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RESEARCH ARTICLE

PREVALENCE AND SEVERITY OF RHINOSINUSITIS AMONG PEOPLE LIVING IN TAIF, SAUDI ARABIA

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Abstract

Background: Chronic rhinosinusitis (CRS) has become a huge burden on healthcare systems of Saudi Arabia. It has been estimated that its prevalence rate across the world is more than 20%. There are many challenges in the treatment when a patient has rhinosinusitis (RS) with more severe and refractory forms.

Aim: To assess the prevalence and severity of rhinosinusitis among people living in Taif, Saudi Arabia and to explore the relationship between prevalence, severity and different socio-demographic factors.

Methodology: This was a cross-sectional study conducted among people living in Taif, Saudi Arabia from May - July 2022. Data were taken from Al Hada Armed Forces Hospital, and Prince Mansour Military Hospital, using a self-administered questionnaire from the patients.

Results: A total of 364 participants were included in this study. More than 58% participants were females. Most of the participants were in age group 18-30 years. Furthermore, the prevalence of rhinosinusitis was 57.4%. In order to assess severity of rhinosinusitis sino nasal test (SNOT-22) was done, the average score was found to be 33.5 ± 26.3 out of 110 in a range of 0-103. It was found that the prevalence of RS was significantly associated with several socio demographic variables such as: gender, age, marital status, occupational status, educational level and monthly income of participants.

Conclusion: The results revealed a high prevalence and severity scores of rhinosinusitis among people living in Taif, Saudi Arabia. It is recommended to conduct future research with the significantly associated factors.

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Introduction:-

Recently, there has been a continuous upsurge in respiratory disorders, causing the patients to visit the emergency departments. One such respiratory disorder, which has become the most frequent global healthcare problem, is rhinosinusitis (RS) with an increasing incidence and prevalence rates these days. The condition is defined as an inflammation of the lining membranes of nasal and paranasal sinuses that lingers for more than twelve weeks

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(Fokkens et al., 2012). Rhinosinusitis is accompanied by at least two of the following characteristic symptoms that require medical attention as soon as possible; loss of taste and smell, facial pressure or pain, anterior or posterior nasal discharge, and nasal blockage or congestion accompanied by CT changes and complementary endoscopic or radiographic signs (Adibelli et al., 2011).

Rhinosinusitis is classified into three forms based on the duration of its clinical symptoms; acute RS (persists for less than four weeks), subacute RS (persists for four to eight weeks), and chronic RS (persists for more than eight weeks) (Leung et al., 2008). Several factors play a significant role in the chronicity of rhinosinusitis, including the ostiomeatal complex, osteitis, mucus recirculation, and ostial blockage (Kucuksezeret al., 2018).

Besides its three forms (acute, subacute, and chronic), there are several subtypes of chronic rhinosinusitis, which are confirmed based on nasal endoscopic examination. These subtypes include chronic rhinosinusitis with nasal polyps (CRSwNP) and chronic rhinosinusitis without nasal polyps (CRSsNP). The diagnosis of these subtypes is important in clinical practices because in western countries, nasal polyps are steroid responsive and eosinophilic. Furthermore, the symptoms presented CRSwNP are more severe than those of CRSsNP (Oakley et al., 2017). In CRS with nasal polyps, the inflamed mucous membrane of nasal and paranasal sinuses exhibits outgrowths of inflamed mucosa, which prolapses into the nose (Lu et al., 2013).

There are multiple etiological factors and possible initial triggers that contribute to the development of CRS with nasal polyps, including bacterial, fungal, and viral infections, and allergy. These triggers cause the development of nasal polyps by causing inflammation of the sinus mucosa (Hulse et al., 2015). Other forms of rhinosinusitis include pediatric CRS, dental sinusitis, Methicillin-resistant *Staphylococcus aureus* (MRSA) infection, and fungal sinusitis.

