


Role of Desert Climate in Bisha City on Chronic Sinusitis Symptoms and Risk Factors

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Abstract

Objectives: This study aimed to estimate the prevalence of CRS and its risk factors among people in Bisha, Saudi Arabia. **Method:** A cross-sectional study was conducted in Bisha City, Saudi Arabia, involving all accessible adults aged 18 and older. The minimum required sample size was 384 participants, based on a 5% margin of error and a 95% confidence interval. The study was conducted from November 2024 to January 1, 2025, using an online questionnaire distributed via social media. The questionnaire was validated, and participants were recruited through the author's professional networks, family, and friends, allowing any viewer in Bisha City to respond voluntarily. The chi-square test and multiple logistic regressions were applied. **Results:** A total of 416 participated in the study; 299 (71.9%) were female and 117 (28.1%) were male. The mean age was 29.5 years, and the mean BMI was 25.28. Out of all participants, 81 (19.47%) were found to have CRS. **Conclusion:** This study highlights the significant prevalence of chronic rhinosinusitis (CRS) in Bisha City, particularly among married individuals and those with chronic conditions. Various risk factors, including environmental allergen exposure, smoking, obesity, and deviated nasal symptoms, are associated with a higher risk of CRS. Environmental factors, particularly the desert climate and dust exposure in Bisha, seem to exacerbate the prevalence of CRS.

Keywords

Sinusitis, Chronic Sinusitis, Chronic Rhinosinusitis, Adult, Prevalence, Risk Factors, Saudi Arabia

1. Introduction

Chronic sinusitis is a significant health problem worldwide, affecting almost 15% of people [1], with a prevalence rate reported to be between 6% and 27.1% [1] [2]. The eastern province of Saudi Arabia has a higher prevalence of chronic rhinosinusitis [3], and there has been a noticeable rise in this condition nationwide. The paranasal sinuses include the maxillary, frontal, sphenoidal, and ethmoidal sinuses. They begin as diverticula from the nasal mucosa at birth, develop further after the eruption of permanent teeth, and reach full development in adolescence [4]. Inflammation of the lining membranes of one or more sinuses is called sinusitis or rhinosinusitis [1]. Sinusitis is caused by various inflammatory factors, including pathophysiology, which obstruct the sinus cavity and lead to infection and chronic inflammation [5]. It is diagnosed by identifying two symptoms from a range of symptoms lasting for 12 consecutive weeks. These symptoms can include facial pressure, fullness or pain, nasal obstruction, headache, clear or mucopurulent nasal discharge, and hypo or anosmia [6]. Chronic sinusitis symptoms can last up to 90 days, with or without severe flare-ups [5]. It is associated with significant medical treatment costs, decreased workplace productivity, and a substantially reduced quality of life [7]. The socioeconomic burden of chronic sinusitis was recognized in 1996, with a direct cost of \$5.8 billion [8]. Bisha is situated in the southwestern region of Saudi Arabia and is known for its desert climate, characterized by hot summers and mild winters. Despite the high prevalence of chronic rhinosinusitis (CRS), there is a lack of comprehensive data on its true occurrence, especially across various demographic groups and geographic regions. The high frequency, impact on quality of life, and financial cost of CRS make it a serious public health concern. However, to our knowledge, no previous study has explored the distribution of CRS among people in Bisha. Focusing on Bisha is crucial due to its unique desert climate, which may exacerbate CRS through increased dust exposure and allergens. Additionally, the region's demographic diversity may reveal varying susceptibility to CRS, highlighting the need for targeted public health interventions. This study aimed to estimate the prevalence of CRS and its risk factors among people in Bisha.

2. Materials and Methods

This cross-sectional study was conducted in Bisha, Saudi Arabia, from November 2024 to January 1, 2025. Using an electronic sample size calculator, we determined that the minimum required sample size was 384 participants, based on a 5% margin of error and a 95% confidence interval.

The questionnaire was distributed online through social media, utilizing the author's professional networks, friends, and family, allowing any viewer to respond voluntarily in Bisha City. We included adult participants aged 18 years and above, living in the Bisha province and its surrounding areas. We excluded those who refused to participate. Data collection included questions about the general and demographic information of the respondents and questions assessing the risk

factors that may affect the development of CRS. The questionnaire also included questions assessing the score of sinus symptoms of sinusitis using a GA2LEN, validated Arabic self-reported 6-item questionnaire, adapted from the work of Albaharna H *et al.* [9], which assessed chronic sinusitis prevalence. Each question assessing the score of sinus symptoms was scored with 1 point, and a total score of 4 points or more was considered indicative of CRS.

The collected data was coded, entered, and analyzed using the Statistical Package for the Social Sciences (SPSS) version 23. The chi-square test and multiple logistic regressions were applied to determine the statistical significance of associations, with p-values of 0.05 or less considered statistically significant.

3. Results

A total of 416 participated in the study, with 299 (71.9%) female and 117 (28.1%) male. The mean age was 29.5 years, and the mean BMI was 25.28. Out of all participants, 81 (19.47%) were found to have CRS. **Table 1** shows the sociodemographic data of the study population and its association with CRS. Marital status and place of residence were statistically significant ($P = 0.011$ and $P = 0.001$, respectively). Body mass index (BMI) was significantly associated with CRS ($P = 0.012$).

