

Article

Analysis of Physical Activity and Comorbidities in Spanish Asthmatics

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Abstract: The prevalence of comorbidities in asthmatics is high. Comorbidities may complicate the clinical management of asthma, increasing the risk for exacerbation and even death. The objective of the present research was to establish the prevalence of 31 asthma comorbidities and to assess the association of these comorbidities with physical activity (PA) in Spanish asthmatics. Data of the Spanish National Health Survey 2017 (cross-sectional design) were used in this study. A total of 1014 people (42.1% males) with asthma participated in this study (age range 15–69 years). The IPAQ (International Physical Activity Questionnaire) short form was the instrument administered to evaluate PA (exposure), and the self-reported answer to the question “Have you ever been diagnosed with . . . ?” determined the presence of comorbidities (outcomes). This association was assessed by multivariable logistic regression. Results demonstrated a huge presence of comorbidities (89.3%). The most prevalent were chronic allergy (61.1%), chronic lumbar pain (28.7%), chronic cervical pain (24.2%), high cholesterol (20.9%), Chronic Obstructive Pulmonary Disease (COPD) (19.4%), migraine (19.2%) and hypertension (19.3%). PA level under 600 metabolic equivalent of task (MET)·min/week showed a significant association with urinary incontinence (3.10 [1.62–5.94]), osteoporosis (1.90 [1.00–3.61]) and chronic anxiety (1.69 [1.13–2.53]). Therefore, comorbidities and PA levels should be considered in the prevention and treatment of asthmatics, in order to improve their quality of life.

Keywords: respiratory health; exercise; prevalence; adults

1. Introduction

Asthma is a frequent and potentially serious chronic condition that affects all age groups [1]. Over 339 million people worldwide are affected by asthma [2]. According to previous research, the worldwide prevalence of asthma diagnosed in the adult population is 4.3% [3]. In Spain, the epidemiological study of chronic obstructive pulmonary disease (IBERPOC) found a prevalence of 4.9% in adults aged 40–69 years [4], and according to the Spanish National Survey 2017, a prevalence of 6% was found in Spanish people aged 15–69 years [5].

Chronic airway inflammation related to wheezing, chest tightness, shortness of breath, cough and variability in expiratory airflow limitation are some of the symptoms present in asthmatics. An insufficient control of asthma symptoms is a risk factor to develop crisis relating to asthma [1]. The previous aspects, together with the possibility of having EIB (exercise-induced bronchoconstriction), could reduce physical activity (PA) levels in asthmatics [6]. Therefore, asthmatics are usually involved in lower levels of PA in comparison with non-asthmatics [6,7]. In people with asthma, regular PA may be useful in the control of asthma [8–10]. Several studies suggest that regular PA reduces asthma symptoms [11,12], airway responsiveness [13], EIB [9] and the risk of asthma exacerbations [13,14] and increases exercise capacity [15,16] and quality of life [9,11,13] in people with asthma.

However, asthma is a heterogeneous disease that can be associated with a number of comorbidities. The term comorbidity was coined in 1970 by Feinstein and it refers to “any additional co-existing ailment” [17]. Comorbidities could be independent of asthma or be associated with the disease, but they could complicate clinical management of asthma [18,19], increasing the risk for exacerbation [20], unscheduled asthma care [21], poor asthma control and impaired quality of life [1] and mortality [22]. Therefore, it is important to recognize them.

Rhinosinusitis, food allergy, obstructive sleep apnoea syndrome (OSAS), gastroesophageal reflux (GER) and mental health disorders are the most frequent conditions in people with asthma [1,18,19,23]. Asthmatics have significantly more comorbid conditions than non-asthmatics [24,25]. A recent study, which examined the prevalence of 39 comorbidities in more than one million Scottish adults, found that the most prevalent comorbidities in adults with asthma were hypertension (20%), depression (17%), pain (16%) and COPD (chronic obstructive pulmonary disease) (13%) [26]. Moreover, obese patients show more difficulties in the control of asthma, probably because of a different type of airway inflammation that contributes to other comorbidities like OSAS and GER and due to a poor shape and a decrease in lung volume caused by abdominal fat, which contributes to dyspnoea [1].