A large population is affected by chronic rhinosinusitis due to animal dander, cockroaches, molds, and dust mites. The symptoms of chronic rhinosinusitis might worsen with poorly controlled allergies. The risk of chronic rhinosinusitis increases when an individual is exposed to airborne irritants, such as tobacco smoke or formaldehyde. People, who have a compromised immune system, antibody deficiency, or hypogammaglobinemia, are more likely to suffer from chronic rhinosinusitis (Hassan et al., 2013).

If a patient is having problems with their immune defenses that directly infect the sinuses, nose, and lungs are also at a significant risk of acquiring chronic rhinosinusitis. The chances of chronic rhinosinusitis also increase with repeated exposure to viral infections, such as common cold. It has also been reported that a deviated septum, which blocks one or both nostrils and results in nasal blockage, has also been associated with increased possibility of chronic rhinosinusitis (Hamid et al., 2015).

Another type of rhinosinusitis is allergic fungal sinusitis (AFS), which is caused by several fungal species, including the *Aspergillus*, *zygomycetes*, *Bipolaris*, *Curvularia*, and *Excerohilum* (Michaet al., 2008). To keep the symptoms of chronic rhinosinusitis always in check, a lifelong treatment is required. There are many treatment options available for managing this chronic condition, but many challenges occur, especially for patients with more severe and refractory forms. Many medical and surgical therapies are also an effective way of treating rhinosinusitis (Bachert et al., 2014).

Concerning its prevalence, chronic sinusitis, more preferably known as rhinosinusitis affects 15% of the world population with a prevalence rate ranging from 6% to 27% (Shi et al., 2015; Hastan et al., 2011). The prevalence rate of chronic rhinosinusitis is 12% in the United States of America (USA), while in Europe, it is almost 11% (Kobayashi et al., 2015). Since, there has recently been an upsurge in the incidence rate of rhinosinusitis in Saudi Arabia, the eastern province of Saudi Arabia has more cases of rhinosinusitis. CRS is associated with nasal polyposis, analgesic intolerance, and bronchial asthma. Its prevalence has been reported to be 20% in patients with nasal polyposis (Dutre et al., 2013). The prevalence of CRS in patients varies according to their environment and geography. It has been reported in a Chinese study that there has been a strong association of chronic rhinosinusitis with some environmental and occupational exposures (Goa et al., 2016). Some geographical and occupational factors also contribute to the increased prevalence of AFS. However, there is no association between the increased prevalence of rhinosinusitis and socioeconomic status (Lu-Myers et al., 2015).

Identifying the prevalence of chronic rhinosinusitis in Saudi Arabia in different genders and age group is important for early diagnosis and management. To identify the rate of prevalence of rhinosinusitis, one cross-sectional study

was conducted in Saudi Arabia, and concluded that people living in Saudi Arabia showed a high prevalence of rhinosinusitis, among which, female population was more at risk. The most prevalent age group at an increased risk of rhinosinusitis was 21 to 30 years old (Abualnasret al., 2017).

Another study was conducted in the capital of Mazandaran, Iran to evaluate the prevalence of fungal rhinosinusitis (FRS) and the causative agents responsible for the disease. It was concluded in the study that in patients with chronic rhinosinusitis, FRS was the most common form of disorder with *Aspergillus* being the most prevalent isolated fungi. There was a strong association of AFRS with history of eosinophilic mucin, atopy, and sinonasal polyps (Hedayatiet al., 2010).

The occurrence of CRS is very common in pediatric population; however, it is quite different than in adults. Children with rhinosinusitis experience symptoms, including post-nasal discharge with a thick yellow-green nasal discharge, low energy, bad breath, swelling around the eyes, crankiness, and cough. It has been estimated that 5% to 13% of upper respiratory infections develop to acute rhinosinusitis in children (McDermott et al., 2020). One such study was conducted to identify the clinical presentation and prevalence of rhinosinusitis in pediatric population in Aseer, Saudi Arabia. It was concluded that chronic rhinosinusitis was a common respiratory infection in pediatric population of different ages (Alshehri et al., 2017).