Table 1. Sociodemographic data and its association with CRS.

Sociodemographic	Category	Frequency N = 416 (%)	CRS N (%)	Chi-square test (N 416)	P-value
Age	18 - 30 years old	265 (63.7)	43 (16.2)	7.272	0.064
	31 - 40 years old	79 (19)	19 (24.1)		
	41 - 50 years old	57 (13.7)	13 (22.8)		
	More than 50 years old	15 (3.6)	6 (40.0)		
Gender	Male	117 (28.1)	27 (23.1)	1.350	0.245
	Female	299 (71.9)	54 (18.1)		
Nationality	Saudi	411 (98.8)	81 (19.7)	1.224	0.269
	Non-Saudi	5 (1.2)	0 (0)		
Marital status	Married	169 (40.6)	39 (23.1)	11.237	0.011*
	Single	238 (57.2)	39 (16.4)		
	Divorced	7 (1.7)	1 (14.3)		
	Widow	2 (0.5)	2 (100)		
Educational level	Bachelor	294 (70.7)	56 (19.0)	1.897	0.594
	Diploma	38 (9.1)	6 (15.8)		
	Postgraduate studies	15 (3.6)	2 (13.3)		
	High school or less	69 (16.6)	17 (24.6)		
Job status	Employee	141 (33.9)	35 (24.8)	6.728	0.081
	Unemployed/ Retired	84 (20.2)	13 (15.5)		
	Student	180 (43.3)	29 (16.1)		
	Freelance	11 (2.6)	4 (36.4)		

Continued

Place of residence	Bisha Governorate	368 (88.5)	61 (16.6)	17.048	0.001*
	Villages of Bisha Governorate	48 (11.5)	20 (41.7)		
Income (per month)	<5000 SAR	246 (59.1)	40 (16.3)	7.515	0.057
	5000 - 10,000 SAR	64 (15.4)	11 (17.2)		
	10,001 - 15,000 SAR	59 (14.2)	18 (30.5)		
	>15,000 SAR	47 (11.3)	12 (25.5)		
BMI	<18.5 Under weight.	39 (9.4)	4 (10.3)	10.883	0.012*
	18.5 - 24.9 Normal weight	179 (43.1)	28 (15.6)		
	25 - 29.9 Overweight	114 (27.4)	23 (20.2)		
	30 or more, Obese	84 (20.2)	26 (31.0)		

*Statistically significant. CRS stands for chronic rhinosinusitis. BMI stands for body mass index.

Table 2. Allergens and risk factors and their association with CRS.

Variables	Category	No CRS (%)	CRS N (%)	Chi-Squared test N (416)	P-value
Exposure to pets	Yes	52 (65.8)	27 (34.2)	13.45	0.001*
	No	283 (84.0)	54 (16.0)		
Exposure to detergents	Yes	139 (76.8)	42 (23.2)	12.848	0.091
	No	206 (87.7)	29 (12.3)		
Exposure to dust and plants	Yes	183 (74.1)	64 (25.9)	16.081	0.001*
	No	152 (89.9)	17 (10.1)		
Exposure to gases and smoke	Yes	84 (64.1)	47 (35.9)	32.826	0.001*
	No	251 (88.1)	34 (11.9)		
Exposure to humid environment	Yes	56 (82.4)	12 (17.6)	0.172	0.678
	No	279 (80.2)	69 (19.8)		
Smoking	Yes	24 (64.9)	13 (35.1)	6.355	0.012*
	No	311 (82.1)	68 (17.9)		
DM	Yes	14 (63.6)	8 (36.4)	4.227	0.040*
	No	321 (81.5)	73 (18.5)		
HTN	Yes	20 (74.1)	7 (25.9)	0.767	0.381
	No	315 (81.0)	74 (19.0)		
Seasonal flu vaccine	Yes	96 (82.8)	20 (17.2)	0.51	0.475
	No	239 (79.7)	61 (20.3)		
Deviated nasal septum	Yes	39 (62.9)	23 (37.1)	14.435	0.001*
	No	296 (83.6)	58 (16.4)		
Asthma	Yes	26 (59.1)	18 (40.9)	14.422	0.001*
	No	309 (83.1)	63 (16.9)		

*Statistically significant. CRS stands for chronic rhinosinusitis. DM stands for diabetes mellitus. HTN stands for hypertension.

In terms of allergen exposure, 79 (19%) participants were exposed to pets, 181 (43.5%) to detergents, 247 (59.4%) to dust and plants, 131 (31.5%) to gases and smoke, and 68 (16.3%) to a humid environment. Allergen exposure was signifi-

findings indicated that diabetes increased the risk of CRS (OR = 2.513, 95% CI: 1.016 - 6.212, P = 0.046). Adults with nasal septum deviation were significantly more likely to develop CRS (OR = 3.010, 95% CI: 1.673 - 5.414, P = 0.001). Participants with asthma also had a significantly higher likelihood of having CRS (OR = 3.396, 95% CI: 1.756 - 6.565, P = 0.001). The responses from the 6-item questionnaire assessing sinus symptom scores are presented in **Table 4**.