It is known that sustained and regular participation in PA helps not only in primary, but also in secondary prevention of a series of chronic conditions [27–29]. However, there is no evidence about how PA can contribute to reduce the risk of suffering from comorbidities in asthmatic adults. It is hypothesized that lower PA levels would increase the risk of comorbidities.

Knowledge about the spectrum of diseases that could affect asthmatics and about how they differ according to PA levels would aid health professionals to identify, prioritize and control asthma comorbidities. Hence, the purpose of this research was to establish the prevalence of 31 different asthma comorbidities and to analyse the associations of levels of PA with the risk of these comorbidities in Spanish people with asthma aged 15–69 years.

2. Materials and Methods

2.1. Study Design

This research had a cross-sectional design, and it was written following the STROBE guidelines (Strengthening the Reporting of Observational Studies in Epidemiology) [30].

2.2. The Survey

We analysed data extracted from the 2017 Spanish National Health Survey. All details about the survey method were previously published [31]. In summary, a stratified three-stage sampling was utilized for data collection. Firstly, the census categories were contemplated, then the family dwellings, and finally, a family member aged 15 or over was elected within each dwelling. The sections were selected within each stratum with probability proportional to their size. A systematic sampling was used to choose the dwellings with equal probability in each section, prior arrangement by size of the dwelling. This procedure led to self-weighting samples in each stratum. To select the family member who filled out the Adult Questionnaire, the random Kish method was employed, which assigns equal probability to all adults in the dwelling. Data were collected by a CAPI (computer-assisted personal interviewing), carried out in the selected participants' dwellings. The interviewers, who were previously qualified, filled in the questionnaires with the information provided by the participants. This research was executed following the principles of the World Medical Association Declaration of Helsinki. Data from the Spanish National Health Survey are public and anonymous, so no ethical approval was required [31]. The present secondary analyses were approved by the Ethical Research Committee of the University of Murcia.

2.3. Participants

The participants of this study were Spanish people suffering from asthma ($n = 1014$; 587 females and 427 males) (Table 1). Inclusion criteria were: (1) age range 15–69 years and (2) affirmative answer to the question “Have you ever been diagnosed with asthma?” People older than 69 years were not taken into account since they did not respond to the PA questions of the survey. The International Physical Activity Questionnaire (IPAQ) short form was firstly designed for supervising PA in adults (age range 15–69 years). Then, until further development and testing is carried out, the use of IPAQ is not advisable in younger and older ages [32]. Before responding to the survey questions, all participants voluntarily agreed to participate in the study by signing an informed consent form.

Table 1. Sample characteristics according to physical activity (PA) level.

Characteristic	Category	PA < 600 MET·min/Week			PA ≥ 600 MET·min/Week		p
		N	N	%	N	%	
Sex	Male	427	122	28.6	305	71.4	0.081
	Female	587	198	33.7	389	66.3	
Education	Level A	466	171	36.7	295	63.3	0.003 *
	Level B	195	59	30.3	136	69.7	
	Level C	353	90	25.5	263	74.5	
Marital Status	Married	509	182	35.8	327	64.2	0.004 *
	Not Married	505	138	27.3	367	72.7	
Smoking	Current	235	79	33.6	156	66.4	0.254
	Former	265	73	27.5	192	72.5	
	Never	514	168	32.7	346	67.3	
Alcohol	Yes	692	199	28.8	493	71.2	0.005 *
	No	322	121	37.6	201	62.4	
Obesity	Yes (≥30)	220	96	43.6	124	56.4	<0.001 *
	No	772	214	27.7	558	72.3	
	Missing	22	10		12		
Comorbidities	Yes	905	292	32.3	613	67.7	0.163
	No	109	28	25.7	81	74.3	
Medication	Yes	822	259	31.5	563	68.5	0.944
	No	192	61	31.8	131	68.2	
			Av.	SD	Av.	SD	
BMI			27.3	5.9	25.9	5.0	<0.001 *
Age			45.2	14.4	42.2	14.8	0.003 *

N: sample size; %: percentage; MET: Metabolic equivalent of task; Level A: ≤ 1st period secondary; Level B: 2nd period secondary and post-secondary (not tertiary); Level C: tertiary; Av.: average; SD: standard deviation. *p*-values are based on chi-squared tests (categorical) and T tests (continuous). * $p < 0.05$.

