Deanship of Graduate Studies

Al-Quds University

Determinants of Asthma and Asthma-like-Symptoms among Al-Quds University Health Campus Students

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Determinants of Asthma and Asthma-like-Symptoms among Al-Quds University Health Campus Students

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Thesis Approval

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Dedication

To my family, who have always supported me

To the driving force of my success; my father

To the spirit of my absent mother,

To the warm hand and pillar of my strength; My Grandma

To my sole brother, and my sisters

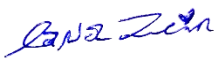
To the beloved homeland of Palestine, where we strive to improve its public health

I dedicate this thesis to all of them with utmost sincerity.

Lana Ali Zien Hnaihen

Declaration:

I certify that this thesis submitted for the degree of Master, is the result of my own research, except where otherwise acknowledged, and that this study (or any part of the same) has not been submitted for a higher degree to any other university or institution.



Signed:

Lana Ali Zein Hnaihen

Date: 1/2/2024

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First and foremost, I thank God for providing me with the strength and patience to complete this task.

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I am grateful for the unwavering support and encouragement of my family and friends. I would like to express my sincere gratitude to my grandmother, who has always been there for me, praying for me, and taking care of me after my mother's passing. I pray that my mother's soul may rest in peace. I also want to thank my father for being my pillar of strength and always pushing me forward.

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Lana Ali Zien Hnaihen

Determinants of Asthma and Asthma-like-Symptoms among Al-Quds University Health Campus Students

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Abstract

Background: Asthma is a major health problem, which affects people of all ages at all stages of life. In Palestine, physician-diagnosed asthma among schoolchildren was 3.8% in 2000. Many risk factors have changed over the last two decades because of environmental and lifestyle changes. A limited number of studies were conducted on adults in Palestine, in particular in adults aged 18-30 years of age. Therefore, there is a need for updated information on the epidemiology of asthma among adults in Palestine.

Aim & objectives: This study aims to examine the prevalence and risk factors of asthma and asthma-like symptoms among Al-Quds University Health Campus students. Its objectives are to identify the relationship between the various environmental, congenital**,** lifestyle, and socio-demographic factors, with the risk of asthma and asthma-like symptoms occurrence.

Study methodology: A cross-sectional study design was used. A two-stage probability sample was used (by faculty affiliation and study year) to select the study subjects. In each faculty, classes were randomly selected for each study year. A GAN Phase I questionnaire; a translated adult's questionnaire was used to collect information that answers the study questions. All data was entered and analyzed using SPSS. Bivariate analysis and chi-square test were used to examine the association between asthma and asthma-like symptoms with the various study exposures. Multivariate logistic models were developed to determine the various associations and control for possible confounders**.** All variables that were significant in the bivariate model (p-value<0.05) were entered in a separate model for each

asthma and asthma-like symptom. The adjusted odds ratios and their confidence intervals were reported.

Results: Our study consisted of 819 university students from the health campus faculties. The mean age of the students was 20 years and 78.1% of them were females**.** Among the student population in our study, the current prevalence of wheezing stands at 21%, and 9.8% of participants experienced severe episodes of wheezing in the past 12 months. The prevalence of asthma ever was 10%. Also, 6.3% reported that medical doctors confirmed their asthma. 17% of participants who reported having asthma had urgently visited a doctor and 6% went to an emergency department for breathing problems. Only 5% of them were admitted to the hospital due to breathing problems and 22.7% reported limited usual activity (at university, at work, or home) in the past 12 months. While 6.3% of the participants had jobs causing wheezing, and 9.9% left jobs due to breathing issues.

In the multivariate regression analysis, current wheezing and severity of asthma were associated with a history of hay fever, asthma, and rhinitis. Also, cooking with wood, ever-smoking tobacco, and consumption of seafood including fish per week were significantly associated with an increased risk for current wheezing and asthma severity. However, cooking with natural gas was associated with a decreased risk of having asthma severity.

Ever having asthma, individuals with a confirmed history of hay fever had a 3.11-fold increase in the risk of asthma, while those with a history of eczema had a 1.9-fold increase. Those with a family history of asthma or rhinitis were at an elevated risk of developing asthma. Individuals with a confirmed history of hay fever or eczema by a doctor had a significantly increased risk of being diagnosed with asthma. Also, diagnosed asthma was significantly associated with a family history of asthma. Furthermore, heating the house with agricultural crop residue increased the risk of having a diagnosed asthma by 3.65 times. However, the low consumption of unhealthy foods such as fast food, sweets, and soft drinks up to twice per week was significantly associated with a considerable decrease in asthma risk.

Conclusion: The prevalence of asthma among adults has been increasing worldwide, making it a major health concern. However, recent data on the prevalence of asthma among adults in Palestine is scarce. Our study provides updated information on the epidemiology of asthma among young adults at al-Quds University, one of Palestine's largest universities. Our results showed a significant association

between asthma and asthma-like symptoms with several risk factors such as a history of hay fever or eczema, a family history of asthma or allergic rhinitis, environmental exposures, and lifestyle factors. on the other hand, cooking with natural gas and adults who consume fewer unhealthy foods such as fast food, sweets, and soft drinks are less likely to develop asthma and asthma-like symptoms.

Recommendations:

Raise awareness among university students about asthma and asthma-like symptoms, including the risk factors that should be avoided and encouraging people to adopt a healthy lifestyle and reduce environmental exposure that may increase the risk of asthma and asthma-like symptoms. Also, providing updated evidence-based strategies, tools, and information on the severity of asthma symptoms and associated risk factors. Also, develop national guidelines with public health officials and health care providers to minimize asthma prevalence, morbidity, and mortality among the Palestinian population. More research is needed to study the prevalence and determinants of asthma and asthma-like symptoms among a larger population of adults in Palestine. In general, asthma research in Palestine is old, and new research must be encouraged to keep up with the changing environmental exposure and lifestyle factors.

محددات الربو والأعراض المصاحبة بالربو بين طلاب المجمع الصحي في جامعة القدس

إعداد: لانا علي حنيحن

إشراف: د. نهى الشريف

ملخص الدراسة:

خلفية الدراسة: يعتبر الربو من المشاكل الصحية التي تؤثر على الناس من جميع الأعمار في جميع مراحل الحياة. وفي فلسطين، بلغت نسبة الربو المشخصة طبيا بين أطفال المدارس ٣.٨ في المائة في عام ٢٠٠٠. وقد تغير العديد من عوامل الخطر على مدى العقدين الماضيين بسبب التغيرات البيئية وتغيرات أسلوب الحياة .

وقد تم اجراء عدد محدود من الدراسات عن البالغين في فلسطين، ولا سيما البالغين الذين تتراوح أعمارهم بين ١٨ و ٣٠ سنة. ولذلك، هناك حاجة لمعلومات محدثة حول وبائيات الربو بين البالغين في فلسطين.

الهدف الرئيسي من الدراسة: تهدف هذه الدراسة إلى بحث مدى انتشار وعوامل خطر انتشار مرض الربو والاعراض المصاحبة له بين طلاب المجمع الصحي في جامعة القدس. وتتمثل أهدافها في تحديد العلاقة بين مختلف العوامل البيئية، الوراثية، وأسلوب الحياة، والعوامل الاجتماعية والديموغرافية مع احتمال حدوث الربو والأعراض الشبيهة بالربو .

منهجية الدراسة: تم استخدام الدراسة المقطعية. حيث تم اختيار العينة الطبقية الثنائية حسب كليات المجمع الصحي وتوزيع العينة المحسوبة حسب الكلية والسنة الدراسية للطلبة في كل كلية. اما اختيار الصف في كل سنة فقد تم عشوائيا وتم دعوة الطلبة في الصف المختار للمشاركة في تعبئة الاستمارة الالكترونية. وقد أدخلت جميع البيانات وجرى تحليلها باستخدام البرنامج الاحصائي SPSS وأُجري تحليل للمناظير المزدوجة واستُخدم اختبار chi-square لفحص العلاقة بين الربو والأعراض الشبيهة بالربو وبين مختلف حالات التعرض للدراسة. وتم اجراء تحليل الانحدار المتعدد للمتغيرات multivariate models لتحديد مختلف العوامل المرتبطة بحدوث الربو والأعراض الشبيهة به. وتم حساب معدلات التأثير odds ratio and 95% confidence intervals

النتائج: تكونت دراستنا من ٨١٩ طالباً جامعياً من كليات المجمع الصحي في جامعة القدس. وكان متوسط عمر الطلاب ٢٠ سنة، و٧٨.١٪ منهم إناث. بينت نتائج الدراسة بان الانتشار الحالي للصفير يبلغ ٢١ %، و ٩.٨ % من المشاركين تعرضوا لفترات حادة من الصفير في الأشهر الـ ١٢ الماضية. وكان انتشار الربو ١٠٪ من أي وقت مضى. أيضاً، ٦.٣٪ أبلغوا أن الأطباء أكدوا ربوهم. ١٧٪ من المشاركين الذين أبلغوا إصابتهم بالربو زاروا الطبيب بشكل عاجل و ٦٪ ذهبوا إلى قسم الطوارئ لمشاكل التنفس. ولم يدخل المستشفى إلا ٥٪ فقط بسبب مشاكل في التنفس وأفادت نسبة ٢٢.٧٪ عن نشاط معتاد محدود (في الجامعة أو العمل أو في المنزل) خلال الـ ١٢ شهرًا الماضية بسبب مشاكل في التنفس، في حين أن نسبة ٦.٣ % من المشاركين كانت لديهم وظائف تسبب الصفير، ونسبة ٩.٩ % تركت وظائف بسبب مشاكل التنفس.

وفي تحليل الانحدار المتعدد المتغيرات، اقترنت عمليات التأرجح الحالية وشدة الربو بتاريخ من حمى القش، والربو، والاكزيما. كما أن الطبخ باستخدام الخشب والتبغ المدخن على الدوام واستهلاك الأغذية البحرية، بما في ذلك الأسماك أسبوعياً يرتبطان ارتباطاً كبيراً بتزايد المخاطر التي تتعرض لها حالياً عمليات التصفير وشدة الربو. غير أن الطهي باستخدام الغاز الطبيعي يرتبط بانخفاض خطر التعرض لشدة الربو.

اما المشاركين في الدراسة ولديهم تشخيص مؤكد بحمى القش فلقد ارتبطت هذه الزيادة بزيادة احتمالية قدرها ٣.١١ مرة في خطر الاصابة بالربو، في حين أن الأفراد الذين لديهم تاريخ من الاكزيما زادت احتمالية الاصابة لديهم بمقدار ١.٩ مرة. أما أولئك الذين لديهم تاريخ عائلي من الربو أو الاكزيما فأظهرت النتائج بانهم معرضون بدرجة عالية لخطر حدوث مرض الربو لديهم. أما الأفراد الذين لهم تشخيص مؤكد من حمى القش أو الأكزيما من قبل طبيب فقد ازدادت احتمالية الإصابة لديهم بالإصابة بالربو. كما أن تشخيص الربو يرتبط ارتباطاً كبيراً بالتاريخ الأسري من مرض الربو. وعلاوة على ذلك، فإن تدفئة المنزل بمخلفات المحاصيل الزراعية يزيد من خطر تشخيص مرض الربو بمقدار ٣.٦٥ مرات. كما أن انخفاض استهلاك الأغذية غير الصحية مثل الوجبات السريعة، والحلوى، والمشروبات اللينة حتى مرتين في الأسبوع كان مرتبطاً إلى حد كبير بانخفاض كبير في مخاطر الاصابة بالربو.

الخلاصة: يتزايد انتشار الربو بين البالغين في جميع أنحاء العالم، مما يجعله مصدر قلق صحي كبير. ومع ذلك، فإن البيانات الحديثة حول مدى انتشار الربو بين البالغين في فلسطين نادرة. توفر دراستنا معلومات محدثة عن وبائيات الربو بين الشباب في جامعة القدس، إحدى أكبر الجامعات في فلسطين. أظهرت نتائجنا وجود ارتباط كبير بين أعراض الربو والأعراض الشبيهة بالربو مع العديد من عوامل الخطر مثل تاريخ حمى القش أو الأكزيما، وتاريخ عائلي من الربو أو التهاب الأنف التحسسي، والتعرض البيئي، وعوامل نمط الحياة. من ناحية أخرى، ارتبط الطهي بالغاز الطبيعي وانخفاض استهلاك الأطعمة غير الصحية مثل الوجبات السريعة والحلويات والمشروبات الغازية بانخفاض خطر الإصابة بالربو والأعراض الشبيهة بالربو بين البالغين.

التوصيات: توعية طلاب الجامعات حول مرض الربو والأعراض المشابهة له، بما في ذلك عوامل الخطر التي يجب تجنبها وتشجيع الناس على تبني أسلوب حياة صحي وتقليل التعرض البيئي الذي قد يزيد من خطر الإصابة بالربو والأعراض المشابهة للربو. كما يجب توفير استراتيجيات وأدوات ومعلومات محدثة قائمة على الأدلة حول شدة أعراض الربو وعوامل الخطر المرتبطة بها. أيضًا، تطوير مبادئ توجيهية وطنية مع مسؤولي الصحة العامة ومتخصصي الرعاية الصحية للحد من انتشار الربو والوفيات الخاصة بالسكان الفلسطينيين. اما في المجال البحثي، فهناك حاجة إلى مزيد من البحث لدراسة مدى انتشار ومحددات مرض الربو والأعراض المشابهة له بين عدد أكبر من السكان البالغين في فلسطين. بشكل عام، تعتبر أبحاث الربو في فلسطين قديمة، ويجب تشجيع الأبحاث الجديدة لمواكبة التغيرات البيئية وعوامل نمط الحياة.

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List of abbreviations:

Abbreviation	Definition
SPSS	Statistic Package for Social Science
ECRHS	The European Community Respiratory Health Survey
ISAAC	International Study of Asthma and Allergies in Childhood
GAN	Global Asthma Network
AQU	Al-Quds University
PCBS	Palestinian Center Bureau of Statistics
WHO	World Health Organization
CDC	Centers for Disease Control and Prevention
CI	Confidence Interval
OR	Odds Ratio
AOR	Adjusted Odds Ratio
US	United State
BMI	Body Mass Index
AD	Atopic dermatitis
ETS	Environmental Tobacco Smoke
PR	Prevalence Ratio
ALRI	Acute Lower Respiratory Infections
PEFR	Peak Expiratory Flow Rate
CRD	Chronic Respiratory Disease
NO2	Nitrogen Dioxide

Chapter One: Introduction

1.1 Background

Asthma is a major noncommunicable disease that can significantly impact the quality of life and health care of individuals and communities (WHO, 2023). It affects people of all ages at all stages of life and is the most common chronic disease among children (Naghavi M et al., 2017). Asthma is more common in high-income countries than in low- and lower-middle-income countries (WHO, 2023). It is a serious public health concern that can significantly impact individuals' health, productivity, and quality of life (Naghavi M et al., 2017). At the global level, asthma ranks 16th for living with disability, and 28th for increased disease burden (Vos T et al., 2017). Guardians and children have both missed work or school due to asthma-related symptoms (Xu et al., 2016). According to the World Health Organization (WHO), asthma afflicted 262 million people in 2019 and caused 455,000 deaths (Vos et al., 2020). By 2025, another 100 million people are expected to be affected according to the Global Asthma Network report (2018).

Several worldwide studies have been conducted in the past three decades. The European Community Respiratory Health Survey (ECRHS) is a research that assessed the regional variance in asthma and allergy in adults using the same tools and terminology from 1993 to 2000. According to the ECRHS, there are significant regional disparities in the prevalence of asthma, atopy, and bronchial responsiveness, with high rates in English-speaking nations and low rates in the Mediterranean area and Eastern Europe. Risk factor analyses have underlined the impact of occupational exposure to asthma in adulthood. Indoor allergens (mites and cats) strongly correlated with bronchial responsiveness to allergens. Treatment pattern analysis has demonstrated that asthma management varies substantially between different countries, and asthma is typically undertreated (Janson et al., 2001).

The International Study of Asthma and Allergies in Childhood (ISAAC) was a pioneering global epidemiological research program that was started in 1991 to examine eczema, rhinitis, and asthma in childhood due to considerable concern that these conditions were becoming more common in both western and developing countries. Phase III was used to compare asthma prevalence through cross-sectional studies (Asher et al., 2021). Following up on the ISAAC, the Global Asthma

Network (GAN) Phase I collected additional data concerning asthma prevalence, severity, diagnoses, management, and asthma essential medicine usage (Ellwood et al., 2017). Palestine participated in ISAAC research in the years 2000-2003, and carried out phase 1 and phase 2 research. According to updated research using this method, one out of ten children aged 6–7 and adolescents aged 13–14 have wheezed over the preceding 10 years of a study; about half of them experienced severe symptoms (Asher et al., 2021). As well as in developing countries such as Brazil, China, and the United States of America (Ren et al., 2022; Toledo et al., 2011). In the United States of America, asthma prevalence among children less than 18 years of age was 5.8% (0.38) in 2020 (CDC, 2020). The prevalence of current asthma and severe asthma increased in the Eastern Mediterranean and Africa, while it decreased in Southeast Asia and the Western Pacific (Asher et al., 2021).

In the Middle East, the prevalence of asthma in the population aged less than 20 years found the highest in Tehran, Iran (35.4%) and in Kuwait (15%) (Alavinezhad & Boskabady, 2018).

In Palestine, very few studies have been conducted on the prevalence of asthmatic children. El Sharif et al., (2002) carried out a study in Ramallah and Gaza Governorates, which showed that children in villages, cities, and refugee camps had wheeing in the previous 12 months with the prevalence of 8.2%, 7.2%, and 12.6%, respectively (N. El-Sharif et al., 2002). Almost the same prevalence of asthma is found in neighboring countries like Jordan, Lebanon, and Egypt among those less than 20 years old (Alavinezhad & Boskabady, 2018). In Israel, asthma affects 7% of children aged 13-14 years and is more prevalent among Jews than Arabs, and in urban areas than in rural areas (Shohat et al., 2000).

Asthma symptoms can also be triggered by the same allergens that trigger hay fever symptoms such as pollen, dust mites, and pet dander. In addition, skin or food allergies can trigger asthma symptoms in some people. This is called allergic asthma or allergy-induced asthma (Mayo Clinic, 2022). Various studies have shown that asthma prevalence is linked to several determinants. Some of these factors are considered non-modifiable risk factors. Genetic factors family history of asthma, and asthma-like symptoms were shown to be strong risk factors for asthma occurrence (Ren et al., 2022). Other modifiable risk factors such as environmental factors and lifestyle factors were also significant risk factors (Asher et al., 2021; Ren et al., 2022). In addition, socioeconomic level was also associated with asthma occurrence (Asher et al., 2021).