Being a huge burden on healthcare systems, rhinosinusitis is becoming a healthcare, and due to the lack of data, there are only a few studies regarding the prevalence of rhinosinusitis in Saudi Arabia. One such study was conducted in Al-Baha region of Saudi Arabia to assess the prevalence of rhinosinusitis. It was concluded in the study that there was a high prevalence of symptoms in patients with CRS with an increased risk of developing severe complications. The study also concluded that there is a high need for the proper management of the condition to prevent complications in the future (Alzahraniet al., 2017). Thereby, this study aimed to assess the prevalence and severity of rhinosinusitis among people living in Taif, Saudi Arabia and to explore the relationship of prevalence and severity of RS with different socio-demographic factors.

Material and Methods:-

This was an observational descriptive cross sectional study assessing the prevalence and severity of rhinosinusitis among people living in Taif, Saudi Arabia from May - July 2022. Ethical approval was granted by the Research and Ethics Committee, Medical Services General Directorate, Western Region, Ministry of Defense, Saudi Arabia, Ref # REC-2022-5-625, dated: 22 May 2022.

The study population was recruited from general public during the study period. All patients aged 18 years old or more, and living in Taif, Saudi Arabia were included in this study. However, children and adolescents aged less than 18 years, not living in Taif, Saudi Arabia, and patients who refused to give consent to participate in this study were excluded.

The sample size was calculated using EPI info program. Based on 95% confidence interval, 5% margin of error and total of selected population. The estimated sample size was 384 and was adjusted to 422 to compensate for 10% non-response rate.

Data were taken from Al Hada Armed Forces Hospital, and Prince Mansour Military Hospital, using a self-administered questionnaire from the patients. The aim of the study was clearly explained in the interface. The Sino-Nasal Outcome Test 22 validated for Arabic was used in this study.

Data were coded, entered and analyzed using statistical package for the social sciences (SPSS) version 23.0. Qualitative data were expressed in the form of numbers and percentages.

Results:-

Characteristics of the study participants:

In a total of 346 participants more than 58% were females; most of the participants fell in age group 18-30 years, and majority of them were Saudi (95%). More than half of them were single (nearly 60%) and more than 50% of them had bachelor's degree. Greater than third of them were employed. Majority of the participants had monthly

income less than 10,000 SAR, while more than seventeen percent had monthly income of 10,000 - 14,999 SAR. The details of the sociodemographic characteristics of the participants is grouped in Table 1.

Table 1:- Socio-demographic characteristics of the participants (n=364).

Variable	Categories	Frequency	Percent
Gender	Male	150	41.2%
	Female	214	58.8%
Age (years)	18-30	225	61.8%
	31-40	58	15.9%
	41-55	71	19.5%
	56-70	9	2.5%
	71 or more	1	0.3%
Nationality	Saudi	349	95.9%
	Non-Saudi	15	4.1%
Marital status	Single	217	59.6%
	Married	138	37.9%
	Divorced	7	1.9%
	Widow	2	0.5%
Educational level	Primary	4	1.1%
	Intermediate	8	2.2%
	Secondary	117	32.1%
	Bachelor	195	53.6%
	Other	40	11%
Occupational status	Employed	126	34.6%
	Unemployed	57	15.7%
	Private business	11	3%
	Retired	19	5.2%
	Other	151	41.5%
Average monthly income (SAR)	< 10,000	235	64.6%
	10,000-14,999	63	17.3%
	15,000-20,000	49	13.5%
	> 20,000	17	4.7%

Prevalence of rhinosinusitis among the study participants:

When the prevalence of RS among the study participants was assessed, it was found that more than half of the participants suffered from rhinosinusitis as shown in Figure 1.

