



Impact of Anxiety and Depression on the Level of Asthma Control Among Jordanian Adults with Asthma

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Purpose: Recent studies imply that psychological factors may actively contribute to the development of asthma. It is generally known that people with asthma frequently suffer from psychological illnesses. This association can make it challenging to reach asthma control. This study aimed to assess the prevalence of depression and anxiety among Jordanian adults with asthma, in addition to the link between asthma control levels and these psychological disorders.

Patients and Methods: This cross-sectional study included 175 adults with asthma who visited the tertiary asthma clinic in three Jordanian Governmental hospitals. Sociodemographic data was collected directly from the patients who were assessed for their level of depression and anxiety using a self-administered questionnaire, the Hospital Anxiety and Depression Scale (HADS). Also, asthma control was assessed using the Asthma Control Test (ACT). The relation between the different sociodemographic variables and clinical data, particularly depression and anxiety and asthma control level, was assessed.

Results: Among 175 asthmatic patients, 60.57% had poor disease control, 8% had anxiety alone, 11.43% had depression alone, and 53.14% had anxiety plus depression. Poor asthma control was significantly associated with anxiety and depression ($p=0.044$) and low levels of education ($p=0.001$). Further, a lower level of education was also related to higher levels of anxiety and depression.

Conclusion: Most of the assessed Jordanian patients with asthma had their disease poorly controlled. Anxiety and depression are common among the studied sample of adults with asthma, and they appear to affect the level of disease control, suggesting the possibility that addressing these psychological conditions could enhance asthma control levels.

Keywords: Asthma, Asthma control, anxiety, depression, Jordan

Introduction

The International Guidelines for Asthma Management (GINA) emphasizes the idea that asthma control should be regarded as the treatment goal in addition to being a crucial factor related to the disease severity as well as how to manage medications using a step-up and step-down strategy.¹ Clinical trials provide robust evidence that asthma control may be attained in many patients. However, it is essential to acknowledge the disparity between the level of control achieved in these trials and the control obtained in clinical practice.^{2,3}

Several studies were conducted to assess the level of asthma control. The European National Health and Wellness Survey, an online cross-sectional study, investigated the level of asthma control in five European countries: France, the UK, Germany, Italy, and Spain. The findings indicated a prevalence of 6% of asthma, approximately 80% of asthma patients received treatment, and about 50% of them have their asthma not well controlled. Furthermore, 55% of the patients were not well-controlled within the treated group.⁴ Similarly, another study assessed the level of asthma control

among the adult population of the United States and revealed that 41% of patients had not well-controlled asthma.⁵ Further, according to another study that aimed to assess the level of asthma control in nine Asia-Pacific nations, only 7.6% of the investigated individuals with asthma have their disease well-controlled.⁶ These findings indicate that a good percentage of patients with asthma are still uncontrolled and highlight the need to assess other variables that might potentially impact the control of asthma.

Several studies showed that individuals with chronic medical conditions exhibit a higher prevalence of psychological disorders than the general population.⁷ This occurrence has been demonstrated more in patients with asthma than in those with other chronic diseases. In this context, the World Mental Health Survey, a large comprehensive study done across 17 countries in the Americas, Europe, the Middle East, Asia, and the South Pacific, confirmed the association between asthma and psychological diseases where patients with asthma showed a higher frequency of depressive and anxiety disorders in comparison to those without asthma.⁸ Based on a meta-analysis that examined the prevalence of anxiety disorders among adult patients diagnosed with asthma, it was found that the mean prevalence of any anxiety disorder was 34% in these patients.⁹ Furthermore, Strine et al reported that individuals diagnosed with asthma have a greater probability of experiencing anxiety and depression throughout their lifespan when compared to non-asthmatics.¹⁰ Notably, patients with severe asthma were also more prone to express symptoms of depression than those with less severe asthma.¹¹

The exact risk factors predisposing patients with asthma to the development of anxiety or depression are still unclear. Although asthma and psychological disorders may be associated through common factors, some studies found that certain factors are associated with a higher incidence of these psychological disorders among patients with asthma. For example, Cooper et al found a higher prevalence of anxiety among patients with asthma who were females and with increasing age.¹² Strine et al found that depression and anxiety are more common among patients with asthma who were females, those with lower education, those who were previously married compared to those who were currently married, and those who were unemployed, retired, or unable to work.¹⁰ Al-Dubai et al also revealed that sociodemographic factors, including increasing age, being retired or unemployed, and having low income, were significantly associated with anxiety or depression.¹³ Another more recent study reported that depression was more prevalent in patients with asthma with a history of smoking, hypertension, and arthritis and less likely in patients with higher education and increasing age.¹⁴ Another study found that patients with asthma who are depressed tend to be older and obese.¹⁵

Findings of previous studies provide sufficient justification for conducting screenings of patients with asthma for potential co-occurring psychological problems. Additionally, it is crucial to make simultaneous therapy efforts to manage both asthma and related psychological issues. Therefore, studying the potential correlation between asthma and psychological disorders is essential. Only a few studies examined the relationship between asthma and depression or anxiety in the Middle East. To the best of our knowledge, no studies were done to evaluate the relationship between depression and anxiety and the level of asthma control among adults with asthma in Jordan. Based on these observations, this study aimed to investigate the link between the different patients' characteristics, particularly anxiety and depression, and level of asthma control as evaluated by the Asthma Control Test (ACT), a self-administered questionnaire, among a sample of Jordanian adults with asthma.

Materials and Methods

Study Sample

This study was a cross-sectional study, and it was conducted on adult outpatients with asthma who visited the tertiary asthma clinics in three Jordanian governmental hospitals (Amman; Prince Hamza Hospital, Amman; Al Bashir Hospital, Zarqa; Al-Zarqa New Governmental Hospital) between October 2022 and May 2023, patients who were over 18 years old, had an asthma diagnosis of any severity level, and had been receiving outpatient follow-up care for more than six months were included. Patients with a history of other lung disorders, recent asthma exacerbation, congestive cardiac failure or cor pulmonale, acute (in the previous four weeks), or chronic upper and/or lower respiratory system infections were excluded. All patients were receiving pharmacological treatment according to GINA guidelines using both controller and rescue medications. Healthcare practitioners provide patients with all the needed details about the medication dosage, frequency, and use of inhalers. Furthermore, patients have easy access to their medications through

the hospitals' pharmacies, where they are trained on medication use by clinical pharmacists. All patients claimed to be committed to their medications. The local research ethics committees of the hospitals approved the study protocol. All participants had provided their written informed consent to participate in the study.

