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Original Research Article

Rhinological Problems at Agricultural-industrial Area, Rabak City, Sudan

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Abstract

Background: Rhinological disorders were increasingly observed at Agricultural-industrial areas at Rabak city.
Study Objectives: The study aimed to identify the prevalence of nasal disorders and to find if there is a relationship between them and participants residence in an Agricultural- industrial area.
Methods: The study was cross-sectional descriptive conducted during the summer of 2017, a well-structured questionnaire was used to screen (n=297) participants at Rabak city for nasal disorders. Nasal examinations were conducted using Killian's nasal speculum and nasal endoscope to reach the diagnosis, and then suitable management was approached followed by clinical outcome assessment, whilst the association of the two main risk factors; Smoking and Asthma were evaluated. Data were analyzed statistically and manipulated in a suitable way.
Results: Majority of participant (28.6 %) were at (20-40) years old of both sex living at urban industrial part of Rabak city, the study revealed that most of nasal problems were combinations of 3 nasal symptoms (28.4) or more which include; nasal discharge, nasal itching, loss of smell, epistaxis and nasal blockage. The most prevalent nasal disorder alone was nasal blockage (12.5%) and nasal itching (4.5). Pale nasal mucosa and hypertrophied nasal turbinate were noticed more on patient with 3 nasal symptoms (40%) and (19.3%) respectively. Patients with 3 nasal symptoms were diagnosed as Allergic rhinitis (28.4%) and were treated medically (21%) with reported outcome of (22.7%). Strong association was also observed between nasal blockage and the risk of smoking and bronchial Asthma in patient with AR in multi-variable analysis with Odds ratios; [(2.251(95% CI: 3.355±15.672, p = <0.000)) and ((5.456 (95%CI: 2.393±12.439, p= <0.000)], respectively.
Conclusion: Allergic rhinitis was reported as a common disorder with main nasal blockage symptom triggered by smoking and highly associated with bronchial asthma among population lived at Rabak city agricultural and industrial area. It was recommended that, Smoking should be prohibited for all industrial areas resident, whilst asthmatic patients were recommended to live away.

Keywords: Nasal problems, Allergic rhinitis, Industrial area, Smoking, Asthma, Nasal blockage

INTRODUCTION

Ears, Nose and Throat (ENT) problems occur frequently in the community and are common reasons for consulting general practitioner (GPs) (Hannaford et al., 2005).

Traditionally, rhinitis is divided into allergic (AR) and non-allergic (NAR) rhinitis. The first one is the most common form and it is associated with an immunoglobulin E (IgE)-mediated immune response against allergens (Bousquet et al., 2001). Allergic rhinitis is a common disorder and it's strongly linked to asthma, suggesting that these conditions are closely related and has led to the concept of 'one airway, one disease (Small and Kim, 2011; K et al., 2008).

It can be classified into seasonal and perennial types based on the timing of symptoms and the causative

agents (Brożek et al., 2010). The prevalence of AR has generally increased worldwide in both adults and children over the last 2 decades (Zhang and Zhang, 2014). In addition, symptoms of allergic rhinitis were found to be trigged with industrial and agricultural grass pollutions introduction issue, and It documented to affects Quality of life, school and work attendance and performance this agreed with Luyt (1996).

It's diagnosed by history and examination backed up by specific allergy tests (K et al., 2008). Indeed, studies have suggested that ~20%-50% of patients with allergic rhinitis have clinical asthma, whereas >80% of patients with allergic asthma having concomitant rhinitis symptoms (G et al., 2003; Chen et al., 2008).

Tobacco smoke exposure remains common and has been linked with an increased risk of multiple upper respiratory conditions in various age groups. Significant associations have been suggested between tobacco and allergic rhinitis (Shargorodsky et al., 2015).

Allergic rhinitis, have been increasing over years in Africa where the illiteracy rate was high and education is important in the management of Allergic rhinitis (J et al., 2007).