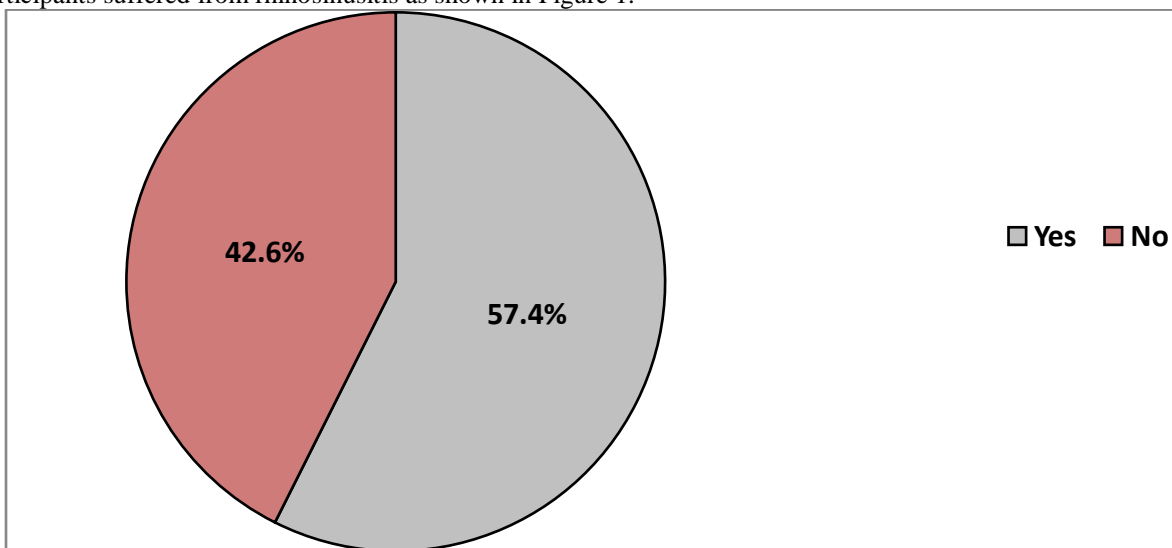


Figure 1:- Prevalence of rhinosinusitis among the study participants.

When symptoms and social - emotional consequences of rhinosinusitis were assessed, it was revealed that more than 34% participants did not feel the need to blow their nose, 38% had not experienced sneezing, and more than 35% didn't develop runny nose. Regarding blockage and congestion of nose 29% participants had no problem with it, more than half participants didn't experience any loss of taste or smell. More than 30% participants were not irritable or frustrated, more than 40% were not sad due to the disease and more than half of the participants were not embarrassed due to this condition as summarized in Table 2 and Figure 2.

Table 2:- Symptoms and social/emotional consequences of rhinosinusitis.

How severe the problem is when you experience it and how often it happens	No problem	Very mild problem	Mild or slight problem	Moderate problem	Severe problem	Problem as bad as it can be
	N (%)					
Need to blow nose	124 (34.1)	76 (20.9)	67 (18.4)	64 (17.6)	20 (5.5)	13 (3.6)
Sneezing	141 (38.7)	76 (20.9)	59 (16.2)	54 (14.8)	25 (6.9)	9 (2.5)
Runny nose	130 (35.7)	73 (20.1)	69 (19)	54 (14.8)	30 (8.2)	8 (2.2)
Blockage/congestion of nose	106 (29.1)	60 (16.5)	55 (15.1)	70 (19.2)	50 (13.7)	23 (6.3)
Loss sense of taste/smell	207 (56.9)	39 (10.7)	34 (9.3)	29 (8)	35 (9.6)	20 (5.5)
Cough	168 (46.2)	68 (18.7)	42 (11.5)	51 (14)	22 (6)	13 (3.6)
Post nasal discharge	173 (47.5)	60 (16.5)	44 (12.1)	46 (12.6)	28 (7.7)	13 (3.6)
Thick nasal discharge	136 (37.4)	65 (17.9)	61 (16.8)	61 (16.8)	28 (7.7)	13 (3.6)
Ear fullness	149 (40.9)	67 (18.4)	37 (10.2)	58 (15.9)	39 (10.7)	14 (3.8)
Dizziness	196 (53.8)	50 (13.7)	25 (6.9)	42 (11.5)	28 (7.7)	23 (6.3)
Ear pain/pressure	177 (48.6)	63 (17.3)	37 (10.2)	41 (11.3)	31 (8.5)	15 (4.1)
Facial pain/pressure	184 (50.5)	50 (13.7)	38 (10.4)	45 (12.4)	35 (9.6)	12 (3.3)
Difficulty falling asleep	142 (39)	52 (14.3)	36 (9.9)	60 (16.5)	44 (12.1)	30 (8.2)
Waking up at night	141 (38.7)	51 (14)	46 (12.6)	65 (17.9)	34 (9.3)	27 (7.4)
Lack of a good night sleep	138 (37.9)	69 (19)	33 (9.1)	51 (14)	42 (11.5)	31 (8.5)
Waking up tired	117 (32.1)	59 (16.2)	52 (14.3)	52 (14.3)	50 (13.7)	34 (9.3)
Fatigue during the day	111 (30.5)	60 (16.5)	56 (15.4)	57 (15.7)	49 (13.5)	31 (8.5)
Reduced productivity	141 (38.7)	54 (14.8)	56 (15.4)	50 (13.7)	43 (11.8)	20 (5.5)
Reduced concentration	133 (36.5)	62 (17)	50 (13.7)	44 (12.1)	53 (14.6)	22 (6)
Frustrated/restless/irritable	128 (35.2)	50 (13.7)	50 (13.7)	58 (15.9)	48 (13.2)	30 (8.2)
Sad	154 (42.3)	47 (12.9)	63 (17.3)	40 (11)	34 (9.3)	26 (7.1)
Embarrassed	195 (53.6)	50 (13.7)	45 (12.4)	32 (8.8)	25 (6.9)	17 (4.7)