Table 4. Questionnaire items and population responses.

Question	Response	Portion
Have you ever been diagnosed with chronic sinusitis?	92	22.12%
Do you have any nasal allergies, such as hay fever?	120	28.85%
Have you experienced nasal congestion for more than 12 weeks in the past year?	125	30.05%
Have you felt pain or pressure around your forehead, nose, or eyes for more than 12 weeks in the past year?	133	31.97%
Have you noticed a change in the color of your nasal discharge or throat mucus for more than 12 weeks in the past year?	92	22.12%
Have you had a decreased or lost sense of smell for more than 12 weeks in the past year?	90	21.64%

4. Discussion

Healthcare costs related to chronic rhinosinusitis are notably higher compared to conditions such as acute asthma, resulting in an average of 5.79 workdays lost [10]. Undiagnosed chronic rhinosinusitis can significantly impact an individual's quality of life. Survey studies can estimate its prevalence, highlighting the importance of regular sinus check-ups to prevent negative outcomes.

In 2021, a large online survey conducted in Saudi Arabia involved 4963 subjects. The study found that the prevalence of chronic rhinosinusitis (CRS) was 22.5%, indicating a high occurrence of CRS, particularly among older females, individuals with chronic conditions, and those exposed to risk factors such as smoking [11]. In the ongoing study of Bisha City's general population, 47% were found to have CRS. Although no significant association was found, CRS frequency was higher in female participants. Allergen exposure, such as pets, dust, plants, gases, smoke (P = 0.001), and smoking (P = 0.005), was significantly associated with CRS. This aligns with findings by Alhazmi WA *et al.* [11] and Homood MA *et al.* [12], where these factors were shown to be a high risk for developing CRS.

In the current study, CRS was found to be slightly higher in individuals younger than 30 years, although this association was not statistically significant. CRS was statistically significant in married individuals and those residing in urban areas (P = 0.011 and P = 0.001, respectively). These findings are contrary to Homood MA *et al.* [12], which found CRS was more prevalent among the young and those living in rural areas, and less prevalent among married individuals.

Asthma was found to be associated with CRS ($P = 0.001$), and CRS was less prevalent in asthmatic patients than in the general population. A study conducted in 2022 among asthmatic patients in Saudi Arabia found that the prevalence of rhinosinusitis among individuals with asthma was low [13].

In the study conducted by Hakami NA *et al.* [14] in Jazan in 2020, no significant relationship was found between diabetes mellitus and hypothyroidism with CRS. This finding contradicts our study, which found a significant association between diabetes mellitus and CRS ($P = 0.017$).

According to the findings, hypertension does not appear to be associated with the prevalence of CRS disease ($P > 0.05$). However, a cross-sectional study involving 52,992 subjects reported that sinusitis is linked with hypertension only in women [15].

In the clinical evaluation of patients with chronic rhinosinusitis (CRS), it is essential to recognize the multifactorial nature of the disease, encompassing various phenotypes. Furthermore, considering the presence of obesity is important when assessing individuals with CRS [16]. A high body mass index has been shown to be associated with CRS ($P = 0.012$) and is considered a high-risk factor, possibly related to a sedentary lifestyle. This finding was supported by a meta-analysis conducted in 2024, which indicated a positive association between overweight, obesity, and CRS [17].

In our study, the risk of CRS increased in participants with deviated nasal symptoms. Deviated nasal symptoms were studied by Orlandi RR [18], who concluded that septal deviation is linked to an increased prevalence of rhinosinusitis.

Clinical research indicates that pollutants may significantly exacerbate disease severity in specific demographic groups. However, their influence on the incidence or prevalence of chronic rhinosinusitis (CRS) remains uncertain [19].

Bisha is known for its desert climate, which contributes to the high exposure to dust in our study participants. Prolonged exposure to arid environments may aggravate sinusitis, leading to inflammation and irritation of the sinus passages. This could explain the relative increase in CRS in our study population.

5. Limitations

This study is limited by a small number of representative samples of Bisha people, and the findings cannot be generalized to the total population of Saudi Arabia since Bisha city is known for its desert climate, which could increase prevalence in this specific population. Survey-validated tools can assess the current prevalence of certain diseases; however, self-reported data can be subjective and prone to recall bias. A complete history, examination, and investigation are required to determine the actual prevalence of CRS.

6. Conclusion

This study highlights the significant prevalence of chronic rhinosinusitis (CRS) in Bisha City, especially among married individuals and those with chronic condi-

tions. Risk factors such as environmental allergen exposure, smoking, obesity, and deviated nasal symptoms are linked to a higher risk of CRS. The desert climate and dust exposure in Bisha seem to exacerbate the prevalence of CRS. Recognizing these associations is essential for healthcare providers to develop targeted prevention and management strategies.

Consent to Participate

Informed consent was obtained from all participants.

Ethical Approval

Ethical approval was obtained from King Abdullah Hospital in Bisha City, Saudi Arabia, via reference number E-CTS REF No. BIS-24-00019, dated: 23-10-2024.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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