Potential allergens include grass pollens that are mostly seasonal, grass pollens may induce hypersensitivity reactions almost throughout the year particularly in Africa with spring type of climate (Luyt, 1996). Epidemiological reports in Africa have indicated higher prevalence of allergic sensitization in urban than in rural communities (C et al., 1996; Patel et al., 2018).

Other allergens incriminated in allergic rhinitis include; weeds, trees molds, house dust mite, cat, cockroach and truck traffic (Galant et al., 1998; Arnedo-Pena et al., 2017).

Allergic Rhinitis characterized by one or more symptoms including sneezing, nasal itching, nasal blockage, and clear rhinorrhea, Nasal itching, sneezing and profuse rhinorrhea are classic of early AR, However, nasal obstruction manifests as a prominent symptom with time (Skoner, 2001; Bahceciler and Galip, 2014; Khanna and Shah, 2005).

Clinical signs of allergic rhinitis consistent with an allergic cause include, but are not limited to, pale discoloration of the nasal mucosa, edematous nasal mucosa red and watery eyes (Seidman et al., 2015; Okubo et al., 2017).

Empiric treatment can be initiated without allergy testing, but testing is required for definitive diagnosis and consideration of certain trigger-specific therapies such as allergen avoidance and allergen immunotherapy (Azmeh and Dykewicz, 2018).

Intranasal corticosteroids are the most effective medication class for monotherapy management of Allergic Rhinitis and when combined with intranasal antihistamines can be even more effective (Azmeh and Dykewicz, 2018; Wallace, et al., 2017).

The most recent addition to intranasal sprays for the maintenance therapy of AR is MP-AzeFlu, a single formulation nasal spray of azelastine hydrochloride and fluticasone propionate in an advanced delivery system (Berger and Meltzer, 2015).

Other options for treating mild symptoms include nasal antihistamines, leukotriene-receptor antagonists (Wheatley and Togias, 2015).

When pharmacotherapy is not effective or produces unacceptable side effects, allergen immunotherapy by inducing allergen-specific immune tolerance is a known effective option with no practical controversy (Jutel et al., 2015; Greiner et al., 2011).

Treatment and follow up were crucial for the best outcome, to avoid different drugs side effects, furthermore it detect any suspected complications (K et al., 2017).

Although, nasal problems will have expected to be high, there is no enough data on the epidemiology of nasal disorders among Sudanese, at industrial area of Rabak city. This study was aimed to determine the prevalence of nasal disorders among participants presenting to a secondary care hospital and to identify the associated risk factors at White Nile State, Sudan.

METHODOLOGY

Ethical considerations

The study was approved by the Health Insurance Research Committee, White Nile state, in the form of Ethical Clearance. Besides, patient verbal informed consent was accepted by all participant patients or their co-patients in individualized patterns.

Study design

A prospective cross-sectional, hospital-based study was done during the period between August–November 2017 among patients presenting to the Health Insurance ENT clinics at Rabak city, Sudan.

Study population

All patients attending Rabak city ENT clinics suffering from any nasal problems during the study period whom fit the study inclusion criteria were enrolled voluntarily after obtaining verbal informed consent

A-Inclusion criteria

The study inclusion criteria include; all ages from both sex whom suffered from nasal problems were eligible to

Table 1. Demographic data, n= 297

Patterns	Frequency/Percentage	p-value
1- Age		
< 5	25(8.4)	p<0.0001
5 <10	39(13.1)	
10< 20	63(21.2)	
20<40	85(28.6)	
40<60	69(23.2)	
60>	16(5.4)	
2- Sex		
Male	158(53.2)	0.270
Female	139(46.8)	
3- Residence		
Urban	87(29.3)	p<0.0001
Urban-industrial	98(33)	
Rural	43(14.5)	
Rural industrial	56(18.9)	
Others	13(4.4)	
4- Occupation		
Industrial worker	30(10.1)	p<0.0001
Farmer	35(11.8)	
Officer	22(7.4)	
Free duties	41(13.8)	
Security officer	6(2.0)	
Other occupations	7(2.4)	
Not working	131(44.1)	
Child	25(8.4)	
5- Education		
Illiterate	28(9.4)	p<0.0001
Preschool	25(8.4)	
Basic	133(44.8)	
Secondary	54(18.2)	
University and higher	57(19.2)	

participate actively in the study.

