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Prevalence of Respiratory Tract Bacterial Pathogens among Carpenters in Owerri, Imo State Nigeria

Helen Ifeoma Udujih[1], Christabel Freddy[1], Obinna Godwin Udujih[2], Chimezie Christian Iwuala[2] and *Emmanuel Ifeanyi Obeagu[3]

[1]Department of Medical Laboratory Science, Imo State University, Owerri, Imo State, Nigeria.
[2]Department of Public Health, School of Health Technology, Federal University of Technology, Owerri, Imo State, Nigeria.
[3]Department of Medical Laboratory Science, Kampala International University, Uganda.
Corresponding author: Emmanuel Ifeanyi Obeagu, Department of Medical Laboratory Science, Kampala International University, Uganda., emmanuelobeagu@yahoo.com

ABSTRACT

A survey on the prevalence of respiratory tract bacterial pathogens among carpenters in Owerri, Imo states was carried out between the month of August and September; 2021. A total of 30 samples, 15 sputum and 15 throat swabs were randomly collected from carpenters in two different local government areas of Owerri; to determine the prevalence of bacterial pathogens in the respiratory tract of the carpenters. To determine the prevalence of age-related respiratory tract bacterial pathogens among the carpenters. To identify the highest bacterial pathogens, present in the sputum samples collected from the carpenters. To determine the microbial load among the infected subjects. To determine the knowledge, attitude, practices of the carpenters. Standard microbiological techniques were used to analyze the sputum and throat swabs. The results showed that the prevalence of respiratory tract bacterial pathogens was 46.66% in 30 subject which was considered high. The bacterial pathogens isolated include; *Streptococcus pyogenes, Klebsiella pneumoniae* and *Streptococcus pneumoniae*. The total viable bacterial count ranges from $3.6x10^5$ to $8.9x10^5$ Cfu/ml. The most prevalent bacteria were *Streptococcus pyogenes* (64.29%), followed by *klebsiella pneumoniae* (28.57%) and the least was

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Streptococcus pneumoniae (7.14%). In Owerri, the highest prevalence was recorded in Owerri municipal (50.00%) and the least in New Owerri (40.00%). Age group of 51-60 years had the highest prevalence of 62.50%, while those between 61-70 years were recorded least (25.00%). The most common respiratory symptom experienced by the carpenters were; Fever (96.00%), Headache (94.00%), itchy eyes (40.00%), cough (20%), chest pain (10.00%), difficulty in breathing (dyspnea) (10.00%) and sore throat (2.00%). There was high prevalence of respiratory tract bacterial pathogens among carpenters in Owerri, Imo state. The age and duration of employment of carpenters was also responsible for high prevalence of respiratory tract bacterial pathogens among carpenters. Therefore, occupational health programmes should be introduced by the government to create awareness among the workers (carpenters) to make their workstations conducive and to go for regular health checkup. Carpenters should use nose mask during working (cutting of wood with saw and spraying of the wood with chemicals) to prevent the inhalation of wood dust and chemicals.

Keywords: Prevalence, respiratory tract, bacteria pathogens, carpenters

INTRODUCTION

Carpenters are faced with Occupational diseases, which are work related illnesses. It is estimated that at least two million people are exposed to wood dust every day around the world [1]. In general, wood dust exposure, deteriorates respiratory tract, increases the prevalence of respiratory diseases [2-4], and exacerbates existing illness with increases in cancer incidence and deaths [5-6]. Occupational exposures play a role in the onset of several respiratory diseases and the lung function deficit. The international agency for Research on cancer (IARC) classifies wood dust as a human carcinogen [7]. Carpenters are exposed to wood dust during cutting woods in making different shapes of wood in making different furniture items, frame and cabinet making etc. During work, the wood dust is partly suspended in the air, which is inhaled by the carpenters and affects their respiratory tracts. Mikkelsen *et al.* [8] supported this result, and according to them, wood dust was suspended in the air and inhaled by the carpenters. Respiratory tracts disease and defect in pulmonary function are major causes of occupational exposures. Respiratory tract bacteria among industries workers have been reported that workers in industries are exposed to relatively high levels of pulmonary contaminants in their working environment [9]. Carpentry work was associated with a high frequency of respiratory tract bacteria, particularly after exposure to irritating chemicals during work [10].

MATERIALS AND METHOD

Study Area

The study was carried out in Owerri, Imo State. Owerri is the capital of Imo State Nigeria, set in the heart of Igboland.

Study Population

A total of 30 subjects were used in the study. The subjects were aged 15-70 years and were randomly selected from Owerri.

Selection Criteria

The subjects were randomly selected from different local government in Owerri. An informed consent was obtained from the individuals. Information in respect of age was obtained.