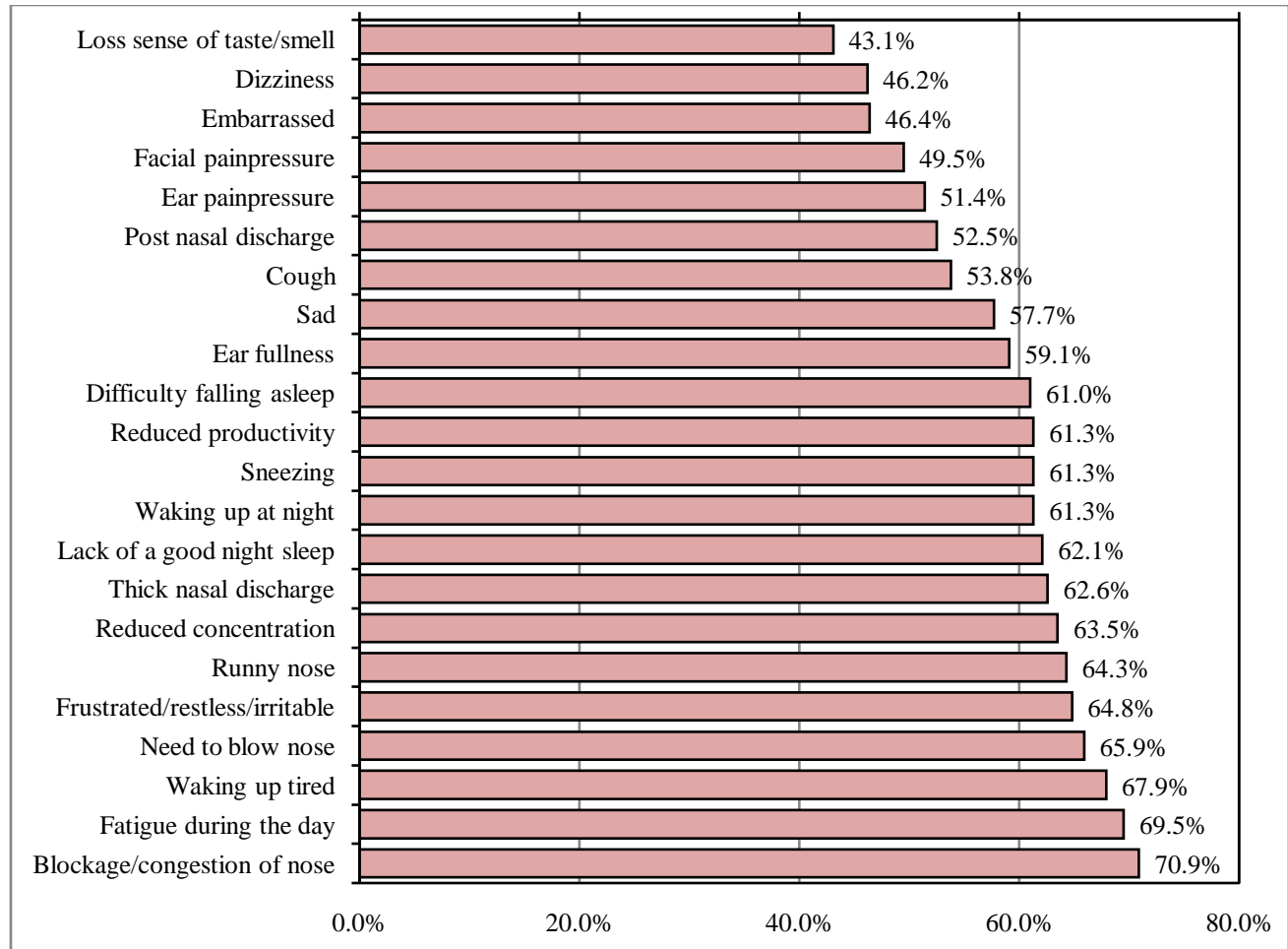


Figure 2:- Frequency of symptoms and social/emotional consequences of rhinosinusitis.

Sino-Nasal Outcome test (SNOT-22):

In order to assess severity of rhinosinusitis, sino nasal test (SNOT-22) was conducted, the average score was found to be 33.5 ± 26.3 out of 110 in a range of 0 - 103.

Factors associated with prevalence and severity of rhinosinusitis:

There was no significant association between gender and prevalence (P value = 0.270), nevertheless there was a significant association between gender and severity of rhinosinusitis (P value = 0.027). Regarding association between age distribution of participants and prevalence of the disease, there was a significant association between age and prevalence of the disease (P value <0.001) as well as significant association between age and SNOT-22 score (P value <0.001). Concerning about marital status of the participants, a significant association was found between both prevalence (P value < 0.001) and severity of rhinosinusitis (P value < 0.001). While assessing the association between educational level of the participants and prevalence of rhinosinusitis, a significant association was found (P value = 0.006), but there was no significant association with severity of rhinosinusitis (P value = 0.09). Further, occupational status and average monthly income also had a significant association with the prevalence of rhinosinusitis (P value = 0.001, P value = 0.001) as well as with SNOT-22 score (P value = 0.001, P value = 0.02), respectively. Factors associated with the prevalence and severity of the rhinosinusitis are summarized in Table 3.

Table 3:- Factors associated with prevalence and severity of rhinosinusitis.

Variable	Categories	Prevalence of Rhinosinusitis	P value	SNOT-22 Score		P value
				Mean	SD	
Gender	Male	81 (54%)	0.270	29.9	23.2	0.027

	Female	128 (59.8%)		35.9	28.0	
Age (years)	18-30	105 (46.7%)	< 0.001	27.7	24.6	< 0.001
	31-40	44 (75.9%)		38.5	25.1	
	41-55	53 (74.6%)		45.8	27.0	
	56-70	6 (66.7%)		44.9	28.2	
	71 or more	1 (100%)		51.0	-	
Nationality	Saudi	201 (57.6%)	0.744	33.7	26.4	0.298
	Non-Saudi	8 (53.3%)		26.5	21.2	
Marital status	Single	104 (47.9%)	< 0.001	28.0	24.3	< 0.001
	Married	98 (71%)		41.9	27.3	
	Divorced	5 (71.4%)		30.9	19.3	
	Widow	2 (100%)		48.5	33.2	
Educational level	Primary	2 (50%)	0.006	37.5	22.5	0.091
	Intermediate	7 (87.5%)		38.5	25.4	
	Secondary	64 (54.7%)		32.1	26.6	
	Bachelor	122 (62.6%)		36.0	25.5	
	Other	14 (35%)		23.7	28.0	
Occupational status	Employed	85 (67.5%)	0.003	39.2	26.6	0.001
	Unemployed	32 (56.1%)		33.1	24.9	
	Private business	8 (72.7%)		33.7	17.8	
	Retired	14 (73.7%)		46.2	24.2	
	Other	70 (46.4%)		27.2	25.9	
Average monthly income (SAR)	< 10,000	137 (58.3%)	0.001	33.6	25.4	0.020
	10,000-14,999	45 (71.4%)		37.3	23.9	
	15,000-20,000	24 (49%)		34.1	31.1	
	> 20,000	3 (17.6%)		15.1	26.3	