B-Exclusion criteria

The study exclusion criteria include; any individual without incomplete investigations or had concomitant other ENT disease were excluded.

Sample size estimation

The simplest formula of sample size determination (N = PQZ2/d2) was used to estimate our sample size (N = 297).
Where N = sample size, P = prevalence factor, Q = 1–p, Z = constant 95% occurred 1.96, and d = desired margin.

Data collection procedure

Data were collected using well-designed questionnaire, participants of the study were approached by asking questions regarding their personal data, nasal-related symptoms, whilst investigator performed clinical examinations, nasal-related diagnosis, investigations and the management. In addition to, the follow-up records of treated and patients' referral especially for those in need of surgical interventions. All patients had undergone a detailed history and a complete physical examination by the ENT consultant and appropriate investigations were requested depending upon the patient complaint and consequently treated.

Data analysis

The patients' data were analyzed statistically using the SPSS version 21. The descriptive statistical summarization was done. The associations between patients' personal data and risk factors with the dependent variables were conducted using chi-square test. Result considered significant at p-value < 0.05.

RESULTS

Majority 85(28.6%) of participants aged 20-40 years old, from both sex, whilst most population 98(33%) lived at urban-industrial part of the city, as shown in Table 1,

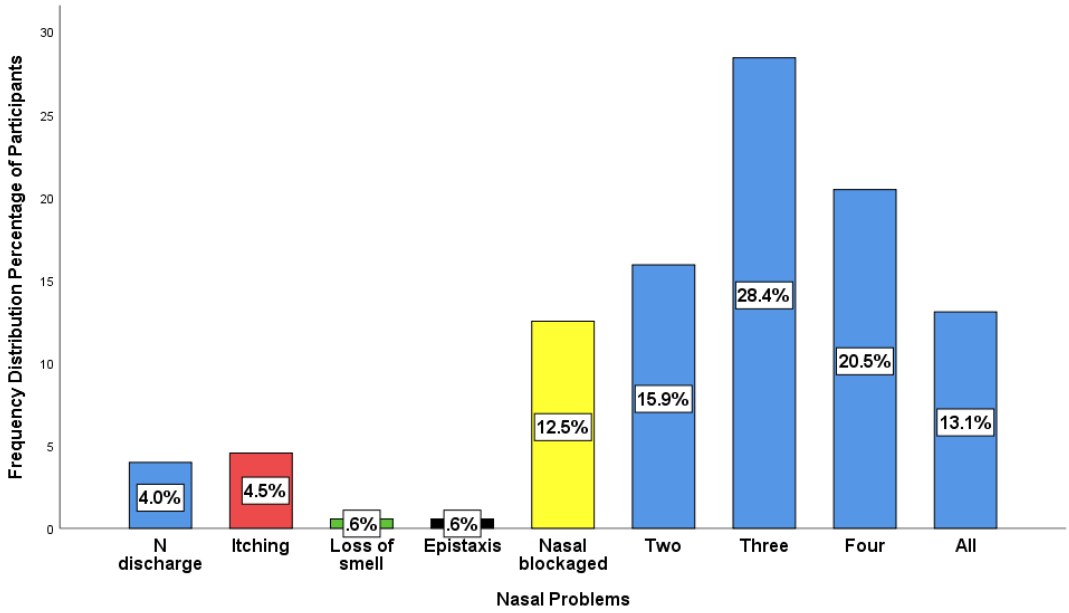

Figure 1. The frequency distribution percentage of the five main Rhinological problems reported among the study populations.