1.2 Problem statement:

Studies on the epidemiology of asthma in Palestine were mainly conducted two decades ago. According to these studies, the prevalence of physician-diagnosed asthma among schoolchildren in Palestine was 3.8%, which is lower than the prevalence in neighboring Israel at 7.5% (Hasan et al., 2000; Shani et al., 2013). Globally, the average prevalence of adult asthma and wheezing are 4.3%, and 8.6% respectively (To et al., 2012a). However, recent data on the prevalence of asthma among adults in Palestine is scarce. Therefore, there is a need for updated information on the epidemiology of asthma among adults in Palestine. In general, major risk factors were having a family history of asthma and allergies, exposure to house dust mites, and some trees.

The Global Asthma Network (GAN) was established in 2012 as a cooperation between ISAAC and the International Union Against Tuberculosis and Lung Disease (The Union) to enhance asthma care in low- and middle-income countries (GAN, 2012). According to GAN Phase I hypotheses, the burden of asthma is changing among individuals of all ages globally, including children, adolescents, and adults ("The Global Asthma Report 2022," 2022). This change can be attributed to various factors such as changes in the environment, lifestyle, socioeconomic status, health services provision, and treatment options (Al Zabadi & El Sharif, 2009; Asher et al., 2021; Ren et al., 2022) Furthermore, there is a significant disparity in asthma diagnosis and management worldwide, with potential modifiable risk or protective factors. It is also crucial for individuals with asthma to identify and avoid their specific triggers to help manage their symptoms effectively. According to an ISAAC phase three-based study, asthma prevalence has doubled in Jordan over the 10 years from 1999 to 2009 (Abu-Ekteish et al., 2009).

According to the Global Asthma network report (2022), the aims of GAN Phase I are to measure the prevalence, severity, management, and risk factors of asthma worldwide by ISAAC Phase III methods (Mikkelsen, 2022). Moreover, the study should evaluate the association between environmental, and lifestyle exposure and asthma and asthma-like symptoms among adults in Palestine which is a low- to lower-middle-income country.

1.3 Study Justification:

Studies that have been conducted on asthma prevalence and determinants among children in Palestine have typically been conducted 20 years ago, as a study in 2002 showed that children living in refugee camps of Ramallah governorate had a higher prevalence of asthma (12.6%) than those living in urban areas of the governorate (El-Sharif et al., 2002). Another study was conducted in two governorates in Palestine; Ramallah and north Gaza; on the geographical variation of asthma among schoolchildren using ISAAC for two age groups. Results show that children living in north Gaza had slightly higher asthma prevalence rates than those living in Ramallah. However, the difference was the opposite in older children with significantly higher rates in Ramallah (N. A. El-Sharif et al., 2003)

In Figure 1, younger children had a wheezing prevalence of 9.6% and a physician-diagnosed asthma prevalence of 8.4%, which were higher than older children with a prevalence of 7.2% and 5.9%, respectively (N. A. El-Sharif et al., 2003)

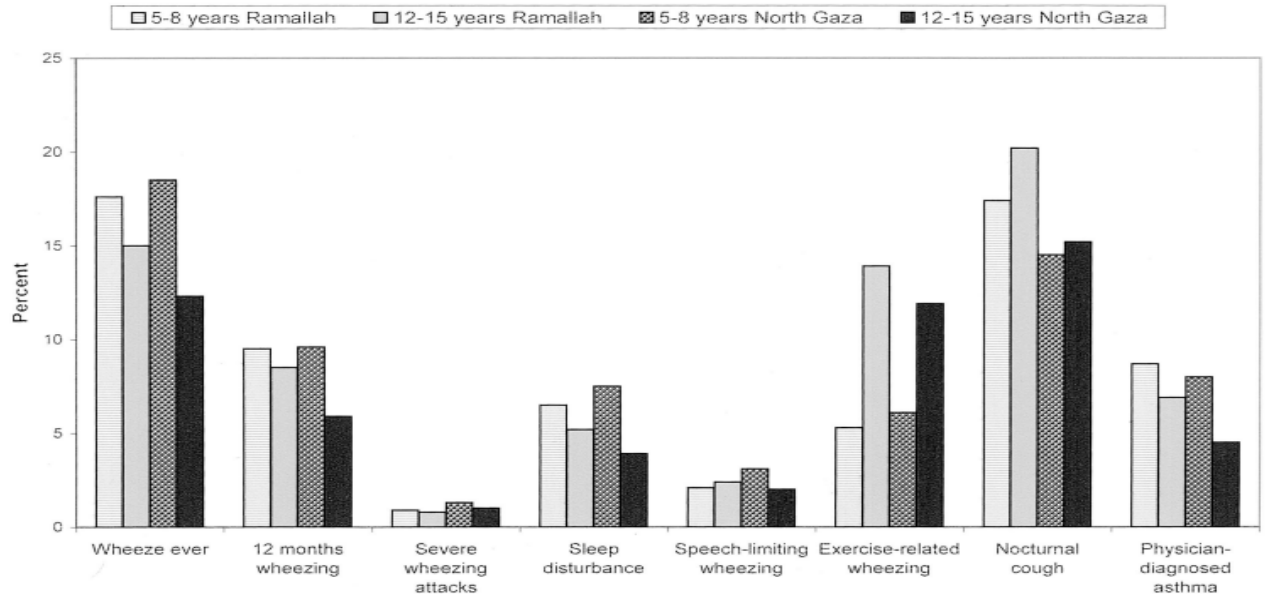

Figure 1. Differences in asthma and asthma symptoms prevalence rates between the two governorates for the two age groups in Palestine in 2000/2001. (El-Sharif et al., 2003)

A few studies were conducted to determine the risk factors of asthma and asthma-like symptoms in Palestine, including an analysis of domestic mite and pet allergen concentrations and

endotoxins, which is important in the epidemiology of asthma and allergies. Furthermore, a study by El Sharif N et al., 2004 found that there are differences in asthma and allergy prevalence between cities, villages, and refugee camps in terms of residence, environment, and socioeconomic status (El Sharif N et al., 2004).

Twenty years have passed since the last studies. We expect that the determinants for asthma and asthma-like symptoms have changed due to changes in lifestyle and environmental exposures.

The International Study for Asthma and Allergies (ISAAC) recommends repeating the baseline study 10 years later since they expect that these exposures might have changed. Furthermore, GAN Phase I has extended the study design and methodology of ISAAC Phase III to include adults, addressing the lack of global data on asthma prevalence in this age group (Innes Asher et al., 2020). Thus, it is imperative to conduct this new study to determine asthma and asthma-like symptoms prevalence and risk factors among Al-Quds University Health Campus students.

1.4 Aim:

To examine the prevalence of asthma and asthma-like symptoms among Al-Quds University Health Campus students, and to determine the risk factors for asthma and asthma-like symptoms among students.

1.5 Objectives:

1. To determine the prevalence rate of asthma and asthma-like symptoms among Al-Quds University Health Campus students
2. To identify the relationship between asthma and asthma-like symptoms and socio-demographic factors.
3. To identify the relationship between asthma and asthma-like symptoms and family history factors.
4. To identify the relationship between asthma and asthma-like symptoms and environmental factors.
5. To identify the relationship between asthma and asthma-like symptoms and lifestyle factors.

1.6 Expected outcome

The findings of this study will provide valuable references to the scientific community, healthcare providers, and researchers about recent epidemiology and the determinants of asthma and asthma symptoms among Palestinian adults of university students; it will help in the prevention and monitoring of asthma, and it will assist policymakers in developing a strategic plan to improve adult's health in Palestine.

1.7 Study context:

Al-Quds University (AQU) is a Palestinian university established in 1978 and the world's only university located behind a separation wall. The University's main campus is in Abu Dis. AQU offers higher education and community services in Jerusalem and the surrounding cities, villages, and refugee camps in the West Bank.

AQU is a collegiate research university with over Its fifteen faculties provide 100 undergraduate and postgraduate programs in a wide range of scientific fields, including medicine, biological sciences, arts and humanities, business and management, law and jurisprudence, engineering, and social sciences. The university has about 12,000 full-time enrolled students, including 9,500 undergraduates and 2,500 graduates. More than 55% of all students are female (*Al-Quds at a Glance,* 2022).

The health campus complex is one of the largest colleges in the university, and it offers various health disciplines such as allied health professions, dentistry, medical school, pharmacy, and public health. The health campus complex has a total of 6,871 registered students throughout the semester.

1.8 Thesis structure

This thesis will be presented in 6 chapters as follows:

- **Chapter 1**: contains the background of the study, problem statement, study justification, study aim and objectives.
- **Chapter 2**: includes literature review of international, regional, and in-country studies and research.
- **Chapter 3**: includes the study conceptual framework.
- **Chapter 4** covers the study area, methods, population, sampling, and sample size. It also addresses ethical considerations for data collecting, processing, and analysis.
- **Chapter 5** presents results.
- **Chapter 6** covers discussion, limitations, conclusions, and recommendations.

Chapter Two: Literature Review

2.1 Introduction

In this chapter, we will be presenting the epidemiology of asthma and asthma-like symptoms in Palestine. In addition, factors associated with asthma and asthma-like symptoms will be presented which will reflect the study objectives. In specific, literature concerning Palestine will be presented too.

2.2 Epidemiology of Asthma Worldwide

According to an updated study on the current worldwide epidemiology of asthma in 2017, data shows 43.12 million new asthma cases were reported (incidence, 0.56%), with a prevalence of 3.57% and a mortality rate of 0.006%. Incidence of asthma can peak before the age of 5 years (36% of all cases), whereas prevalence peaks between 0 and 14 years (33% of cases) (Mattiuzzi & Lippi, 2020).

A cross-sectional study was undertaken in 14 countries throughout the world to look at the prevalence and severity of asthma over time. The researchers tracked asthma symptoms in two age groups of schoolchildren. The data suggest that one out of ten children aged 6-7 and adolescents aged 13-14 had wheezed in the previous ten years; almost half of them suffered severe symptoms (Asher et al., 2021).

According to a recent study in adults, the global prevalence rates of doctor-diagnosed asthma, clinical/treated asthma, and wheeze are 4.3%, 4.5%, and 8.6%, respectively. These rates vary significantly amongst the 70 countries studied, with differences ranging up to 21 times (To et al., 2012).

2.3 Prevalence of Asthma in the Middle East

The Middle East has a lower prevalence of asthma than most developed countries. According to the ISAAC criteria, the overall prevalence of diagnosed asthma was 7.53% (95% confidence

interval: 6.38-8.75). Asthma prevalence in the 6-7 years age group was 7.43% (95% Cl: 5.75-9.10), while in the 13-14 years age group was 7.57% (95% Cl: 5.78-9.29) (Mirzaei et al., 2017).

According to the ISAAC phase I survey, Tehran, Iran had the highest asthma prevalence of 35.4% among children and adults; Kuwait had a self-designed asthma survey that showed a prevalence of 15%. ISAAC reported the lowest prevalence at 1% in Kermanshah, Iran, while the ECRHS questionnaire reported 2% in Tehran, Iran (Alavinezhad et al., 2018). Childhood asthma recurrence may be just as common in adulthood as new-onset asthma, which could have an occupational foundation.

For adults, according to an analysis utilizing the Community Respiratory Health Study (ECRHS) questionnaire in the following countries of Middle Eastern nations— Egypt, Turkey, Kuwait, Saudi Arabia, and the United Arab Emirates—the adjusted prevalence of adult asthma was 4.4% in Turkey, 6.7% in Egypt and 7.6% in the Gulf cluster. Additionally, 18.2% had wheezed in the last 12 months, 11.3% had been diagnosed with asthma by a physician, and 10.6% reported taking medication for asthma (Tarraf et al., 2018).

In Palestine, El Sharif et al., (2002) carried out a study in the Ramallah governorate, which showed that children in villages, cities, and refugee camps had wheezed in the previous 12 months with a prevalence of 8.2%, 7.2%, and 12.6%, respectively (El-Sharif et al., 2002).

This section provides a brief assessment of the literature on some of the study's main concerns.

2.4. Lifestyle factors

Factors related to lifestyle are of major concern in our study since some are considered risk factors and others are considered protective factors.

2.4.1 Diet:

Several dietary factors have been linked to an increased risk of asthma and asthma-like symptoms. For example, Hijazi et al. (2000) reported that dietary variables are connected with a 2-3-fold increase in the chance of developing asthma symptoms. A cross-sectional study conducted in Jeddah and Saudi Arabia found that less consumption of milk (95% CI: 1.21- 4.75) (P value 0.04) and vegetables (95% CI: 0.98-8.09) (P value 0.01) is related with a significant increase in asthma

occurrence, as is eating fast food. The use of animal or vegetable-based oils in cooking and consuming fish is considered to be a protective factor (Hijazi et al., 2000).

A prospective cohort study in Dutch suggested that high consumption of fish and whole grain products may protect children from asthma, while consumption of fruits, vegetables, and dairy products showed no apparent relationships with asthma outcomes (Tabak et al., 2006).

In addition, soft drinks, particularly those containing sugar, have been linked to asthma in both children and adults (Al-Zalabani et al., 2019). A study of 986 Qatari adults found that those who consumed soft drinks at least seven times per week had more than double the likelihood of having asthma compared to non-consumers (ORs: 2.60, 95% CI: 1.20–5.63). The study controlled for demographics, BMI, inflammation, physical activity, smoking, and fruit and vegetable intake (Al Ibrahim et al., 2019).

The Global Asthma Report 2022 identifies diet and nutrition as potential risk and severity factors for asthma (Mikkelsen, 2022). A cross-sectional research of adolescents in Saudi Arabia used GAN methodologies to investigate the relationship between eating patterns and asthma symptoms. During this study, nearly half of the teens polled reported consuming an unhealthy diet on most or all days. The study demonstrated that eating an unhealthy diet on most or all days, including fast food, soft drinks, and processed meat, is substantially linked with asthma symptoms in teenagers (OR = 1.3; 95%CI: 1.0-1.8; P = 0.033). However, there is no significant connection with asthma severity ($p > 0.05$). Additionally, consumption of a healthy diet and other risk factors of the study were not significantly related to symptoms of asthma or severity ($P > 0.05$) (Aljishi et al., 2022).

Also, consuming seafood fish has a protective effect against developing wheezing among teenagers (AOR: 0.29, 95% CI: 0.10–0.79) as shown in a study conducted in Brazil using a Global Asthma Network Phase one questionnaire (Urrutia-Pereira et al., 2021).

2.4.2 Smoking:

Smoking is a significant risk factor for asthma. Studies show that smokers are 1.61 times more likely to acquire asthma and 1.71 times more likely to experience asthma exacerbations as adults (Mogassabi et al., 2019). Globally, a majority of adult asthmatics are either current or former smokers (Thomson et al., 2022).

A population-based incident case-control research was done in southern Finland to evaluate the link between current and previous smoking and the development of asthma in adults. The results showed that the adjusted odds ratio (OR) for developing asthma is 1.33 (95% CI; 1.00 – 1.77) for current smokers and 1.49 (95% CI; 1.12–1.97) for ex-smokers. The risk rises with the count of cigarettes smoked each day and cumulative smoking (Piipari et al., 2004).

In addition to smoking, exposure to secondhand smoke can increase the risk of developing asthma and worsen asthma symptoms. In Najran, KSA, a descriptive, cross-sectional, and facility-based study was conducted with adult asthmatic Saudi patients to examine the common risk factors associated with asthma. The results demonstrated that either active or passive smoking was strongly linked with asthma in adults at Najran (P-value = 0.041 and 0.012) (NK & AY, 2017).

In addition, smoking a water pipe raises the risk of lung conditions and respiratory discomfort (Darawshy et al., 2021). One of the long-term consequences of smoking water pipes is a higher chance of developing asthma and having asthma attacks (Mogassabi et al., 2019). Additionally, electronic cigarette (E-cigarette) use may have adverse respiratory effects. Adolescents and young adults who use e-cigarettes may experience adverse respiratory symptoms, for example bronchitis, breath shortness, and asthma (Chaffee et al., 2021). In the USA, a cross-sectional study showed that individuals who currently use e-cigarettes have a 39% greater chance of reporting asthma in comparison to those who have never used e-cigarettes [OR: 1.39; 95% CI: 1.15-1.68). Moreover, the likelihood of having asthma increased with greater e-cigarette use. In comparison to those who have never used e-cigarettes, the probability of having self-identified asthma rose from 1.31 (95% CI: 1.05-1.62) in occasional users to 1.37 (95% CI: 1.21-2.48) in daily users (Osei et al., 2019).

The Palestinian Central Bureau of Statistics reported that 49% of water-pipe-only smokers were young adults (18-29 years of age) and about 3% of electronic cigarette smokers were individuals aged 18 years and above (PCBS, 2022). A cross-sectional study that was conducted in the West Bank found that 47.7% of young Palestinians aged 18-25 were tobacco smokers (N=1997). The study aimed to evaluate factors that either promote or inhibit smoking among Palestine's youth. As a result of the study's analysis of smoking's health effects, it was found that several symptoms are more common in smokers than non-smokers, comprising dyspnea, coughing, chest discomfort, tightness, and inflammation in the chest, as well as heart disease and hypertension (p value < 0.001) (Seir et al., 2020). To determine the prevalence of smoking cigarettes and water pipes among a

sample of Palestinian university students, another cross-sectional survey was carried out. The results showed that 33.4% of students had ever used a water pipe, and 30% of students were current tobacco users (Tucktuck et al., 2017) .

A study in the Gaza Strip examined the main risk factors contributing to bronchial asthma through a case-control study. According to the study, smoking tobacco has a 66% increased risk of bronchial asthma. The study also reported that Arrjila (water pipe) smoke has a 70% raised risk of bronchial asthma (OR 1.742 CI: 1.148-2.643) (Matar, 2018)

2.5 Family history of asthma and atopy:

A family history of asthma was shown to be a risk factor for asthma occurrence. Individuals with a family history of asthma, particularly close relatives like parents or siblings, are at a higher risk. Having an asthmatic parent raises the likelihood of having asthma three to six times compared to someone without a parent with asthma (American Lung Association, 2023). Developing asthma is more likely if atopic dermatitis (AD) starts very early, is severe and persistent, and if there is early sensitization, high IgE levels, FLG null mutations, or if parents have atopy (Yaneva & Darlenski, 2021).

Asthma among siblings is indicative of a parent's illness (Bjerg et al., 2007). In an Indian study, a father's history of asthma increased the risk compared to a mother's history (Mathew et al., 2011). However, in a meta-analysis, maternal asthma was a stronger risk factor for the illness in children than paternal asthma (Lim et al., 2010).

