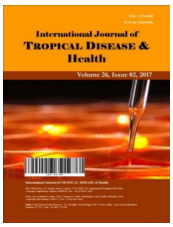

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Epidemiology of Wheezes and Diagnosed Asthma among School Children Aged 12-17 Years in Three States of Sudan 2016

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Authors' contributions

This work was carried out in collaboration between all authors. Authors SAB and HAM designed the study, performed the statistical analysis and wrote the first draft of the manuscript. Author SH and other authors managed the literature searches. Authors SAB and HAM revised the final manuscript for the scientific and intellectual content. All authors read and approved the final manuscript.

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ABSTRACT

Background: There is a dearth of recent information on wheezes and Asthma in Sudan. Asthma is a non-communicable disease that affected more than 300 million persons in 2014 and contributes to more than 15 million disability-adjusted life years (DALYs).
Objectives: This study was conducted to determine the prevalence of wheezes and asthmatic school children in the three states of Sudan.
Materials and Methods: Three states of Sudan were selected for field training of the fifth year medical students as part of the curriculum. A two-stage sampling procedure was carried out. Seventeen rural areas were randomly selected from the three states as the first stage. Thereafter;

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two primary schools were selected from each area randomly, one for girls and one for boys. The eligible study population was children at 7th and 8th grades of primary schools. A mini adapted questionnaire from the international study of asthma and allergies in children (ISAAC) was used to collect the data.

Results: A total of 1598 school children aged 12-17 years were enrolled in the study. Males children were 162(46.4%) and females were 187(53.6%).Freelancers fathers of children accounted for 259(74.2%) and housewives mothers were 270 (77.4%). Literate fathers and mothers were 1468(92%) and 1377(86%) respectively Children experienced an episode of wheezes during the last 12 months prior to the study were 349(21.8%). School children diagnosed asthmatic prior to the study were 199 (57%) among children suffered from wheezing episodes and the prevalence of diagnosed asthmatic in total study children in the three states was 12.5%. Two hundred children (57.3%) had experienced sleep disturbance among children with wheezing episodes. The difficulty of breath while playing was experienced by 211(60.7%) children. Children experienced difficulties during the speech were 183(52.7%). Those who had a cough without flu or chest infection were 211(60.7%). Presence of smokers and trees in the households of the children were significantly associated with wheezing episodes.

Conclusions: The prevalence of wheezes and Asthma among school children is high in rural Sudan. Smoking and trees were significantly associated with wheezing episodes. Health policy at the state level should include the control of asthma and raise the population awareness.

Keywords: Prevalence; wheezes; asthma; school children; Sudan.

1. INTRODUCTION

Globally; asthma affected more than 300 million of the population in 2014 [1]. Its prevalence is increasing up to 9.5% from 2005 to 2015 for both sexes and all ages. It is estimated that 4.3% of the population globally are affected by asthma by annual estimate rate of 9.5% among children [2]. Asthma has increased as a non-communicable disease and contributed to more than 15 million DALYs and 180,000 deaths per year [3]. The deaths due to asthma represent more than 1% of the global burden of diseases worldwide with increase prevalence each decade by more 50% [3]. Two decades ago, it was shown that the prevalence of asthma among children was 7.3% in Bangladesh in South Asia region [3]. In the USA, the prevalence of asthma among children was 9.6 % with the highest rate (13.5 %) among low-socio-economic status population [4]. Asthma contributed to increasing the ratio of observed years lived with disability (YLDs) to the expected YLDs by 1.18 in Sudan [5]. During the last decade in Khartoum State; the prevalence of wheezes and severe asthma among school children aged 13-14 years were 12.5% and 5.5% respectively [6]. Studies regarding the epidemiology of asthma were few in African countries as well as in Sudan [7]. Epidemiological information about asthma is needed since that asthma is one of the five respiratory conditions among children [8]. Knowledge of epidemiology of wheezes and diagnosed asthma among school children is almost deficient in the recent literature regarding children in the states of Sudan. The aim was to study the epidemiology of wheezes, asthma and environmental risks among children of primary schools in the 7th and 8th grades in three States of Sudan during November 2016.