Data Collection Tools

The study was based on a questionnaire covering the socio-demographic and clinical data along with the elements of the asthma control test (ACT) and the hospital anxiety and depression scale (HADS). The socio-demographic and clinical data collected included age, gender, smoking history, education, employment, body mass index (BMI), disease duration, and history of atopy. The research team members visited the asthma clinics at the three hospitals to meet the patients, and patients who met the inclusion criteria were enrolled in the study. To maintain patients' confidentiality, patients' names were not collected, nor was any personal or sensitive information, and the patients' privacy was maintained while answering the questionnaire. All surveys were completed during a single follow-up clinic visit during a 30-minute interview session with each patient. All interviews were held in a separate room at the clinic to maintain the patients' privacy. Asthma control analysis was performed based on the asthma control test (ACT).¹⁶ The ACT is a self-administered questionnaire that has been verified for use in assessing asthma management.¹⁶ The Arabic version of ACT, which was previously validated for use, was used to correlate with the sample spoken and read language.¹⁷ The test consists of 5 questions inquiring about the last four weeks: episodes of shortness of breath, sleeping abnormalities due to asthma symptoms, limitations of daily activities, the use of rescue medication, and patient self-rated level of asthma control. Each question is scored on a 5-point scale—from 1 to 5, and the total score ranges from 5 to 25. A score ≥ 20 on the ACT is considered well-controlled asthma.¹⁶

The levels of anxiety and depression were assessed using The Hospital Anxiety and Depression Scale (HADS), which has been frequently utilized to assess psychological disorders in various clinical groups.¹⁸ It consists of 14 questions—7 for anxiety and 7 for depression, each rated on a 4-point scale from 0 to 3. This gives a maximum subscale score of 21 for anxiety and depression, respectively. The Arabic version of HADS, which was previously validated for use, was used to correlate with sample spoken and read language.¹⁹ A score of 0–7 was considered normal, 8–10 as borderline abnormal, and 11–21 as abnormal or consistent with anxiety or depression on either subscale. For most parts of the analysis and discussion, a score of 8 points or more on either subscale was considered abnormal or diagnostic for anxiety or depression.

Statistical Analysis

Continuous factors were summarized as median and range. Categorical variables were summarized as counts and percentages. A univariate analysis employed the chi-square test to identify associations between poorly controlled asthma and sociodemographic variables and clinical data. The Pearson correlation coefficient was employed to establish the correlation between the Hospital Anxiety and Depression Scale (HADS) scores and Asthma Control Test (ACT) scores. A logistic regression analysis was utilized to identify the variables that have a significant correlation with poorly controlled asthma. The regression model included variables that exhibited p-values less than or equal to 0.05 in the univariate analysis, with the outcome variable of interest being poorly controlled asthma. All tests were two-sided. The cut-off value for statistical significance was established at p-values less than or equal to 0.05. The statistical study was conducted using IBM SPSS Statistics software for Windows version 29, developed by IBM Corporation in New York, USA.

Results

Characteristics of the Enrolled Patients

A total of 175 adult patients with asthma were involved in the study. Sixty-nine patients (39.43%) had their asthma level well controlled by the ACT (score ≥ 20), whereas 60.57% had poorly controlled asthma; the mean ACT score was 17.67 (SD: 4.4). [Table 1](#) summarizes the features of the overall patients. The patients were almost homogenous in female/ male gender groups, and the two groups of smoking, and most (~83%) were 50 or younger. About 57% of the patients had a college or higher school level of education, and 52% were unemployed, whereas the remaining were either employed or retired. Most patients (~80%) had a BMI lower than 30, and 49% had a history of atopy. Anxiety and/ or depression were

Table 1 Sociodemographic and Clinical Characteristics of the Patients

Variable	Number (%)
Age	
≤ 30	61 (34.86)
31–50	84 (48.00)
> 50	30 (17.14)
Gender	
Male	87 (49.71)
Female	88 (50.29)
Smoking	
Current or former smoker	86 (49.14)
Never smoker	89 (50.86)
Level of education	
College or Higher	100 (57.14)
High School	61 (34.86)
Less than high school	14 (8.00)
Employment status	
Employed	73 (41.71)
Unemployed	91 (52.00)
Retired	11 (6.29)
BMI	
< 25	73 (41.71)
25–29.9	68 (38.86)
≥ 30	34 (19.43)
History of atopy	
Yes	86 (49.14)
No	89 (50.86)
Duration of asthma	
Median (Range)	10 (1–45)
Level of asthma control*	
Well-controlled	69 (39.43)
Poorly controlled	106 (60.57)
Psychological condition**	
Neither anxiety nor depression	48 (27.43)
Only anxiety	14 (8.00)

(Continued)

Table 1 (Continued).

Variable	Number (%)
Only depression	20 (11.43)
Anxiety and depression	93 (53.14)

Notes: *Well-controlled asthma: ACT score ≥ 20 . **Anxiety: HADS-anxiety score ≥ 8 ; Depression: HADS-depression score ≥ 8 .

Abbreviation: BMI, body mass index.

reported by about 73% of the patients, considering a score of ≥ 8 as abnormal or consistent with anxiety or depression; 8% had anxiety alone, 11.43% had depression alone, and 53.14% had anxiety and depression. The mean HADS score was 8.42 (SD: 4.1) for anxiety and 8.26 (SD: 4.0) for depression. By dividing the patients into three groups according to the HADS results in Table 2, about 31% had a borderline abnormal level, and $\sim 30\%$ had an abnormal level of anxiety. On the other hand, about 38% showed a borderline abnormal level, and $\sim 27\%$ had an abnormal level of depression.

Figure 1A and B represents the patients' distribution in the three categories of educational levels (A) and the four categories of psychological conditions (B) in relation to their level of asthma control.

