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PREVALENCE OF PATHOGENIC BACTERIA ASSOCIATED WITH BRONCHIAL ASTHMA PATIENTS ATTENDING ASHAKA CEMENT CLINIC, FUNAKAYE, GOMBE STATE, NIGERIA.

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ABSTRACT

Asthma has been one of the most prevalent chronic childhood conditions in many countries. This condition has repeatedly been a major burden for affected children and their families, which results into a great challenge for public health organizations and health care providers, and researchers who are working hard to finding the key causes. Pathogenic bacteria have been observed to pose public health challenges associated with patients suffering from childhood asthma. This study was conducted to determine the prevalence and intensity of childhood asthma among patients attending Ashaka Cement Clinic, Funakaye LGA, Gombe state, Nigeria within the periods of October 2016 to March 2017. A total of 155 patients from four wards of the clinic were screened for symptoms and signs of asthma using questionnaire designed to collect patients' age, history, chemical examination and in-depth interviews were carried. Sputum and oropharyngeal swabs from the posterior walls of oropharynx were obtained and examined using standard laboratories methods. An oral prevalence of 3.9% was observed out of the 155 patients examined. High prevalence of 39.3%, 46.0%, 25.5% and 41.2% were observed in Jalingo ward, Anguwan Kara ward, Wuro Ibba ward and Maza ward, respectively. The age group 0 – 9 years recorded the highest prevalence of 42.1% with no significant differences among age groups ($P< 0.05$). Males recorded higher prevalence of 39.4% more than the females (38.5%) with no significant difference ($P<0.05$). Factors associated with the presented symptoms of asthma on multivariate analysis were passive smoking (O R 3.33, 95% CL 1.85. 7.65), pets at home (O R 5.5, 95% CL 1.04 – 29.15) and absence of windows in living rooms (O R 4.03, 95% CL 1.17 – 13.79). Other factors such as family history of asthma, history of worm infestation, fuel used for cooking, location of kitchen and food allergy were not significant on statistical analysis. The species of bacteria isolated and identified from asthma patients include *Chlamydia Pneumoniae* (22.5%), *Mycoplasma pneumoniae* (10.8%), *Bordetella Pertussis* (4.4%), *Streptococcus pneumoniae* (3.0%) *and Staphylococcus aureus* (1.9%). The study draws attention to the health hazards posed by pathogenic bacteria and risk factors associated with asthma among patients in the study area. The urgent need for a decisive control intervention to stern the problems cannot be overemphasized. Furthermore, there is a need to establish a computerized data bases for information sharing among researchers and personnels involved in the implementation of control programme to improve the surveillance system and

allow quick and adequate access responds to asthma outbreak, epidemiological database, risk factors associated with the disease as well as GIS database on Asthma.

Keywords: Pathogenic bacteria, asthmatic patients, prevalence, bronchial asthma

INTRODUCTION

Asthma has been one of the most prevalent chronic childhood conditions in many countries. This condition has repeatedly posed a major burden for affected children and their families, which results into a serious challenge for public health organizations and health care providers, and researchers who search for the key causes (Akinbami *et al*., 2009). Globally, millions of children are affected by asthma representing the major cause of childhood disability (Newacheck and Halfon, 2000). Asthma may negatively affect a child's ability to learn, play, and sleep. Consequently, it may require potentially complex and costly interventions leading to both direct medical and indirect expenses such as missed work and school days (Williams, 2006; Sullivan and Weiss, 2001; Weiss, 2001).

Asthma is a chronic inflammatory disorder in susceptible individuals, causing recurrent episodes of wheezing, breathlessness and tightness in the chest. The episodes are associated with airways narrowing resulting into obstruction of airflow, which is reversible spontaneously or by medications (Anon, 1999). An increased prevalence rate and severity of asthma has been reported worldwide (Peat, 1994). Also report shows a wide variation (4-19%) in the prevalence of the disease in school children from different parts of the world (Anon, 1998). Different risk factors responsible for the development of asthma such as passive smoking, allergen derived from pets, poor ventilation, family history of asthma, environmental pollution such as dust, smoke, dew, biomass used in the kitchen and allergy to particular food has been reported (Dezateux, 2004).