2.4. Physical Activity (Exposure)

PA was evaluated with the IPAQ short form. Total PA metabolic equivalent of task (MET)-minutes/week was calculated by the following formula: sum of walking + moderate + vigorous MET·minutes/week scores. Then, following the instructions for data processing and analysis of the IPAQ, participants were divided in two groups [32]: (1) under 600 MET·minutes/week and (2) at least 600 MET·minutes/week, which meant achieving PA recommendations. IPAQ has been validated in adult populations worldwide, and it is a valid ($\rho = 0.30$, 95% CI: 0.23–0.36) and reliable (Spearman’s $\rho = 0.81$, 95% CI: 0.79–0.82) instrument [33]. The IPAQ short form has been validated in Spanish adults as well ($r = 0.277$; $p < 0.05$) with a 75% of sensitivity and specificity ($k = 0.33$) [34].

2.5. Comorbidities (Outcomes)

The 31 comorbidities analysed were based on the data available in the 2017 Spanish National Health Survey. Participants who answered affirmatively to the question “Have you ever been

diagnosed with ... (each comorbidity studied)”? were determined to suffer from that specific condition. The comorbidities studied are described in Table 2. Chronic allergy includes rhinitis, conjunctivitis, dermatitis, food allergy or another kind of allergy (excluding allergic asthma). Some of these diseases were analysed in previous studies, and rhinosinusitis, food allergy, gastroesophageal reflux (GER), psychological diseases and obstructive sleep apnoea syndrome (OSAS) were found to be common in asthma patients [1,23].

Table 2. Prevalence of comorbidities in people with asthma.

Group of Comorbidities	Comorbidities	N	%	Global %
Cardiovascular diseases	Hypertension	196	19.3	32.2
	Myocardial infarction	14	1.4	
	Angina, coronary HD	20	2.0	
	Other HD	50	4.9	
	Stroke	16	1.6	
	Varicose veins (legs)	143	14.1	
Musculoskeletal disorders	Arthrosis	187	18.4	39.3
	CBP cervical	245	24.2	
	CBP lumbar	291	28.7	
	Osteoporosis	49	4.8	
Immunological disease	Chronic allergy	625	61.6	61.1
Respiratory disease	COPD	197	19.4	19.4
Digestive problems	Liver dysfunction	19	1.9	18.1
	Stomach/duodenal ulcer	55	5.4	
	Chronic constipation	64	6.3	
	Haemorrhoids	118	11.6	
Urogenital diseases	Urinary incontinence	51	5.0	15.5
	Kidney problems	56	5.5	
	Prostate problems (men)	27	6.3	
	Menopausal problems (women)	57	9.7	
Eye problems	Cataracts	58	5.7	5.7
Dermatological problems	Chronic skin problems	118	11.6	11.6
Mental health problems	Depression	152	15.0	20.6
	Chronic anxiety	143	14.1	
	Other mental problems	28	2.8	
Neurological disorder	Migraine	195	19.2	19.2
Neoplasias	Malignant tumours	51	5.0	5.0
Endocrinal and metabolic diseases	Thyroid problems	83	8.2	27.3
	Diabetes	73	7.2	
	High cholesterol	212	20.9	
Permanent injuries (accident)		92	9.1	9.1

N: sample size; %: percentage, HD: heart disease, CBP: chronic back pain, COPD: chronic obstructive pulmonary disease.

Comorbidities were classified following the ICD (International Classification of Diseases) in 13 different groups: (1) cardiovascular diseases; (2) musculoskeletal disorders; (3) immunological diseases; (4) respiratory diseases; (5) digestive problems; (6) urogenital diseases; (7) eye problems; (8) dermatological problems; (9) mental health problems; (10) neurological disorders; (11) neoplasias; (12) endocrinal and metabolic diseases; (13) permanent injuries [35].