Analysis of the Patients' Features According to Asthma Control Level

The analysis of the patients' features in relation to the level of asthma control in Table 3 showed a statistically significant association between the level of asthma control and the level of education ($p=0.001$) and psychological conditions ($p=0.044$), where poorer asthma control was found in those had a lower level of education, and those with anxiety plus depression. Significant weak negative correlations were observed between ACT scores and HADS scores for both anxiety and depression (HADS depression and ACT: Pearson correlation: -0.360 , $p=0.000$, HADS anxiety and ACT: Pearson correlation: -0.316 , $p=0.000$;) (Figure 2A and B). However, no statistically significant association was found with age, gender, smoking, employment, BMI, or history of atopy. Further analysis between the detailed levels of anxiety and depression according to the level of asthma control showed a significant association, where most patients with borderline or abnormal levels of anxiety or depression according to HADS results showed a poor level of asthma control (Table 2).

Table 2 The Level of Psychological Disorders According to the Level of Asthma Control

Variable	Number (%)	Level of asthma control by ACT*		P value
		Well-controlled	Poorly controlled	
	175 (100%)	69 (39.43)	106 (60.57)	
Anxiety level				0.034
Normal	68 (38.86)	35 (50.73)	33 (31.13)	
Borderline abnormal	55 (31.43)	17 (24.64)	38 (35.85)	
Abnormal	52 (29.71)	17 (24.64)	35 (33.02)	
Depression level				0.006
Normal	62 (35.43)	32 (46.38)	30 (28.30)	
Borderline abnormal	66 (37.71)	27 (39.13)	39 (36.79)	
Abnormal	47 (26.86)	10 (14.49)	37 (34.91)	

Notes: *Well-controlled asthma: ACT score ≥ 20 . Normal: a score of 0–7, Borderline abnormal: a score of 8–10, Abnormal: a score of 11–21. Bold P-values are statistically significant ≤ 0.05 .

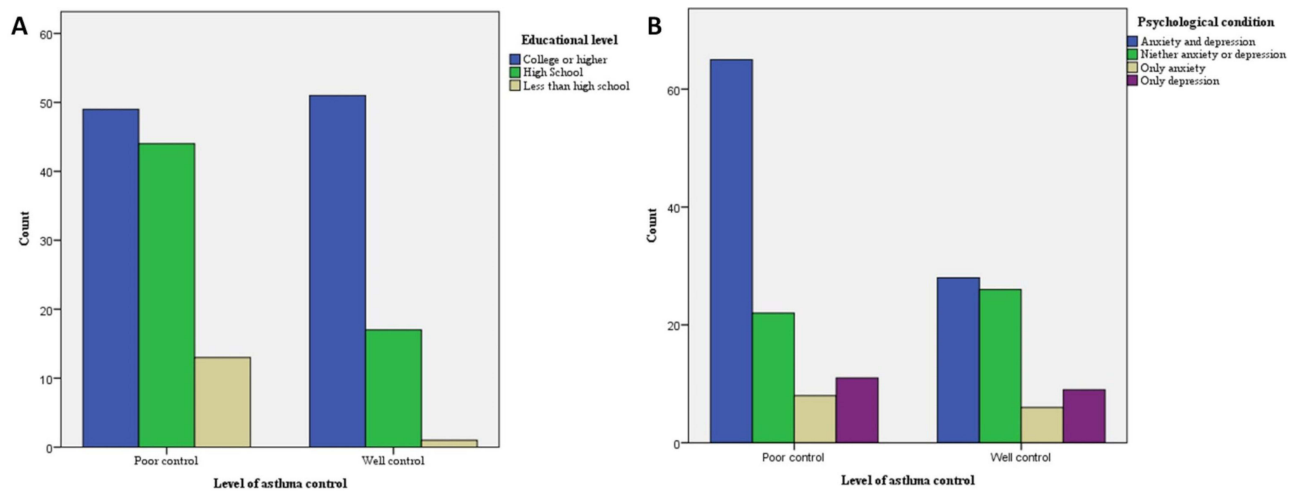


Figure 1 (A) Bar chart representing the patients' distribution in the three categories of educational level in relation to their level of asthma control. **(B)** Bar chart representing the patients' distribution in the four categories of psychological conditions in relation to their level of asthma control. **Notes:** Well-controlled asthma: ACT score ≥ 20 . Anxiety: HADS-anxiety score ≥ 8 ; Depression: HADS-depression score ≥ 8 .

The multivariate analysis of the factors that were significantly associated with poorly controlled asthma in the univariate analysis revealed that individuals with a high school education level or less have a higher likelihood of experiencing poorly controlled asthma compared to those with a college or higher educational level. The odds ratio (OR) for individuals with less

Table 3 Analysis of Patients' Sociodemographic and Clinical Features According to the Level of Asthma Control

Variable	Number (%)	Level of asthma control by ACT*		P value
		Well-controlled	Poorly controlled	
	175 (100%)	69 (39.43)	106 (60.57)	
Age				0.268
≤ 30	61 (34.86)	29 (42.03)	32 (30.19)	
31–50	84 (48.00)	30 (43.48)	54 (50.94)	
> 50	30 (17.14)	10 (14.49)	20 (18.87)	
Gender				0.687
Male	87 (49.71)	33 (47.83)	54 (50.94)	
Female	88 (50.29)	36 (52.17)	52 (49.06)	
Smoking				0.227
Current or former smoker	86 (49.14)	30 (43.48)	56 (52.83)	
Never smoker	89 (50.86)	39 (56.52)	50 (47.17)	
Level of education				0.001
College or Higher	100 (57.14)	51 (73.91)	49 (46.23)	
High School	61 (34.86)	17 (24.64)	44 (41.51)	
Less than high school	14 (8.00)	1 (1.45)	13 (12.26)	

(Continued)

