availability The database with all the responses of the EHISS 2020 was downloaded. These data are available on the INE website, being freely accessible and of public use.

Code availability Not applicable.

Declarations

Ethics approval This study used secondary, anonymized data from the 2020 European Health Interview Survey in Spain (EHISS), an official national survey conducted by the Spanish National Statistics Institute and the Ministry of Health within the European and national statistical framework. As the present study involved secondary analysis of fully anonymized data, no additional ethical approval was required for this study.

Consent to participate Not applicable.

Consent for publication Not applicable.

Conflicts of interest The authors declare that they have no conflict of interest.

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