Rhinitis or asthma among adults as associated factors with symptoms of depression

Depression and rhinitis or asthma

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Summary

Background. It has been observed that diseases such as rhinitis and asthma not only affect the physical health of individuals but can also significantly impact their psychological well-being. The aim of this study is to analyze the relationship between allergic rhinitis (AR), non-allergic rhinitis (NAR), and asthma with symptoms of depression in adults. **Methods.** Comparative cross-sectional study. Adult subjects diagnosed with AR, NAR or asthma were selected and a fourth group of apparently healthy individuals (control group) was recruited. Study subjects were included consecutively. Multivariate binary logistic regression models were used to

investigate the association of the diseases in this study (AR, NAR or asthma) with the 21 symptoms of depression from the Beck Depression Inventory-II. The adjusted odds ratio (aOR) was used as the test statistic. **Results.** A total of 257 participants (60% women; mean age 33.2 years) were included and compared cross-sectionally in four groups: AR (n=59), NAR (n=42), asthma (n=80), and a control group (n=76). In women, asthma and allergic rhinitis were associated with loss of energy and tiredness or fatigue. On the contrary, among men, neither asthma nor allergic rhinitis showed an association with the variables analyzed. However, anxiety showed an association as a risk factor for symptoms of depression in both sexes. **Conclusions.** Our study reveals for the first time that although the spectrum of symptoms of depression is broad, rhinitis and asthma are only related to some of them.

Key words

Asthma; allergic rhinitis; depression; cross-sectional study; adult; sleep habits; fatigue; pessimism; energy loss; sleep.

Introduction

The American Psychiatric Association defines depression as a mental disorder characterized by mood changes and cognitive and physical symptoms that persist for a period of at least two weeks (1). In the United States, the prevalence of depression in individuals aged 20 years or older is 8.1% (2), but this figure may differ according to sex, socioeconomic level, and the presence of a chronic disease; the prevalence of depression in cardiovascular diseases is 73%, in metabolic diseases 55%, and in respiratory diseases 88% (3).

The relationship between some chronic respiratory diseases and psychological well-being is a topic of growing interest. It has been observed that diseases such as rhinitis or asthma can have repercussions that go beyond the symptoms they cause; these patients may experience fatigue (61%), drowsiness (54%), and poor sleep quality (45%) (4), as well as anxiety (23%-54%) or depression (25%-51%) (5-8).

Although the association of emotional disorders with multiple diseases including rhinitis and asthma has been analyzed, the role these diseases play in individual depression symptoms has rarely been studied, that is to say, less attention has been paid to the possible relationship between specific depression symptoms such as energy loss, changes in sleep habits, concentration difficulty, fatigue, feelings of hopelessness and among others with respiratory diseases such as rhinitis and asthma. A better understanding of this relationship could have significant implications for the diagnosis and treatment of depression in patients with rhinitis or asthma, as some depressive symptoms may be confused with the physical effects of these diseases which could lead to incorrect diagnosis or inadequate treatment of depression. Consequently, the purpose of this study is to analyze the relationship between allergic rhinitis (AR), non-allergic rhinitis (NAR), or asthma with symptoms of depression.

Material and Methods

This cross-sectional study included four study groups: two of them comprised patients with a recent diagnosis of AR or asthma, a third group with NAR (chronic rhinosinusitis with or without nasal polyposis, nasal septum deviation or turbinate hypertrophy), and another considered as a control group made up of apparently healthy subjects. All patients were adults (≥ 18 years) recruited from the outpatient clinic of an allergy service; the control group consisted of blood donors. Individuals with a personal history of chronic diseases (diabetes, cancer, hypertension, chronic renal failure, rheumatoid arthritis, urticaria, among others), pregnant women, or those who had experienced the loss of a loved one in the last 6 months were excluded. The recruitment period was from January to December 2023, and subjects were included consecutively.