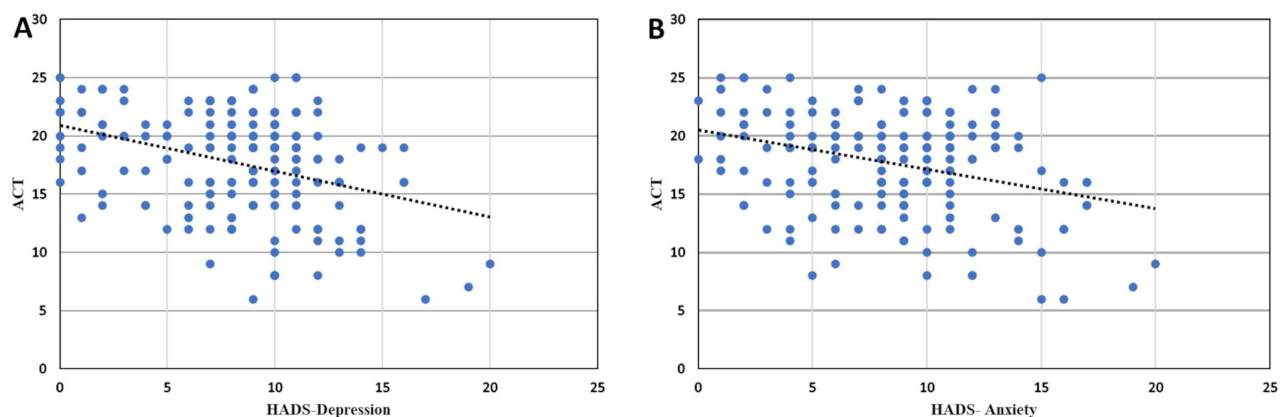
Table 3 (Continued).

Variable	Number (%)	Level of asthma control by ACT*		P value
		Well-controlled	Poorly controlled	
Employment status				0.063
Employed	73 (41.71)	28 (40.58)	45 (42.45)	
Unemployed	91 (52.00)	33 (47.83)	58 (54.72)	
Retired	11 (6.29)	8 (11.59)	3 (2.83)	
BMI				
< 25	73 (41.71)	32 (46.38)	41 (38.68)	0.312
25–29.9	68 (38.86)	22 (31.88)	46 (43.40)	
≥ 30	34 (19.43)	15 (21.74)	19 (17.92)	
History of atopy				0.227
Yes	86 (49.14)	30 (43.48)	56 (52.83)	
No	89 (50.86)	39 (56.52)	50 (47.17)	
Psychological condition**				0.044
Neither anxiety nor depression	48 (27.43)	26 (37.68)	22 (20.75)	
Only anxiety	14 (8.00)	6 (8.70)	8 (7.55)	
Only depression	20 (11.43)	9 (13.04)	11 (10.38)	
Anxiety and depression	93 (53.14)	28 (40.58)	65 (61.32)	

Notes: *Well-controlled asthma: ACT score ≥ 20 . **Anxiety: HADS-anxiety score ≥ 8 ; Depression: HADS-depression score ≥ 8 . Bold P-values are statistically significant ≤ 0.05 .

Abbreviation: BMI, body mass index.

than a high school education was 2.5, with a 95% confidence interval (CI) of 1.24–5.1. Similarly, the OR for individuals with a high school education level was 12.3, with a 95% CI of 1.5–100.9. Additionally, the presence of anxiety and depression in asthmatic patients was shown to be marginally significant (p -value = 0.052), suggesting that individuals with both depression

**Figure 2** Significant correlations between the ACT scores and HADS scores.

Notes: (A) Negative correlation between ACT scores and HADS-depression scores (Pearson correlation: -0.316 , $p = 0.000$). (B) Negative correlation between ACT scores and HADS-anxiety scores (Pearson correlation: -0.360 , $p = 0.000$).

and anxiety are more prone to experiencing inadequate control of their asthma compared to those with neither anxiety nor depression (odds ratio: 2.1; 95% confidence interval: 1.0–4.5) (Table 4).

Analysis of the Patients’ Features According to the Psychological Disorders

Table 5 shows patients’ features according to their different psychological disorders. About 79% of the patients having poorly controlled asthma had anxiety, depression, or a combination of anxiety and depression. In addition to further proving the correlation between the psychological profile of the patients and their level of asthma control, we found a significant correlation between psychological conditions and the level of education of the patients, where most patients with lower levels of education had anxiety and depression.

Table 4 Multivariate Logistic Regression Model Risk Factors of Poorly Controlled Asthma (ACT < 20)

Characteristics	Odd ratio	95% CI	P value
Level of education			0.005
Less than high school	2.5	1.24–5.1	0.011
High school	12.3	1.5–100.9	0.019
Psychological condition			0.176
Only anxiety	1.276	0.4–4.4	0.701
Only depression	0.933	0.3–2.9	0.904
Anxiety and depression	2.1	1.0 –4.5	0.052

Note: Bold P-values are statistically significant ≤ 0.05.

Table 5 Features of the Involved Patients According to Their Psychological Conditions

Variable	Number (%)	Psychological condition**				P value
		Neither anxiety nor depression	Only anxiety	Only depression	Anxiety and depression	
	175 (100%)	48 (27.43)	14 (8.00)	20 (11.43)	93 (53.14)	
Age						0.976
≤ 30	61 (34.86)	18 (37.50)	4 (28.57)	8 (40.0)	31 (33.33)	
31–50	84 (48.00)	23 (47.92)	7 (50.0)	8 (40.0)	46 (49.46)	
> 50	30 (17.14)	7 (14.58)	3 (21.43)	4 (20.0)	16 (17.20)	
Gender						0.176
Male	87 (49.71)	25 (52.08)	5 (35.71)	14 (70.0)	43 (46.24)	
Female	88 (50.29)	23 (47.92)	9 (64.29)	6 (30.0)	50 (53.76)	
Smoking						0.421
Current or former smoker	86 (49.14)	25 (52.08)	4 (28.57)	11 (55.0)	46 (49.46)	
Never smoker	89 (50.86)	23 (47.92)	10 (71.43)	9 (45.0)	47 (50.54)	

(Continued)

Table 5 (Continued).