Table 2. Relationship between Demographic and nasal problems, n=39

Patterns	**Nasal Discharge**	**Nasal Itching**	**Smell Loss**	**Epistaxis**	**N Blockage**
Frequency/Percentage					
1- Age	**n=7**	**n=8**	**n=1**	**n=1**	**n=22**
< 5	2(29)	1(13)	0(0)	0(0)	5(23)
5 <10	2(29)	0(0)	0(0)	0(0)	0(0)
10<20	2(29)	1(13)	1(1)	1(1)	3(14)
20<40	0(0)	3(38)	0(0)	0(0)	6(28)
40<60	1(14)	3(38)	0(0)	0(0)	5(23)
60>	0(0)	0(0)	0(0)	0(0)	3(14)
p-value					**0.008**
2- Sex	**n= 7**	**n=8**	**n=1**	**n=1**	**n=22**
Male	4(57)	4(50)	0(0)	0(0)	12(54)
Female	3(43)	4(50)	1(100)	1(100)	10(45)
3- Residence	**n=7**	**n=8**	**n=1**	**n=1**	**n=22**
Urban	2(28.6)	4(50)	0(0)	1(100)	7(31.8)
Urban ind	4(57.1)	2(25)	1(100)	0(0)	5(22.7)
Rural	1(14.3)	0(0)	0(0)	0(0)	3(13.6)
Rural-ind	0(0)	1(12.5)	0(0)	0(0)	6(27.2)
Others	0(0)	1(12.5)	0(0)	0(0)	1(4.5)
4- Occupation	**n=7**	**n=8**	**n=1**	**n=1**	**n=22**
Indust-worker	1(14.2)	0(0)	1(100)	0(0)	0(0)
Farmer	0(0)	2(25)	0(0)	0(0)	5(22.7)
Officer	0(0)	1(12.5)	0(0)	0(0)	3(13.6)
Free duties	0(0)	2(25)	0(0)	0(0)	4(18.1)
Not working	4(57.1)	2(25)	0(0)	1(100)	5(22.7)
Child	2(28.6)	1(12.5)	0(0)	0(0)	5(22.7)

NB: Any combination of two or more clinical conditions were excluded from the table, to avoid complications and duplications.

most of the population were not working and this accounted for 131 (44.1%), majority of population were at the basic level of education and this accounted for 133 (44.8), see Table1

Five main common nasal problems were reported either alone or in combination, moreover, the most common nasal problems was nasal blockage and represent (12.5%), see Fig. 1