The diagnosis of AR was established following the guidelines proposed by Allergic Rhinitis and its Impact on Asthma (9), which include nasal symptoms related to aeroallergen exposure supported by at least one positive allergy sensitization test; in those patients where, allergic sensitization could not be documented, they were included in the NAR group. The diagnosis

of asthma followed the most recent recommendations from the Global Initiative for Asthma (10); in addition to presenting symptoms compatible with asthma, patients had to undergo forced spirometry showing reversible obstruction determined by an increase in Forced Expiratory Volume in 1 second (FEV_1) of at least 200 ml and 12% of the predicted value after using a short-acting bronchodilator. In this group of asthma patients, those with or without allergic rhinitis were included.

Symptoms of depression were assessed using the Beck Depression Inventory-II (BDI-II) which was administered the same day the results of the allergy sensitization skin tests were obtained. The BDI-II consists of 21 statements with Likert-type responses designed to investigate the presence of symptoms of depression in the previous two weeks. Each statement offers the possibility of 4 responses (score from 0 to 3), a higher score indicates that the severity of depressive symptoms is also higher.; for the purposes of this study, subjects selecting responses 1 to 3 in each statement were grouped into one group; additionally, the Beck Anxiety Inventory (BAI) was administered to identify the presence of anxiety (11); the BAI provides the opportunity to identify anxiety symptoms that occurred during the week preceding its application, and its interpretation is similar to that of the BDI-II.

Information was also obtained on the subject's sex and age, marital status, current tobacco or alcohol use, exercise practice (walking, running, swimming, gymnastics, or ball games for at least 30 minutes/day), sleep duration (normal: 6 to 8 hours; short: ≤ 5 hours; long: ≥ 9 hours) (12), and body mass index category (BMI = weight (kg)/ [height (m)]^2).

The study received approval from the ethics committee host institution (Approval Number/CEI 00085). This research adheres to the recommendations established in the Declaration of Helsinki of the World Medical Association. All participants provided written informed consent to be included in the study. Additionally, another consent was obtained to carry out the skin tests and respiratory function tests. In cases where the BDI-II or BAI score indicated the presence of depression or anxiety participants were invited to receive specialized medical care.

In each of the 4 study groups, continuous variables were expressed as medians and interquartile ranges, and qualitative variables as frequencies and proportions. The chi-square test was used to compare proportions in independent groups; additionally, the Kolmogorov-Smirnov test and Levene's statistic were used to verify if the age variables, BAI, and BDI-II scores met a normal distribution and homoscedasticity of variances among study groups; as they did not, the medians were compared using the Kruskal-Wallis test, and the Mann-Whitney U test with Bonferroni correction was used as a post-hoc test. The strength of the association of asthma and rhinitis with depression symptoms was analyzed by logistic regression models; where the dependent variable was each of the 21 statements of the BDI-II; for the purposes of this study, the results show only those models where asthma or rhinitis showed a significant association with any of the dependent variables; in all models, the covariates included were: the subject's sex, current alcohol consumption, exercise practice, obesity, sleep duration, and presence of anxiety. A p-value ≤ 0.05 was used to establish statistical significance. Data analysis was performed using IBM SPSS Statistics (Armonk, NY, USA) version 29.0.

Results

A total of 257 participants were included, with an average age of 33.2 ± 9.1 years, mostly women (60%). The current frequency of tobacco and alcohol consumption was 12% and 35% respectively. More than 60% of the participants reported engaging in some type of physical activity, and over three-quarters reported having a normal sleep duration. Regarding BMI, one-quarter were obese. The median scores for the BAI and BDI-II were 8, respectively (Table I). Out of all the included participants, 80 had asthma, 59 had AR, and 42 had NAR; the control group consisted of 76 apparently healthy subjects (Table I). Although an initial significant difference was found in the median age, post-hoc analysis showed no group had a significantly higher age than the control group. The asthma or AR groups were characterized by a higher proportion of women and a higher frequency of obesity. In contrast, the NAR group had a higher frequency of smoking and current alcohol consumption, engaged in more exercise, and

had a longer normal sleep duration. Additionally, the asthma and AR groups had significantly higher median scores on the BAI and BDI-II compared to the control group. Conversely, the NAR group had a lower median score than the control group, although a significant difference was found only in the BAI scale. In any case, the asthma group followed by the AR group had the highest scores on both scales (Table I).