Variable	Number (%)	Psychological condition**				P value
		Neither anxiety nor depression	Only anxiety	Only depression	Anxiety and depression	
	175 (100%)	48 (27.43)	14 (8.00)	20 (11.43)	93 (53.14)	
Level of education						0.028
College or Higher	100 (57.14)	37 (77.08)	7 (50.00)	9 (45.00)	47 (50.54)	
High School	61 (34.86)	10 (20.83)	7 (50.00)	8 (40.00)	36 (38.71)	
Less than high school	14 (8.00)	1 (2.08)	0 (0.00)	3 (15.00)	10 (10.75)	
Employment status						0.554
Employed	73 (41.71)	21 (43.75)	5 (35.71)	11 (55.0)	36 (38.71)	
Unemployed	91 (52.00)	23 (47.92)	9 (64.29)	7 (35.0)	52 (55.91)	
Retired	11 (6.29)	4 (8.33)	0 (0.00)	2 (10.0)	5 (5.38)	
BMI						0.362
< 25	73 (41.71)	25 (52.08)	7 (50.00)	10 (50.00)	31 (33.33)	
25–29.9	68 (38.86)	14 (29.17)	4 (28.60)	7 (35.00)	43 (46.24)	
≥ 30	34 (19.43)	9 (18.75)	3 (21.40)	3 (15.00)	19 (20.43)	
History of atopy						0.651
Yes	86 (49.14)	26 (54.17)	8 (57.14)	8 (40.00)	44 (47.31)	
No	89 (50.86)	22 (45.83)	6 (42.86)	12 (60.00)	49 (52.69)	
Level of asthma control*						0.044
Well-controlled	69 (39.43)	26 (54.17)	6 (42.86)	9 (45.00)	28 (30.11)	
Poorly controlled	106 (60.57)	22 (45.83)	8 (57.14)	11 (55.00)	65 (69.89)	

Notes: *Well-controlled asthma: ACT score ≥ 20 . **Anxiety: HADS-anxiety score ≥ 8 ; Depression: HADS-depression score ≥ 8 . Bold P-values are statistically significant ≤ 0.05 .
Abbreviation: BMI, body mass index.

Discussion

Asthma is a significant worldwide health issue affecting all ages. The prevalence of asthma in Jordan is high, ranging from 8.8% to 9.5% among children in one study, which also showed that the prevalence of asthma has alarmingly doubled over ten years in Jordan.²⁰ Further recent studies revealed a prevalence of asthma of 2.38% among schoolchildren²¹ and 6.2% among adolescents²² and reaching 10% among elderly patients in Jordan.²³ Although several treatment options are available for asthma, some patients fail to achieve control of their disease symptoms.²⁴ The current study aimed to assess the relationship between the patient's clinical features, particularly psychological disorders, and the level of asthma control (as assessed by ACT) among Jordanian adult patients. The results showed that 60.57% of the patients had poorly controlled disease (ACT score < 20). The prevalence of psychological disorders among the involved patients was as follows: anxiety alone at 8%, depression alone at 11.43%, and depression plus anxiety at 53.14%. A statistically significant association was found between psychological disorders, low education levels, and poor disease control. Further, a lower level of education was significantly associated with a higher incidence of anxiety and depression. This is the first study to address the relatively high prevalence of anxiety and depression among a Jordanian subpopulation with asthma and further suggest a negative impact of these psychological disorders on disease

control. Identifying such associations may help the healthcare providers in Jordan adjust treatment strategies to manage these psychological disorders in patients with asthma, which may result in disease control and burden reduction.

The level of asthma control yielded by this study, with 39.43% of the patients having well-controlled asthma, falls within the range reported by several previous studies. A recent study conducted on Jordanian asthmatic patients revealed a 45.2% level of asthma control, considering an ACT score of < 20 as a definition of poorly controlled asthma.²⁵ Another Jordanian study reported that about 30% of the involved patients had their asthma controlled.²⁶ Further, a large cross-sectional study performed by ESMAA used the ACT questionnaire and the 2012 GINA guidelines to assess the control of asthma among adult patients in the Middle East and North Africa (MENA) area and revealed that less than 30% of the enrolled patients had their asthma well-controlled and they found that the low level of asthma control is associated with active smoking, lower education level, or poor commitment to medication use.²⁷ Similarly, many worldwide studies revealed low levels of asthma control among patients.^{4-6,28} On the other hand, a study conducted in Italy reported a higher level of asthma control, where 71% of the investigated patients had well-controlled asthma (ACT score ≥ 20).¹⁵

The persistent pattern of poorly controlled asthma reported in several studies, even when individuals are being treated according to the guidelines, implies that factors other than medical care impact illness control. Among these factors, psychological disorders have been proposed to impact asthma control, mainly since the prevalence of these disorders is higher in asthmatic patients than in the general population.²⁹ In this study, the prevalence of anxiety alone was 8%, that of depression alone was 11.43%, and that of depression combined with anxiety was 53.14%. These rates are lower than the rates reported among the general Jordanian population (23.7% and 13.3% for anxiety and depression, respectively)^{30,31} because, in this work, these prevalences were calculated for each disorder isolated. However, suppose the prevalence of each psychological disorder was estimated regardless of the other. In that case, we have a very high rate of anxiety (61.14%, 107/175) and depression (64.57%, 113/175) compared to the general population. Furthermore, this study revealed a very high level of anxiety plus depression among patients with asthma. Interestingly, the univariate analysis of the patients' characteristics in relation to the level of asthma control revealed a statistically significant association between the level of asthma control and the level of education ($p = 0.001$) and psychological conditions ($p = 0.044$), where those having lower levels of education or having anxiety plus depression showed lower levels of asthma control. However, no association was found with other factors, including age, gender, smoking, employment status, BMI, or history of atopy. Although lower levels of education may potentially impact the patients' commitment to their asthma management, which may be reflected in the level of disease control, the results of the multivariate analysis also showed that those expressing anxiety and depression symptoms are more prone to have inadequate asthma control. Moreover, the ACT scores had an inverse relationship to the HADS scores for both anxiety and depression. In a similar way, an assessment of the association between psychological disorders and the patients' characteristics revealed a significant association with the lower level of education and poor control of asthma but not with other factors.

Different studies on asthmatic patients have revealed great variability in the rates of anxiety and depression related to different sample sizes, patient heterogeneity, and different methodologies used. However, most stated high rates of these disorders in patients with asthma compared to the general population.⁸⁻¹⁰ The findings of this work are consistent with most previous studies regarding the presence of psychological disorders among adult patients with asthma and their association with the level of disease control. In one study, Cooper et al investigated 872 adults with asthma, with a relatively similar age group to this study, for the presence of psychological disorders using the HADS and reported a 47.3% prevalence of anxiety and 22.3% prevalence of depression among these patients, which both were higher than the rates in the control groups, further, the levels of these psychological disorders were higher with increasing age.¹² Urrutia et al aimed to assess psychological disorders' effect on asthma control and quality of life. This study included relatively more patients in the elderly age group than the current study, and all patients lack a history of smoking. HADS scale was used to investigate the presence of psychological disorders, and accordingly, the results showed that 31% of the patients with asthma had anxiety alone, 2% had depression alone, and 10% had anxiety combined with depression. Further, they found that poorly controlled asthma was more associated with anxiety plus depression and female gender; thus, they concluded that these psychological disorders negatively affect asthma control.³² Another group investigated the effect of having anxiety or depression on asthma control and asthma-related quality of life using the asthma control questionnaire (ACQ) to assess asthma control level³³ and the Primary Care Evaluation of Mental Disorders (PRIME-MD) interview to assess for the presence of the