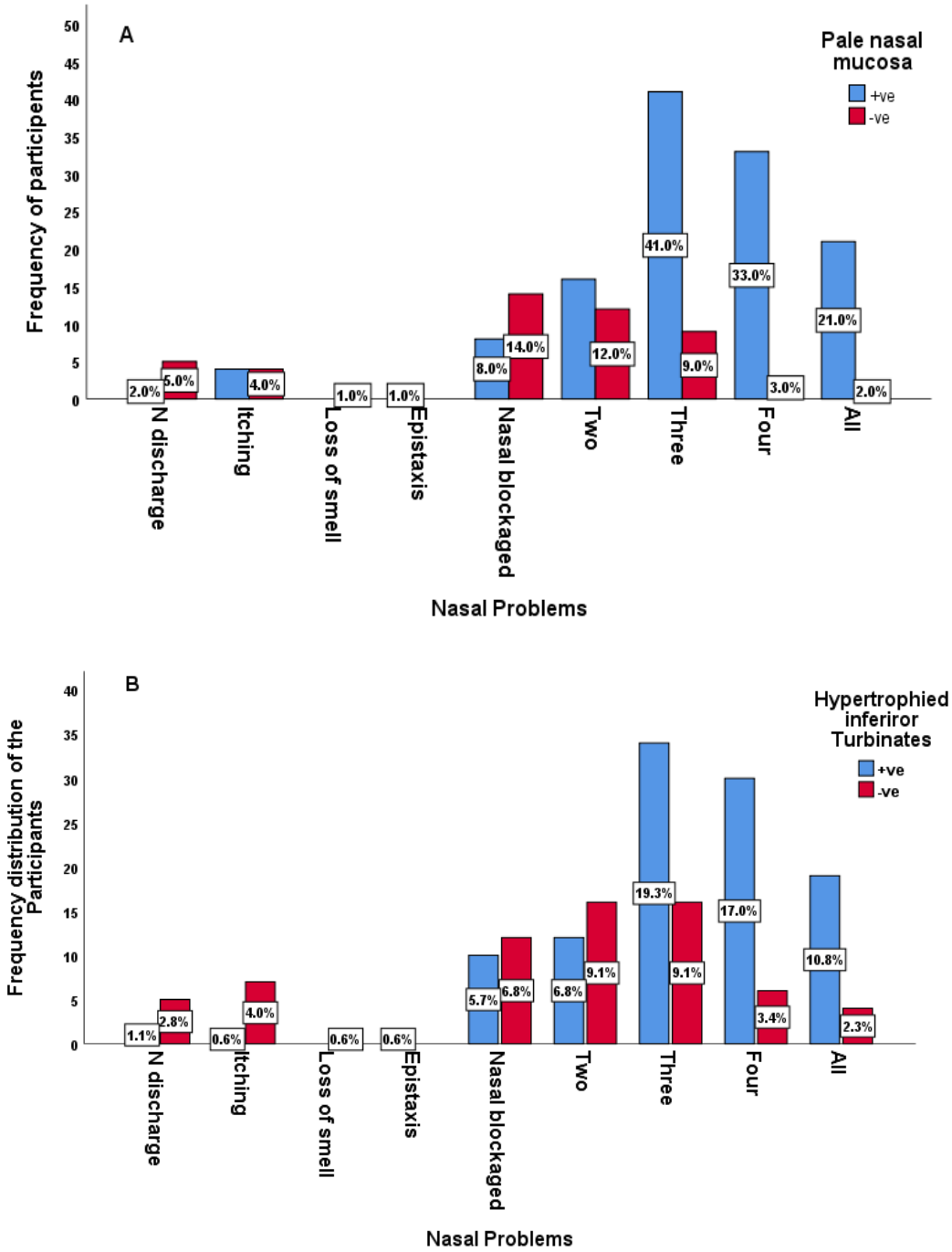

Figure 2. The frequency distribution percentage of the common Nasal problems and the two clinical examinations used for their diagnosis; Pale nasal mucosa(**A**) and Hypertrophied inferior turbinates (**B**) among the participants.

The nasal blockage was found to be common in the age group (20-40) years old, of both sex among non-working populations whom lived in Urban and rural industrial with basic level of education, see table 2.

Clinical examinations showed that pale nasal mucosa sign was the common for patients suffering from three or more nasal problems (Fig 2A).

On the other hand, hypertrophied inferior turbinates signs were more noticed among population suffering from nasal obstruction as shown in (Fig 2B).

Combined modalities of treatment were noticed among patients suffered of three or more nasal problems, whilst patients suffered from nasal obstruction were treated medically only, see Fig.3