Exclusion Criteria

a. Subjects below the age of 15 and above 70years.
b. Subjects who were on Antibiotics.
c. Immunocompromised patient.
d. Subjects with chronic disease in complications such as cancer, chronic liver disease, anaemia. The reason is because, the immune system of the patient is already weak as a result of one of these complications, hence this bacterial easily infect them which may not be the actual cause of the illness.
e. Subjects who did not give their consent.

Sample Collection

The subject was asked to take deep breath (that is breathing in through the nose and exhaling through the mouth) to help loosen secretions, then the subject was asked to force a deep cough to ensure a sample is obtained from the lower respiratory tracts. Sputum sample was collected in a universal container with a wide top, throat swabs was also

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collected from the subjects using swab sticks then the container was properly labelled with the subject's name, sample number and date of collection. The sample was sent to the Laboratory as soon as possible for diagnosis.

Sample Survey

A total of 30 samples were randomly collected from the carpenters with the age bracket of 15-70 from different local government in Owerri, Owerri municipal and New Owerri. The samples were collected in the morning, afternoon and evening hours.

Biochemical Characterization of the Bacteria

Urease test [11].

Procedure

The entire surface of the Christensen's urea slope was inoculated. It was incubated at 37^{0}c in the incubator. It was examined after overnight incubation. The pink red colour of urease positive reaction was observed.

Citrate Utilization Test [11].

Procedure

Simmons citrate agar slants of 2ml in each vial were prepared by autoclaving at (15psi), 121^{0}c. Using sterile techniques, small amount of the experimental bacteria from 24hrs pure culture was inoculated into the vials by means of streak inoculating needle and the vials were incubated for 48hrs at 37^{0}c

Catalase test [11].

Procedure

A microscopic slide was placed inside a petridish. Using a sterile inoculating loop, a small number of bacteria from a 24hrs old culture was placed onto the organisms on the microscopic slide. One drop of 3% H_2O_2 was placed onto the organism on the microscopic slide using a dropper and observed for immediate bubble formation. Bubbles formation indicates a catalase positive test.

Oxidase Test

Procedure

A small piece of filter paper was soaked in Gaby and Hadley oxidase test reagent and was allowed to dry. Using an inoculating loop, a well isolated colony from pure 24hrs culture was picked and rubbed onto filter paper and observed for colour change. Colour change to dark purple indicates a positive result.

BILE SOLUBILITY TEST

This helps to differentiate S. pneumoniae, which is soluble in bile and bile salts, from other alpha-haemolyticStreptococci (viridians streptococci) which are insoluble

Procedure

Several colonies of the test organism in the tube containing 2ml of physiological saline was emulsified, to give a turbid suspension. The organism suspension was divided between two tubes. one tube was added two drops of sodium deoxycholate reagent and mixed. To the other tube (negative control), two drops of distilled water was added and mixed. The both tubes were left for 10 to 15 minutes at 35 to 37^{0}c then looked out for turbidity in the tube containing the sodium deoxycholate.

Aryl Sulphatase Test

Procedure

Three ml of the medium with 0.1ml of broth culture of the test organism were inoculated. It was incubated for 14-18 days at 37^{0}c. Two drops of 2NN_aOH was added to the culture to detect free phenolphthalein. An immediate pink red colour is indicative of positive arylsulphatase test.

Pyrrolidony Arylamidase (PYR) Test:

Procedure

The growth of two to three morphologically similar colonies were picked with a sterilized bacteriologic loop and was emulsified in small volume of PYR broth. The tube was incubated at 35^{0}c for 4 hours. One drop of PYR reagent was added and color change was observed. The reaction was read and recorded 1 minute after the addition of the reagent.

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Aesculin Hydroxysis

Procedure

Slope was inoculated with the test organism. It was incubated at 37c overnight. Brownish to black colouration of the medium indicates a positive hydrolysis of aesculin to aesculetin and glucose. The blackening is due to the reaction of the aglycone with the ferric salt.

Statistical Analysis

Data were entered and analyzed using analysis of variance (ANOVA) and results recorded.

RESULTS

30 carpenters were examined, 15 sputum samples and 15 throat swabs. 6(40.00%) samples of sputum had bacteria presence while 8(53.33%) samples of throat swabs also had bacteria presence.