2.6. Covariates

Covariates were selected according to previous research [36,37]. Sex, age, education level and marital status were included as sociodemographic variables. Education level was based on the highest level completed and was categorized according to the Spanish Classification of Education Levels as Level A (\leq 1st period secondary), Level B (2nd period secondary and post-secondary (not tertiary)), and Level C (tertiary) [38]. Marital status was classified as married versus not married, which included

those who were single, divorced, separated or widowed. Smoking, alcohol consumption and BMI (body mass index) were also selected as covariates. Smoking was categorised into 3 categories: never, past and current smoking. Consumption of alcohol was categorised as yes/no. BMI was calculated as weight (kg) divided by height (m) squared. Both weight and height were self-reported. The definition of obesity was $BMI \geq 30 \text{ kg/m}^2$. In relation to the presence of other comorbidities, participants were divided in two groups: those who had one or more comorbidities and those who had no comorbidities. Medication intake was considered as a dichotomous variable as well. Participants were included in the “yes” group if they had taken at least one of the following twenty-two medications in the last two weeks: (1) flu/cold medication; (2) pain medication; (3) fever medication; (4) sedatives; (5) allergy medication; (6) antibiotics; (7) diarrhoea medication; (8) heart medication; (9) rheumatism medication; (10) blood pressure medication; (11) digestive problems medication; (12) diabetes medication; (13) antidepressants; (14) laxatives; (15) vitamins/minerals/tonics; (16) slimming medicines; (17) cholesterol medication; (18) thyroid medication; (19) menopausal hormones; (20) contraceptive pill; (21) natural products (plant-based products [31]); (22) others.

2.7. Data Analyses

The characteristics of the sample were described through descriptive statistics. The mean and SD (standard deviation) were used for continuous variables (age, BMI), while frequencies and percentages were utilized for categorical variables (sex, age, marital status, education level, smoking, alcohol consumption, obesity, medication intake, presence of comorbidities and PA). Descriptive statistics were used to determine the prevalence of every comorbidity and group of comorbidities as well. Statistical significance in sample characteristics according to PA was analysed by chi-squared tests (categorical variables) and T test (continuous variables)

Multivariable logistic regression analyses were employed to study the associations between each comorbidity and quantity of PA. Three different models were used to carry out the analyses. Model 1 was not adjusted; Model 2 was adjusted for sex, age, BMI education level, marital status, smoking habits and alcohol consumption; and Model 3 was adjusted considering the variables “presence of other comorbidities” and “medication intake” as well, in addition to the same variables used in Model 2. All variables were included in the regression analyses as categorical variables except age and BMI, which were treated as continuous variables. There were missing data only on the variable BMI (2.2%). Results from the multivariable logistic regression analyses were presented as odds ratios (OR) with 95% of confidence intervals (CI). Bonferroni correction was applied to control the family-wise error rate, so statistical significance was set at $p < 0.0016$.

Statistical Package for Social Sciences version 23 (SPSS, International Business Machines Corporation, Armonk, NY, USA) was used to carry out these analyses.

3. Results

The sample was composed of 1014 Spanish asthmatic people. Participants’ mean age (SD) was 43.17 (14.7) years, with a range between 15–69 years. A total of 57.9% were females, and 42.1% were males. The prevalence of participants who do not reach PA recommendations was 31.6%. Nine out of ten people with asthma presented comorbidities. An average of 3.6 concurrent comorbidities (max:20, min:3, mo:1) was found. In Table 1, sample characteristics are described according to PA level.

The differences in sample characteristics according to PA were significant for education level, marital status, alcohol consumption, obesity, BMI and age.

Overall, the prevalence of comorbidities in asthmatics is shown in Table 2. Chronic allergy showed the highest prevalence, with 61.1%. Chronic lumbar and cervical pain, high cholesterol, COPD, migraine and hypertension were diseases with a high prevalence as well, all of them with around a 30–20% prevalence. According to the ICD classification, sixty-one-point-one percent of asthma participants had immunological disease, followed by musculoskeletal disorders (39.1%), cardiovascular diseases (32.2%) and endocrinal and metabolic diseases (27.3%).

Associations between asthma comorbidities and PA are shown in Table 3. When models were not adjusted, hypertension, arthrosis, chronic cervical and lumbar pain, osteoporosis, chronic constipation, haemorrhoids, urinary incontinence, kidney problems, cataracts, depression, chronic anxiety and migraine were significantly associated with PA ($p < 0.05$). When models were adjusted for age, BMI, sex, education level, marital status, smoking and alcohol consumption, engaging in less than 600 MET·min/week of PA was significantly associated with a greater probability of existing osteoporosis, urinary incontinence and chronic anxiety ($p < 0.05$). When the analyses were adjusted for medication intake and presence of comorbidities as well, PA was also significantly associated with osteoporosis, urinary incontinence and chronic anxiety ($p < 0.05$). Urinary incontinence showed the highest probability with an odds ratio of 3.10 [1.62–5.94]. Nevertheless, when Bonferroni correction was applied, only chronic anxiety, depression, urinary incontinence, osteoporosis and arthrosis were significant (unadjusted models) and urinary incontinence when models were adjusted ($p < 0.001$).