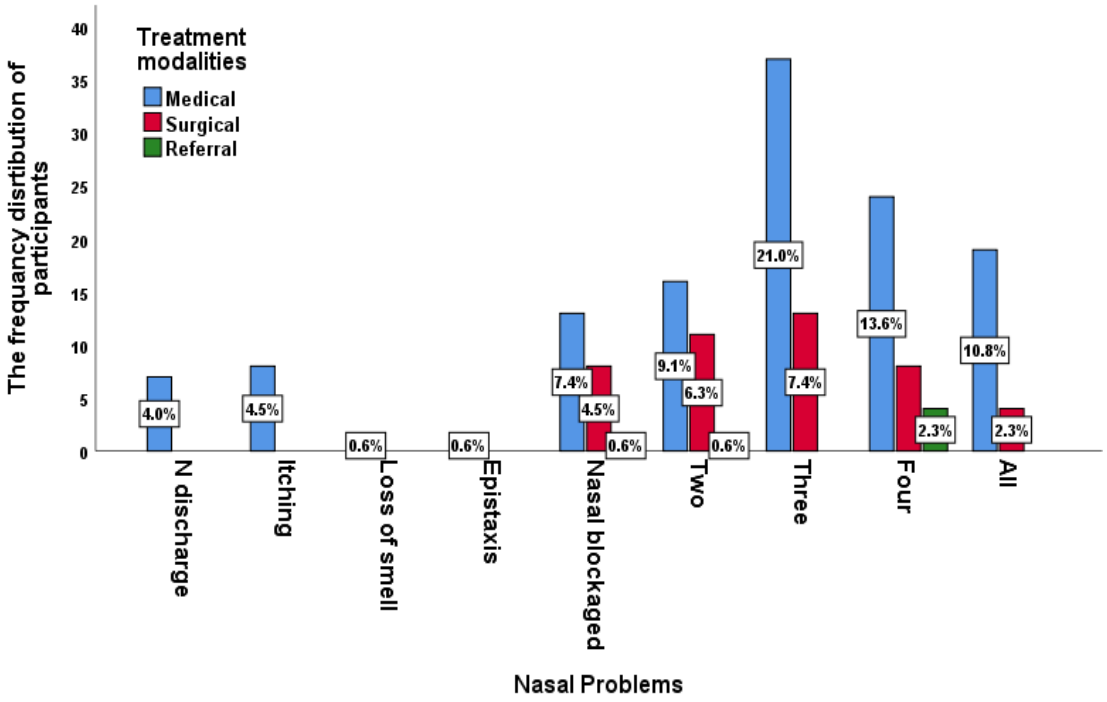

Figure 3. The frequency distribution percentage of therapeutic modalities for common nasal symptoms among the study population.