The role of infection in asthma may vary as it may exacerbate established asthma or be a contributing factor to the initial development of the clinical onset of asthma condition (Darveaux and Lemanske, 2014). Sufficient evidence implicates the two roles showing particular viral pathogens such as human rhinovirus (HRV) and respiratory syncytial virus (RSV), as part of the most likely causative agents of asthma onset (Darveaux and Lemanske, 2014; Thomas *et al*., 2013; Mackenzie *et al*., 2013). Following the inception of asthma infection, especially those from viruses are a common precipitant of asthma exacerbations (James *et al*., 2012). Bacterial infections and their colonization have been associated with severity and recurrent wheeze, which could be independent or a cofactor with viruses (Darveaux and Lemanske, 2014; Kloepfer *et al*., 2014). Precisely, bacterial infections like *Mycoplasma pneumonia* and *Chlamydia pneumonia*, together with fungi in the case of allergic bronchopulmonary aspergillosis, are known to play a possible role in inducing and exacerbating the disease (Darveaux and Lemanske, 2014; Agarwal *et al*.,2013).

Bacterial infection may also contribute to airways remodeling through the activation of fibrosis by the release of growth factors such as transforming growth factor Beta, fibroblast activation and release of extra cellular matrix protein (Resol *et al*., 2011). In addition, bacterial products may induce goblet cell hypaplasia and glandular hypertrophy. Changes that can be reflected in an increased airways wall thickness are detectable on a high-resolution computed tomogram. The study aimed at determining the prevalence rate and co-existence between pathogenic bacteria and asthma in the study area.

MATERIALS AND METHODS

Enrollment Criteria

The study was carried out in Ashaka Cement Clinic in Funakaye Local Government, Gombe, Nigeria. Enrollment was offered to all patients reporting to consult a medical officer that were encountered by the clinician–investigator during the course of the study and who had laryngitis, biphasic illness (Pharyngitis and / or laryngitis, followed by bronchitis or pneumonia) wheezing or atypical pneumonia. Patient's refusal was not documented but is believed to be minimal for the study. Those that have answered on the questioner YES to ten out of the twelve questions using sterile gloves face mask EVEPON sterile swab stick moistened in normal saline was used to clean around pharynx. The tongue was depressed with disposable wooden spatula to control contamination of the specimen.

Ethical Clearance

The study protocol was approved by the ethics committee of the ministry of health and consented hospitals. All subjects gave their informed consent.

Sample Collection

Prior to sampling, introductory letter was served to the management of the clinic and consent towards sample collection was sought accordingly with reference to ethical clearance as well. Patients showing clinical manifestation like wheezy breathing cough as well as information regarding exposure to environmental and/or chemical pollutions were considered. A total of 155 samples were randomly collected fortnightly from consenting patients who visited this clinic with complains of respiratory illness between October 2016 and March 2017 (6 months). The samples were collected from the pharynx using EVEPON sterile swab stick. To avoid sample contamination by the tongue or the oral cavity a wooden tongue spatula was used and then transported the sample to the laboratory for examination as described by Cheesbrough (2009).

Isolation and cultural characteristics of bacteria

Isolation, identification and characterization of the bacteria isolates were carried out using the method reported by Cheesbrough (2004). All samples were immediately cultured on Blood agar (BA) and MacConkey agar (MCA) plates prepared according to

manufacturer's instructions. The inoculated plates were incubated for an overnight at 37^0C. Colonial macroscopic morphologies which include texture, size, edges, elevation, odour, haemolysis, and colour were observed as preliminary identification of suspected pathogens.

Microscopy and Characterization of the isolates

To further identify the suspected colonies, Gram Stain and Microscopy were employed. In this method a smear of the suspected colonies was made on sterile glass slides and stained using the Gram stain techniques. The smears were examined using 40x and 100x objectives of a light microscope. Gram staining was done as describe Cheesbrough (2004). The isolates were characterized based on Bergey's manual for determination of bacteria species as shown by Don *et al.*, (2003).

Sensitivity test drugs

Commercially prepared cartridges containing multiple and single paper antibiotic sensitivity discs manufactured by Abtek, (1991) to October 2015 and Oxoid, (1997) to October, 2015, were used as antibiotic susceptibility testing discs based on recommendations by European Committee on antimicrobial testing (ELLCAST) in diffusion method.