Table 3. Association of PA and asthma comorbidities (outcome) estimated by multivariable logistic regression.

Comorbidities	OR ¹	CI 95% ¹	p ¹	OR ²	CI 95% ²	p ²	OR ³	CI 95% ³	p ³
Hypertension	1.49	1.08–2.06	0.016 *	1.11	0.76–1.61	0.592	1.10	0.75–1.62	0.616
Myocardial infarction	0.87	0.27–2.78	0.809	0.26	0.06–1.14	0.074	0.52	0.06–1.13	0.071
Angina, coronary HD	1.08	0.74–4.38	0.197	0.83	0.29–2.38	0.734	0.83	0.28–2.40	0.723
Other HD	1.23	0.62–2.23	0.489	1.08	0.58–2.02	0.796	1.08	0.58–2.02	0.805
Stroke	2.20	0.82–5.91	0.118	1.31	0.45–3.84	0.625	1.26	0.43–3.74	0.672
Varicose veins (legs)	1.15	0.79–1.68	0.452	0.85	0.56–1.28	0.437	0.85	0.56–1.28	0.435
Arthrosis	1.93	1.40–2.68	<0.001 **	1.39	0.93–2.07	0.109	1.37	0.91–2.06	0.130
CBP cervical	1.46	1.08–1.97	0.014 *	1.20	0.86–1.67	0.289	1.20	0.86–1.69	0.282
CBP lumbar	1.52	1.14–2.02	0.004 *	1.31	0.96–1.78	0.089	1.32	0.96–1.80	0.087
Osteoporosis	2.58	1.45–4.60	0.001 **	1.96	1.04–3.70	0.036 *	1.90	1.00–3.61	0.048 *
Chronic allergy	0.90	0.69–1.19	0.467	0.91	0.68–1.21	0.495	0.83	0.60–1.14	0.253
COPD	1.29	0.927–1.78	0.132	1.02	0.72–1.46	0.899	1.01	0.70–1.44	0.979
Liver dysfunction	1.98	0.80–4.92	0.142	1.40	0.54–3.64	0.486	1.36	0.52–3.54	0.536
Stomach/duodenal ulcer	1.48	0.85–2.58	0.168	1.00	0.54–1.84	0.995	1.01	0.54–1.86	0.986
Chronic constipation	2.01	1.21–3.34	0.007 *	1.56	0.90–2.68	0.112	1.56	0.90–2.69	0.115
Haemorrhoids	1.57	1.06–2.33	0.024 *	1.31	0.86–2.00	0.207	1.33	0.87–2.03	0.196
Urinary incontinence	4.32	2.39–7.80	<0.001 **	3.22	1.69–6.15	<0.001 **	3.10	1.62–5.94	0.001 **
Kidney problems	1.96	1.14–3.37	0.015 *	1.42	0.80–2.54	0.236	1.39	0.78–2.50	0.265
Prostate problems (males)	1.51	0.67–3.40	0.317	0.89	0.33–2.41	0.821	0.88	0.31–2.48	0.813
Menopausal problems (females)	0.98	0.55–1.75	0.947	0.82	0.43–1.54	0.532	0.82	0.43–1.56	0.535
Cataracts	1.97	1.16–3.36	0.013 *	1.43	0.76–2.68	0.270	1.41	0.75–2.65	0.292
Chronic skin problems	1.18	0.77–1.77	0.428	1.15	0.76–1.74	0.511	1.15	0.75–1.75	0.517
Depression	1.84	1.29–2.61	0.001 **	1.37	0.92–2.04	0.126	1.33	0.89–1.99	0.168
Chronic anxiety	2.15	1.50–3.09	<0.001 **	1.72	1.16–2.56	0.007 *	1.69	1.13–2.53	0.010 *
Other mental problems	1.21	0.55–2.66	0.632	0.93	0.40–2.15	0.866	0.89	0.39–2.06	0.787
Migraine	1.39	1.00–1.92	0.050 *	1.21	0.86–1.72	0.276	1.23	0.86–1.76	0.260
Malignant tumours	1.56	0.88–2.76	0.132	1.44	0.78–2.64	0.240	1.41	0.77–2.59	0.272
Thyroid problems	1.18	0.74–1.89	0.489	1.03	0.62–1.70	0.910	1.03	0.62–1.70	0.923
Diabetes	1.38	0.85–2.26	0.196	0.86	0.49–1.51	0.602	0.82	0.47–1.45	0.497
High cholesterol	1.18	0.86–1.63	0.311	0.90	0.62–1.30	0.572	0.88	0.61–1.28	0.505
Permanent injuries (accident)	1.00	0.63–1.58	0.994	0.86	0.53–1.39	0.535	0.84	0.52–1.37	0.489