psychological disorders in a sample of adult patients with an age range of 18–75 years, and smoker patients were also involved.³⁴ The results revealed that 8% had depressive disorders only, 12% had anxiety disorders only, and 11% had both disorders; these psychological disorders were significantly associated with female gender, being unemployed or unmarried, but not with other variables such as age, smoking, education, or BMI. Interestingly, while both anxiety and depression disorders were associated with poorer asthma-related quality of life, only depressive disorders were associated with poorer asthma control, while no impact of anxiety or gender was identified.³⁵ Trzcińska et al tried to detect the potential association between the degree of asthma control and the prevalence of anxiety and depression. This study was conducted on 128 randomly chosen people with asthma with different levels of asthma control and an age average of 41.73 ± 14.13 . The study depended on a questionnaire survey, utilizing tools such as the Beck Depression Inventory, State-Trait Anxiety Inventory (STAI) - X-1 and X-2 surveys, and the ACT. They found that people with depression were described by an essentially lower level of asthma control in contrast with those without depression ($p < 0.001$). Additionally, the results revealed that as the severity of depression and age increased, the level of asthma control significantly declined. However, no association between anxiety and level of asthma control was identified in this study.³⁶ Toyama et al analyzed 1962 adult patients (aged 16 years or more and involving smokers and nonsmokers) with asthma evaluated using the ACT and Patient Health Questionnaire 9. They revealed that depression negatively impacted the ACT scores, so they suggested that the patient's depressive state should be taken into consideration at the time of evaluation.³⁷ Coban and Aydemir studied 174 patients with asthma with an age range relatively similar to the current study; however, they did not receive therapy for their allergy, at least for the last month. The results showed that 33.3% of the enrolled patients had anxiety, and 47.7% had depression. Moreover, patients with uncontrolled asthma had significantly higher anxiety and depression scores using the HADS scale. On the other hand, patients with anxiety and depression had lower ACT scores; however, no association was found between allergy and level of asthma control or emotional status.³⁸ The results of Çoban & Ediger were also consistent with these, where they reported that both anxiety and depression were predictors of poor asthma control.³⁹ Di Marco et al investigated a cohort of patients with a relatively similar age range and BMI distribution to the current study and involving smokers and nonsmokers treated according to GINA guidelines.¹⁵ The results of multivariate analysis showed that anxiety, depression, age ≥ 65 years, and FEV1 $< 60\%$ of the predicted value but not gender or BMI were significantly associated with poor asthma control.¹⁵ On the other hand, they also found that depression was more common in older obese patients with asthma. Ciprandi et al similarly studied the impact of depression and anxiety on 263 outpatients with asthma with a mean age of 39.2 years and fewer patients with a smoking history compared to the current study using the ACT and HADS questionnaires. Of the involved patients, 36.9% (97 patients) had anxiety, 11% (29 patients) had depression, and 71 patients had both anxiety and depression. Depression was more common among patients with a higher BMI. Analysis showed that anxiety and depression were significantly associated with poor asthma control and lower ACT scores ($P < 0.001$ for both).⁴⁰ Another study involved a large cohort of 3182 patients with moderate to severe asthma and a mean age of 46.8 years involving smokers and nonsmokers, concluded that anxiety and depression are associated with asthma and that these factors were independently associated with poor asthma control, where anxiety had almost four times greater impact on asthma control than depression. Interestingly, they also found that after six months of standardized asthma therapy, the patients showed considerable improvement in these psychological as well as improved asthma control.⁴¹ A more recent population-centered study involved a cohort of patients with a relatively similar age range, smoking history, and BMI to the cohort in the current study found a prevalence of 16.7% of depression among asthmatic patients, which was higher than the control group and further revealed that low asthma control was strongly related to the presence of depression in these patients.⁴²

Therefore, most of these studies revealed high rates of anxiety and depression among patients with asthma, as well as a significant association between these disorders and levels of asthma control, suggesting that these emotional disorders negatively impact asthma control. Many factors may play a role in the relationship between psychological disorders and the low level of asthma control. These psychological and emotional disorders may trigger asthma symptoms and lead to changes in breathing patterns, worsening the symptoms. A previous study found a statistically significant link between anxiety and depression and the reporting of asthma-related symptoms, such as episodes of dyspnea after activity and waking up with dyspnea.⁴³ Additionally, these disorders may affect patients' compliance with daily medication and increase or decrease the usage of rescue medication because of incorrect interpretation of asthma symptoms. They may also affect lifestyle factors such as diet and exercise, which are essential parts of managing asthma. It was found that the

presence of anxiety and depression in patients with asthma is associated with low asthma-related quality of life, particularly anxiety disorder associated with more frequent use of bronchodilators.³⁵ Further, psychological disorders may lead to increased perception of symptoms, which may lead to low levels of disease control, resulting in more health care utilization and more frequent emergency department visits.^{15,44}

Although in this study, anxiety and depression were only significantly associated with lower levels of education and poor asthma control, evidence from other studies revealed several factors to be associated with an increasing incidence of these psychological disorders among patients with asthma, such as female gender, increasing age, high BMI, smoking, hypertension, arthritis, lower level of education, being unemployed, being unmarried or having a low income. Therefore, addressing these factors and trying to avoid the modifiable ones may be essential in decreasing the incidence of psychological disorders in patients with asthma, which may positively be reflected in the overall patient outcomes and, consequently, quality of life.