The frequency of anxiety and depression levels varied among the groups compared. Severe anxiety predominated in the asthma group, while moderate anxiety was more common in the AR group. Meanwhile, 98% of the NAR group and 88% of the control group had no anxiety. Regarding severe depression, it was more frequent in the AR group, while moderate depression was higher in the asthma group. Once again, 93% of the NAR subjects and 86% of the control group had no depression. Due to some cells having expected values < 5, it was not possible to calculate the p-value using the chi-square test in Table II.

Table III shows a univariate analysis comparing depression symptoms according to respiratory diseases. Compared to the control group, depression symptoms were more frequent in the asthma or AR groups, except for feelings of failure, feelings of punishment, and suicidal thoughts.

Table IV show the results of a multivariate analysis of the relationship between depression symptoms and asthma or rhinitis. In all patients, allergic rhinitis was associated as a risk factor ($OR > 1, p \leq 0.05$) with all the variables analyzed except with "changes in sleeping pattern" and "concentration difficulty;" in contrast, asthma was associated only with "loss of energy" and "tiredness or fatigue" ($OR > 1, p \leq 0.05$); anxiety was associated with all variables ($OR > 1, p \leq 0.05$) except "self-criticalness," while physical activity was shown to be a protective factor ($OR < 1, p \leq 0.05$) for "self-criticalness" and "tiredness of fatigue." In women, asthma and allergic rhinitis were shown to be risk factors for "loss of energy" and "tiredness or fatigue"; however, anxiety showed an association as a risk factor for all variables analyzed in the model; additionally, obesity showed a higher risk of "pessimism" while alcoholism was inversely

associated with "self-criticalness." On the contrary, the epidemiological profile previously found in women differs from that of men. Neither asthma nor allergic rhinitis showed an association with symptoms of depression in men. In contrast, anxiety showed a strong association with the variables analyzed (OR > 1, $p \leq 0.05$), except for “self-criticalness.” Finally, in men, physical activity was shown to be a protective factor (OR < 1, $p \leq 0.05$) for “self-criticalness” and “tiredness or fatigue.”

Discussion and conclusions

Our study shows for the first time that asthma and AR are associated with some symptoms of depression. Specifically, asthma is independently related to loss of energy and tiredness; while allergic rhinitis, was associated as a risk factor for pessimism, self-criticalness, loss of energy, and a feeling of tiredness or fatigue. It also shows that when patients were categorized by sex; for example, in women, both asthma and allergic rhinitis were independently associated with loss of energy and fatigue; in contrast, in men, no symptoms of depression were associated with either study group.

One of the symptoms of depression that has been most closely associated with asthma or allergic rhinitis is changes in sleep habits. In patients with asthma, insomnia is the most common.; it is estimated that nearly 50% of asthma patients experience insomnia, and this condition becomes even more notable when asthma is uncontrolled (13). It has also been observed that people with asthma have a lower quality of life and spend more time experiencing daytime sleepiness compared to those without asthma; once more, lack of asthma control was a triggering factor for these events (14). Another finding in asthma patients is that they sleep less than those without the disease (15). A recent meta-analysis evaluated sleep disorders in relation to asthma, including insomnia, sleep quality, and insufficient sleep time; after adjusting for potential confounding variables such as age under 12 years and family history of asthma,