Children whose parents had asthma have the highest asthma risk (OR: 15.92, 95% CI: 4.66–54.45), according to research conducted in seven Chinese cities (Yu et al., 2021). In Hangzhou-China, a high percentage (10.1%) of family history of asthma appeared in asthmatic children compared with non-asthmatic (1.7%), p-value <0.001 (Xu et al., 2016). Another study found that current wheezing among schoolchildren is also associated with an allergy condition and asthmatic family history (OR: 2.20, 95% CI: 1.69-2.87) (Dastoorpoor et al., 2021)

Also, adults with a family history of asthma were shown to be at a significantly higher risk of acquiring new-onset asthma. A study conducted among adults in Mysore-Karnataka-India showed that compared to maternal asthma (OR = 10.23, P-value 0.03), paternal asthma was linked to a higher incidence of asthma in the kids (OR = 11.82, P-value 0.003) (Davoodi P et al., 2015).

According to a cross-sectional by Akiki et al. (2021), the rate of asthma among Lebanese adults was 6.7%. The results found that several factors have been identified to be positively correlated with asthma diagnosed by a doctor. These include having secondary level of education (AOR (95% CI)=4.45 (1.14-17.3)), a history of chronic respiratory illnesses in the family (AOR=2.78 95% CI:(1.32-5.83)), lung problems as a child (AOR=15.9, 95% CI: (7.02-35.8)), and allergic rhinitis (AOR=4.19 95% CI: (2.03-8.65)) (Akiki et al., 2021).

2.6 Socio-demographic factors

Socioeconomic factors also play an important role in asthma occurrence, for example, a study conducted about worldwide trends in the burden of asthma symptoms in school-aged children showed that over 27 years, the prevalence of current wheezing decreased in low-income countries, while it increased in lower-middle-income countries, and it remained stable in upper-middle and high-income countries (Asher et al., 2021).

According to the American Lung Association, the prevalence of current asthma among children is higher in males (8.3%) compared to females (6.7%). However, in adults, females (9.8%) are more likely to have asthma than males (5.5%) (American Lung Association, 2020).

2.7 Environmental factors

Environmental factors such as air pollution and weedy areas were associated with a greater risk for asthma. A cross-sectional study was conducted to examine the environmental factors that are linked to asthma and its severity in 13-14-year-old African children from countries that participated in ISAAC phase III. The study found that some of the factors associated with current asthma such as Smoking by the mother (OR = 1.41; 95%CI 1.23-1.64; P < 0.001), use of electricity for home heating (OR = 1.13; 95%CI 1.01-1.28; P = 0.04), use of open fires (OR = 1.28; 95%CI 1.08-1.51; P = 0.01), regular exercise (three or more times a week) (OR = 1.29; 95%CI 1.11-1.50; P = 0.001), and intake of paracetamol at least once a month (OR = 1.23; 95%CI 1.13-1.33; P < 0.001). However, having two or more elder siblings was found to be protective (OR 0.87, 95% CI 0.77-0.98; P = 0.03) (Ayuk et al., 2018). Almost the same factors were associated with severe asthma, mother smoking (OR = 1.61; 95%CI: 1.38-1.89; P < 0.001), frequent and regular physical activity (three or more times per week) (OR = 1.42; 95%CI: 1.23-1.64; P < 0.001), taking paracetamol at least once a month (OR 1.20; 95%CI 1.07-1.34; P < 0.001), and having a cat at home (OR = 1.14; 95%CI 1.04-1.25, P = 0.03) (Ayuk et al., 2018).

Another cross-sectional study was conducted to evaluate the prevalence of asthma and its associated environmental factors within a 6–12-year-old in a Metropolitan environment. The study showed that indoor pollution and smoking at home had a crucial role in the prevalence of asthma. Whether the child had been exposed during the first year of life (OR = 1.61, CI: 1.18–2.16, p = 0.0018) or at the time of the survey (OR = 1.65, CI: 1.24–2.18, p = 0.0005), smoking associated with asthma (Molnár et al., 2021).

Using the ISAAC questionnaire, a cross-sectional study has been carried out in Rabigh, Saudi Arabia, to determine the prevalence and risk factors of asthma in children and adolescents. The findings indicate that the most significant risk factors for physician-diagnosed asthma in children and adolescents in Rabigh City are family history of eczema (AOR: 2.85, 95% CI: 1.10–7.41, p = 0.03), exposure to fragrances or incense (AOR: 5.59, 95% CI: 1.95–16.12, p = 0.001), and viral respiratory infection-induced wheezing (AOR: 6.35, 95% CI: 2.24–18.02, p = 0.001) (Alahmadi et al., 2023).

A study conducted in Mexico's primary and secondary school children to investigate asthma risk factors showed the following results: for children aged 6-7 years, the risk factors for current wheezing were the presence of rhinitis (OR 4.484; 95%CI: 3.915-5.134) and itchy rash symptoms (OR 1.735; 95%CI: 1.461-2.059). As for adolescents aged 13-14 years, the most significant risk factors were rhinitis symptoms (OR 3.492; 95%CI: 3.188-3.825) and allergic rhinitis diagnosis (OR 2.144; 95%CI: 1.787-2.572) (Del-Río-Navarro et al., 2020).

Asthma is linked to exposure to environmental tobacco smoke (ETS) in the home. An examination of a cross-sectional study carried out in Kuwait demonstrated that adolescents who self-reported having asthma were more likely to be smokers (adjusted prevalence Ratio (PR) = 1.82; 95% CI: 1.30–2.56; p = 0.001) or had experienced exposure to secondhand smoke (adjusted PR = 1.64; 95% CI: 1.21–2.23; p = 0.002) than non-asthmatic (Booalayan et al., 2020).

Also, a study conducted in Iran found that a higher risk of current wheezing among schoolchildren is associated with tobacco smoke exposure in the property (OR: 1.43, 95 %, CI:1.04-1.96) (Dastoorpoor et al., 2021). It is also evident in Brazil with higher odds (AOR: 4.97, 95% CI: 1.01-24.46) (Urrutia-Pereira et al., 2021).

In Indonesia, a study conducted among schoolchildren showed that the prevalence of current wheeze was low in Yogyakarta (4.6%). The most risk factors among children aged 6-7 years were respiratory problems such as they suffered from wheezing in the first 12 months of life (aOR: 10.94: 95% CI: 4.27 −28.01), or suffering from pneumonia (aOR: 3.67, 95% CI: 1.51–8.88), and a nutritional factors such as consumption of fast food in the past 12months (aOR: 2.93, 95% CI: 1.10–7.80), also an environmental factors such as living in truck traffic region (aOR: 3.00, 95% CI: 1.44–6.24); whereas children who were exclusive breastfeeding for >6 months were less likely to have current wheeze (aOR: 0.31, 95% CI: 0.12–0.80) (Triasih et al., 2023). In adolescents aged 13-14 years, the most factors which increased the risk of developing current wheeze were obesity (aOR: 1.60, 95% CI: 1.10–2.31), consumption of fast food once or twice a week (aOR: 1.43 95% CI: 1.00–2.03), and paracetamol in the previous 12 months (aOR: 1.84 95% CI: 1.41–2.39); whereas consumption of nuts once or twice a week decreased the risk of current wheeze (aOR: 0.67, 95% CI: 0.49 −0.90) (Triasih et al., 2023)

A cross-sectional study was conducted to assess asthma prevalence and risk factors among 20-65-year-olds in Khuzestan province, Iran. The study found that the most potent risk factors for asthma in adults were having airway hyperresponsiveness (OR = 13.52; 95% CI: 9.61–19.02), having a family history of asthma (OR = 2.88; 95% CI: 2.23–3.71), living in urban areas (OR = 2.15; 95% CI: 1.43–3.21), having mold in the building (OR = 1.95; 95% CI: 1.29–2.92), and living near a main street (OR = 1.44; 95% CI: 1.14–1.82). The most important protective factors were having dense green space (OR = 1.69; 95% CI: 1.30–2.20) and a garden near the home (OR = 1.42; 95% CI: 1.12–1.80) (Idani et al., 2020).

2.7.1 cooking and heating fuel:

There is a growing body of evidence that suggests that cooking and heating fuel can have a significant impact on asthma occurrence. Cooking is an essential activity in our daily lives, but it can also have harmful effects on our health. Household cooking methods can impact asthma risk. Exposure to particulate matter, particularly when using solid fuels like wood or coal, is associated with a higher risk of developing asthma. These fine particles can irritate the airways and exacerbate symptoms (Holm et al., 2018; Stern et al., 2020).

According to studies performed by the University of Melbourne, gas cooking, wood burning stoves, and home heating are associated with a higher risk of asthma and a deterioration in lung

function (Dai et al., 2021). Burning solid fuel, such as wood, can result in a higher risk of asthma. Children living in households with high nitrogen dioxide concentrations from cooking with gas stoves may have greater asthma symptoms and report increased usage of asthma rescue drugs (Sood A & Doo K, 2018). However, The National Health and Nutrition Examination Survey (NHANS) research found no evidence linking the usage of gas stoves to respiratory symptoms or pulmonary function (Eisner, 2003)

In a cross-sectional study using ISAAC phase three, the results showed that the use of an open fire for cooking was associated with an increased risk of asthma symptoms and diagnosis in both age groups (6-7 years and 13-14 years) (OR: 2·17 (95% CI 1·64–2·87) (OR: 1·35 (1·11–1·64). It also found that the use of gas as a cooking fuel was not associated with asthma outcomes in either age group (Wong et al., 2013).

A pooled dataset of Demographic and Health Surveys conducted in countries of sub-Saharan Africa revealed that cooking with biomass fuels (such as wood, charcoal, or dung) was associated with an increased risk of acute lower respiratory infections (ALRI) among children, especially during winter and spring seasons. Additionally, cooking indoors during the rainy season without having a separate kitchen was a statistically significant determinant of ALRI (OR 1.80; CI: 1.30, 2.50) (Buchner & Rehfuess, 2015).

In several studies, gas cooking has been associated with asthma or wheezing in children, even after other factors such as tobacco smoke and pets were adjusted (Li et al., 2023). A study that was conducted in the United States (US) found that 12.7% (95% CI = 6.3–19.3%) of childhood asthma nationwide is attributable to gas stove use, and this percentage varies by state (Gruenwald et al., 2023). However, another US study among adults found that indoor air pollutants, such as cooking or heating appliances were not significantly linked to wheeze and asthma (Arif et al., 2003). Therefore, it is important to take necessary measures to reduce exposure to these harmful particles while cooking, such as using cleaner fuels or improving ventilation in cooking areas.

2.8 Atopy:

Atopy, a term used to describe a genetic predisposition to allergic conditions, plays a significant role in the development of various allergic diseases. These Allergic conditions like hay fever and eczema often coexist and are associated with an increased risk of asthma (Vaillant, 2023). Up to

60% of patients with atopic dermatitis develop asthma or hay fever (allergic rhinitis) later in life, and up to 30% have food allergies (Bieber, 2008)

Allergic rhinitis, or hay fever, involves inflammation of the nasal passages due to allergens like pollen, dust mites, or pet dander. Individuals with hay fever are more likely to develop asthma, especially if their symptoms persist throughout the year rather than being seasonal (Austin et al., 1999)

Atopic Dermatitis (Eczema) is characterized by itchy, inflamed skin. It often occurs in people with a genetic tendency toward allergies. The severity of eczema is associated with an increased risk of developing other allergic conditions, including asthma, hay fever, and food allergies (De Pietro Crt, 2023).

2.9 Asthma Epidemiology among adults in Palestine

A few studies were conducted on children to determine the risk factors of asthma and asthma-like symptoms in Palestine, including an analysis of domestic mite and pet allergen concentrations and endotoxins, which is important in the epidemiology of asthma and allergies. Furthermore, the study found that there are differences in asthma and allergy prevalence between cities, villages, and refugee camps in terms of residence, environment, and socioeconomic status. (El Sharif et al., 2004).

An examination of a cross-sectional study of asthmatic Palestinian patients in Gaza revealed that a prudent diet pattern, which included a high intake of whole grains, fish and products of shellfish, beans and legumes, vegetables, tomatoes, fruits, and vegetable oils, was linked to a lower prevalence of poorly controlled asthma than a western diet pattern, which included a high intake of refined grains, red meat, poultry, junk food, eggs, low and high-fat dairy products, hydrogenated fats, sugar, candies, desserts, and snack foods (el Bilbeisi et al., 2019)

In a case-control study in the Gaza Strip among adult patients with asthma who attended UNRWA clinics, a significant risk factor for bronchial asthma included a low level of education OR:0.795 (95% CI: 0.674 -0.937). Exposure to all types of smoking increases the risk of bronchial asthma by 66% as results show. Additionally, not using heating in cold weather or air cooling in extreme temperatures was linked to bronchial asthma. There is also an increased risk due to family history (genetic) nearby four times OR (CI) = 3.7 (2.071- 6.619). Food or drug allergy was also found to

be a risk factor for bronchial asthma. According to environmental exposure, the researcher found that exposure to perfume, and dust in the home also had a risk of bronchial asthma OR (CI) =1.824 (1.379-2.413), OR (CI) = 1.824 (1.005-1.796). Also, stress and Upper respiratory tract infection (URTI) was shown to raise the probability of developing bronchial asthma to OR (CI) = 1.480 (1.019-2150), OR (CI) = 2.029 (1.564-2.63) respectively (Matar, 2018)

According to another study at An-Najah University in Palestine (2005), asthma is statistically significantly associated with gender, smoking, and chronic respiratory infections, in a predominantly male population (Minawi, 2005).

A cross-sectional study including one thousand Al -Najah University students was carried out in the Nablus area to explore the impact of age, sex, and body weight on peak expiratory flow rate (PEFR) values. (PEFR measures how fast someone exhales air from their lungs, and it helps diagnose and monitor lung diseases like asthma (Phillips, 2018)). To obtain the expected value, the prediction equations for PEFR for Europeans (British) and equations for normal lung function values for the Iranian population were used. The study found a significant correlation ($p<0.01$) between predicted PEFR values using European and Iranian equations for both males and females of all ages. However, no significant correlation was found between PEFR and BMI for either gender across all age groups (Ghazal-Musmar et al., 2010)

Another cross-sectional study examined the factors linked with chronic asthma severity in patients over 5 years who visited the emergency rooms of Alia Governmental Hospital in Hebron district (N =121). The researcher found that moderate/severe asthma was prevalent among 45.5% of the patients. and was associated with regular intake of oral theophylline (AOR, 18.22; 95% CI, 1.93–17), frequent use of oral steroids, and frequent use of inhaled short-acting beta-agonists. They also found that 43% of moderate/severe asthmatics reported an inability to afford or obtain asthma medicines, and more likely to have difficulties in using inhalers, and had more hospital admissions and ER visits due to asthma (Al Zabadi & El Sharif, 2009)

A case-control study was conducted in the Gaza Strip among individuals aged 18-60 years with and without chronic respiratory disease (CRD). The results found that controls had significantly higher education, income, and better ventilation in their homes ($P < 0.001$). They also had better smoking habits, physical activity, vitamin C consumption, and longer sleep compared to cases (P

< 0.001). According to the main aim of the study, the analysis showed that CRD patients had worse vitamin C status, oxidative stress, inflammation, and blood oxygen saturation than healthy people. They also had impaired glucose metabolism, but not lipid metabolism. These findings suggest that vitamin C deficiency may contribute to the metabolic complications of CRD (Abuhajar et al., 2021)

A prospective study was conducted in Hebron City, Palestine among female hairdressers who participated in a baseline survey in 2008 and were followed up in 2013. The study found that working as a hairdresser had negative effects on respiratory health such as wheezing, chest tightness, and shortness of breath. Those who continued to work experienced more breathing problems and lower lung function than those who left the profession. Furthermore, the longer they worked, the worse their lung function became. During the 5-year follow-up, 16% of hairdressers left the job, with 28% citing health issues or other reasons for their departure. The study also found high levels of ammonia in some salons, which can be harmful to the lungs. Ammonia is often used in hair products (Nemer et al., 2015).

Chapter Three: Study conceptual framework

3.1 Introduction

In this chapter, the study conceptual frame and study operational definitions will be presented.

3.2 Definitions

Asthma is A long-term condition that affects both children and adults. The air channels in the lungs narrow due to inflammation and tightness of the muscles around the tiny airways (WHO, 2022). Individuals with asthma experience variable airway obstruction and bronchial hyperresponsiveness, which can result in a range of symptoms such as wheezing, coughing, chest tightness, and shortness of breath (Nhlbi, 2007). These symptoms are triggered by exercise, allergies, and cold air, and are worse at night, but they are intermittent. Pollen or animal dander are also common allergens that trigger asthma attacks. Other conditions may have asthma-like symptoms that cause breathing problems (*Asthma: Symptoms and Diagnosis - InformedHealth.org - NCBI Bookshelf*, 2017).

Wheezing is the whistling or rattling sound that is made by breathing when the airway is partially blocked. Wheezing in asthma can be triggered by exposure to airborne allergens such as pollen, mold, animals, or house dust (C., 2020).

Hay fever: Acute allergic reaction to pollen, known as allergic rhinitis, is often seasonal and characterized by sneezing, nasal discharge and congestion, eye irritation, and watering (Merriam-Webster, 2023).

Eczema is a term used to describe a group of medical conditions that result in the inflammation of the skin. This condition is characterized by persistent itching, redness of the skin, and the appearance of a rash (Mayo Clinic, 2023)

3.3 Study conceptual model

Many risk factors are associated with asthma among children and adults (Asher et al., 2021; Ren et al., 2022). These factors are divided into two main categories: Non-modifiable risk factors such as family history and genetic factors, and modifiable factors i.e. environmental (Ren et al., 2022)

and lifestyle factors that may play an important role in the prevalence of asthma and asthma-like symptoms (Asher et al., 2021).

The conceptual framework was built based on the literature review, it shows what the researcher studied, and it consists of the risk factors of asthma and asthma-like symptoms as follows:

- **Family history factor**: Asthma in children is influenced by interactions between genetic and environmental factors. Specific genes linked to asthma and atopy may be passed down through families. These genes can affect the immune system's response to environmental stimuli and so contribute to the development of asthma. It is crucial to emphasize, however, that inheriting susceptibility genes does not guarantee the development of asthma; rather, it raises the risk (Yaneva & Darlenski, 2021).