HD: heart disease. CBP: chronic back pain. OR: odds ratio. CI: confidence interval. * $p < 0.05$. ** $p < 0.001$. ¹ Models not adjusted. ² Models adjusted for sex, age, BMI, education level, marital status, smoking and alcohol consumption. ³ Models adjusted for sex, age, BMI, education level, marital status, smoking, alcohol consumption, medication intake and presence of comorbidities.

4. Discussion

To the best of authors' knowledge, the present study was the first study carried out in Spain analysing in a representative sample the associations between PA and the presence of 31 different asthma comorbidities. The results of the present study showed that not achieving PA recommendations was associated with more risk of comorbidities, especially urinary incontinence, osteoporosis and chronic anxiety.

The presence of comorbidities was high among Spanish with asthma aged 15–69 years. A total of 87.3% of the participants presented at least one comorbidity. It was higher than the prevalence of comorbidities found in another cross-sectional research among 84,505 Scottish adults with asthma that showed a 62.6% prevalence of asthmatics with one or more health conditions [26]. The most prevalent comorbidity was chronic allergy (61.1%), likely owing to many asthma patients having a phenotype of allergic asthma, which is associated with past and/or a family history of allergic diseases [1]. This concurred with previous studies that have also found allergic conditions like sinusitis, rhinitis, dermatitis, eczema and food allergy as important asthma comorbidities [39,40]. Allergy could be connected to asthma through genetic and environmental factors, which predispose people to contract this disease [25]. However, it is important to underline that our study did not find significant associations between low PA levels and existing chronic allergy among those with asthma ($p = 0.467$).

Chronic lumbar and cervical pain, high cholesterol, COPD, migraine and hypertension showed a high prevalence as well (20–30%) among the participants of the present study. In another study, which analysed the prevalence of comorbidities in asthmatics adults, hypertension (20%), depression (17%), pain (16%) and COPD (13%), showed the highest prevalences [26]. Some of them concurred with our results, but they were slightly lower than in the current study. In a cohort study with a five year follow-up that compared the risk of comorbidities between individuals with and without asthma by age, a significantly higher physician claim among individuals with asthma aged 18–64 years for the vast majority of comorbidities was found, with 50% or more for respiratory diseases (without including asthma) and psychiatric conditions [25].

Several studies found that cardiovascular diseases [41,42] and metabolic diseases, like diabetes [43], decrease when patients engage in moderate-vigorous PA, but in this research, a significant correlation of these comorbidities in asthmatics who achieved PA recommendations (600 or more MET·min/week) was not found, with the exception of hypertension (OR = 1.49; CI 95% = 1.08–2.06), when models were not adjusted.