sleep disorders did not show a greater association with asthma; however, a significant association was observed with an increase in asthma prevalence and incidence (16). Regarding the association between AR and sleep disorders, three studies showed the following findings: in the first, it was observed that AR patients had lower sleep quality compared to subjects without rhinitis (15); in the second, a group of women with AR experienced more sleep problems during the 30 days prior to the study (17); finally, the third study was a meta-analysis that documented that AR patients were more likely to experience insomnia, nocturnal enuresis, restless sleep, sleep-related breathing disorders, snoring, difficulty breathing, daytime sleepiness, and use of sleeping pills (18). In the case of NAR and sleep disorders, it has been observed that, like AR patients, they experience more daytime sleepiness and have lower sleep quality (19). To explain the higher frequency of sleep disorders in asthma or rhinitis patients, various reasons have been proposed; the sensation of shortness of breath, either due to bronchial obstruction or fear of suffocation (20), nasal obstruction, which tends to worsen at night; additionally, the use of medications to treat these conditions, such as montelukast, which has been associated with an increased risk of neuropsychiatric disorders, including sleep disorders (21). Although in the multivariate analysis, we did not find evidence of an association between changes in sleep patterns and any of the study groups (asthma, AR, or NAR), this may have been influenced by the role that anxiety has on sleep characteristics. Previous research has not always included anxiety as another covariate, as we did in this study.

When analyzing depression symptoms in AR or asthma patients, we observed that they were more likely to exhibit loss of energy and fatigue compared to the control group. It has been observed that AR patients show greater impairment in comprehensive attention tests than NAR patients and that these tests improve in their results after one year of continuous treatment with topical nasal steroids and oral antihistamines (22); these patients also make more errors in specific spatial working memory tasks during the pollen season compared to the control group (23). Regarding fatigue and loss of energy, there is confusion about whether they are the same

phenomenon; for the purposes of this study, both will be discussed together. These symptoms have been mainly analyzed in AR patients, where it has been observed that a large number of them manifest fatigue as part of extra-nasal symptoms, and this is more intense when nasal symptoms are uncontrolled (4). In these patients, it has been observed that fatigue is not only physical but also mental (17), and it is favored and exacerbated by exposure to environmental aeroallergens (24). Finally, according to the BDI-II, approximately 30% of all participants exhibited some degree of pessimism. Pessimism is characterized by fatalism, skepticism, assertion of decline, and hopelessness (25); probably, NAR patients, knowing that their clinical condition might not have a resolution, showed a greater tendency to manifest pessimism compared to the control group. It would be interesting to develop new studies that allow the follow-up of patients with chronic respiratory diseases, such as asthma or rhinitis, who also have some degree of depression or anxiety. Timely treatment of depression or anxiety promotes a better quality of life; in addition to pharmacological therapy, other therapies, such as cognitive behavioral therapy, can be included (26).

Among the limitations, it should be noted how sleep habit disorders were assessed, as no specific instrument was used for this as in the studies mentioned earlier, such as the Pittsburgh Sleep Quality Index, which has been used to measure sleep quality in asthma (14), or has been used in Mexico in patients with diabetes (27); however, a notable difference is that the BDI-II delves more into sleep pattern changes, either by a reduction or an increase in sleep hours, which provided the opportunity to identify a greater number of patients with this problem; something similar happened with the way fatigue, concentration, or pessimism was measured; in this sense, more studies are needed to evaluate these points in more detail. Two additional limitations are: first, the difficulty in evaluating the role of medication use in controlling respiratory disease symptoms. However, since most newly diagnosed asthma or rhinitis patients were not receiving regular medication treatment, this factor is likely not as relevant when interpreting the results. Second, the study was conducted in a university hospital, where

medical services are mainly directed at the population without social security. Finally, due to the limited number of patients with severe depression across all study groups, drawing definitive conclusions regarding the prevalence of severe depression in any specific group is challenging.

In summary, our findings suggest that both asthma and rhinitis, whether allergic or non-allergic, can be independently associated with some depression symptoms, highlighting the importance of evaluating mental health in patients with chronic respiratory diseases.