- **Environmental factors**: According to the World Health Organization (WHO), a variety of environmental allergens and irritants are associated with asthma, including indoor and outdoor air pollution, dust mites, mold, and occupational exposure to chemicals, fumes, and dust (WHO, 2023). Air pollution poses a significant risk to public health worldwide, particularly to respiratory conditions. It is responsible for approximately 8 million deaths per year, with outdoor pollution accounting for over 4.2 million of these deaths. Indoor pollution is also a concerning factor, leading to more than 3.8 million deaths annually. Respiratory symptoms are often induced by pollutant agents, and this interference can have a detrimental impact on asthma outcomes such as incidence, prevalence, hospital admissions, emergency department visits, mortality, and asthma attacks. The relationship between pollutant exposure and human host factors is complex, and there is still much to learn about the pathways that give rise to asthma as a public health issue. Epigenetic changes in the respiratory tract microbiome, oxidative stress, and immune dysregulation are all potential routes through which pollutants impact health. Furthermore, the modern Western lifestyle, characterized by urbanization and increased indoor time, has resulted in greater exposure to polluted air (Chatkin et al., 2022).

  Air pollution hurts asthma outcomes in both adult and pediatric populations. Indoor pollutants can have a significant impact on individuals with asthma. These pollutants can be attributed to heating and cooking sources, as well as mold. Additionally, outdoor

pollutants can induce asthma symptoms, exacerbations, and can lead to a decrease in lung function. Therefore, it is important to take measures to reduce exposure to these pollutants in order to improve the respiratory health of individuals with asthma (A. I. Tiotiu et al., 2020)

- **Lifestyle factors:** Asthma occurrence in adults is associated with lifestyle factors such as diet and smoking. Although the exact mechanisms are not fully understood, research has shown that these factors can contribute to the development of asthma in adults.

- **Smoking:** smoking poses a significant risk for asthma. There are numerous potential mechanisms in which smoking may increase the likelihood of asthma. Cigarette smoke can trigger inflammation in the airways, compromise the immune system, and interfere with the body's natural repair processes, making the airways more susceptible to other irritants, such as pollen or dust(Thomson et al., 2022). Additionally, smoking can cause harm to the lungs and diminish their function, making breathing more difficult (WHO, 2023). At the individual level, genetic factors and other environmental factors are also involved in modifying the risk. Possessing a hereditary predisposition to atopy may increase the likelihood of developing asthma among smokers. Nevertheless, research has revealed that the combined impact of parental atopy and smoking on asthma risk is additive rather than synergistic (Piipari et al., 2004)

- **Diet:** Understanding the correlation between diet and asthma risk in adults can be challenging due to the various types of the disease and the inflammation it causes in the airways (Guilleminault et al., 2017). Research suggests that consuming a poor diet, such as a Western diet high in processed foods, red meat, and sweets, can increase airway inflammation (Wood et al., 2011). Conversely, a Mediterranean diet rich in fruits and vegetables, known for its antioxidant properties, may aid in reducing the inflammation in the airways (Romieu et al., 2009; Wood et al., 2008) .

- **History of atopy** (history of asthma, allergic rhinitis, and eczema) (Mortimer et al., 2022; Ren et al., 2022).

- **Socio-demographic Factors** (Age, gender, place of residency, and marital status).

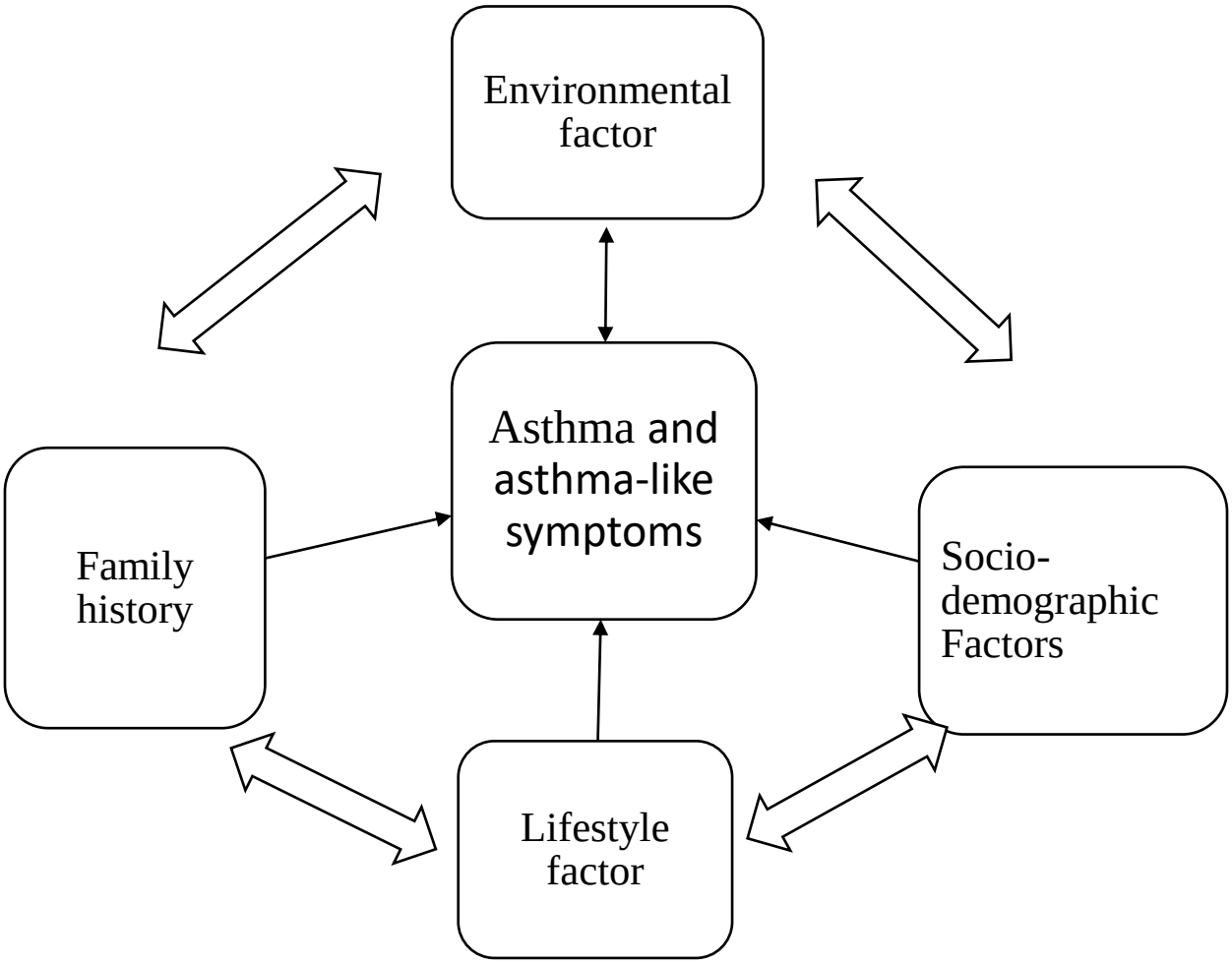

Figure 2. Study conceptual framework

Chapter 4 Methodology

4.1 Introduction

In this chapter, study setting, sample frame, sampling methods and sample size are presented. Also, study tools, and statistical analysis are described.

4.2 Setting

This study was conducted at Al-Quds University Health Complex which is a medical facility located on the Abu Dies Main Campus in Jerusalem. The complex comprises several health-related faculties, including the Faculty of Medicine, Faculty of Public Health, Faculty of Dentistry, Faculty of Pharmacy, and Faculty of Allied Health Professions.

4.3 Study design

The study design is a cross-sectional.

4.4 Sample frame and Sampling method:

All students registered at the health camps are the sample frame for this study. Table 4.1 shows the distribution of students by faculty

Table 4.1 Distribution of students by faculty

Faculty	Number of Students
Allied health profession	2569
Dentistry	990
Medical school	2233
Pharmacy	774
Public health	305
Total	**6871**

A two-stage probability sample was used (by faculty and study year). We distributed the sample size by probability proportional to size by faculty number of students. A random selection for classes for each study year was selected in each faculty. We selected the sampling class from the list of classes of certain day of the week by faculty and study year and the researcher distribute the questionnaire link in that lecture for students to fill in.

4.4 Sample size:

Using the EPI tools program, the sample calculation formula yielded a total of 385 subject to be sampled using the following parameters: a precision level of 95 percent, an estimated percentage level of the dependent variable five percent (see tab1e 4.2). The expected response rate was 80%, so we added another 20% as shown in table 4.3. In total, the targeted sample size was 461.

Table 4.2: Sample Size Calculation Results

Sample sizes for varying prevalence and precision values						
	AP = 0.01	AP = 0.02	AP = 0.05	AP = 0.1	AP = 0.2	AP = 0.5
Precision = 0.01	381	753	1825	3458	6147	9604
Precision = 0.02	96	189	457	865	1537	2401
Precision = 0.05	16	31	73	139	246	**385**
Precision = 0.1	4	8	19	35	62	97
Precision = 0.2	1	2	5	9	16	25

This sample size was distributed as in table 4.3

Table 4.3: Sample distribution

Faculty	Number of Students	percent	Sample size
Allied health profession	2569	37%	171
Dentistry	990	14%	65
Medical school	2233	32%	150
Pharmacy	774	11%	55
Public health	305	4%	20
Total	**6871**	**100%**	**461**

4.5 Study tool:

A GAN Phase I questionnaire; a translated adult's questionnaire was used to collect information that answers the study questions (Alomary et al., 2022). We got a permission to use the Saudia Arabi translated version. It is a standardized questionnaire provided by the ISAAC and developed by the GAN. Additional questions were incorporated in line with the behavioral and lifestyle characteristics of the university students

The questionnaires included questions related to each studied factor of the conceptual framework. In addition to assessing asthma prevalence and severity, it explores asthma management and environmental factors. The questionnaire consisted of demographic questions on age, sex, marital status, place of residence, and faculty as well as question about the height and weight of students at the time of the survey.

Questionnaire parts:

The questionnaire is consisted of 39 questions including 3 main parts about student's health and lifestyle as following:

Part 1: Sociodemographic factors.

Part 2: (Questions 1-24) refers to student's health.

Part 3: (Questions 25-39) are about other aspects of student's lifestyle and environmental exposures.

4.6 Validity

The study questionnaire was reviewed and validated by three specialists; a pharmacist, a doctor, and an epidemiologist. They evaluated the content of the questionnaire. All their comments and suggestions were considered. The questionnaire was validated and piloted after its development. The piloting was done to test the capacity of students to understand the questionnaire wording, phrasing, and layout. The questionnaire layout was modified after the pilot. The version we used is the translated Arabic questionnaire that was previously used in Saudia Arabia (Alomary et al., 2022).

4.7 Data collection:

Google form link was used for data collection. Data was collected from students by sending an electronic link of the questionnaire to fill out. The questionnaire was distributed electronically to students to fill out during class hour after permission from the faculty dean and class instructor.

4.8 Statistical Analysis:

All data was coded, then entered and analyzed using SPSS (statistical package for social sciences). Bivariate analysis was done and a chi-square test was used to examine the association between asthma and asthma-like symptoms with the various study exposures. Multivariate logistic models were developed to determine the various associations and control for possible confounders**.** All variables that were significant in the bivariate model (p-value<0.05) were entered in a separate logistic regression model for each asthma and asthma-like symptom. The adjusted odds ratios and their 95% confidence intervals were reported.

4.9 Definition of main outcomes:

According to the Global Asthma Network studies (Lai et al., 2009), the definition of outcomes as follows:

- **"Current wheeze"** in asthma was defined as a positive answer to the question "Have you had wheezing or whistling in the chest in the past 12 months?" People with **"severe asthma symptoms"** were defined as those with current wheeze who, in the past 12 months, reported having had four or more attacks of wheeze, or more than one night per week sleep disturbance from wheeze, or wheeze affecting speech (Lai et al., 2009).

- **"Asthma ever"** was defined as a positive answer to the question "Have you ever had asthma?"

- **"Diagnosed asthma**" was defined as a positive response to the question, "Was your asthma confirmed by a doctor?"

- **"Hay fever ever"** was defined as a positive answer to the question "Have you ever had hay fever?"

- **"Eczema ever"** was defined as a positive answer to the question "Have you ever had eczema?"

Chapter five: Results

5.1 Introduction:

In this chapter results are presented in three parts: Descriptive analysis of participants' characteristics, the bivariate analysis of main outcomes with study exposures, and finally the multivariate analysis.

5.2 Descriptive analysis:

The study had a total of 819 participants, which exceeded our expectations. We expected that some classes we selected to sample would have around 50 students, but we found that some classes such as in the medical school faculty had more than 200 students. The advantage of having a larger sample size lies in the increased study power, which enhances the credibility of the results.

5.2.1 Participants' characteristics:

Our study consisted of 819 university students, mostly from Faculty of Allied Professions and the Faculty of Medicine. 30.2% were in their second year, and 78.1% of the students were females. Most of the students were single, and more than half lived in cities. The mean age of the students was 20 years and the mean value of body mass index was 23.14 (see Table 5.1).

Table 5.1: Participants' characteristics

		Frequency (N)	(%)
Faculty	Allied profession	221	27.0%
	Dentistry	118	14.4%
	Medical school	221	27.0%
	Pharmacy	200	24.4%
	Public health	59	7.2%
Academic year	First	162	19.8%
	Second	247	30.2%
	Third	159	19.4%
	Forth	138	16.8%
	Fifth	80	9.8%
	Sixth	33	4.0%
Sex of the respondent	Male	179	21.9%
	Female	640	78.1%
Marital status	Not single	32	3.9%
	Single	787	96.1%
Place of residence	City	460	56.2%
	Village	301	36.8%
	Refugee Camp	36	4.4%

	Other	22	2.7%
Age	Mean (SD) (Min-Max)	20.0 (±1.8) (17-37)	
Body mass index	Mean (SD) (Min-Max)	23.14 (±3.76) (14.84-40.01)	

5.2.2 Prevalence of Asthma and asthma-like symptoms

Table 5.2 demonstrates that 83% of the research group never or rarely had trouble breathing, whereas 13.7% had repeatedly trouble breathing, but it always gets completely better. Only 3.1% said they had trouble breathing continuously and that it was never quite right. In addition, 21% reported current wheezing. However, 14% of them experienced wheezing attacks, and 16% had sleep disturbances as a result of wheezing. Also, 16% reported feeling breathless when wheezing was present. In addition, 29% reported sleep disruption due to shortness of breath and 47% due to coughing in the previous 12 months. Only 10.5% had impaired speech due to present wheezing.

In addition, table 5.2 shows that 9.8% of the participants were affected by symptoms of severe asthma. The prevalence of asthma ever was 10%. Also, 6.3% who had asthma ever were reported that medical doctors confirmed their asthma. Only 5.2% had a written plan for asthma control and 17.9% of the participants experienced an asthma attack in the past 12 months.

Table 5.2: Prevalence of asthma and severity of asthma symptoms among the participants.

		N	(%)
Ever had trouble breathing	Never	295	36.0%
	only rarely	387	47.3%
	repeatedly, but it always gets completely better	112	13.7%
	continuously, so that your breathing is never quite right	25	3.1%
Current wheezing*	Yes	172	21.0%
	No	647	79.0%
Current wheezing attacks	None	552	67.4%
	1 to 3	85	10.4%
	4 to 12	29	3.5%
	More than 12	7	0.9%
	I do not remember	47	5.7%
	Not apply	99	12.1%
	Never woken with wheezing	684	83.5%

Sleep disturbance due to current wheezing	Less than one night per week	97	11.8%
	One or more nights per week	38	4.6%
Ever been breathless when the wheezing was present	Yes	133	16.4%
	No	679	83.6%
Sleep disturbance due to shortness of breath in the past 12 months	Never	573	70.5%
	Less than one night per week	180	22.1%
	One or more nights per week	60	7.4%
Sleep disturbance due to coughing in the past 12 months	Never	427	52.5%
	Less than one night per week	254	31.2%
	One or more nights per week	132	16.2%
Limit in speech due to current wheezing	Yes	85	10.5%
	No	734	89.6%
Symptoms of severe asthma**	Yes	80	9.8%
	No	739	90.2%
Asthma ever	Yes	82	10.0%
	No	737	90.0%
Asthma confirmed by a doctor (diagnosed asthma)	Yes	51	6.3%
	No	757	93.7%
Had a written plan for asthma control	Yes	42	5.2%
	No	766	94.8%
Asthma attacks in the past 12 months	Yes	60	17.9%
	No	275	82.1%

* Prevalence of asthma symptoms was estimated based on the positive responses to the question on wheeze in the last 12 months

(current wheeze)

**Severe asthma symptoms were defined as reporting having current wheeze, in addition to experiencing frequent and severe episodes of wheeze in the past 12 months (>4 attacks of wheeze, or >1 night per week sleep disturbance from wheeze or wheeze affecting speech)

5.2.3 Prevalence of other asthma symptoms in the past 12 months (current attacks)

Table 5.3 indicates that 17% of participants who reported having asthma had urgently visited a doctor and 6% went to an emergency department for breathing problems. Only 5% of them were admitted to the hospital due to breathing problems and 22.7% reported limited usual activity (at university, at work, or home) in the past 12 months. While 6.3% of the participants had jobs causing wheezing, and 9.9% left jobs due to breathing issues.

Table 5.3: Prevalence of other asthma symptoms in the past 12 months

		N	(%)
times of urgently being to a doctor because of breathing problems	None	**279**	**83.0%**
	1 to 3	**51**	**15.2%**
	4 to 12	**4**	**1.2%**
	More than 12	**2**	**0.6%**
times of urgently being in an emergency department without being admitted to the hospital because of breathing problems	None	**316**	**94.0%**
	1 to 3	**17**	**5.1%**
	4 to 12	**1**	**0.3%**
	More than 12	**2**	**0.6%**
times of being admitted to the hospital because of breathing problems	None	**317**	**94.9%**
	1	**12**	**3.6%**
	2	**3**	**0.9%**
	More than 2	**2**	**0.6%**
limited usual activity days (at work or Place of residence or in the university) because of breathing problems in the past 12 months	None	**260**	**77.4%**
	1 to 3	**51**	**15.2%**
	4 to 12	**19**	**5.7%**
	More than 12	**6**	**1.8%**
Ever worked in a job that caused wheezing	Yes	**52**	**6.3%**
	No	**767**	**93.7%**
Ever leaving any of the jobs because they affect breathing	Yes	**22**	**9.9%**
	No	**200**	**90.1%**

5.3 Bivariate analysis:

5.3.1 Bivariate analysis of participants' demographic characteristics:

Table 5.4 shows that factors in the table did not show any significant associations between ever having asthma symptoms or wheezing in the past 12 months and participants' demographic characteristics (p-value >0.05).