In the current study, multivariable logistic regression showed that exercising less than 600 MET·min/week was significantly associated with 210% higher odds of urinary incontinence, 90% of osteoporosis and 69% of chronic anxiety. When compared with healthy population, the odds for developing the previous comorbidities in asthmatics was high [44–47]. A longitudinal study carried out in older women concluded that performing less than 372 MET·min/week was associated with 4% higher odds for urinary incontinence (OR = 1.04 CI 95% = 0.92 – 1.18). Recently, in a population study carried out in 124,434 healthy adults of South Korea, it was found that participants achieving 600–6000 MET·min/week had significantly lower risk of anxiety symptoms [44]. That barely concurred with the results of the present study, where we found a significant positive association between chronic anxiety and engaging in less than 600 MET·min/week of PA in asthmatics. In this way, a recent meta-analysis concluded that higher levels of PA are correlated with a lower probability of developing anxiety [45]. An explanation of this could be the fact that engaging in PA helps them to avoid things they are anxious about, like thoughts relating to their condition. In relation to osteoporosis, Shetty et al. [46] reported a 40% lower risk of osteoporosis among active males and Shenoy et al. [47] found a 32% reduced osteoporosis risk with each extra 10 METs of PA. This barely concurred with our results, which reported a higher risk of osteoporosis in asthmatics who engaged in lower PA levels, but with higher odds (100.2%).

Regarding cataracts, a newly published research work determined that exercising less than 600 MET·minutes/week was associated with a 32.3% higher risk of cataracts [28]. The present study

showed increased odds of cataracts in asthmatics as well, but it was much higher (97.1%). However, the odds were only significant when models were not adjusted.

Recently, Sánchez-Castillo et al. [48] studied Spanish adults with COPD using data from the Spanish National Health Survey as well. When models were adjusted, this study showed significant increased odds for urinary incontinence (110.6%), chronic constipation (97.2%), cataracts (82.5%), chronic anxiety (50.8%) and chronic lumbar pain (48.7%) in those who performed less than 600 MET·min/week. Increased odds for urinary incontinence (231.3%) and chronic anxiety (70.6%) were also found in asthmatics. On the contrary, associations between PA and osteoporosis were reported, and significant associations with chronic constipation, chronic lumbar pain and cataracts in the adjusted models were not found. Currently, with the available literature, it is difficult to explain why different associations between PA and comorbidities among asthmatics and COPD patients appear. Randomized control trials are needed to clarify this.

When focusing on the long-term benefits of PA in asthmatics, Russell et al. [37] found a protective effect by increasing the frequency of low PA, but no significant associations were found with moderate and vigorous PA. Another recent longitudinal study determined that an exercise training program, together with a weight loss lifestyle in obese adults with asthma was able to reduce depression symptoms, asthma symptoms and the risk of obstructive sleep apnoea [49]. The present study found a significant positive correlation between comorbidities (chronic anxiety, urinary incontinence and osteoporosis) and undertaking a low quantity of PA, but long-term benefits could not be established because its cross-sectional character only allowed speculating about the direction of the association. In the contrary, Cassim et al. [50] found no association with PA on asthma nor asthma on PA. However, these associations were analysed in children and adolescents aged 6–14 years, so this comparison should be considered with caution.

The strengths of the current manuscript were its large representative sample of Spanish asthmatic people aged 15–69 years and the administration of an internationally recognized, validated and reliable questionnaire to assess PA. However, some limitations should be considered. IPAQ is a reference instrument in measuring a population's PA level, but it is self-reported, and people may over- or under-report their level of PA. Assessment of asthma and comorbidities was self-reported as well, thus potentially introducing bias into the analyses. Asthma subtype was not established because it was not specified in the Spanish National Health Survey. The question relating to asthma included all types of asthma (allergic, not allergic, adult-onset, asthma with persistent airflow limitation, asthma with obesity). Furthermore, due to the cross-sectional design, the direction of the associations found was unknown. Consequently, future longitudinal research is required to make this direction clearer.

5. Conclusions

Summarizing, nine out of ten people aged 15–69 years with asthma residing in Spain had comorbidities. Chronic allergy was the most prevalent with 61.1%, followed by chronic lumbar and cervical pain, high cholesterol, COPD, migraine and hypertension. Unadjusted models determined significant positive associations between low PA (<600MET·min/week) and urinary incontinence, osteoporosis, chronic anxiety, arthrosis, depression, chronic back pain (CBP) lumbar, chronic constipation, cataracts, CBP cervical, kidney problems, hypertension, haemorrhoids and migraine. When adjusted by sex, age, BMI, education, marital status, smoking, alcohol, presence of comorbidities and medication intake, there was a significant association between low PA and existing urinary incontinence, osteoporosis and chronic anxiety among asthmatics. Therefore, comorbidities and PA levels should be considered in the prevention and treatment of asthmatics, in order to improve their quality of life.

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