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Contributions

Conceptualization: TIBP, NAPG, MEAM, MBB

Formal Analysis: JMR, MBB

Investigation: TIBP, MEAM

Methodology: TIBP, JMR, MRF, MBB

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Writing – review & editing: TIBP, JMR, NAPG, MEAM, MRF, MBB

Conflict of interest

The authors declare that they have no conflict of interests.

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Table I. Clinical Characteristics of the Participants.

		Group				
	Total	Control	Asthma	Allergic rhinitis	Non-allergic rhinitis	*p*
	n = 257	*n* = 76	*n* = 80	*n* = 59	*n* = 42	
Age in years, median (P_{25}, P_{75})	32.0 (26.0, 40.0)	31.0 (23.0, 39.8)	35.0 (28.0, 40.8)	30.0 (25.0, 41.0)	31 (25.0, 39.3)	0.045*
Sex, *n* (%)						< 0.001
Female	155 (60.3)	27 (35.5)	65 (81.3)	49 (83.1)	14 (33.3)	
Male	102 (39.7)	49 (64.5)	15 (18.8)	10 (16.9)	28 (66.7)	
Marital status, *n* (%)						0.201
Married	131 (51.0)	31 (40.8)	50 (62.5)	29 (49.2)	21 (50.0)	
Single	87 (33.9)	31 (40.8)	16 (20.0)	23 (39.0)	17 840.59	
Common-law relationship	20 (7.8)	6 (7.9)	8 (10.0)	4 (6.8)	2 (4.8)	
Divorced	13 (5.1)	5 (6.6)	5 (6.3)	1 (1.7)	2 (4.8)	
Widowed	6 (2.3)	3 (3.9)	1 (1.3)	2 (3.4)	0 (0)	
Current smoking, *n* (%)	31 (12.1)	9 (11.8)	7 (8.8)	5 (8.5)	10 (23.8)	0.072
Current alcohol consumption, *n* (%)	90 (35.0)	37 (48.7)	18 (22.5)	12 (20.3)	23 (54.8)	< 0.001
Physical activity, yes, *n* (%)	165 (64.2)	55 (72.4)	39 (48.8)	39 (66.1)	32 (76.2)	0.004
Sleep duration, *n* (%)						0.040
Normal	195 (75.9)	62 (81.6)	58 (72.5)	41 (69.5)	34 (81.0)	
Short	17 (6.6)	1 (1.3)	4 (5.0)	9 (15.3)	3 (7.1)	

Large	45 (17.5)	13 (17.1)	18 (22.5)	9 (15.3)	5 (11.9)	
BMI categories, *n* (%)						0.029
Undernutrition	3 (1.2)	0 (0)	2 (2.5)	1 (1.7)	0 (0)	
Normal	80 (31.1)	22 (28.9)	23 (28.7)	24 (40.7)	11 (26.2)	
Overweight	106 (41.2)	40 (52.6)	27 (33.8)	16 (27.1)	23 (54.8)	
Obesity	68 (26.5)	14 (18.4)	28 (35.0)	18 (30.5)	8 (19.0)	
BAI score, median (P_{25}, P_{75})	8.0 (3.0, 18.0)	4.0 (2.0, 8.0)	16.0 (7.25, 26)	12 (6.0, 23.0)	3.0 (0, 5.25)	< 0.001**
BDI-II score, median (P_{25}, P_{75})	8.0 (3.0, 15.0)	5.0 (2.0, 10.0)	14.0 (7.0, 18.0)	11.0 (6.0, 17.0)	3.5 (1.0, 7.25)	< 0.001***

BMI: Body mass index

BAI: Beck Anxiety Inventory

BDI-II: Beck Depression Inventory-II

P25: 25th percentile, P75: 75th percentile

p-value obtained by Kruskal-Wallis test or chi-square test

Post-hoc comparison using Mann-Whitney U test with p-value adjustment using Bonferroni method:

*Age: asthma vs. control: p = 0.08 (NS); allergic rhinitis vs. control: NS; chronic rhinitis vs. control: NS

**BAI score: asthma vs. control: p < 0.001; allergic rhinitis vs. control: p < 0.001; chronic rhinitis vs. control: p = 0.07

***BDI-II score: asthma vs control: p < 0.001; allergic rhinitis vs. control: p < 0.001; chronic rhinitis vs. control: NS

NS: not significant

Table II. Frequency of Anxiety and Depression.