Table 1: samples with bacteria presence

Samples	No. of samples	Frequency	Percentage %
Sputum	15	6	40.00
Throat swab	15	8	53.33

The bacterial isolates seen include Streptococcus pyogenes, Klebsiella pneumoniae, and Streptococcus pneumoniae. Streptococcus pyogenes was seen in 9 (64.29%) samples out of 30 samples, Klebsiella pneumoniae was seen in 4(28.57%) samples and streptococcus pneumonia was seen in 1(7.14%). Streptococcus pyogenes has the highest mean bacterial count; $8.9x10^5$, followed by Klebsiella pneumoniae; $6.7x10^5$, and then Streptococcus pneumoniae; $3.6x10^5$

Table 2: bacterial count of bacterial isolates

Bacteria	Frequency N =30	Percentages (%)	Mean bacterial count (Cfu/ml)
Streptococcus pneumoniae	1	7.14	$3.6x10^5$
Klebsiella pneumonia	4	28.57	$6.7x10^5$
Streptococcus pyogene	9	64.29	$8.9x10^5$

Out of 30 participants 6 were within the age 21-30 years, 5 were within the age 31-40 years, 7 were within the age 41-50 years, 8 were within the age 51-60 and 4 were within the age 61-70. Those within the age of 51-60 years has the highest prevalence of bacterial pathogens in the age distribution; 5(62.5%), while those within the age of 61-70 years has the least; 1(25.00%).

Table 3: prevalence of bacterial pathogens by age distribution

Age group	**No examined**	**No of positive(%)**	**No of negative(%)**
21-30	6	2(33.33)	4(66.66)
31-40	5	2(40.00)	3(60.00)
41-50	7	4(57.14)	3(42.85)
51-60	7	5(62.50)	2(28.57)
61-70	5	1(25.00)	4(80.00)
Total	30	14(46.66)	16(53.33)

All isolates except isolate 2, were gram positive and cocci in form, isolate 2 was gram negative and rod shape, all having varying colony morphology on the culture plate. Samples was collected in Owerri; Owerri municipal (Naze, Aladinma and Ikenegbu) and Owerri north. It was observed that Owerri municipal has the highest prevalence; 10(50.00%), while Owerri north has the least; 4(40.00%).

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Table 4: prevalence of bacterial pathogens according to the areas of collections

Areas samples collections	No examined	No of positive(%)
Owerri municipal	20	10(50.00%)
New Owerri	10	4(40.00)
Total	30	14(46.66)

DISCUSSION

In this study the bacteria content of sputum and throat swab was investigated among 30 carpenters in Owerri, Imo state. Out of the 30 samples, 14(46.66%) samples yielded bacterial pathogens. The bacterial isolates identified are *Streptococcus pyogenes* 9(64.29%), *Klebsiella pneumoniae* 4(28.57%) and *Streptococcus pneumoniae* 1(7.14%). The total viable bacterial count ranges from $3.6x10^5$ to $8.9x10^5$ Cfu/ml. *Streptococcus pyogenes*, a gram-positive organism, is a common cause of upper respiratory infection. This bacterium can be transmitted through inhalation of respiratory droplets, skin contact, contacts with objects, surface, or dust that is contaminated with bacteria. It causes infections like sore throat, rheumatic fever, streptococcal pharygnitis, heart disease, scarlet fever, etc. The presence of the *Streptococcus pyogenes* in the samples is an indication that the carpenters might be infected with rheumatic fever, sore throat, heart disease, pharyngitis and severe life - threatening infections, if not treated properly may lead to the death of the carpenter. The prevalence of respiratory tract infections increased with age, which means that aged carpenters suffer more from different kinds of respiratory diseases in comparison to young age group. This result corroborates with the work of [12-13]. They also reported that the prevalence of respiratory symptom increased with age. The study also shows that the respiratory disease of carpenters was significantly high with duration of employment. This study shows that 5(62.50%) of the carpenters that had most of the bacterial pathogens has been working for over 20 years. From the questionnaire, the most frequent health complaints among the carpenters were; fever 48(96.00%), headache 47(94.00%), eyes irritation (itching eyes 20(40.00%), cough 10(20.00%), chest pain 5(10.00%), difficulty in breathing (dyspnea) 5(10.00%) and sore throat 1(2.00%). Other studies also found that complaints concerning eyes and nose were most frequent [14-17]. The inter group analyses of the carpenters showed that the alteration of respiratory indices was dependent upon the duration of exposure to the hazardous wood dust and environmental condition. As the exposure increased, the tendency of respiratory tract diseases also increased among the carpenters. The study shows that long exposure (over the years) to the working environment causes respiratory tract bacterial pathogens among carpenters.

CONCLUSION

There was high prevalence of respiratory tract bacterial pathogens among carpenters in Owerri, Imo state. The age and duration of employment of carpenters is also responsible for high prevalence of respiratory tract bacterial pathogens among carpenters. This occurs due the inhalation of wood dust and chemical while working in the carpentry industry. Due to the exposure to these health hazards, there is need for Carpenters to pay attention to their health. This study also concludes that wearing nose mask while working helps to reduce the prevalence rate of respiratory tract bacteria pathogens among carpenters.

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