2. MATERIALS AND METHODS

A cross-section study was designed to study the epidemiology of asthma among children in primary schools.

2.1 The Study Area

Three states of Sudan were selected for field training of medical students. The states were Gazera, White Nile and the Northern States. The three states were divided geographically into several localities. Gazera State had seven localities; White Nile State had six localities and Northern State had four localities. Localities were further divided functionally into administrative units at each state.

2.2 The Study Population

The eligible study population was children at 7th and 8th grades of primary schools.

2.3 Sampling and Sample Size

Two-stage sampling procedure was carried out. The first stage was carried by random selection of 17 rural areas from the 17 localities in the

three states. In the second stage, one primary school for girls and one for boys were randomly selected from each rural area. This resulted in 34 primary schools (17 girls and 17 for boys) and a total sample of 1598 eligible children.

2.4 Tools and Data Collectors

Structured pre-coded and pre-tested questionnaire was designed by the department of community medicine – faculty of medicine – University of Khartoum. The questionnaire was adapted from the international study of asthma and allergies in childhood Phase I (ISAAC) [6]. It included a complaint of wheezes and its effect on the child sleep, speech and play during last 12 months prior to the study and the environmental risks. The data collectors were medical students as part of the rural field training curriculum. Ethical clearance was obtained from the Department of Community Medicine, Faculty of Medicine and the permission from states` authorities. Data were cleaned and managed by the software SPSS version 20. Descriptive statistics were presented and chi-square test at 95% CL was used to test for risk factors associated with the presence of wheezes.

3. RESULTS

Out of 1598 children, 349 (21.8%) children had ever experienced an episode of wheezes during last 12 months prior to the study [Fig. 1]. Children experienced more than one episode of wheezes were 222 (63.6%) and 127(36.4%) had only one episode [Fig. 1]. The age of the total eligible children in the study ranged between 12-17 years with the mean 13.3 $\pm$1.1 years [Table 1]. The younger children who had ever an episode of wheezes during last 12 months prior to the study accounted for 229 (65.6%) out of children who experienced wheezes (349) [Table 1].

The gender distribution of the children with wheezes was 162 (46.4%) males and 187(53.6%) females [Table 1]. Freelancers fathers of children accounted for 259(74.2%) and housewives mothers accounted for 270 (77.4%) [Table 1]. Literate fathers and mothers were 325(93.1%) and 301 (86.2%) respectively [Table 1]. Children experienced sleep disturbances because of wheezes were 200 (57.3%) [Fig. 2]. Children who experienced difficulties of play or speech because of wheezes accounted for 60.7% and 52.7% respectively [Fig. 3]. The children experienced a cough without flu or chest infection during last 12 months accounted for 60.7% [Fig. 4]. The prevalence of known asthmatic children in the total study children was (199) 12.5% which accounted for 57% of the children who experienced wheezes [Fig. 5]. Presence of smokers and trees in the households of the children are significantly associated with an episode of wheezes, p-values 0.001 and 0.005 respectively [Table 2].

4. DISCUSSION

In this study, one fifth (21.8%) of the school children experienced current wheezes episodes in three selected states of Sudan, Gazera, White Nile and the Northern States. This prevalence is double the prevalence of asthma in a study carried out in western, northern, eastern and central states of Sudan [9]. Although the two studies were carried out in the States of Sudan but the difference of the study population could affect the prevalence of wheezes and asthma where the later study was carried among adults. The prevalence of known asthmatic children in this study is alarming compared to the prevalence among schoolchildren in Northern Portugal and India [10,11]. While the trend of wheezes and asthma in Sudan is increasing, the prevalence in Europe is decreasing [12,13]. The genetic and environmental factors of asthma in Sudan could be associated with its prevalence although that rural environment was shown to have some protective mechanism against certain types of asthma [14] Asthma as chronic disease in developing countries is among the top ten causes of DALYs among the 5-14 years old children and has an economic burden on the poorly equipped health system [14,15].