Table 5.4: Association between Ever having asthma and current wheezing with participants' demographic characteristics

		Asthma ever				Chi-square	Current wheezing				Chi-square
		Yes N=82		No N=737			Yes N=172		No N=647		
		N	%	N	%	P-value	N	%	N	%	P-value
Faculty	Allied profession	21	25.6%	200	27.1%	.641	48	27.9%	173	26.7%	.191
	Dentistry	15	18.3%	103	14.0%		32	18.6%	86	13.3%	
	medical school	18	22.0%	203	27.5%		38	22.1%	183	28.3%	
	pharmacy	23	28.0%	177	24.0%		45	26.2%	155	24.0%	
	public health	5	6.1%	54	7.3%		9	5.2%	50	7.7%	
Academic year	First	15	18.3%	147	19.9%	.827	42	24.4%	120	18.5%	.126
	Second	21	25.6%	226	30.7%		55	32.0%	192	29.7%	
	Third	19	23.2%	140	19.0%		36	20.9%	123	19.0%	
	Forth	13	15.9%	125	17.0%		25	14.5%	113	17.5%	
	Fifth	10	12.2%	70	9.5%		10	5.8%	70	10.8%	
	Sixth	4	4.9%	29	3.9%		4	2.3%	29	4.5%	
Sex of the respondent	Male	22	26.8%	157	21.3%	.251	43	25.0%	136	21.0%	.262
	female	60	73.2%	580	78.7%		129	75.0%	511	79.0%	
Marital status	Not single	2	2.4%	30	4.1%	.469	6	3.5%	26	4.0%	.750
	Single	80	97.6%	707	95.9%		166	96.5%	621	96.0%	
Place of residence	City	45	54.9%	415	56.3%	.552	94	54.7%	366	56.6%	.408
	Village	34	41.5%	267	36.2%		66	38.4%	235	36.3%	
	Refugee Camp	2	2.4%	34	4.6%		5	2.9%	31	4.8%	
	Other	1	1.2%	21	2.8%		7	4.1%	15	2.3%	

Table 5.5 shows that only asthma severity showed a significant difference by faculty (p-value < 0.05). Other factors in the table did not show any significant associations between asthma severity or being diagnosed with asthma and the demographic characteristics of the participants (p-value >0.05).

Table 5.5: Association between asthma symptoms severity and diagnosed asthma with demographic characteristics

		Asthma severity				**Chi-square**	**Asthma confirmed by a doctor (Diagnosed)**				**Chi-square**
		Yes N=80		**No N=739**			**Yes N=51**		**No N=757**		
		N	%	N	%	**P-value**	N	%	N	%	**P-value**
Faculty	Allied profession	27	33.8%	194	26.3%	**.045**	12	23.5%	205	27.1%	.829
	Dentistry	13	16.3%	105	14.2%		10	19.6%	105	13.9%	
	medical school	11	13.8%	210	28.4%		14	27.5%	205	27.1%	
	pharmacy	25	31.3%	175	23.7%		12	23.5%	187	24.7%	
	public health	4	5.0%	55	7.4%		3	5.9%	55	7.3%	
Academic year	First	18	22.5%	144	19.5%	.256	7	13.7%	151	19.9%	.762
	Second	27	33.8%	220	29.8%		14	27.5%	230	30.4%	
	Third	16	20.0%	143	19.4%		11	21.6%	146	19.3%	
	Forth	15	18.8%	123	16.6%		9	17.6%	129	17.0%	
	Fifth	4	5.0%	76	10.3%		7	13.7%	72	9.5%	
	Sixth	0	0.0%	33	4.5%		3	5.9%	29	3.8%	
Sex of the respondent	Male	22	27.5%	157	21.2%	.198	11	21.6%	164	21.7%	.987
	female	58	72.5%	582	78.8%		40	78.4%	593	78.3%	
Marital status	Not single	2	2.5%	30	4.1%	.494	1	2.0%	30	4.0%	.471
	Single	78	97.5%	709	95.9%		50	98.0%	727	96.0%	
Place of residence	City	43	53.8%	417	56.4%	.399	27	52.9%	428	56.5%	.534
	Village	33	41.3%	268	36.3%		22	43.1%	274	36.2%	

	Refugee Camp	1	1.3%	35	4.7%		2	3.9%	34	4.5%	
	Other	3	3.8%	19	2.6%		0	0.0%	21	2.8%	

Table 5.6 shows that current wheezing and asthma severity are significantly associated with BMI faculty (p-value < 0.05), but not with the age of the participants. Otherwise, in **Table 5.7**, ever having or being diagnosed with asthma did not show any significant association with either age or BMI (p-value >0.05).

Table 5.6: Association between current wheezing and asthma severity with other demographic factors

Variable	**Description**	**Current wheezing**			**Asthma severity**		
P value		**Yes**	**No**	**Sig.**	**Yes**	**No**	**Sig.**
Age	Mean (SD)	19.74 (2.00)	20.01 (1.72)	.946	19.67 (1.54)	19.99 (1.81)	.678
Body mass index (BMI)	Mean (SD)	23.69 (4.27)	22.98 (3.60)	**.020**	24.18 (4.83)	23.03 (3.69)	**.000**

Table 5.7: Association between asthma ever and diagnosed asthma with other demographic factors

Variable	**Description**	**Asthma ever**			**Diagnosed asthma**		
P value		**Yes**	**No**	**Sig.**	**Yes**	**No**	**Sig.**
Age	Mean (SD)	20.17 (1.58)	19.93 (1.81)	.904	20.27 (1.62)	19.94 (1.80)	.871
Body mass index (BMI)	Mean (SD)	24.05 (4.24)	23.03 (3.69)	.275	24.09 (4.46)	23.07 (3.72)	.205

5.3.2 Atopy, family history of atopy and participants' having asthma and asthma-like symptoms

Table 5.8 shows that the main outcomes of the study of current wheezing and asthma severity showed a significant association with participants' history of ever having atopy of hay fever or eczema and being diagnosed with atopy of hay fever or eczema (p-value < 0.05) also with a family history of asthma, rhinitis, or eczema (p-value < 0.05).

Table 5.8: Association between current wheezing and severity of asthma symptoms with participants' history of atopy and family history of atopy

		Current wheezing				Chi-square	Asthma severity				Chi-square
		Yes N=172		No N=647			Yes N=80		No N=739		
		N	%	N	%	P-value	N	%	N	%	P-value
Participants" History											
Ever had hay fever	Yes	63	36.6%	107	16.5%	.000*	36	45.0%	134	18.1%	.000*
	No	109	63.4%	540	83.5%		44	55.0%	605	81.9%	
Diagnosed hay fever	Yes	38	22.2%	45	7.1%	.000*	22	27.8%	61	8.4%	.000*
	No	133	77.8%	593	92.9%		57	72.2%	669	91.6%	
Ever had eczema	Yes	50	29.1%	139	21.5%	.036*	27	33.8%	162	21.9%	.017*
	No	122	70.9%	508	78.5%		53	66.3%	577	78.1%	
Diagnosed eczema	Yes	37	21.8%	91	14.2%	.015*	20	25.3%	108	14.7%	.014*
	No	133	78.2%	552	85.8%		59	74.7%	626	85.3%	
Family history											
Asthma	Yes	76	44.2%	122	18.9%	.000*	44	55.0%	154	20.8%	.000*
	No	96	55.8%	525	81.1%		36	45.0%	585	79.2%	
Rhinitis	Yes	70	40.7%	121	18.7%	.000*	42	52.5%	149	20.2%	.000*
	No	102	59.3%	526	81.3%		38	47.5%	590	79.8%	
Eczema	Yes	84	48.8%	211	32.6%	.000*	40	50.0%	255	34.5%	.006*
	No	76	44.2%	122	18.9%		40	50.0%	484	65.5%	

*. The Chi-square statistic is significant at the .05 level.

Table 5.9 shows that ever having asthma and diagnosed asthma were associated with participants' history of ever having atopy of hay fever or eczema and being diagnosed with atopy of hay fever or eczema. Also, asthma ever was associated with a family history of asthma rhinitis, or eczema (p-value < 0.05). However, being diagnosed with asthma was not associated with a family history of eczema (p-value >0.05) but it shows an association with a family history of asthma or rhinitis (p-value < 0.05).

Table 5.9: Association between ever having asthma symptoms and diagnosis with participants' history of atopy and family history of atopy

		Asthma ever				**Chi-square**	**Diagnosed asthma**				**Chi-square**
		Yes N=82		**No N=737**			**Yes N=51**		**No N=757**		
		N	%	N	%	**P-value**	N	%	N	%	**P-value**
Participants" History											
Ever had hay fever	Yes	40	48.8%	130	17.6%	.000*	25	49.0%	141	18.6%	.000*
	No	42	51.2%	607	82.4%		26	51.0%	616	81.4%	
Diagnosed Hay fever	Yes	26	32.5%	57	7.8%	.000*	19	37.3%	62	8.3%	.000*
	No	54	67.5%	672	92.2%		32	62.7%	687	91.7%	
Ever had eczema	Yes	34	41.5%	155	21.0%	.000*	23	45.1%	159	21.0%	.000*
	No	48	58.5%	582	79.0%		28	54.9%	598	79.0%	
Diagnosed Eczema	Yes	26	32.1%	102	13.9%	.000*	19	37.3%	104	13.8%	.000*
	No	55	67.9%	630	86.1%		32	62.7%	648	86.2%	
Family history											
Asthma	Yes	49	59.8%	149	20.2%	.000*	33	64.7%	161	21.3%	.000*
	No	33	40.2%	588	79.8%		18	35.3%	596	78.7%	
Rhinitis	Yes	43	52.4%	148	20.1%	.000*	29	56.9%	157	20.7%	.000*
	No	39	47.6%	589	79.9%		22	43.1%	600	79.3%	
Eczema	Yes	40	48.8%	255	34.6%	.011*	23	45.1%	265	35.0%	.145
	No	42	51.2%	482	65.4%		28	54.9%	492	65.0%	

*. The Chi-square statistic is significant at the .05 level.

5.3.3 Environmental factors association with asthma and asthma like symptoms

5.3.3a Cooking:

Table 5.10 shows that current wheezing and asthma severity showed a significant association with the following types of fuel used daily for cooking by household (Wood, Straw/shrubs/grass, Animal Dung, and agricultural crop residue) and with whether the food was cooked at home or not (p-value < 0.05). Also, asthma severity shows a significant association with a natural gas used as fuel for cooking, and the type of stove usually used for cooking, and the place of cooking (p-value < 0.05). However, only current wheezing shows a significant association with whether smoke is removed by the hood or chimney (p-value < 0.05).

Table 5.10: Association between current wheezing, asthma severity with type of fuel used for cooking

		Current wheezing				**Chi-square**	**Asthma severity**				**Chi-square**
		Yes N=172		**No N=647**			**Yes N=80**		**No N=739**		
		N	%	N	%	**P-value**	N	%	N	%	**P-value**
What type of fuel does your household use daily for cooking?											
Food cooked at home	Yes	23	13.4%	52	8.0%	.031*	16	20.0%	59	8.0%	.000*
	No	149	86.6%	595	92.0%		64	80.0%	680	92.0%	
Electricity	Yes	123	71.5%	449	69.4%	.591	54	67.5%	518	70.1%	.631
	No	49	28.5%	198	30.6%		26	32.5%	221	29.9%	
Natural gas	Yes	148	86.0%	560	86.6%	.863	62	77.5%	646	87.4%	.014*
	No	24	14.0%	87	13.4%		18	22.5%	93	12.6%	
Coal/lignite	Yes	15	8.7%	55	8.5%	.927	8	10.0%	62	8.4%	.625
	No	157	91.3%	592	91.5%		72	90.0%	677	91.6%	
Wood	Yes	31	18.0%	57	8.8%	.001*	19	23.8%	69	9.3%	.000*
	No	141	82.0%	590	91.2%		61	76.3%	670	90.7%	
Straw/shrubs/grass	Yes	15	8.7%	21	3.2%	.002*	7	8.8%	29	3.9%	.045*

	No	157	91.3%	626	96.8%		73	91.3%	710	96.1%	
Animal Dung	Yes	9	5.2%	13	2.0%	.020*	5	6.3%	17	2.3%	.038*
	No	163	94.8%	634	98.0%		75	93.8%	722	97.7%	
Agricultural crop residue	Yes	10	5.8%	17	2.6%	.038*	7	8.8%	20	2.7%	.004*
	No	162	94.2%	630	97.4%		73	91.3%	719	97.3%	
type of stove usually used for cooking	Griddle stove	11	6.4%	29	4.5%	.051	8	10.0%	32	4.3%	.000*
	Open fire	4	2.3%	5	0.8%		4	5.0%	5	0.7%	
	Two or three pot stoves	151	87.8%	586	90.6%		65	81.3%	672	90.9%	
	Sunken pot stove	2	1.2%	22	3.4%		1	1.3%	23	3.1%	
	Don't know	4	2.3%	5	0.8%		2	2.5%	7	0.9%	
Is smoke removed by hood or chimney?	neither	95	55.2%	334	51.6%	.001*	42	52.5%	387	52.4%	.083
	Hood	66	38.4%	303	46.8%		33	41.3%	336	45.5%	
	Chimney	11	6.4%	10	1.5%		5	6.3%	16	2.2%	

Table 5.10….. continues

When was chimney last cleaned?	Never	10	13.9%	35	15.0%	.571	5	13.2%	40	15.0%	.777
	More than 3 months ago	7	9.7%	11	4.7%		4	10.5%	14	5.2%	
	1-3 months ago	6	8.3%	18	7.7%		3	7.9%	21	7.9%	
	Less than 1 month ago	14	19.4%	41	17.6%		6	15.8%	49	18.4%	
	Don’t know	35	48.6%	128	54.9%		20	52.6%	143	53.6%	
Place of cooking	In a room used for living / sleeping	9	5.2%	14	2.2%	.145[b]	5	6.3%	18	2.4%	.050*
	In a separate room used as a kitchen	148	86.0%	587	90.7%		65	81.3%	670	90.7%	

	In a separate building used as a kitchen	13	7.6%	39	6.0%		9	11.3%	43	5.8%	
	Outdoors	2	1.2%	7	1.1%		1	1.3%	8	1.1%	
type of ventilation present where the stove is used	Closed room	9	5.2%	38	5.9%		5	6.3%	42	5.7%	
	Room with eaves spaces	8	4.7%	29	4.5%		4	5.0%	33	4.5%	
	Room with open windows / doors	141	82.0%	539	83.3%	.851	61	76.3%	619	83.8%	.172
	Room with 3 or fewer walls	14	8.1%	41	6.3%		10	12.5%	45	6.1%	

In **Table 5.11**, the results show that ever having asthma and diagnosed with asthma showed a significant association with wood as a type of fuel used daily for cooking by households and with the type of stove usually used for cooking (p-value < 0.05), but only diagnosed asthma showed a significant association with animal dung (p-value < 0.05). Also, only ever having asthma showed a significant association with the place of cooking and type of ventilation present where the stove is used (p-value < 0.05). Other factors in the table did not show any significant associations between ever having asthma symptoms or diagnosed asthma with cooking (p-value >0.05).

Table 5.11: Association between having ever asthma, diagnosed asthma with type of fuel used for cooking

		Asthma ever				Chi-square	Diagnosed asthma				Chi-square
		Yes N=82		No N=737			Yes N=51		No N=757		
		N	%	N	%	P-value	N	%	N	%	P-value
What type of fuel does your household use daily for cooking?											
Food cooked at home	Yes	8	9.8%	67	9.1%	.843	4	7.8%	70	9.2%	.737
	No	74	90.2%	670	90.9%		47	92.2%	687	90.8%	
Electricity	Yes	56	68.3%	516	70.0%	.747	34	66.7%	528	69.7%	.643
	No	26	31.7%	221	30.0%		17	33.3%	229	30.3%	
Natural gas	Yes	68	82.9%	640	86.8%	.326	45	88.2%	655	86.5%	.728
	No	14	17.1%	97	13.2%		6	11.8%	102	13.5%	
Coal/lignite	Yes	4	4.9%	66	9.0%	.210	3	5.9%	67	8.9%	.466
	No	78	95.1%	671	91.0%		48	94.1%	690	91.1%	
Wood	Yes	16	19.5%	72	9.8%	.007*	12	23.5%	76	10.0%	.003*
	No	66	80.5%	665	90.2%		39	76.5%	681	90.0%	
Straw/shrubs/grass	Yes	7	8.5%	29	3.9%	.054	5	9.8%	31	4.1%	.056
	No	75	91.5%	708	96.1%		46	90.2%	726	95.9%	
Animal Dung	Yes	4	4.9%	18	2.4%	.196	4	7.8%	18	2.4%	.020*
	No	78	95.1%	719	97.6%		47	92.2%	739	97.6%	
Agricultural crop residue	Yes	5	6.1%	22	3.0%	.134	3	5.9%	24	3.2%	.297
	No	77	93.9%	715	97.0%		48	94.1%	733	96.8%	
type of stove usually used for cooking	Griddle stove	4	4.9%	36	4.9%	.000*	2	3.9%	38	5.0%	.002*
	Open fire	3	3.7%	6	0.8%		3	5.9%	6	0.8%	
	Two or three pot stoves	66	80.5%	671	91.0%		41	80.4%	686	90.6%	
	Sunken pot stove	5	6.1%	19	2.6%		4	7.8%	20	2.6%	
	Don't know	4	4.9%	5	0.7%		1	2.0%	7	0.9%	

Table 5.11 continues……

		Asthma ever				Chi-square	Diagnosed asthma				Chi-square
		N	N%	N	N %	**P-value**	N	N%	N	N %	**P-value**
Is smoke removed by hood or chimney?	Neither	43	52.4%	386	52.4%	.997	32	62.7%	392	51.8%	.200
	Hood	37	45.1%	332	45.0%		19	37.3%	344	45.4%	
	Chimney	2	2.4%	19	2.6%		0	0.0%	21	2.8%	
When was chimney last cleaned?	Never	3	7.5%	42	15.8%	.518	2	8.7%	42	15.2%	.173
	More than 3 months ago	4	10.0%	14	5.3%		4	17.4%	14	5.1%	
	1-3 months ago	4	10.0%	20	7.5%		2	8.7%	21	7.6%	
	Less than 1 month ago	7	17.5%	48	18.1%		3	13.0%	51	18.4%	
	Don’t know	22	55.0%	141	53.2%		12	52.2%	149	53.8%	
Place of cooking	In a room used for living / sleeping	8	9.8%	15	2.0%	.000*	3	5.9%	19	2.5%	.462
	In a separate room used as a kitchen	66	80.5%	669	90.8%		45	88.2%	681	90.0%	
	In a separate building used as a kitchen	6	7.3%	46	6.2%		3	5.9%	49	6.5%	
	Outdoors	2	2.4%	7	0.9%		0	0.0%	8	1.1%	
type of ventilation	Closed room	7	8.5%	40	5.4%	.040*	3	5.9%	42	5.5%	.649
	Room with eaves spaces	7	8.5%	30	4.1%		4	7.8%	32	4.2%	

present where the stove is used	Room with open windows / doors	59	72.0%	621	84.3%		40	78.4%	632	83.5%	
	Room with 3 or fewer walls	9	11.0%	46	6.2%		4	7.8%	51	6.7%	

5.3.3b Heating:

Table 5.12 shows that current wheezing and asthma severity showed a significant association with the following types of fuel mainly used for heating: (Biogas, Wood, Straw/shrubs/grass, and Agricultural crop residue) (p-value < 0.05). Only asthma severity showed a significant association with charcoal used for heating (p-value 0.026). Also, only current wheezing showed a significant difference by using animal dung for heating (p-value 0.008). Other factors in the table did not show any significant associations between having current wheezing or asthma severity with heating (p-value >0.05).