		Group				
	Total	Control	Asthma	Allergic rhinitis	Non-allergic rhinitis	*p*
	n = 257	*n* = 76	*n* = 80	*n* = 59	*n* = 42	
Anxiety						
No	175 (68.1)	67 (88.2)	35 (43.8)	32 (54.2)	41 (97.6)	
Mild	24 (9.3)	6 (7.9)	12 (15.0)	5 (8.5)	1 (2.4)	
Moderate	34 (13.2)	2 (2.6)	17 (21.3)	15 (25.4)	0 (0)	
Severe	24 (9.3)	1 (1.3)	16 (20.0)	7 (11.9)	0 (0)	
Depression						
No	181 (70.4)	65 (85.5)	40 (50.0)	37 (62.7)	39 (92.9)	
Mild	43 (16.7)	6 (7.9)	25 (31.3)	10 (16.9)	2 (4.8)	
Moderate	22 (8.6)	2 (2.6)	13 (16.3)	7 (11.9)	0 (0)	
Severe	11 (4.3)	1 (3.9)	2 (2.5)	5 (8.5)	1 (2.4)	

The values indicate absolute frequencies, with percentages in parentheses.

The p-value is not shown (not valid) because the chi-square test found expected frequencies < 5.

Table III. Depression Symptoms According to Respiratory Disease.

Symptoms	Total *n* = 257	Group				*p*
		Control *n* = 76	Asthma *n* = 80	Allergic rhinitis *n* = 59	Non-allergic rhinitis *n* = 42	
1. Sadness	74 (28.8)	18 (23.7)	30 (37.5)	20 (33.9)	6 (14.3)	0.029
2. Pessimism	74 (28.8)	11 (14.5)	34 (42.5)	25 (42.4)	4 (9.5)	< 0.001
3. Past failure	51 (19.8)	9 (11.8)	21 (26.3)	14 (23.7)	7 (16.7)	0.114
4. Loss of pleasure	119 (46.3)	26 (34.2)	48 (60.0)	34 (57.6)	11 (26.2)	< 0.001
5. Guilty feeling	116 (45.1)	29 (38.2)	43 (53.8)	33 (55.9)	11 (26.2)	0.005
6. Punishment feeling	56 (21.8)	11 (14.5)	19 (23.8)	18 (30.5)	8 (19.0)	0.146
7. Self-dislike	68 (26.5)	12 (15.8)	29 (36.3)	21 (35.6)	6 (14.3)	0.003
8. Self-criticalness	112 (43.6)	24 (31.6)	34 (42.5)	36 (61.0)	18 (42.9)	0.008
9. Suicidal thought or wishes	31 (12.1)	6 (7.9)	14 (17.5)	8 (13.6)	3 (7.1)	0.207
10. Crying	79 (30.7)	13 (17.1)	38 (47.5)	20 (33.9)	8 (19.0)	< 0.001
11. Agitation	110 (42.8)	27 (35.5)	46 (57.5)	29 (49.2)	8 (19.0)	< 0.001
12. Loss of interest	82 (31.9)	21 (27.6)	31 (38.8)	25 (42.4)	5 (11.9)	0.004
13. Indecisiveness	110 (42.8)	28 (36.8)	39 (48.8)	33 (55.9)	10 (23.8)	0.006
14. Worthlessness	50 (19.5)	7 (9.2)	20 (25.0)	19 (32.2)	4 (9.5)	0.001