This study has some potential limitations that should be noted. First, all patients were included in the tertiary asthma clinics so that selection bias may exist. Second, this is a cross-sectional study, and without a control group of healthy individuals, the causal relationship between depression and anxiety and the level of asthma control cannot be determined with certainty; the other possibility is that poorly controlled asthma may predispose the patients to develop these psychological disorders is still there. Third, psychological disorders were assessed using a simple questionnaire instead of a structured psychiatrist interview. Despite this limitation, the HADS scale has been validated and used successfully, and some studies showed that it correlates well with other methods.⁴⁵ Fourth, due to the small size of the assessed sample, these results may not be generalizable to all adults with asthma in Jordan. Fifth, although the patients were treated according to GINA guidelines using controller and rescue medications, patients' adherence to their medication could not be guaranteed with certainty, which may have affected their level of disease control. Finally, the measurement of asthma control was based primarily on self-reporting by the patients, so it may have some recall bias, and further, the psychological status may influence the reporting of the respiratory symptoms.

Conclusion

This study showed that most of the assessed Jordanian adults with asthma have poorly controlled disease. We also found that anxiety and depression are common among these patients with asthma, particularly since many have combined anxiety and depression. A significant association was also found between these psychological disorders, low education levels, and low levels of asthma control. These results suggest that anxiety and depression may negatively impact asthma control levels. Given similar results presented by other authors, these findings represent sufficient rationale for screening psychological disorders among patients with asthma. Treating these disorders may help decrease the potential interference with asthma management and, at minimum, may improve asthmatic individuals' health-related quality of life. Therefore, a larger study prospectively investigating the relationship between psychological disorders and the level of asthma control while assessing the impact of psychological treatment on disease control should be performed.

Data Sharing Statement

The data utilized and analyzed during the current study are available from the corresponding author upon request.

Ethics Approval and Informed Consent

The Institutional Review Boards of Hashemite University (No.23/9/2021/2022), Ministry of Health (No.16907), and Prince Hamza Hospital (No.1817) approved this study, and all procedures were performed in agreement with the 1964 Declaration of Helsinki and its relevant amendments. All participants had provided their written informed consent to participate in the study.

Consent for Publication

All authors confirm that any details of this work can be published.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

All authors declare that they have no conflicts of interest related to this study.

References

1. Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention, 2023. Updated July 2023. Available from: www.ginasthma.org.
2. Barnes NC. Can guideline-defined asthma control be achieved? the gaining optimal asthma control study. *Am J Respir Crit Care Med*. 2004;170.
3. Bateman ED, Boushey HA, Bousquet J, et al. Can guideline-defined asthma control be achieved? The gaining optimal asthma control study. *Am J Respir Crit Care Med*. 2004;170(8):836–844. doi:10.1164/rccm.200401-033OC
4. Demoly P, Paggiaro P, Plaza V, et al. Prevalence of asthma control among adults in France, Germany, Italy, Spain and the UK. *Eur Respir Rev*. 2009;18(112):105–112. doi:10.1183/09059180.00001209
5. Fuhlbrigge A, Reed ML, Stempel DA, Ortega HO, Fanning K, Stanford RH. The status of asthma control in the U.S. adult population. *Allergy Asthma Proc*. 2009;30(5):529–533. doi:10.2500/aap.2009.30.3276
6. Gold LS, Thompson P, Salvi S, Faruqi RA, Sullivan SD. Level of asthma control and health care utilization in Asia-Pacific countries. *Respir Med*. 2014;108(2):271–277. doi:10.1016/j.rmed.2013.12.004
7. Verhaak PFM, Heijmans MJWM, Peters L, Rijken M. Chronic disease and mental disorder. *Soc Sci Med*. 2005;60(4):789–797. doi:10.1016/j.socscimed.2004.06.012
8. Scott KM, Korf MV, Ormel J, et al. Mental Disorders among Adults with Asthma: Results from the world mental health surveys. *Gen Hosp Psych*. 2008;29(2):123–133. doi:10.1016/j.genhosppsy.2006.12.006
9. Weiser EB. The prevalence of anxiety disorders among adults with Asthma: A meta-analytic review. *J Clin Psychol Med Set*. 2007;14(4):297–307. doi:10.1007/s10880-007-9087-2
10. Strine TW, Mokdad AH, Balluz LS, Berry JT, Gonzalez O. Impact of depression and anxiety on quality of life, health behaviors, and Asthma Control Among Adults in the United States with Asthma, 2006. *J Asthma*. 2008;45(2):123–133. doi:10.1080/02770900701840238
11. Yonas MA, Marsland AL, Emeremni CA, Moore CG, Holguin F, Wenzel S. Depressive symptomatology, quality of life and disease control among individuals with well-characterized severe asthma. *J Asthma*. 2013;50(8):884–890. doi:10.3109/02770903.2013.810750
12. Cooper CL, Parry GD, Saul C, et al. Anxiety and panic fear in adults with asthma: prevalence in primary care. *BMC Fam Pract*. 2007;8(1):62. doi:10.1186/1471-2296-8-62
13. Al-Dubai SA, Ganasegeran K, Alshakka M, et al. Anxiety And Depression Among Asthmatic Patients In Malaysia. *ASEAN J Psychiatry*. 2016;17(1).
14. Yang H, Lin P, Liang Z. Risk factors for depression in asthmatic individuals: findings from NHANES (2005–2018). *PLoS One*. 2023;18(6):e0287336.
15. Di Marco F, Verga M, Santus P, et al. Close correlation between anxiety, depression, and asthma control. *Respir Med*. 2010;104(1):22–28. doi:10.1016/j.rmed.2009.08.005
16. Nathan RA, Sorkness CA, Kosinski M, et al. Development of the asthma control test: A survey for assessing asthma control. *J Allergy Clin Immunol*. 2004;113(1):59–65. doi:10.1016/j.jaci.2003.09.008
17. Lababidi H, Hijaooui A, Zarzour M. Validation of the Arabic version of the asthma control test. *Ann Thorac Med*. 2008;3(2):44–47. doi:10.4103/1817-1737.39635
18. Zigmond AS, Snaith RP. The Hospital Anxiety and Depression Scale. *Acta Psychiatr Scand*. 1983;67(6):361–370. doi:10.1111/j.1600-0447.1983.tb09716.x
19. Terkawi A, Tsang S, AlKahtani G, et al. Development and validation of Arabic version of the Hospital Anxiety and Depression Scale. *Saudi J Anaesth*. 2017;11(5).
20. Abu-Ekteish F, Ootom S, Shehabi I. Prevalence of asthma in Jordan: comparison between Bedouins and urban schoolchildren using the International Study of Asthma and Allergies in Childhood Phase III protocol. *Allergy Asthma Proc*. 2009;30(2):181–185. doi:10.2500/aap.2009.30.3208
21. Nour A, Alsayed AR, Bashedi I. Prevalence of Asthma amongst Schoolchildren in Jordan and Staff Readiness to Help. *Healthcare*. 2023;11(2):183. doi:10.3390/healthcare11020183
22. Al-sheyab NA, Alomari MA. Prevalence, associated factors, and control level of asthma symptoms among adolescents in Northern Jordan. *Int J Adolesc Med Health*. 2018;32(3):20170159. doi:10.1515/ijamh-2017-0159
23. Dahmash EZ. Physicians' knowledge and practices regarding Asthma in Jordan: A cross-sectional study. *Front Public Health*. 2021;9:712255. doi:10.3389/fpubh.2021.712255
24. Partridge MR, Van Der Molen T, Myrseth SE, Busse WW. Attitudes and actions of asthma patients on regular maintenance therapy: the INSPIRE study. *BMC Pulm Med*. 2006;6(1):13. doi:10.1186/1471-2466-6-13