Table 5.12: Association between having current wheezing and asthma severity with heating

		Current wheezing				**Chi-square**	**Asthma severity**				**Chi-square**
		Yes N=172		**No N=647**			**Yes N=80**		**No N=739**		
		N	%	N	%	**p-value**	N	%	N	%	**p-value**
Heating house when it is cold	Yes	165	95.9%	615	95.1%	.632	77	96.3%	703	95.1%	.655
	No	7	4.1%	32	4.9%		3	3.8%	36	4.9%	
Type of fuel mainly use for heating:											
Electricity	Yes	140	81.4%	531	82.1%	.838	64	80.0%	607	82.1%	.637
	No	32	18.6%	116	17.9%		16	20.0%	132	17.9%	
Natural gas	Yes	52	30.2%	221	34.2%	.332	27	33.8%	246	33.3%	.934
	No	120	69.8%	426	65.8%		53	66.3%	493	66.7%	
Biogas	Yes	10	5.8%	14	2.2%	**.012***	7	8.8%	17	2.3%	**.001***

	No	162	94.2%	633	97.8%		73	91.3%	722	97.7%	
Kerosene	Yes	7	4.1%	15	2.3%	.207	4	5.0%	18	2.4%	.178[a]
	No	165	95.9%	632	97.7%		76	95.0%	721	97.6%	
Charcoal	Yes	6	3.5%	9	1.4%	.068	4	5.0%	11	1.5%	**.026***
	No	166	96.5%	638	98.6%		76	95.0%	728	98.5%	
Liquefied petroleum gas	Yes	9	5.2%	36	5.6%	.865	2	2.5%	43	5.8%	.216
	No	163	94.8%	611	94.4%		78	97.5%	696	94.2%	
Coal/lignite	Yes	8	4.7%	17	2.6%	.170	4	5.0%	21	2.8%	.286
	No	164	95.3%	630	97.4%		76	95.0%	718	97.2%	
Wood	Yes	46	26.7%	111	17.2%	**.005***	23	28.7%	134	18.1%	**.022***
	No	126	73.3%	536	82.8%		57	71.3%	605	81.9%	
Straw/shrubs/grass	Yes	16	9.3%	28	4.3%	**.010***	9	11.3%	35	4.7%	**.014***
	No	156	90.7%	619	95.7%		71	88.8%	704	95.3%	
Animal Dung	Yes	8	4.7%	9	1.4%	**.008***	3	3.8%	14	1.9%	.269
	No	164	95.3%	638	98.6%		77	96.3%	725	98.1%	
Agricultural crop residue	Yes	13	7.6%	11	1.7%	**.000***	8	10.0%	16	2.2%	**.000***
	No	159	92.4%	636	98.3%		72	90.0%	723	97.8%	
type of stove usually used for heating	Electric Fireplace	94	63.1%	370	67.9%	.351	43	58.9%	421	67.8%	.349
	Gas fireplace	28	18.8%	101	18.5%		15	20.5%	114	18.4%	
	Heating by fire	26	17.4%	69	12.7%		15	20.5%	80	12.9%	
	all	1	0.7%	1	0.2%		0	0.0%	2	0.3%	
	both electric and gas	0	0.0%	4	0.7%		0	0.0%	4	0.6%	

Table 5.13 shows that both ever having asthma and being diagnosed with asthma showed a significant association with the agricultural crop residue (p-value < 0.05). Asthma ever also showed a significant association with both Kerosene and Charcoal but not with other factors in the table. Also, diagnosed asthma showed a significant association with Straw/shrubs/grass (p-value < 0.05) but not with other factors.

Table 5.13: Association between having ever asthma and diagnosed asthma with heating

		Asthma ever				Chi-square	Diagnosed asthma				Chi-square
		Yes N=82		No N=737			Yes N=51		No N=757		
		N	%	N	%	p-value	N	%	N	%	p-value
Heating house when it is cold	Yes	80	97.6%	700	95.0%	.298	50	98.0%	719	95.0%	.324
	No	2	2.4%	37	5.0%		1	2.0%	38	5.0%	
Type of fuel mainly use for heating:											
Electricity	Yes	72	87.8%	599	81.3%	.145	43	84.3%	617	81.5%	.616
	No	10	12.2%	138	18.7%		8	15.7%	140	18.5%	
Natural gas	Yes	26	31.7%	247	33.5%	.742	17	33.3%	253	33.4%	.990
	No	56	68.3%	490	66.5%		34	66.7%	504	66.6%	
Biogas	Yes	3	3.7%	21	2.8%	.680	2	3.9%	22	2.9%	.679
	No	79	96.3%	716	97.2%		49	96.1%	735	97.1%	
Kerosene	Yes	5	6.1%	17	2.3%	**.044***	3	5.9%	18	2.4%	.128
	No	77	93.9%	720	97.7%		48	94.1%	739	97.6%	
Charcoal	Yes	5	6.1%	10	1.4%	**.002***	2	3.9%	13	1.7%	.259
	No	77	93.9%	727	98.6%		49	96.1%	744	98.3%	
Liquefied petroleum gas	Yes	3	3.7%	42	5.7%	.442	3	5.9%	42	5.5%	.920
	No	79	96.3%	695	94.3%		48	94.1%	715	94.5%	
Coal/lignite	Yes	1	1.2%	24	3.3%	.309	1	2.0%	24	3.2%	.629
	No	81	98.8%	713	96.7%		50	98.0%	733	96.8%	
Wood	Yes	19	23.2%	138	18.7%	.332	15	29.4%	142	18.8%	.063
	No	63	76.8%	599	81.3%		36	70.6%	615	81.2%	
Straw/shrubs/grass	Yes	8	9.8%	36	4.9%	.063	6	11.8%	38	5.0%	**.040***
	No	74	90.2%	701	95.1%		45	88.2%	719	95.0%	
Animal Dung	Yes	3	3.7%	14	1.9%	.289	1	2.0%	16	2.1%	.941
	No	79	96.3%	723	98.1%		50	98.0%	741	97.9%	
Agricultural crop residue	Yes	7	8.5%	17	2.3%	**.002***	6	11.8%	18	2.4%	**.000***
	No	75	91.5%	720	97.7%		45	88.2%	739	97.6%	
type of stove usually used for heating	Electric Fireplace	45	60.8%	419	67.6%	.285	25	53.2%	433	67.8%	.214
	Gas fireplace	13	17.6%	116	18.7%		11	23.4%	116	18.2%	
	Heating by fire	16	21.6%	79	12.7%		11	23.4%	84	13.1%	
	all	0	0.0%	2	0.3%		0	0.0%	2	0.3%	
	both electric and gas	0	0.0%	4	0.6%		0	0.0%	4	0.6%	

5.3.4 Lifestyle factors association with asthma and asthma like symptoms

5.3.4a Smoking:

Table 5.14 shows that current wheezing and asthma severity showed a significant difference by ever having tobacco smoking, current tobacco smoking, and electronic cigarette smoking (p-value < 0.05). Only current wheezing shows a significant association with a water pipe (narghile) smoking at the place of residence smoking (p-value < 0.05).

Table 5.14: Association between current wheezing and severity of asthma symptoms with smoking

		Current wheezing				**Chi-square**	**Asthma severity**				**Chi-square**
		Yes N=172		**No N=647**			**Yes N=80**		**No N=739**		
		N	%	N	%	**p-value**	N	%	N	%	**p-value**
Ever tobacco smoking	Not at all	141	82.0%	587	90.7%	**.001***	665	90.0%	63	78.8%	**.005***
	Less than daily	9	5.2%	27	4.2%		31	4.2%	5	6.3%	
	Daily	22	12.8%	33	5.1%		43	5.8%	12	15.0%	
Current tobacco smoking	Not at all	149	86.6%	605	93.5%	**.011***	687	93.0%	67	83.8%	**.007***
	Less than daily	7	4.1%	15	2.3%		19	2.6%	3	3.8%	
	Daily	16	9.3%	27	4.2%		33	4.5%	10	12.5%	
water pipe (narghile) smoking at Place of residence	Yes	35	20.3%	89	13.8%	**.032***	108	14.6%	16	20.0%	.202
	No	137	79.7%	558	86.2%		631	85.4%	64	80.0%	
electronic cigarette smoking	Yes	31	18.0%	49	7.6%	**.000***	63	8.5%	17	21.3%	**.000***
	No	141	82.0%	598	92.4%		676	91.5%	63	78.8%	

*. The Chi-square statistic is significant at the .05 level.

In **Table 5.15**, the results show that ever having asthma and being diagnosed with asthma showed a significant association with current tobacco smoking and also with electronic cigarette smoking (p-value < 0.05). Other factors in the table did not show any significant associations between ever having asthma symptoms or being diagnosed with asthma with smoking by participants (p-value >0.05).

Table 5.15: Association between ever having asthma and diagnosed asthma with smoking

		Asthma ever				**Chi-square**	**Diagnosed asthma**				**Chi-square**
		Yes N=82		**No N=737**			**Yes N=51**		**No N=757**		
		N	%	N	%	**p-value**	N	%	N	%	**p-value**
Ever tobacco smoking	Not at all	68	82.9%	660	89.6%	.180	43	84.3%	677	89.4%	.425
	Less than daily	5	6.1%	31	4.2%		4	7.8%	32	4.2%	
	Daily	9	11.0%	46	6.2%		4	7.8%	48	6.3%	
Current tobacco smoking	Not at all	70	85.4%	684	92.8%	**.002***	44	86.3%	702	92.7%	**.002***
	Less than daily	7	8.5%	15	2.0%		5	9.8%	15	2.0%	
	Daily	5	6.1%	38	5.2%		2	3.9%	40	5.3%	
water pipe (narghile) smoking at Place of residence	Yes	15	18.3%	109	14.8%	.401	10	19.6%	113	14.9%	.368
	No	67	81.7%	628	85.2%		41	80.4%	644	85.1%	
electronic cigarette smoking	Yes	16	19.5%	64	8.7%	**.002***	11	21.6%	68	9.0%	**.003***
	No	66	80.5%	673	91.3%		40	78.4%	689	91.0%	

*. The Chi-square statistic is significant at the .05 level

5.3.4b Diet groups:

As seen in **Table 5.16**; only current wheezing and asthma severity showed an association with consumption of seafood (including fish) per week (p-value < 0.05). Other kinds of diet groups did not show any significant associations (p-value >0.05).

Table 5.16: Association between current wheezing and asthma severity with diet groups

		Current wheezing				Chi-square	Asthma severity				Chi-square
		Yes N=172		No N=647			Yes N=80		No N=739		
		N	%	N	%	p-value	N	%	N	%	p-value
Consumption of meat and eggs per week	Never or Once or twice per week	64	37.2%	254	39.3%	.624	31	38.8%	287	38.8%	.988
	Most or all days	108	62.8%	393	60.7%		49	61.3%	452	61.2%	
Consumption of seafood (including fish) per week	Never or only occasionally	84	48.8%	389	60.1%	**.008***	37	46.3%	436	59.0%	**.028***
	Once or twice or all days per week	88	51.2%	258	39.9%		43	53.8%	303	41.0%	
Consumption of fruits, vegetables and pulses per week	Most or all days	127	73.8%	476	73.6%	.944	58	72.5%	545	73.7%	.810
	Never or Once or twice per week	45	26.2%	171	26.4%		22	27.5%	194	26.3%	
Consumption of starchy products (cereal, bread, pasta, rice, and potatoes) per week	Most or all days	157	91.3%	566	87.5%	.169	70	87.5%	653	88.4%	.820
	Never or Once or twice per week	15	8.7%	81	12.5%		10	12.5%	86	11.6%	
Consumption of fatty products (butter, margarine, olive oil, and nuts)	Most or all days	123	71.5%	436	67.4%	.302	54	67.5%	505	68.3%	.879
	Never or Once or twice per week	49	28.5%	211	32.6%		26	32.5%	234	31.7%	
Consumption of dairy (milk, yogurt and cheese) per week	Most or all days	106	61.6%	356	55.0%	.121	47	58.8%	415	56.2%	.657
	Never or Once or twice per week	66	38.4%	291	45.0%		33	41.3%	324	43.8%	
Low consumption of unhealthy foods (fast-food, sweets and soft drinks) per week	Never or Once or twice per week	62	36.0%	287	44.4%	.050	29	36.3%	320	43.3%	.226
	Most or all days	110	64.0%	360	55.6%		51	63.7%	419	56.7%	

In **Table 5.17**; only diagnosed asthma in the table shows a significant association with low consumption of unhealthy food (fast-food, sweets and soft drinks) per week (p-value, 0.022). Other kinds of diet groups did not show any significant associations (p-value >0.05).

Table 5.17: Association between having ever asthma and diagnosed asthma with diet groups

		Asthma ever				Chi-square	Diagnosed asthma				Chi-square
		Yes N=82		No N=737			Yes N=51		No N=757		
		N	%	N	%	p-value	N	%	N	%	p-value
Consumption of meat and eggs per week	Never or Once or twice per week	24	29.3%	294	39.9%	.061	14	27.5%	301	39.8%	.081
	Most or all days	58	70.7%	443	60.1%		37	72.5%	456	60.2%	
Consumption of seafood (including fish) per week	Never or only occasionally	46	56.1%	427	57.9%	.749	28	54.9%	438	57.9%	.679
	Once or twice or all days per week	36	43.9%	310	42.1%		23	45.1%	319	42.1%	
Consumption of fruits, vegetables and pulses per week	Most or all days	59	72.0%	544	73.8%	.717	35	68.6%	558	73.7%	.426
	Never or Once or twice per week	23	28.0%	193	26.2%		16	31.4%	199	26.3%	
Consumption of starchy products (cereal, bread, pasta, rice, and potatoes) per week	Most or all days	76	92.7%	647	87.8%	.191	49	96.1%	664	87.7%	.073
	Never or Once or twice per week	6	7.3%	90	12.2%		2	3.9%	93	12.3%	
Consumption of fatty products (butter, margarine, olive oil, and nuts)	Most or all days	56	68.3%	503	68.2%	.994	39	76.5%	513	67.8%	.196
	Never or Once or twice per week	26	31.7%	234	31.8%		12	23.5%	244	32.2%	
	Most or all days	50	61.0%	412	55.9%	.379	33	64.7%	424	56.0%	.225

Consumption of dairy (milk, yogurt and cheese) per week	Never or Once or twice per week	32	39.0%	325	44.1%		18	35.3%	333	44.0%	
Low consumption of unhealthy foods (fast-food, sweets and soft drinks) per week	Never or Once or twice per week	27	32.9%	322	43.7%	.062	14	27.5%	332	43.9%	**.022***
	Most or all days	55	67.1%	415	56.3%		37	72.5%	425	56.1%	

5.4 Binary logistic regression analysis

In this section of analysis four models were developed, in which only significant risk factors yielded from bivariate results were included.

According to the data in **Table 5.18**, individuals with a history of hay fever are at a significantly higher risk of experiencing current wheezing, with a 2.19-fold increase compared to those without such a history. Furthermore, individuals with a family history of asthma or rhinitis are also at a significantly higher risk of current wheezing, with increases of 2.9 and 1.9 times respectively, compared to those without such a family history. Cooking with wood is associated with a 1.9-fold increase in the risk of current wheezing. In addition, removing smoke from cooking via a chimney is associated with a significant increase in current wheezing risk (4.5-fold). However, consumption of seafood including fish (once or twice or all days) per week is associated with a significant increase in current wheezing by (1.7-fold) compared with low consumption (never or only occasionally) per week. Also, individuals who ever smoke tobacco daily are at a significantly 2.9-fold increased risk of current wheezing compared to those who have never smoked. Finally, the results showed a significant relationship between the academic year of students and current wheezing. Interestingly, being in the fourth or fifth year of academic study showed an inverse association with developing current wheezing.

Table 5.18: Binary logistic regression model for factors that determine current wheezing

Variable	Sig.	AOR	95% CI	
			Lower	Upper
Academic year	.042			
First	-	Reference		
Second	.182	.702	.418	1.180
Third	.273	.727	.411	1.286
Forth	.023	.484	.259	.905
Fifth	.005	.305	.133	.699
Sixth	.076	.346	.107	1.117
Ever had hay fever (Yes/No)	.002	2.196	1.336	3.609
Family history of Asthma (Yes/No)	.000	2.937	1.962	4.397
Family history of Rhinitis (Yes/No)	.008	1.935	1.189	3.151
cooking by Wood (Yes/No)	.014	1.934	1.140	3.279
Is smoke removed by hood or chimney?	.003			
Neither	-	Reference		
Hood	.169	.761	.515	1.123
Chimney	.004	4.518	1.612	12.666
consumption of seafood (including fish) per week (Once or twice or all days per week)	.006	1.716	1.171	2.516
Never or only occasionally	-	Reference		
Ever tobacco smoking:	.004			
Not at all	-	Reference		
Less than daily	.479	1.373	.572	3.298
Daily	.001	2.947	1.540	5.641
Constant	.000	.136		

Control for: FACULTY, Academic year, AGE , Sex of the respondent, Marital status, Place of residence, Body Mass Index, Ever had hay fever, hay fever confirmed by a doctor, ever had eczema, eczema confirmed by a doctor, Family history of Asthma, Family history of Rhinitis, Family history of Eczema, No food cooked at home, cooking by Wood, cooking by Straw/shrubs/grass, cooking by Animal Dung, cooking by Agricultural crop residue, Is smoke removed by hood or chimney?, Heating by Biogas, Heating by Wood, Heating by Straw/shrubs/grass, Heating by Animal Dung, Heating by Agricultural crop residue, consumption of seafood (including fish) per week, Ever tobacco smoking, Current tobacco smoking , water pipe (narghile) smoking at Place of residence, electronic cigarette smoking.