RESULTS

Prevalence of bacterial mixed infections among patients examined in the Clinic was significantly more than the Double infections (Table 1).

Table 1: Prevalence of bacterial mixed infections among patients examined in the clinic

S/No	Wards	No. of Patients Examined with mixed infection	No. of Patients Examined with double infection
1	Jalingo	74	15
2	Anguwar Kara	33	8
3	Wuro Ibba	19	8
4	Maza	15	4

The occurrence of bacteria isolated in asthma patient from Ashaka Cement Clinic Bajoga is shown in Table 2. Of the 155 samples analyzed, higher prevalence was observed in patients within the age group of 0-9 years with 15(39.50%), followed by those in the age groups of 20-29 and 30-39 years each with 8(21.10%) and then age group of 11-19 years with 4(10.53%) while the least prevalence was observed in patients within the age group of 40 years and above with 3 (7.90%).

Table 2: Prevalence of Asthma in relation to age groups examined in the Clinic

S/No	Age(s)	No Examined	No Infected (%)
1	0 – 9	74	15 (39.50)
2	11 – 19	15	4 (10.53)
3	20 – 29	33	8 (21.10)
4	30 – 39	19	8 (21.10)
5	≥ 40	14	3 (7.90)
	Total	**155**	**38 (100%)**

Prevalence of asthma in relation to sex among patients examined in the study area is shown in Table 3. Of the 155 samples

examined, 78 samples were collected from males while the remaining 77 samples were collected from females. However, higher prevalence of infection was detected among males with a corresponding value of 20(52.60%) than among females with only 18 (47.37%).

Table 3: Prevalence of Asthma in relationship to sex among patients examined in the study area

Sex	No of sample examined	No positive
Male	78	20 (52.60%)
Female	77	18 (47.37%)
Total	**155**	**38(100%)**

Table 4 shows the overall pathogenic bacteria isolated from the asthma patients in the study area. *Chlamydia Pneumoniae* had the highest occurrence, followed by *Streptococcus pneumonia*, *Bordetella pertussis*, *Mycoplasma pneumoniae* whereas *Staphylococcus aureus* had not been detected.

Table 4: Frequency of occurrence of bacteria isolates in asthma patients from Ashaka Cement Clinic Bajoga

S/No	Bacteria	Prevalence	Percentage (%)
1	*Chlamydia pneumoniae*	29	64.40
2	*Mycoplasma pneumoniae*	3	6.67
3	*Bordetella pertussis*	5	11.10
4	*Streptococcus pneumoniae*	8	17.78
5	*Streptococcus aureus*	0	0
	Total	**45**	**100**

DISCUSSION

The result of this investigation has revealed that the relationship of personal smoking, passive exposures to tobacco smoke and to combustion of domestic cooking fuel have significant clinical importance on the exposure to asthma. This observation agrees with earlier reports from India by Dodge and Burrows, (1980) where they similarly observed that these risk factors commonly occurred. This study further showed among these risk factors, passive smoking was observed to be a significant risk factor associated with presence of bronchial asthma symptoms with an odd ratio 3:3. This also agrees with the findings of Wright, (1992) who reported that passive exposure to cigarette is associated with lower respiratory infection in various workers. However, although pets were more present 5:5 times more in home of asthmatic patients as observed in the study, it was the most favoured risk factor than the passive exposure to cigarette. This is rather in contrast to the situation reported in the Canada where cats and dogs appeared to be associated with increased asthma morbidity (Ford *et al.*, 2004). The regard for this difference is unclear. It may however appear to be based on the level of exposure between the risk factors. However, Stranchan and Careey, (1994) have suggested that high prevalence of asthma is attributed to absence of windows in living rooms in addition to inadequate ventilation was observed in homes which result into increased dampness and crodo infection. Therefore, the observed difference in risk factors that predisposed one to infection in the present study with those

reported elsewhere would appear to be for similar reasons. This is significant in terms of exposure to the infection. Factors including family history infection, kitchen in living rooms, food allergy and use of biomass as cooking media were found to be statistically insignificant in the present study. The study also revealed that there was no significant association between positive family history and asthma.

The age range of the infected individuals ranged from 0-40 years and above. The highest prevalence of the infection was recorded in the age group 40 years and above. The high prevalence in this age group appears to be in conformity with other workers (Cassol, 2006). This age group was described by Martindale *et al*., (2005) to be the most susceptible to develop asthma. The preponderance of the disease among young people is due to exposure to the environmental risk factors.