15. Loss of energy	143 (55.6)	29 (38.2)	62 (77.5)	42 (71.2)	10 (23.8)	< 0.001
16. Changes in sleeping pattern	153 (59.5)	40 (52.6)	63 (78.8)	38 (64.4)	12 (28.6)	< 0.001
17. Irritability	102 (39.7)	20 (26.3)	42 (52.5)	33 (55.9)	7 (16.5)	< 0.001
18. Changes in appetite	114 (44.4)	25 (32.9)	49 (61.3)	27 (45.8)	13 (31.0)	< 0.001
19. Concentration difficulty	122 (47.5)	27 (35.5)	49 (61.3)	38 (64.4)	8 (19.0)	< 0.001
20. Tiredness or fatigue	142	26 (34.2)	63 (78.8)	42 (71.2)	11 (26.2)	< 0.001
21. Loss in interest in sex	87 (33.9)	16 (21.1)	42 (52.5)	24 (40.7)	5 (11.9)	< 0.001

The values represent absolute frequencies, with percentages in parentheses.

The p-value was obtained by chi-square test.

Table IV. Multivariate Analysis of the Relationship Between Depression Symptoms and Asthma or Rhinitis.

	Pessimism	Self-criticalness	Loss of energy	Changes in sleeping	Concentration difficulty	Tiredness or fatigue
	aOR (95% CI)	aOR (95% CI)	aOR	aOR (95%	aOR (95% CI)	aOR (95%
All patients						
Group						
Control	1	1	1	1	1	1
Asthma	2.3 (1.0 – 5.5)	1.4 (0.7 – 2.7)	**3.4 (1.6 – 7.1) ***	1.9 (0.9 – 4.0)	1.5 (0.7 – 3.2)	**4.0 (1.9 – 8.9) ***
Allergic rhinitis	**2.8 (1.1 – 6.6) ***	**3.3 (1.6 – 6.9) ***	**2.7 (1.3 – 5.9) ***	1.01 (0.5 – 2.2)	1.9 (0.9 – 4.1)	0.5 (0.2 – 1.1)	**3.3 (1.5 – 7.1) ***
Non-Anxiety (yes)	0.8 (0.2 – 2.6)	1.7 (0.8 – 3.7)	**4.5 (2.2 – 9.4) ***	**5.1 (2.4 – 10.8) ***	**4.8 (2.5 – 9.5)***	**4.3 (2.1 – 9.1) ***
Physical activity (yes)	**4.4 (2.3 – 8.5) ***	NS	NS	NS	NS	**0.5 (0.3 – 0.96) ***
Women						
Group						
Control	1	1	1	1	1	1
Asthma	NS	NS	**5.1 (1.8 – 12.2) ***	1.4 (0.5 – 9.9)	NS	**4.8 (1.7 – 8.3) ***
Anxiety (yes)	**6.8 (3.2 – 14.7) ***	**2.3 (1.2 – 4.5) ***	**5.0 (2.0 – 12.2) ***	**4.2 (1.8 – 9.9) ***	**6.6 (3.1 – 13.9) ***	**3.4 (1.4 – 8.3) ***
Obesity (yes)	**2.6 (1.2 – 5.8) ***	NS	NS	NS	NS	NS
Alcoholism (yes)	NS	**0.3 (0.1 – 0.8) ***	NS	NS	NS	NS
Men						
Group						
Control	1	1	1	1	1	1
Asthma	NS	NS	NS	NS	NS	NS
Anxiety (yes)	**7.0 (2.1 – 23.5) ***	NS	**4.6 (1.3 – 15.9) ***	**19.7 (2.5 – 157.3) ***	**4.9 (1.4 – 16.5) ***	**7.7 (1.8 – 31.8) ***
Obesity (yes)	NS	NS	NS	NS	NS	NS
Alcoholism	NS	NS	NS	NS	NS	NS

aOR: Odds ratio obtained by binary logistic regression adjusted for gender (only in all patients), anxiety, physical activity ≥ 30 minutes per day, current alcohol consumption, obesity, and sleep duration (Method: Forward conditional).
95% CI: 95% confidence interval
NS: Not significant
* p-value ≤ 0.05
Significant results are shown in bold