As seen in **Table 5.19**: individuals with a history of hay fever are at a significantly higher risk of experiencing a severity of asthma symptoms, with a 2.2-fold increase compared to those without such a history. Furthermore, individuals with a family history of asthma or rhinitis are also at a significantly higher risk of getting severe asthma symptoms, with increases of 3.9 and 2.4 times respectively, compared to those without such a family history. Cooking with natural gas was associated with decreased the risk of having asthma severity by 2.7 times, whereas cooking with wood is associated with a 2.6-fold increase in the risk of severe asthma symptoms. However, consumption of seafood including fish (once or twice or all days) per week is associated with a significant increase in the severity of asthma symptoms by (1.6-fold) compared with low consumption (never or only occasionally) per week. Finally, individuals who ever smoke tobacco daily are at a significantly 3.17-fold increased risk of severe asthma symptoms compared to those who have never smoked.

Table 5.19: Binary logistic regression model for factors that determine asthma severity

Variables	Sig.	AOR	95/% CI	
			Lower	Upper
Ever had hay fever (Yes/No)	.015	2.204	1.167	4.161
Family history of Asthma (Yes/No)	.000	3.929	2.303	6.703
Family history of Rhinitis (Yes/No)	.005	2.479	1.323	4.646
cooking by Natural gas (Yes/No)	.003	.370	.190	.720
cooking by Wood (Yes/No)	.004	2.604	1.360	4.987
consumption of seafood (including fish) per week (Once or twice or all days per week)	.046	1.695	1.008	2.850
Never or only occasionally	-	Reference		
Ever tobacco smoking:	.016			
Not at all	-	Reference		
Less than daily	.610	1.336	.438	4.077
Daily	.004	3.172	1.442	6.978
Constant	.000	.050		

Control for: FACULTY, Academic year, AGE , Sex of the respondent, Marital status, Place of residence, Body Mass Index, Ever had hay fever, hay fever confirmed by a doctor, ever had eczema, eczema confirmed by a doctor, Family history of Asthma, Family history of Rhinitis, Family history of Eczema, No food cooked at home, cooking by Natural gas, cooking by Wood, cooking by Straw/shrubs/grass, cooking by

Animal Dung, cooking by Agricultural crop residue, type of stove usually used for cooking, Place of cooking , Heating by Biogas, Heating by Charcoal, Heating by Wood, Heating by Straw/shrubs/grass, Heating by Agricultural crop residue, consumption of seafood (including fish) per week, Ever tobacco smoking, Current tobacco smoking , electronic cigarette smoking.

Table 5.20 presents that individuals with confirmed history of hay fever had a 3.11-fold increase in the risk of asthma, while those with a history of eczema had a 1.9-fold increase. Those with a family history of asthma or rhinitis were at an elevated risk of developing asthma with increases of 4.31 and 2.11 times, respectively. The study reveals no significant association with type of stoves used for cooking and the risk of asthma ever.

Table 5.20: Binary logistic regression model for factors that determine asthma ever

Variables	Category	Sig.	AOR	95% CI	
				Lower	Upper
hay fever confirmed by a doctor	(Yes/No)	.001	3.114	1.600	6.063
ever had eczema	(Yes/No)	.021	1.906	1.104	3.291
Family history of Asthma	(Yes/No)	.000	4.314	2.541	7.323
Family history of Rhinitis	(Yes/No)	.011	2.119	1.190	3.776
type of stove usually used for cooking:		.004			
	Open fire	-	Reference		
	Griddle stove	.873	.844	.106	6.754
	Two or three pot stoves	.389	.464	.081	2.665
	Sunken pot stove	.636	1.638	.212	12.640
	Don't know	.135	5.981	.574	62.345
Constant		.002	.060		

Control for: FACULTY, Academic year, AGE , Sex of the respondent, Marital status, Place of residence, Body Mass Index, Ever had hay fever, hay fever confirmed by a doctor, ever had eczema, eczema confirmed by a doctor, Family history of Asthma, Family history of Rhinitis, Family history of Eczema, cooking by Wood, type of stove usually used for cooking, Place of cooking , type of ventilation present where the stove is used, Heating by Kerosene, Heating by Charcoal, Heating by Agricultural crop residue, Current tobacco smoking , electronic cigarette smoking

Table 5.21 presents that individuals with a confirmed history of hay fever by a doctor had a 4.18-fold increase in the risk of diagnosed asthma. Similarly, those with confirmed eczema have a 2.52-fold increase in risk. Additionally, those with a family history of asthma were at an elevated risk of developing diagnosed asthma with increases of 5.15 times. Furthermore, heating the house with agricultural crop residue increased the risk of having a diagnosed asthma by 3.65 times. However, the low consumption of unhealthy foods such as fast food, sweets, and soft drinks up to twice per week was found to be associated with a considerable decrease in asthma risk, with a 2.3-fold reduction.

Table 5.21: Binary logistic regression model for factors that determine diagnosed asthma

Variable	Sig.	AOR	95% CI	
			Lower	Upper
hay fever confirmed by a doctor (Yes/No)	.000	4.185	2.094	8.362
eczema confirmed by a doctor (Yes/No)	.007	2.528	1.286	4.971
Family history of Asthma (Yes/No)	.000	5.152	2.728	9.728
Heating by Agricultural crop residue (Yes/No)	.030	3.653	1.132	11.782
Low consumption of unhealthy foods (fast-food, sweets and soft drinks) per week (Up to twice)	.015	.421	.210	.843
Most or all days	-	Reference		
Constant	.000	.026		

Control for FACULTY, Academic year, AGE , Sex of the respondent, Marital status, Place of residence, Body Mass Index, Ever had hay fever, hay fever confirmed by a doctor, ever had eczema, eczema confirmed by a doctor, Family history of Asthma, Family history of Rhinitis, cooking by Wood, cooking by Animal Dung, type of stove usually used for cooking, Heating by Straw/shrubs/grass, Heating by Agricultural crop residue, Low consumption of unhealthy foods (fast-food, sweets and soft drinks) per week, Current tobacco smoking , electronic cigarette smoking.

Chapter six: Discussion, conclusion and recommendations

6.1 Introduction and results summary

Our study was a cross-sectional study conducted mainly at Al-Quds University, specifically in the health campus complex. 819 students were included, to study the prevalence and determinants of asthma and asthma like symptoms, including its association with lifestyles and environmental exposure of the study sample.

Students had a mean age of 20-years old mainly in their second academic year. Most from the faculty of health professions and the faculty of medicine. The vast majority (78.1%) of the study sample were females(*Al-Quds at a Glance,* 2022).

Among the student population in our study, the current prevalence of wheezing stands at 21%, and 9.8% of participants experienced severe episodes of wheezing in the past 12 months. The prevalence of asthma ever was 10%. Also, 6.3% reported that medical doctors confirmed their asthma. 17% of participants urgently visited a doctor and 6% went to an emergency department for breathing problems. Only 5% were admitted to the hospital due to breathing problems. 22.7% reported limited usual activity in the past 12 months, while 6.3% had jobs causing wheezing, and 9.9% left jobs due to breathing issues.

In the multivariate regression analysis, current wheezing and severity of asthma were associated with a history of hay fever, asthma, and rhinitis. Also, cooking with wood, ever-smoking tobacco, and consumption of seafood including fish (Once or twice or all days per week) were significantly associated with an increased risk for current wheezing and asthma severity. However, cooking with natural gas was associated with a decreased risk of having asthma severity.

Ever having asthma, individuals with a confirmed history of hay fever had a 3.11-fold increase in the risk of asthma, while those with a history of eczema had a 1.9-fold increase. Those with a family history of asthma or rhinitis were at an elevated risk of developing asthma. Individuals with a confirmed history of hay fever or eczema by a doctor had a significantly increased risk of being diagnosed with asthma. Also, diagnosed asthma was significantly associated with a family history of asthma. Furthermore, heating the house with agricultural crop residue increased the risk of having a diagnosed asthma by 3.65 times. However, the low consumption of unhealthy foods such

as fast food, sweets, and soft drinks up to twice per week was significantly associated with a considerable decrease in asthma risk.

6.2 Prevalence of asthma and asthma-like symptoms:

Among the student population in our study, the current prevalence of wheezing stands at 21%, which is comparable to the rates observed in Middle Eastern countries among adults where the prevalence is 18.2% (Tarraf et al., 2018), and close to the USA's prevalence which is 16.4% (Arif et al., 2003). However, this rate is significantly higher than the global prevalence rate of 8.6% (To et al., 2012a).

According to our study, individuals who reported experiencing a current wheeze and frequent, severe episodes of wheezing in the past 12 months (with more than 4 wheeze attacks or more than one night of sleep disruption per week due to wheeze or wheeze impacting speech) were classified as having severe asthma symptoms. Our findings revealed that 9.8% of participants were affected by these symptoms, consistent with a similar study in western Sweden that reported a prevalence of 9.5% when considering different definitions of asthma severity as uncontrolled asthma (Rönnebjerg et al., 2021) . However, our results were higher than the global prevalence of 2.6% (Mortimer et al., 2022)and the prevalence in India of 1.16% (Singh et al., 2022), but lower than the prevalence in Saudi Arabia among adults with the same severity definition (Alomary et al., 2022).

The prevalence of asthma among students was found to be 6.3%. Similarly, adults in the northern grasslands of China were found to have a 6.5% prevalence rate of asthma (Wang et al., 2021), also the rate of asthma among Lebanese adults was 6.7% (Akiki et al., 2021), Egypt 6.7% and in the Gulf cluster (UAE, Saudi Arabia, Kuwait) 7.6% (Tarraf et al., 2018). In contrast, Jordan displayed a range of 8.8-9.5% prevalence (Abu-Ekteish et al., 2009), and university students in Saudi Arabia had an asthma prevalence of 12.8% (Almonawara, 2021), while Kuwait had an 11.9% (Ziyab, 2017).

6.3 Demographic factors and risk of asthma and asthma like symptoms:

Our study findings indicate that there is no significant association between sex and asthma or asthma-like symptoms. However, it is important to note that previous studies have reported a relationship between sex and the prevalence of asthma, as seen in Iran (Mansouri et al., 2020). The male sex is significantly associated with asthma in Finland (Toppila-Salmi et al., 2021), while the female sex is significantly associated with asthma in the USA (Arif et al., 2003).One of the demographic factors that may impact the risk of asthma and asthma-like symptoms is age. In our study, we did not find a correlation between the participant's age and asthma or asthma-like symptoms. According to a study, older age is found to be a significant baseline risk factor for severe asthma in adults (Toppila-Salmi et al., 2021). However, another study suggests that asthma is more common in children than in adults, but some people may develop asthma later in life, which is known as adult-onset asthma (Dharmage et al., 2019).

Our findings showed a significant relationship between the academic year of students and current wheezing, but not with other asthma-like symptoms. Interestingly, being in the fourth or fifth year of academic study showed an inverse association with developing current wheezing. Based on previous study results, it seems that the academic year may not be directly related to the risk of asthma and asthma-like symptoms among university students, but rather other factors such as personal and family history, lifestyle, environmental exposure, and comorbidities may play a more important role (Almonawara, 2021; Hossein et al., 2007; Mansouri et al., 2020). However, more research is needed to confirm this hypothesis and to explore the possible interactions between these factors and the academic environment.

6.4 Atopy, family history of atopy and risk of having asthma and asthma-like symptoms:

Research has shown that individuals with a family history of atopy diseases, such as asthma, allergic rhinitis, and eczema, have a greater likelihood of developing asthma among adults (Alavinezhad & Boskabady, 2018; Davoodi P et al., 2015). Our study confirms this, revealing a significant association between a family history of asthma and an increased risk of asthma-like symptoms, with high adjusted odds ratios (AOR) for current wheezing (AOR=2.9), severe asthma symptoms (AOR=3.9), asthma ever (AOR=4.3), and diagnosed asthma (AOR=5.1). There is also an increased risk due to family history (genetic) nearby four-fold (OR = 3.7, CI (2.071-6.619) in a

study conducted in Gaza strip in Palestine (Matar, 2018). Similar findings were observed in Iran (OR = 2.88; 95% CI: 2.23–3.71) (Idani et al., 2020), and in Finland (Pallasaho et al., 2011), also among young adults at Saudi Arabia (Alqahtani, 2020).

Similar to a family history of allergic diseases, which was revealed in our study to increase the risk of asthma and asthma like symptoms with similar results to those reported in previous research (Polosa et al., 2005).

Having a history of hay fever increases the likelihood of developing asthma (Pallasaho et al., 2011; Tohidinik et al., 2019). Our research indicates that individuals who have hay fever are particularly at risk of experiencing current wheezing (AOR 2.19, 95% CI 1.336-3.609) or severe asthma symptoms (AOR 2.20). Furthermore, those who have been diagnosed with hay fever by a doctor have significantly higher odds of developing asthma ever (AOR 3.11, 95% CI 1.600-6.063) or being diagnosed with asthma (AOR 4.185, 95% CI 2.094-8.362). These findings were consistent across multiple countries, including Finland (OR 2.15, 95% CI 1.54-3.02) (Pallasaho et al., 2011), Spain (RR = 4.05, 95% CI 1.7–9.6) (Segura-Navas et al., 2018), and Italy (OR, 7.8; 95%CI, 3.1–20.0) (Polosa et al., 2005). In addition to a study conducted is Saudi Arabia that revealed a high prevalence of nasal allergies was associated with asthma symptom (Al Ghobain et al., 2018).

Also, our research revealed that individuals with a history of eczema and those diagnosed with eczema were at an increased risk for asthma ever and diagnosed asthma, but not with current wheezing and asthma severity. This finding is consistent with existing studies conducted in the United States (Silverberg & Hanifin, 2013), Spain (Arnedo-Pena et al., 2020), and other studies (Saunes et al., 2012).

6.5 Environmental exposure and risk of having asthma and asthma like symptoms:

Research indicates that exposure to household fuels for cooking and heating may be linked to allergies and asthma related to the airways (Abebe et al., 2021; Chatkin et al., 2022). In our study, we found that the use of solid fuels like wood and agricultural residues was associated with the development of asthma and similar symptoms. Specifically, cooking with wood increased the risk of experiencing current wheezing and severe asthma symptoms by 1.93 and 2.6 times, respectively but not with other asthma symptoms, compared to those who do not use wood for cooking. Similar

results have been observed in other countries, including Ethiopia (Abebe et al., 2021), Turkey (Uzun et al., 2003), Nigeria (Oluwole et al., 2017), and Saudi Arabia (Alqahtani et al., 2017) with consideration of some variation of asthma definitions. There is an assumption that smoke emanating from the combustion of biomass fuels of wood contains toxic pollutants called oxidants, including particulate matter. Exposure to this particulate matter can irritate the airways and exacerbate symptoms. Epigenetic alterations in the respiratory tract microbiota, oxidative stress, and immunological dysregulation are potential pathways through which pollutants impact health (Chatkin et al., 2022; Holm et al., 2018; Stern et al., 2020). However, a study conducted in Peru has revealed a lack of correlation between exposure to biomass fuel smoke and asthma (Gaviola et al., 2016). Another study conducted in USA reveled that no significant influence of indoor air pollution resulting from the use of home heating or cooking appliances on asthma and wheezing (Arif et al., 2003). Disparities between studies may be attributed to differences in factors such as cooking area, ventilation systems, and intensity of biomass fuel smoke exposure.

Minimizing exposure to cooking smoke and utilizing source ventilation methods such as hoods has been linked to a decrease in the prevalence of asthma (Kile et al., 2014). Our findings indicate that even though removing smoke through a hood may exhibit protective properties in terms of current wheezing, it was not statistically significant. This differs from a study conducted in the USA, which demonstrated a significant reduction in current wheezing when smoke was eliminated through a hood (Kile et al., 2014). On the other hand, our results showed that removing cooking smoke through a chimney was found to be a risk factor for current wheezing but didn't show any association with other asthma like symptoms. Chimneys are used to remove stale, oily air from the kitchen, but they are not a guaranteed solution to prevent breathing disorders. Chimneys come with different types of filters installed inside to collect the oil and smoke particles. The air is then released from your home via the chimney. If the chimney is not cleaned regularly, it can accumulate soot and creosote, which can cause respiratory infections due to soot inhalation (Clinic, 2023).

Cooking with natural gas was associated with decreased the risk of having asthma severity by 2.7 times as shown in our results. Other studies have shown that gas cooking increases the risk of asthma and asthma-like symptoms and revealed that living in homes with elevated nitrogen dioxide (NO2) concentrations from cooking with gas stoves might cause greater asthma symptoms

and may report increased usage of asthma rescue drugs (Sood A & Doo K, 2018). The variability in results may be explained by there was no obvious effect of gas stove use on pulmonary function or respiratory symptoms. According to the (NHANS) study (Eisner, 2003). Moreover, an epidemiological study concluded there is insufficient evidence linking gas cooking and indoor NO2 to asthma and wheezing (Li et al., 2023).

Also, exposure to agricultural crop residue burning through heating by agricultural crop residue was shown a risk factor for diagnosed asthma but not with other asthma-like symptoms. This has been demonstrated in various countries, including Brazil (Cançado et al., 2006) and Thailand (Uttajug et al., 2020). The burning of crop residue releases particulate matter and other pollutants into the air, which can lead to inflammation and damage to the respiratory system. People who live near agricultural areas are at a higher risk of developing asthma and other respiratory diseases (Van Horne et al., 2022).

6.6 lifestyle exposure and risk of having asthma and asthma like symptoms:

Diet:

Several studies suggest that consuming fish and seafood, which are rich in anti-inflammatory omega-3 fatty acids, may help prevent asthma and asthma-like symptoms (Stratakis et al., 2017). However, our research shows an association between seafood consumption and increased risk of current wheezing and asthma severity, specifically when consumed once or twice daily, but not show an association with other asthma-like symptoms. Previous studies have found that fish and fish oil intake during pregnancy and childhood may prevent asthma in children, but there is no significant association among adults (Gunaratne et al., 2015; Stratakis et al., 2017). A recent study in middle east countries suggests that fish consumption may help prevent asthma in adults (Tarraf et al., 2018). However, the variation of the effect of seafood consumption on asthma among adults depends on various factors like the type, amount, and frequency of seafood intake, genetic and environmental susceptibility to asthma, and exposure to other dietary or lifestyle factors. asthma prevention, but no significant association was found in studies among adults23. On the other hand, some people may have allergic reactions to seafood, which can cause asthma-like symptoms when they eat or inhale seafood allergens (Alkazemi et al., 2018). Further research is needed to clarify

the relationship between seafood and asthma. Additionally, heterogeneity between previous findings and our findings might be partly explained by a small sample size of participants who mentioned eating seafood once or twice or all days, and differences in diet assessment and health outcome definitions.