More than half of school children in this study experienced sleep disturbance where positive sleep disorders are significantly associated with asthma [16] It was shown that poor control and management of asthma predicted a high level of sleep disorders among African Americans suggesting a contribution of genetic and race factors [17]. However, asthmatic children were prone to habitual snoring and obstructive sleep apnoea which affect the cognitive abilities of the children [18,19]. Promising preventive measures for asthma among children were studied if they are screened and treated for sleep-disordered breathing that has an improvement mechanism on an asthmatic episode [19].

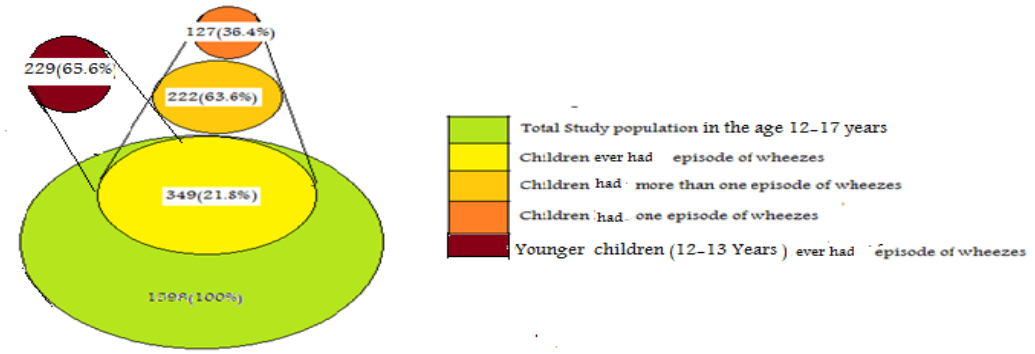

Fig. 1. Prevalence of wheezes during last 12 months prior to the study among children aged 12-17 years at three States of Sudan 2016

Table 1. Characteristics of study children aged 12-17 years with and without wheezes at three States of Sudan 2016 (n=1598)

Characteristics		An episode of wheezes during last 12 months prior to study		Total
		Yes (n=349)	No (n=1249)	
Gender of the child	Male	162(46.4%)	576(46.1%)	738(46.2%)
	Female	187(53.6%)	673(53.9%)	860(53.8%)
Age Groups of children*	12-13 Years	229(65.6%)	816(65.3%)	1045(65.4%)
	>13-17 Years	120(34.4%)	433(34.7%)	553(34.6%)
Occupation of the fathers	Employee	69(19.8%)	269(21.5%)	338(21.2%)
	Freelancer	259(74.2%)	925(74.1%)	1184(74.1%)
	Not working	21(6.0%)	55(4.4%)	76(4.8%)
Occupation of the mothers	Housewife	270(77.4%)	1006(80.5%)	1276(79.8%)
	Employee	49(14.0%)	153(12.2%)	202(12.6%)
	Freelancer	30(8.6%)	90(7.2%)	120(7.5%)
Education of the Father	Illiterate	24(6.9%)	106(8.5%)	130(8.1%)
	Khalwa/primary	93(26.6%)	381(30.5%)	474(29.7%)
	Secondary	133(38.1%)	458(36.7%)	591(37.0%)
	University/above	99(28.4%)	304(24.3%)	403(25.2%
Education of the Mother	Illiterate	48(13.8%)	173(13.9%)	221(13.8%)
	Khalwa/primary	85(24.4%)	376(30.1%)	461(28.8%)
	Secondary	138(39.5%)	487(39.0%)	625(39.1%)
	University/above	78(22.3%)	213(17.1%)	291(18.2%)

**The mean age 13.3±1.1*

Table 2. Environmental risks associated with wheezes among children aged 12-17 years at three States of Sudan 2016 (n=1598)