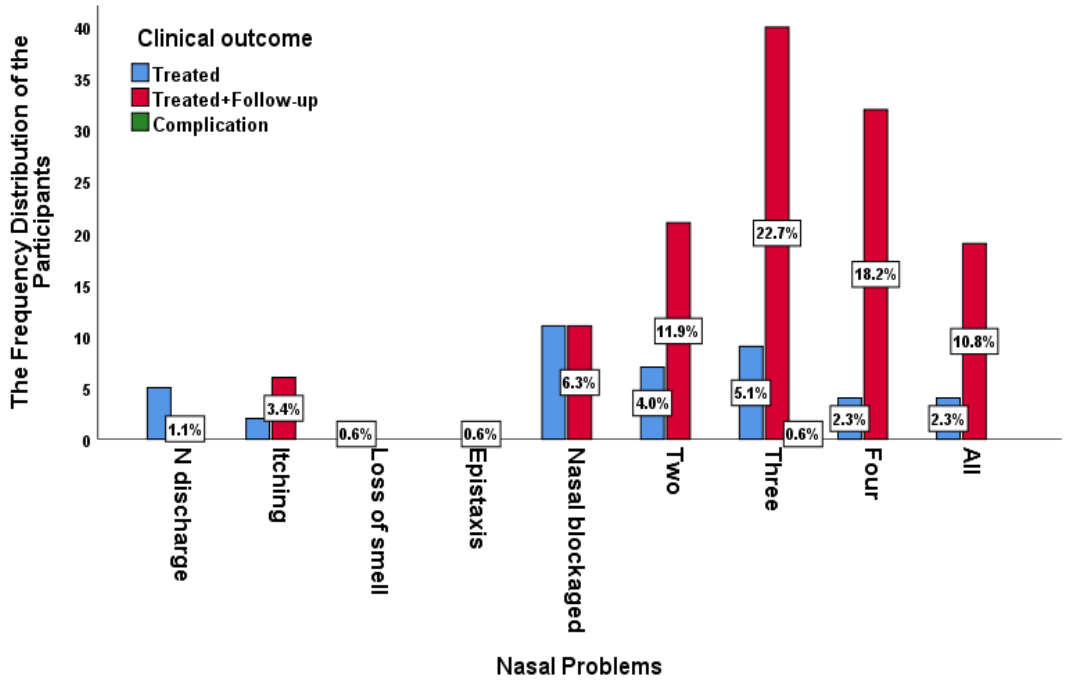

Figure 4. The frequency distribution percentage of clinical outcome for common nasal symptoms among the study population.

Treatment and follow-up were the main outcome among population suffered from nasal itching ,nasal blochage and two or more nasal problems,whilst nasal discharge reguired treatment only without follow up, see Fig 4.

Both smoking and asthma as estimated risk factors showed direct relationship to common nasal problems as shown in table 3.

Table 3. The adjusted odds ratios (ORs) with associated 95% confidence (CI) with its lower and upper limits for common Nasal problems and the risk factors; Smoking and Bronchial asthma among the participants.

Variables	OR	95%CI	p-value
		Lower ± Upper limits	
1- Nasal discharge			
Smoking (+ve/-ve)	3.019	1.587±5.742	0.001
Asthma (+ve/-ve)	2.792	1.364±5.714	0.004
2- Nasal itching			
Smoking(+ve/-ve)	6.354	3.019±13.376	<0.000
Asthma(+ve/-ve)	13.526	4.643±39.406	<0.000
3- Loss of smell			
Smoking(+ve/-ve)	7.756	3.954±15.212	<0.000
Asthma(+ve/-ve)	3.833	1.868±7.865	<0.000
4- Epistaxis			
Smoking(+ve/-ve)	4.168	2.105±8.256	<0.000
Asthma(+ve/-ve)	3.516	1.661±7.443	0.001
5- Nasal blockage			
Smoking(+ve/-ve)	2.251	3.355±15.672	<0.000
Asthma(+ve/-ve)	5.456	2.393±12.439	<0.000

DISCUSSION

Nasal problems expected to be high among Sudanese, particularly at industrial area of Rabak city, whilst the prevalence of nasal disorders among patients and the associated risk factors were not documented.

Our results revealed that, majority of the participants were young, live within industrial areas, this can be taken as evidence that, outdoor exposes the youngest to urban pollutions, these agreed with Potter et. al., (1996). Who reported that all types of allergies were frequently diagnosed in urban regions at South Africa. Also, this agreed with Patel et al., (2018) whom stated that rural living in farm is inversely associated with allergy.

Nasal disorders were observed high among unemployed individuals, this might be they are habitually outdoor most of the day spending their time without any safety precautions, hence, they are subjecting to environmental pollutions of the nearby factories, this findings disagreed with Jung, et al., (2016) who reported that among Korean adults, Nasal disorders, and specially Allergic rhinitis (AR) were associated with high household income and educational level.

Half of the study participants were with basic educational level, this due to the fact that Rabak city is a boarder city hugging a lot of refugees from nearby countries; such as South Sudan, whom have no good income and this is agreed with Belhassen, et.al., (2017), whom reported that there was a clear increase in costs with prevalence of allergic rhinitis in France.

The co-morbid of two up to four nasal disorders were noticed, this is due to that the known clinical features of AR; nasal itching, nasal obstruction, runny nose and loss of smell and this in line with Skoner (2001), (Bahceciler and Galip, 2014) findings.

Moreover, the commonest nasal problem documented was nasal blockage, this agreed with Khanna and Shah, (2005) who categorized the allergic patients with sneezing and running nose or with nasal obstruction.