Research indicates that consuming less unhealthy food may help reduce the likelihood of developing asthma (Antonogeorgos et al., 2021). Our findings suggest that individuals who consume unhealthy food (fast-food, sweets and soft drinks) less frequently (up to twice per week) were at a lower risk of being diagnosed with asthma. However, we did not observe any correlation between low unhealthy food consumption and other asthma-like symptoms. Similar results have been observed in Greece (Antonogeorgos et al., 2021), and Saudi Arabia (Aljishi et al., 2022), where fast food consumption was associated with an increased risk of both asthma and asthma-like symptoms, as has been demonstrated in multiple studies (Nkosi et al., 2020; Saadeh et al., 2015). Unhealthy food is typically high in saturated fat, sodium, cholesterol, and added sugars, which can contribute to inflammation and oxidative stress in the lungs (Wood et al., 2011).

Smoking:

Compared to non-smokers, those who smoke tobacco have more severe asthma symptoms (A. Tiotiu et al., 2021). We found that ever using tobacco daily was a statistically significant risk factor for developing current wheezing and severe asthma symptoms, but not for asthma ever and diagnosed asthma. In contrast, a study in the Gaza Strip reveled that smoking tobacco increases the risk of bronchial asthma by 66% (Matar, 2018). Furthermore, the association between ever using tobacco and asthma has been also well-established in Saudi Arabia (Alomary et al., 2022) and other studies (Murrison et al., 2019; Osei et al., 2019; A. Tiotiu et al., 2021).

The individuals who smoked every day were more significantly at risk of asthma and asthma-like symptoms compared with who smoke less than daily, the mechanism of risk may due to that cigarette smoke can trigger inflammation in the airways, compromise the immune system, and interfere with the body's natural repair processes, making the airways more susceptible to other irritants, such as pollen or dust (Thomson et al., 2022).

6.7 Conclusions

Asthma and asthma-like symptoms are significant health concerns, and it is crucial to identify and avoid the triggers that cause these symptoms. The prevalence of asthma among adults has been increasing worldwide, making it a major health concern. However, recent data on the prevalence of asthma among adults in Palestine is scarce. While most studies on asthma were conducted among children using the ISAAC criteria from twenty years ago, our study provides updated information on the epidemiology of asthma among young adults at al-Quds University, one of Palestine's largest universities with high numbers of students.

Furthermore, we used the updated GAN questionnaire which addresses the lack of global data on asthma prevalence among adults, making our results unique. To our knowledge, no previous studies in Palestine have used the GAN methodology to study the determinants of asthma among adults.

Our findings revealed several significant risks and protective factors of asthma and asthma-like symptoms among adults. Risk factors included a history of hay fever, eczema, a family history of asthma or allergic rhinitis, environmental factors such as cooking with wood and heating the house with agricultural crop residue, and lifestyle factors such as tobacco smoking and daily seafood consumption.

Otherwise, we observed that cooking using natural gas and limiting consumption of unhealthy items including fast food, sweets, and soft drinks were associated with a reduced risk of asthma and asthma-like symptoms among adults.

6.8 Study limitation

Because it was most difficult to reach out to students across all university faculties in the most recent circumstances that Palestine challenges, we had to limit our sample to health campus students at Al-Quds University. Although the health campus complex is one of the largest colleges, offering a wide range of health disciplines to a considerable number of students, our results can

only be generalized for this sample frame. This selection of a particular group as study sample may expose the data to a selection bias.

Furthermore, all collected data regarding breathing problems depended on the participant's answers since we could not use the Peak Expiratory Flow Rate measurement such as spirometry to confirm asthma and asthma-like symptoms among individuals, which may expose our data to a recall bias.

6.9 Recommendations

For university students and general adults:

- Raise awareness about asthma and asthma-like symptoms, including the risk factors that should be avoided.
- Encourage people to adopt a healthy lifestyle, which includes avoiding smoking and consuming a healthy diet with low amounts of fast food and sweets.
- Reduce environmental exposure that may increase the risk of asthma and asthma-like symptoms such as avoiding cooking with wood or heating the house with agricultural crop residues.

For research field:

- Further investigation is necessary to determine the association between asthma and asthma-like symptoms with environmental exposure, in addition to lifestyle factors.
- Further studies are needed regarding the association of asthma and asthma-like symptoms with atopic and family history factors among adults.
- Conduct the same study in different universities across Palestine to reinforce the findings.
- More research is needed to study the prevalence and determinants of asthma and asthma-like symptoms among a larger population of adults in Palestine.
- Asthma studies must be conducted in a wider area of Palestine.
- In general, asthma research in Palestine is old, and new research must be encouraged to keep up with the changing environmental exposure and lifestyle factors.

For policy makers:

- Promote awareness campaigns to reduce the prevalence and risk factors of asthma and asthma-like symptoms among adults.
- Enhance the prevention and management of asthma by providing updated evidence-based strategies, tools, and information on the severity of asthma symptoms and associated risk factors.
- Develop national guidelines with public health officials and health care providers to minimize asthma prevalence, morbidity, and mortality among the Palestinian population.

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Annex:

Consent form

جامعــة القـدس

دعوة للمشاركة في الدراسة : استبانة الدراسة العلمية لانتشار مسببات الحساسية والتحكم بها للبالغين

حضرة الطالب/الطالبة المحترم

السلام عليكم ورحمة الله وبركاته,

يسرنا مشاركتك في الدراسة التي تعتزم كلية الصحة العامة في جامعة القدس القيام بها كمتطلب لرسالة الماجستير في الصحة العامة للطالبة لانا حنيحن بعنوان " انتشار مسببات الربو والحساسية والتحكم بها." بإشراف الدكتورة نهى الشريف. وذلك بهدف قياس معدل انتشار أعراض الربو والحساسية ومسبباتها من خلال دراسة علمية على عينة مقصودة من كليات الجامعة.ستساهم هذه الدراسة في التخطيط لوضع الحلول المناسبة للوقاية من المسببات لأعراض الربو والحساسية بين طلاب الجامعات.

عليه فإنه يسعدنا تعاونكم لتعبئة الاستبانة المرفقة، وإعطاء المعلومات اللازمة، علماً بأننا نتعهد بالمحافظة على سرية هذه المعلومات والتأكيد على عدم استخدامها لغير هذه الدراسة.

شاكرين ومقدرين حسن تعاونكم ، والله الموفق .

فريق عمل الدراسة: الطالبة: لانا حنيحن إشراف: د. نهى الشريف

نموذج الموافقة على المشاركة بالدراسة

عزيزي المشارك،

قبل الموافقة على المشاركة يجب أن تكون على علم بالآتي:

- المشاركة في هذه الدراسة تطوعية ويمكنك الانسحاب من المشاركة في أي وقت دون أبداءً الأسباب.
- وقت تعبئة الاستبانة يستغرق ما بين ٢٠ - ٣٠ دقيقة.
- الدراسة تعتمد على الاستجابة لهذه الاستبانة فقط، ولا يوجد أي تدخل علاجي أو سحب لأي عينة.
- ستراعى الخصوصية التامة ولن تستخدم البيانات لأي غرض آخر غير هذه الدراسة.

توقيع المشارك/ _____ التاريخ --/ --/----

توقيع جامع البيانات / _____ التاريخ --/ --/----

Annex: Arabic questionnaire

جامعـة القـدس

استبانـة الدراسة العلمية لانتشار مسببات الحساسية والتحكم بها للبالغين

٢٠٢٣

اسم الكلية:

تاريخ اليوم: اليوم | الشهر | السنة

تاريخ الميلاد: اليوم | الشهر | السنة

السنة الدراسية

الاسم الرباعي (اختياري:)

العمر:

الجنس:

١. ذكر

٢. أنثى

الحالة الاجتماعية :

١. أعزب/ عزباء
٢. غير أعزب/ عزباء

مكان السكن :

١. مدينة ٢. قرية ٣. مخيم ٤. غير ذلك

الوزن: _____ كيلوجرام الطول: _____ سنتيمتر

الرجاء وضع دائرة حول الجواب الصحيح

واملاء الفراغ المطلوب

١. هل واجهتك سابقاً أي مشكلة في تنفسك؟	**لم تواجهني أبدا**	**نادراً**	**بشكل متكرر ولكن دائماً تتحسن كليا**	**بشكل مستمر ولا يكون التنفس منضبط**

٢. هل حدث لك صفير أو وزيز في الصدر خلال الماضية ؟١٢الأشهر	١. نعم	٢. لا
إذا كانت اجابتك "لا" الرجاء الانتقال إلى السؤال رقم ٩		
٣. كم عدد نوبات الصفير التي حدثت لك خلال الأشهر ١٢الماضية ؟	١. ولا مرة	
	٢. ١-٣مرة	
	٣. ٤-١٢ مرة	
	٤. أكثر من ١٢ مرة	
٤. **خلال الأشهر ١٢الماضية،** بمعدل كم مرة تعرضت لاضطراب في النوم بسبب الصفير؟	١. لم أستيقظ أبداً من الصفير	
	٢. أقل من ليلة واحدة في الأسبوع	
	٣. ليلة واحدة أو أكثر في الأسبوع	
٥. هل حدث لك ضيق في التنفس أثناء وجود صوت الوزيز أو الصفير؟	١.نعم	٢.لا
٦.خلال الأشهر ١٢الماضية ، بمعدل كم مرة تعرضت لاضطراب في النوم بسبب ضيق التنفس؟	١. أبداً	
	٢. أقل من ليلة واحدة في الأسبوع	

	٣. ليلة واحدة أو أكثر في الأ١سبوع	
خلال الأشهر ١٢الماضية ، بمعدل كم مرة . ٧ ؟)الكحة(تعرضت لاضطراب في النوم بسبب السعال	١. أبداً	
	٢. أقل من ليلة واحدة في الأسبوع	
	٣. ليلة واحدة أو أكثر في الأ١سبوع	
خلال الأشهر ١٢الماضية ،هل كان الصفير .٨ شديداً مما أدى للحد من حديثك إلى كلمة واحدة أو كلمتين بين التنفس ؟	**١. نعم**	**٢.لا**
٩.هل سبق وأن أصبت بحساسية الصدر (الربو)؟	**١.نعم**	**٢.لا**
الرجاء الانتقال إلى السؤال رقم ٢٠"اذا كانت اجابتك "لا		
١٠. هل سبق أن تم تشخيصك بحساسية الصدر (الربو) من قبل الطبيب؟	**١.نعم**	٢.لا
١١. هل لديك خطة مكتوبة تخبرك كيف تعتني بحساسية الصدر ؟	**١.نعم**	٢.لا
١٢. كم كان عمرك عندما حدثت لك أول نوبة بحساسية الصدر ؟	.....سنوات	

١٣. هل أصبت بنوبة حساسية الصدر خلال الأشهر ١٢الماضية ؟	١.نعم	٢.لا

١٤. خلال الأشهر ١٢الماضية، كم عدد المرات التي ذهبت فيها إلى لطبيب بشكل طارئ بسبب مشاكل في التنفس؟	**ولا مرة**	**١-٣ مرة**	**٤-١٢ مرة**	**أكثر من ١٢مرة**

١٥. خلال الأشهر ١٢الماضية، كم عدد المرات التي ذهبت فيها بشكل طاريء إلى قسم الطوارئ دون تنويم بسبب مشاكل في التنفس؟	**ولا مرة**	**١-٣ مرة**	**٤-١٢ مرة**	**أكثر من ١٢مرة**

١٦. خلال الأشهر الـ ١٢الماضية ، كم عدد المرات التي دخلت فيها إلى المستشفى (تنويم) بسبب مشاكل في التنفس؟	**ولا مرة**	**١ مرة**	**٢مرة**	**أكثر من ١٢ مرة**

١٧. خلال الأشهر الـ ١٢الماضية ، كم عدد الأيام التي تأثرت فيها نشاطاتك اليومية (في العمل أو المنزل أو الجامعة) بسبب مشاكل في التنفس؟	**ولا مرة**	**١-٣ مرة**	**٤-١٢ مرة**	**أكثر من ١٢مرة**

١٨. هل التحقت بمهنة أدت إلى حدوث صفير أو وزيز في صدرك؟	١.نعم	٢.لا
إذا كانت اجابتك "لا" الرجاء الانتقال إلى السؤال رقم ٢٠		
إذا كانت الإجابة نعم؟ ١٩أ.هل اضطررت لترك هذه المهنة لأنها أثرت على تنفسك؟	١.نعم	٢.لا
٢٠. هل سبق أن أصبت بحمى القش (حساسية الأنف)؟	١.نعم	٢.لا
اذا كانت اجابتك "لا" الرجاء الانتقال إلى السؤال رقم ٢٢		
٢١.هل شخصت اصابتك بحمى القش (حساسية الأنف) من قبل طبيب؟	١.نعم	٢.لا
٢٢.هل سبق أن اصبت بحساسية الجلد (الاكزيما)؟	١.نعم	٢.لا
اذا كانت اجابتك "لا" الرجاء الانتقال إلى السؤال رقم ٢٤		
٢٣. هل تم تشخيصك بحساسية الجلد (الاكزيما) من قبل طبيب؟	١.نعم	٢.لا
٢٤. هل سبث أن أصيب أحد أفراد عائلتك (الأب أو الأم أو الأخوة) بما يلي :	١. نعم	٢. لا

حساسية الصدر (الربو)		
حساسية الأنف (حمى القش)		
حساسية الجلد (الأكزيما)		
<u>الأسئلة من ٢٥-٣٩ تتعلق بنواحي أخرى من حياتك وبيئتك:</u>		
٢٥. ما هو مصدر الطاقة المستخدمة يومياً للطبخ في المنزل؟	١.لا يتم الطبخ في المنزل	
	٢.الكهرباء	
	٣.الغاز الطبيعي	
	٤.الفحم / الفحم الحجري	
	٥.الخشب الحطب	
	٦.القش / الشجيرات / العشب	
	٧.فضلات الحيوانات	
	٨.بقايا المحاصيل الزراعية	
٢٦. ما هو نوع الموقد الذي يستخدم عادة للطبخ؟	اختر النوع (الرقم من الصورة أسفل): _____.	
	أخرى (أذكر) _____.	

	لا أعلم
١  ٢  ٣  ٤ 	
٢٧. هل يتم تصريف الدخان عن طريق مروحة الشفط أو المدخنة؟	١. لا يتم تصريف الدخان
	٢. مروحة الشفط
	٣. مدخنة
إذا قمت باختيار المدخنة أعلاه:	
٢٧أ. متى تم تنظيف المدخنة مؤخراً؟	١.لم يتم تنظيفها
	٢.منذ أكثر من ٣ أشهر

	٣. منذ ١ إلى ٣ أشهر
	٤.قبل أقل من شهر
	٥.لا أعرف
٢٨. أين يتم الطبخ عادة؟	١. في غرفة تستخدم للعيش / النوم
	٢. في غرفة منفصلة تستخدم كمطبخ
	٣. في مبنى منفصل يستخدم كمطبخ
	٤. في الهواء الطلق
	٥.أخرى (حدد) _____.
٢٩. ما هو نوع التهوية الموجودة في المكان الذي يستخدم فيه الموقد؟	١.غرفة مغلقة
	٢.غرفة مع مساحات فارغة
	٣.غرفة مع نوافذ/ أبواب مفتوحة
	٤.غرفة مع ٣ أو أقل من الجدران
	٥.أخرى (حدد) _____.
٣٠. هل تقوم بتدفئة منزلك عندما يكون الطقس بارداً؟	١.نعم ٢.لا
إذا كانت إجابتك "لا" الرجاء الانتقال إلى السؤال رقم ٣٣	
	١. الكهرباء

٣١. ما هو نوع الوقود الذي تستخدمه بشكل أساسي للتدفئة؟	٢.غاز البترول المسال
	٣.الغاز الطبيعي
	٤.الغاز الحيوي
	٥.الكيروسين
	٦.الفحم / الفحم الحجري
	٧.الفحم المعدني
	٨.الخشب
	٩.القش / الشجيرات / العشب
	١٠.روث الحيوانات
	١١.بقايا المحاصيل الزراعية
٣٢. ما هو نوع الموقد الذي يستخدم عادة للتدفئة؟	١.مدفئة كهربائية
	٢.مدفئة غازية
	٣.التدفئة بالنار
	٤. أخرى (أذكر) _____.

٣٣. خلال الأشهر الـ ١٢الماضية، بمعدل كم مرة تأكل أو تشرب الآتي: (يرجى ترك فراغ إذا كنت لا تعرف نوع الطعام)

	أبداً أو في بعض الأحيان فقط	**مرة أو مرتين أسبوعياً**	**معظم أو كل الأيام**

لحم بأنواعه (بقري، ضأن، دجاج)			
مأكولات بحرية (بما في ذلك السمك، الجمبري)			
فاكهه			
خضروات مطبوخة			
خضروات نيئة			
بقوليات (فول، حمص، عدس)			
حبوب ما عدا الخبز			
خبز			
معكرونة			
أرز			
زبدة نباتية			
زبدة حيوانية			
زيت زيتون			
حليب (بما في ذلك نكهة الحليب)			
مشتقات الحليب (بما في ذلك الجبن والزبادي)			
بيض			

مكسرات			
بطاطس			
سكر (بما في ذلك الحلويات)			
وجبات سريعة (برغر)			
وجبات سريعة (غير البرغر)			
مشروبات غازية			
٣٤. هل سبق وأن دخنت التبغ (السجائر) بشكل يومي ؟	١.لا على الإطلاق		
	٢.أقل من يومياً		
	٣.يومياً		
٣٥. حالياً هل تدخن التبغ بشكل يومي؟	١. لا على الإطلاق		
	٢. أقل من يومياً		
	٣.يومياً		
٣٦. إذا كنت قد دخنت التبغ في أي وقت مضى، سواء يومياًّ أو أقل من يومياً، في أي عمر بدأت التدخين؟	العمر: _____.	لا ينطبق _____.	

٣٧. خلال فترة التدخين بمعدل كم مرة تدخن في اليوم ؟	العدد يومياً: _____.	لا ينطبق _____.
٣٨. هل تدخن الشيشة (مثل المعسل، الأرجيلة ، الشيشة) في المنزل؟	١.نعم	٢.لا
٣٩. هل تدخن السيجارة الإلكترونية؟	١.نعم	٢.لا

شكراً جزيلا على تعبئة الاستبانة