Risks of having wheezes		An episode of wheezes during last 12 months prior to study		P-value*
		Yes (n=349)	No (n=1249)	
Presence of smokers in the house (in rooms and household yards)®	Yes	154(44.1%)	390(31.2%)	0.001
	No	195(55.9%)	859(68.8 %)	
Availability of trees inside the house or the surroundings	Yes	262(75.1%)	839(67.2%)	0.005
	No	87(24.9%)	410(32.8%)	
Availability of domestic animals inside the house(goats, poultry, dogs, cats and donkeys)	Yes	237(67.9%)	801(64.1%)	0.205
	No	112(32.1%)	448(35.9%)	

**Fisher exact test*

®Presence of smoker in the house was significantly a risk associated with more than one episode of wheezes

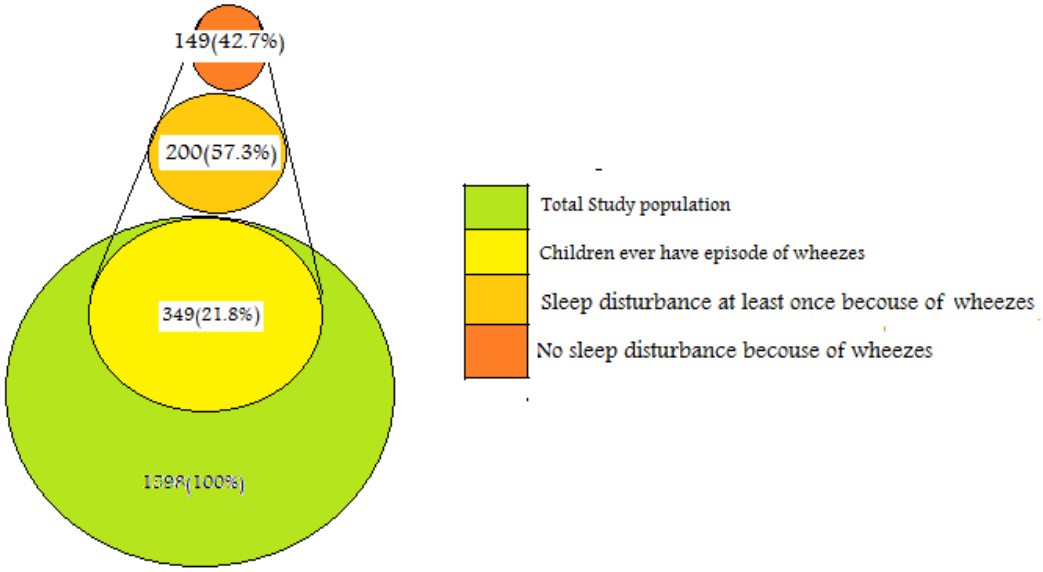

Fig. 2. Prevalence of sleep disturbance because of wheezes among children aged 12-17 years who experienced episodes of wheezes during last 12 months prior to the study at three States of Sudan 2016