25. Albatineh E, Al-Zayadneh E, Al-Shagahin H, Al Soloman A, Altarawneh A, Aldmour I. Asthma Control and Its Predictive Factors in Adult Asthma Patients. *J Clin Med Res.* 2019;11(12):807–817. doi:10.14740/jocmr4021
26. Almomani BA, Al-Sawalha NA, Samrah SM, Gamble JM, Al Momani MA. Asthma insights from Jordan: cross-sectional observational study. *J Asthma.* 2016;53(4):349–355. doi:10.3109/02770903.2015.1121493
27. Tarraf H, Al-Jahdali H, Al Qaseer AH, et al. Asthma control in adults in the Middle East and North Africa: Results from the ESMAA study. *Respir Med.* 2018;138:64–73. doi:10.1016/j.rmed.2018.03.024
28. Peters SP, Jones CA, Haselkorn T, Mink DR, Valacer DJ, Weiss ST. Real-world Evaluation of Asthma Control and Treatment (REACT): Findings from a national Web-based survey. *J Allergy Clin Immunol.* 2007;119(6):1454–1461. doi:10.1016/j.jaci.2007.03.022
29. Heaney LG, Conway E, Kelly C, Gamble J. Prevalence of psychiatric morbidity in a difficult asthma population: relationship to asthma outcome. *Respir Med.* 2005;99(9):1152–1159. doi:10.1016/j.rmed.2005.02.013
30. Barghouti FF, Masalha AI AL, Fayyomi H, Mari'e LO, Ahmad MM. Prevalence of generalized anxiety disorder in family practice clinics. *Clin Pract.* 2018;15(SII).
31. Jaradat AKM. Prevalence of depression among a sample of University Students in Jordan. *UOS J Soc Sci Humanit.* 2012;9(1):177–197.
32. Urrutia I, Aguirre U, Pascual S, et al. Impact of anxiety and depression on disease control and quality of Life in Asthma patients. *J Asthma.* 2012;49(2):201–208. doi:10.3109/02770903.2011.654022
33. Juniper EF, O'byrne PM, Guyatt GH, Ferrie PJ, King DR. Development and validation of a questionnaire to measure asthma control. *Eur Respir J.* 1999;14(4):902–907. doi:10.1034/j.1399-3003.1999.14d29.x
34. Spitzer RL, Williams JBW, Kroenke K, et al. Utility of a new procedure for diagnosing mental disorders in primary care: The PRIME-MD 1000 Study. *JAMA.* 1994;272(22):1749–1756. doi:10.1001/jama.1994.03520220043029
35. Lavoie KL, Bacon SL, Barone S, Cartier A, Ditto B, Labrecque M. What is worse for asthma control and quality of life. *Chest.* 2006;130(4):1039–1047. doi:10.1378/chest.130.4.1039
36. Trzcińska H, Przybylski G, Kozłowski B, Derdowski S. Analysis of the relation between level of asthma control and depression and anxiety. *Med Sci Monit.* 2012;18(3):CR190–CR194. doi:10.12659/MSM.882524
37. Toyama M, Hasegawa T, Sakagami T, et al. Depression's Influence on the Asthma control test, Japanese Version. *Allergol Int.* 2014;63(4):587–594. doi:10.2332/allergolint.14-OA-0708
38. Coban H, Aydemir Y. The relationship between allergy and asthma control, quality of life, and emotional status in patients with asthma: a cross-sectional study. *Allergy Asthma Clin Immunol.* 2014;10(1):67. doi:10.1186/s13223-014-0067-4
39. Çoban H, Ediger D. Control of asthma, quality of life, anxiety and depression symptoms among Turkish patients with asthma. *Electron J Gen Med.* 2018;15(5). doi:10.29333/ejgm/91403
40. Ciprandi G, Schiavetti I, Rindone E, Ricciardolo FLM. The impact of anxiety and depression on outpatients with asthma. *Ann Allergy Asthma Immunol.* 2015;115(5):408–414. doi:10.1016/j.anai.2015.08.007
41. Sastre J, Crespo A, Fernandez-Sanchez T, et al. Anxiety, depression, and asthma control: Changes after standardized treatment. *J Allergy Clin Immunol Pract.* 2018;6(6):1953–1959. doi:10.1016/j.jaip.2018.02.002
42. Grosso A, Pesce G, Marcon A, et al. Depression is associated with poor control of symptoms in asthma and rhinitis: a population-based study. *Respir Med.* 2019;155:6–12. doi:10.1016/j.rmed.2019.06.025
43. Leander M, Lampa E, Rask-Andersen A, et al. Impact of anxiety and depression on respiratory symptoms. *Respir Med.* 2014;108(11):1594–1600. doi:10.1016/j.rmed.2014.09.007
44. Centanni S, Di Marco F, Castagna F, Boveri B, Casanova F, Piazzini A. Psychological issues in the treatment of asthmatic patients. *Respir Med.* 2000;94(8):742–749. doi:10.1053/rmed.1999.0766
45. Orive M, Padierna JA, Quintana JM, Las-Hayas C, Vrotsou K, Aguirre U. Detecting depression in medically ill patients: comparative accuracy of four screening questionnaires and physicians' diagnoses in Spanish population. *J Psychosom Res.* 2010;69(4):399–406. doi:10.1016/j.jpsychores.2010.04.007

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