Discussion:-

In this study, it was aimed to assess the prevalence and severity of rhinosinusitis among people living in Taif, Saudi Arabia and to explore the relationship between prevalence, severity and different socio-demographic factors. According to the data from the National Health Interview Survey in the United States, RS is one of the most commonly diagnosed chronic diseases, affecting 14-16% of the population (Chen et al., 2003; Shashyet et al., 2004). Because of its high prevalence rate, the total cost of CRS has been identified as a socioeconomic burden (Macdonald et al., 2005).

The current study showed high prevalence of rhinosinusitis among people living in Taif, Saudi Arabia. The prevalence was 57.4%. This result was higher than several studies conducted as in Denmark 9%, in Korea 6.95%, and in USA 11.9% (Lange et al., 2013; Kim et al., 2011; Hirsch et al., 2017). There are two explanations for this distinction. First, previous studies adjusted more stringent diagnostic criteria of CRS in defining the RS. Second, the age of participants in each study might be another factor influencing the prevalence difference. An earlier study in Taif found that allergic rhinitis was the second most common allergic disease, affecting 52.82% of the studied population, which was consistent with the current findings (Sabry, 2011).

The current results also demonstrated that more than half of the participants did not experience any loss of taste or smell. Smell loss or reduction is a diagnostic symptom of CRS, and sniffing sticks have proven to be a useful tool in evaluating reduced sense of smell (Hox et al., 2010).

Furthermore, a study conducted in the United States found that co-morbid diseases were most strongly associated with CRS cases who reported smell loss, facial pain and/or pressure, and had the weakest associations with CRS cases who did not report these symptoms (Kuiper et al., 2018). In order to assess severity of rhinosinusitis sino nasal test (SNOT-22) was conducted, the average score was found to be 33.5 ± 26.3 out of 110 in a range of 0 - 103. This is almost similar to another study conducted in Denmark (Lange et al., 2013). However, the current average score was lower than another study which investigated a group of RS patients waiting for surgery and had an average score of

44.4 (Abdalla et al., 2012). This is most likely due to differences in severity of RS among different sampled population.

In addition, the prevalence of RS was significantly associated with several socio demographic variables such as gender, age, marital status, occupational status, educational level and monthly income of the participants. Similarly, results from another study in Korea showed significant association between old age and prevalence of RS (Kim et al., 2011). The change in mucociliary function could explain the higher prevalence in proportion to the increase of RS with age. A previous study discovered that as people get older, their ciliary beat frequency decreases and they develop more pronounced defects in their central microtubulus (Ho et al., 2001).

CRS prevalence, severity, and treatment might be influenced by a number of systemic conditions. In some cases, these conditions warrant classification as distinct subtypes of CRS. Further research would be required to characterize the link between other conditions, such as allergy, and CRS. Physicians must consider the impact of these conditions on their patients' treatment and prognosis (Ryan et al., 2010).

The current study had some limitations. This was a cross sectional study, thereby it lacks the generalizability and a causal relationship rather than the possibility of recall bias.

Conclusion:-

The results revealed a high prevalence and severity scores of rhinosinusitis among people living in Taif, Saudi Arabia. It is recommended to conduct future research with the significantly associated factors. Regular and periodic epidemiological studies on RS are required to reduce socioeconomic expenditure and create a better national health care policy. It could be used to create a strategic public health plan for the most effective management of these diseases.

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