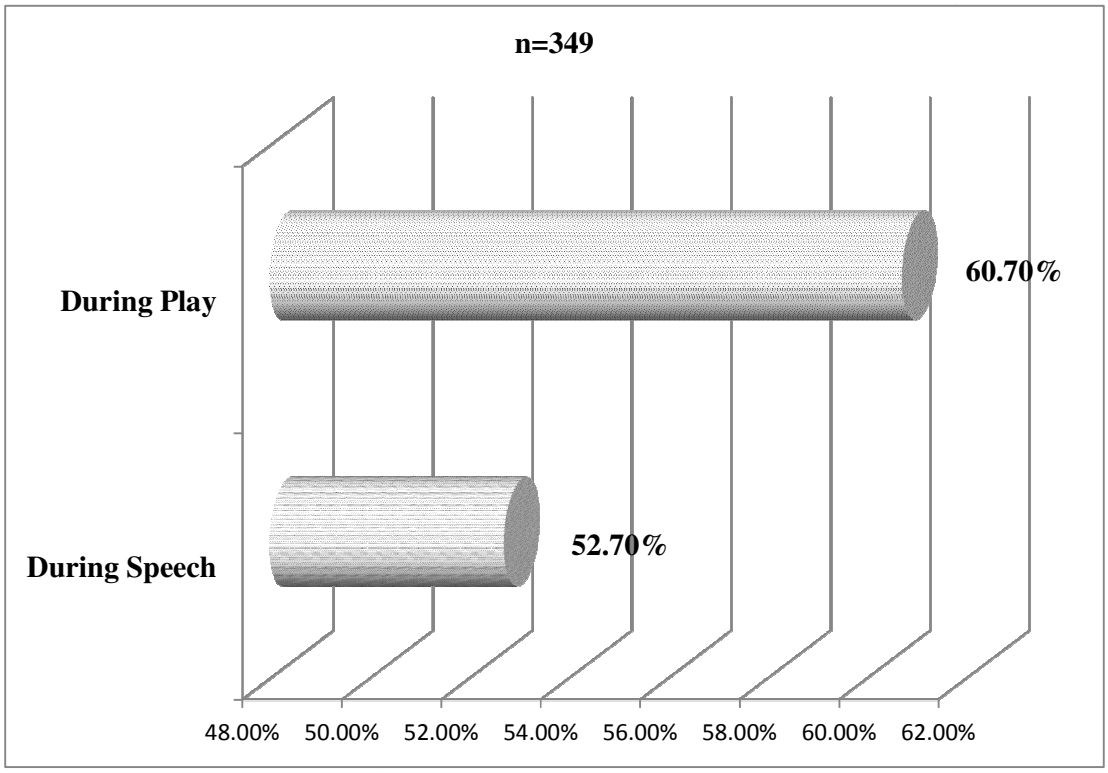

Fig. 3. Prevalence of difficulty of breathing during playing and speech because of wheezes among children aged 12-17 years who experienced an episode of wheezes during last 12 months prior to the study at three States of Sudan 2016

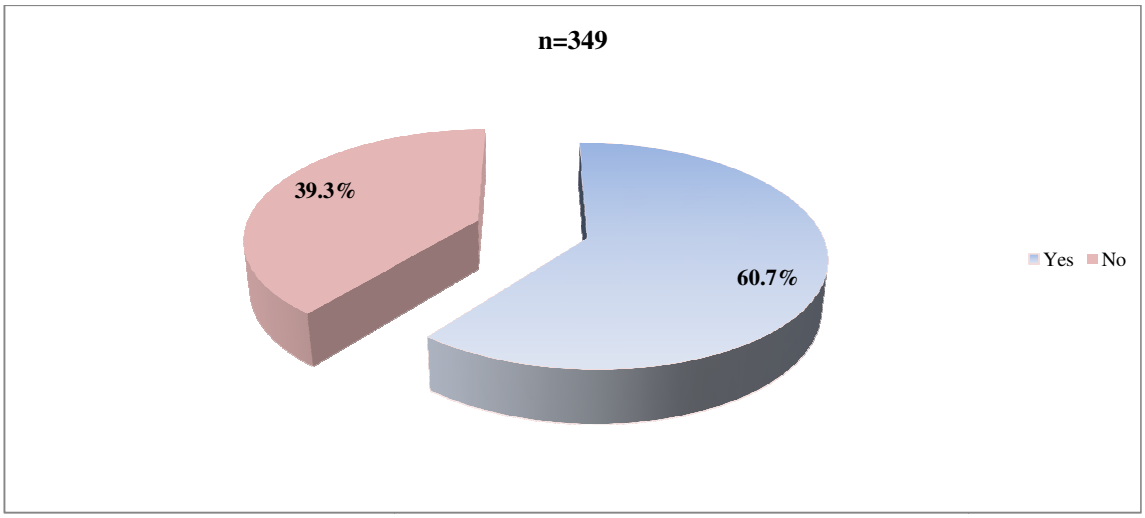

Fig. 4. Prevalence of a dry cough without flu or chest infection among children aged 12-17 years who experienced an episode of wheezes during last 12 months prior to the study at three States of Sudan 2016