The overall sex-related infection showed that female had slightly higher infection rate (38.5%) than male with 34.4% but not statistically significant (x2=0.0103; P>0.05). This is in contrast with some related studies (Lunden *et al*., 2003; Luder *et al*., 2004) who reported higher prevalence of the disease among male than the female. The reasons advanced for this difference might be that male were more exposed to passive smoke than female and therefore more susceptible to the infection. However, the absence of variation in infection between the male and female subjects in this study area is in accordance with the findings of other workers (Basu *et al*., 2008) who attributed this pattern to equal exposure to passive smoking and other environmental factors (Table 3).

The occurrence of bacterial isolates from four different wards is depicted in Table 4. Out of the 155 swab samples examined from the patients as follows: 68 in Jalingo, 26 from Anguwar Kara, 14 from Wuro Ibba and 10 from Maza were recorded in the following percentages of (43.7%), (48.8%), and (45.3%) respectively. The highest frequency of occurrence of bacterial isolates was observed with *Chlamydia pneumoniae* Jalingo (64.40%) while the least was recorded with *Mycoplasma pneumoniae* (6.67%).

The significance difference observed in in infection rate among the four wards is consistent with other reports (Sandberg *et al*., 2004: Schaub *et al*., 2006; Saglani *et al*., 2006). The variations in infection rates among the four wards may be explained in terms of unequal exposure to the risk factors. The study observed that most people acquired the infection during the raining season that is between April and October. However, some cases were reported during the dry season. The risk of asthma infection is generally higher throughout the wet season. The rainy season was also reported as a period of high transmission rate of asthma by earlier workers (Medina *et al*., 2006).

The prevalence figure reported in the study may appear to be lower than the generally quoted figure in the lay press. However, most such impressions are based on observations in hospitals or chest clinics, or other selected populations with a very heavy bias towards inclusion of symptomatic individuals. The population prevalence is an assessment of the

problem from an entirely different perspective. In fact, a population prevalence of 23% is a very high figure from the national viewpoint in calculating disease burden. The morbidity in terms of absence from school and work; hospitalizations and emergency room visits are very high. The economic burden of management of asthma is likely to be huge both for the patient's family as well as for the state.

The study also provides us with valuable information on population prevalence of respiratory symptoms, atopy and asthma. More importantly, it gives us an insight into relationships of respiratory symptoms, atopy and asthma with several independent and causal factors which include the anthropometric and exposure variables. In particular, the relationship of personal smoking , passive exposure to tobacco smoke and to combustion of domestic cooking fuels have significant clinical importance. Although there is a general perception that exposure to biomass fuels may be a risk for asthma, the same is not borne out by our findings.

Approximately one third to one half of asthma cases in population-based studies are attributed to atopy. These figures may be still higher for patients with severe disease. The recently concluded European community respiratory health survey (ECRHS) was the first international multicenter studying adults a common standard protocol measuring atopy and asthma in the same time period. In this study the effect of atopy on the prevalence of asthma varied widely between hospital, probably because of variations in factors related to the expression of asthma and to the prevalence of sensitization, particularly to house dust mites which is overall attributable fraction of asthma symptoms caused by atopy.

There is paucity literature of previous records on the occurrence of asthma in Nigeria. Data on which to make comparison is consequently limited. Occurrence of asthma in the present study area is remarkable. Therefore, the present report is probably the first in the study area.

CONCLUSION

The finding in this study shows that the burden of asthma in the study area was enormous and consequently could be devastating among the inhabitants in spite the effort mode by World Health Organization (WHO) in the goal elimination of the disease. Asthma remain a scourge among rural dwellers in Nigeria. The disease was found in both sexes and in all age classes. Therefore, the degree of the risk of infection involved in these areas has been established by the determination of the infection prevalence rate in the Clinic. There is therefore, the urgent need to institute a control and modality programme in the area to provide relief for individuals with chronic form of the disease.

An integral approach for the elimination of asthma is advocated. There should be coordinated efforts between states and environment, the CEMENT Company, disease investigators, health organizations, NGO's and affected communities to commence the distribution of drugs and mobilization to stop the active transmission going on.

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