Clinical nose examinations showed that pale nasal mucosa and hypertrophied inferior turbinates signs were noticed among the study population, those are known clinical signs for diagnosis of AR, this is agreed with Seidman et al., (2015) and Okubo et al., (2017), whom reported that Nasal mucosal swelling is caused by interstitial edema in the nasal mucosa, due to plasma leakage, and congestion of the nasal mucosal vessels as a direct actions of chemical mediators, such as histamine, PAF, prostaglandin D2, kinin, and particularly leukotriene.

The majority of patients with nasal disorders were treated medically by Nasal decongestant, antihistamine, steroid, systemic antihistamine and systemic decongestants, this is due to the fact that AR without complications was the commonest diagnosis. This agreed with Azmeh and Dykewicz (2018) who reported that Intranasal corticosteroids (INS) are the gold-standard first-line therapy for moderate/severe and/or persistent Allergic Rhinitis. Also, this agreed with Wallace et al. (2017), Berger and Meltzer (Berger and Meltzer, 2015) and Wheatley and Togias (Wheatley and Togias, 2015).

Treatment and follow-up were the main outcomes among population suffering from nasal blockage and two or more nasal problems,this due to the fact that most of the patients with nasal obstruction were suffering from snoring, sleep apnea,nasal polyps that need frequent follow up to prevent suspected complications, this agree with Greiner, et al., (2011). Whilst nasal discharge reguired treatment only without follow up, this because these patients were have mild symptoms and were got quick benefit from oral and local antihistamines.

Smoking was found to be a risk factor with strong significant (p= 0.001, <0.000) relation to patients suffering from all nasal disorders specially nasal blockage following allergic rhinitis, this agreed with Shargorodsky et al. (2015) who stated that Tobacco smoke exposure was associated with increased prevalence of rhinitis symptoms.

Asthma was strongly linked (p= 0.004, 0.001 and <0.000) to participants with all nasal problems and this agreed with Small and Kim (2011) and Scadding,et.al., 2008)

CONCLUSION

The study concluded that, young people who lived at industrial areas were at risk to develop nasal disorders. Besides, unemployed with basic educational level living at industrial areas without protection measures were at risk of AR.

All known AR clinical features were observed among participants as mentioned in the literature. Our participants diagnosed with AR fall within the second category; suffering from nasal blockage and not sneezing and running nose. Both positive findings of applied; pale nasal mucosa and hypertrophied inferior turbinates examinations confirmed our approach to AR diagnosis among the study participants.

Although, the commonest diagnosis reported was AR, the preferred treatment modality was medical option with intra-nasal corticosteroids. Medical treatment with clinical follow-up was the best outcome options in managing simple nasal problems, whilst surgical and referral were options for complicated nasal problems.

Both smoking and asthma as estimated risk factors showed direct relationship to all nasal problems, especially allergic rhinitis, reported among our study participants.

Finally, we recommend patient with basic education level and poor income have to be enrolled on rehabilitation economic and teaching projects. Special care must be intended towards young population to avoid the disabilities of Nasal disorders and its medications side effects. Further evaluations of contributing factors and the mechanism underlying the differences in AR prevalence are needed.

Moreover, any patients suffering from two or more nasal disorders at industrial and agricultural areas should be considered allergic until proof otherwise. Whilst routine physical ENT examinations should be performed among workers at industrial and agricultural site suffering from nasal obstruction for diagnoses of AR and to prevent its future co-morbid complications.

Also, to complete local nasal clinical examinations, nasal endoscopes should be applied following both pale nasal mucosa and hypertrophied inferior turbinates as a routine nasal examination. In addition, the long-term effects of those local steroids, local and systemic decongestants and antihistamines on treating AR need more follow-up.

Smoking should be prohibited for all industrial areas resident, whilst asthmatic patients were recommended to live away as far as possible from industrial and agricultural areas.

Study limitations include; genetic study should be conducted to determine inter-individual variation among middle aged population. Allergic skin tests should be performed to confirm the professional diagnosis of AR.

Conflict of Interest

The authors declare that there are no conflict of interest.

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