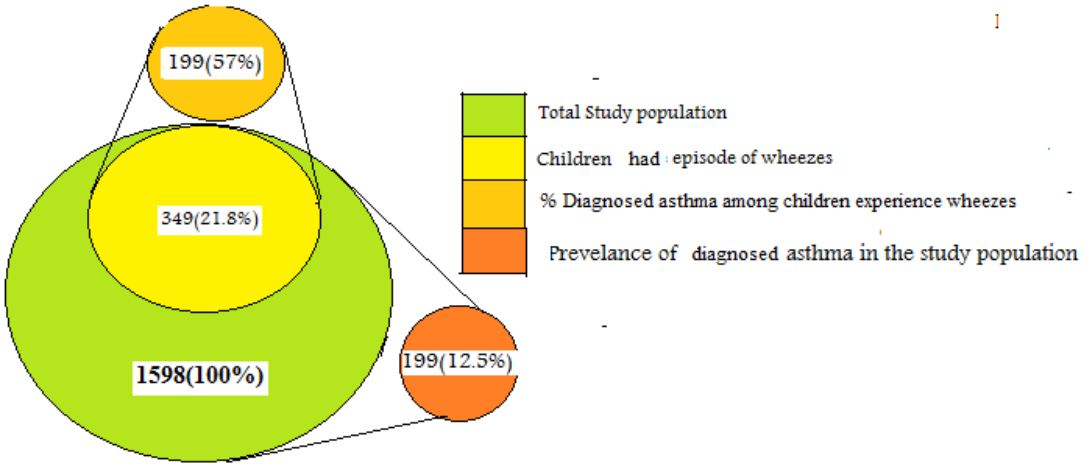

Fig. 5. Prevalence of diagnosed asthma among school children aged 12-17 years in three States of Sudan 2016

Two third of study children explained that wheezes interfere with their playing. This might be due to the sedentary life of the new generation in the internet era and social media interaction. It was shown that obesity and sedentary life could be significant factors associated with asthma [20,21]. However; a pilot study disprove the association of asthma with inactivity showing that active paly improve perceived fitness, asthma status and quality of life among tested children [22].

Half of the school children were having the difficulty of breathing during talk and speech because of wheezes and two third had a dry cough. Commonly asthmatic children breathe slowly and paused longer when they read or talk loud but might not have an effect on voice [23, 24]. A dry cough is associated with viral infections that commonly cause bronchiolitis and exacerbate wheezes and asthma making the child suffers from a chronic cough [25-27].

In this study, exposure to smoking in the households was significantly associated with wheezes where smoking is associated with air way resistance and asthma [9,28] The availability of trees inside the house or the surroundings is

significantly associated risk factor for wheezes episodes in the study children and this is supported by the risk of plants in initiating asthma symptoms among adults in northern and Khartoum states of Sudan [9]. The presence of domestic animals, goats, poultry, dogs, cats, and donkeys was not significantly associated with wheezing episodes. Comparing to a study of asthma among adults, it had shown that presence of domestic animals was triggering the asthma symptoms [9]. Several triggering factors are associated with the occurrence of asthma including the environmental housing conditions and the living residents [29].

5. CONCLUSION

The prevalence of wheezes and diagnosed asthma in the school children is high in Sudan. Smoking and trees are significantly associated with wheezing episodes. Asthma is a major health problem and more studies are recommended. Health policy at states level should include the control of asthma in the primary health care program and raise the population awareness.

6. LIMITATIONS

To minimize recall bias of children; the questionnaire was designed to capture only wheezes and if the child was known asthma without details of types of treatments, severity and others. Furthermore; the selected States were those involved in the Rural Residency Program for the 5th year medical students, therefore the results obtained could not be generalized to the whole country.

CONSENT

As per international standard or university standard, the patient's written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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