
PREVALENCE OF AIRBORNE BACTERIA IN MARKETS IN MAKURDI METROPOLIS

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ABSTRACT

Samples of air were collected from three (3) different markets within Makurdi metropolis namely; Modern Market, Wurukum Market and Wadata Market to check the prevalence of airborne bacteria in the markets. The samples were collected from five (5) different subsites in each market using the exposed plate method and incubated at 37°C for 24 hours. The different colonies that developed after incubation were counted and identified based on their cultural characteristics, Gram reaction and biochemical characteristics. It was noticed that five (5) types of bacteria (*Escherichia coli*, *Neisseria species*, *Salmonella species*, *Staphylococcus species*, *Streptococcus species*) were found in the three (3) markets except in Modern market where *Neisseria species* was not found in any of the subsites. This may be due to the poor sanitary condition in Wadata market which can also affect and increase the bacteria load on food stuff. The sanitary condition should therefore be improved so as to reduce the bacterial load around the areas.

INTRODUCTION

Microorganisms are essential components of the ecosystem, although, a number of microorganisms are present in air, they do not have indigenous flora. Air is not a natural environment for microorganisms as it does not contain enough moisture and nutrients to support their growth and reproduction. However, many pathogens are transmitted through the air on dust particles or on dry residues of saliva droplets and control measures are attempted for these reasons. This is as asserted by Prescott et al [2004] that everything is everywhere, the environment selects. Microorganisms interact with the environment and play important role in succession. Bacterial communities in most environments such as selected areas in Makurdi metropolis are complex with the interactions ranging from being competitive, to being mutually beneficial. [Pelczar, 2006].

- i. Soil bacteria when disturbed by the wind liberates into the air and remain suspended for a very long time, while activities like digging or ploughing the soil may also release soil borne bacteria into the air in form of water droplets or aerosols. This work will create awareness on the quality of air to the individuals around the study area and also educate individuals on the importance of proper cleaning standards. Knowledge of the control of epidemics of airborne diseases could be gained and such cases are addressed through the findings of this research work by taking some measures for dust borne infections, as may be indicated from this work. Therefore, the objectives of this study are:
- ii. To isolate and identify the types of bacteria which could be found in air at different places around the study area.
- iii. To find a relationship between these bacteria and the diseases they cause.
- iv. To investigate the prevalence of airborne bacteria in markets in Makurdi metropolis.

MATERIALS AND METHODS

Study Area

This study was carried out in 3 markets within Makurdi the Benue state capital. The markets involved are Modern market in Anpka ward, Wurukum Market in Wurukum, Wadata Market in Wadata.

Collection of Samples

The Petri dishes containing the media were used to collect the samples of air using the expose-plate method. The media plates were placed at five [5] different locations in each market for 30minutes after which they were taken immediately to the laboratory for incubation. The media plates were incubated at 37 C for 24hours before sub culturing (Cheesbrough, 2002).

Sub Culture

Pure cultures were prepared from the different colonies in the mixed culture and incubated at 37 C for 24hours (Cheesbrough, 2002).

Characterization and Identification of Bacterial Isolates

The bacteria were identified by microscopic examination of the pure cultures by Gram staining and further biochemical tests such as catalase test, coagulase test and oxidase test. (Cheesbrough, 2002).

RESULTS

Air samples were collected from five different subsites namely: meat subsite, fish subsite, vegetable subsite, provision subsite and cloth subsite, from each of the three markets (Modern market, Wurukum market, and Wadata market).

Table 1: shows the bacteria isolated from the various subsites in Modern market and their colony counts.

Table 2: shows the bacteria isolated from the various subsites in Wurukum market and their colony counts.

Table 3: shows the bacteria isolated from the various subsites in Wadata market and their colony counts.

Table 4: shows the percentage occurrence of bacteria in each subsite in the three markets which shows that in Modern market, the fish subsite had the highest percentage with 28.02%, in Wurukum market, the meat subsite had the highest percentage with 24.54% and in Wadata market, the cloth subsite had highest percentage with 25.70%.

Table 5: shows the cultural characteristics, Gram reaction, and biochemical characteristics of the various bacterial isolates

Table 1: Bacteria isolated from Modern Market

Bacterium	Meat subsite	Fish subsite	Vegetable subsite	Provision subsite	Cloth subsite
<i>Escherichia coli</i>	1.0×10^1	2.8×10^1	1.6×10^1	3.2×10^1	5.6×10^1
<i>Salmonella spp.</i>	0.7×10^1	3.6×10^1	1.0×10^2	1.6×10^1	2.8×10^1
<i>Staphylococcus. spp.</i>	2.2×10^1	3.2×10^1	1.2×10^1	1.6×10^1	3.6×10^1
<i>Streptococcus spp.</i>	1.2×10^1	6.4×10^1	2.8×10^1	0.8×10^1	1.2×10^1
TOTAL	5.1×10^1	1.6×10^1	1.56×10^2	7.2×10^1	1.32×10^2

KEY: Absolute figures

Table 2: Bacteria Isolated From Wurukum Market

Bacterium	Meat subsite	Fish subsite	Vegetable subsite	Provision subsite	Cloth subsite
<i>Escherichia coli</i>	6.8 x 10 ¹	4.4 x 10 ¹	6.0 x 10 ¹	3.6 x 1	4.8 x 10 ¹
<i>Neisseria species</i>	3.6 x 10 ¹	-	2.8 x 10 ¹	-	-
<i>Salmonella spp</i>	7.2 x 10 ¹	9.6 x 10 ¹	6.0 x 10 ¹	1.20 x 10 ²	9.6 x 10 ¹
<i>Staphylococcus spp</i>	1.04 x 10 ²	3.6 x 10 ¹	1.28 x 10 ²	4.0 x 10 ¹	8.8 x 10 ¹
<i>Streptococcus spp</i>	3.6 x 10 ¹	4.8 x 10 ¹	1.6 x 10 ¹	2.8 x 10 ¹	-
Total	3.16 x 10 ²	2.24 x 10 ²	2.92 x 10 ²	2.24 x 10 ²	2.32 x 10 ²

KEY: Absolute figures**Table 3: Bacteria isolated from Wadata Market**

Bacteria	Meat subsite	Fish subsite	Vegetable subsite	Provision subsite	Cloth subsite
<i>Escherichia coli</i>	5.2 x 10 ¹	3.6 x 10 ¹	4.8 x 10 ¹	9.6 x 10 ¹	3.0 x 10 ²
<i>Neisseria spp.</i>	0.8 x 10 ¹	-	-	4.8 x 10 ¹	1.0 x 10 ²
<i>Salmonella spp.</i>	1.64x10 ²	2.16x10 ²	2.64x10 ²	1.36x10 ²	2.8 x 10 ²
<i>Staphylococcus spp.</i>	1.08x10 ²	6.9 x 10 ¹	1.24x10 ²	1.72x10 ²	2.15x10 ²
<i>Streptococcus spp.</i>	4.0 x 10 ¹	4.8 x 10 ¹	3.6 x 10 ¹	6.4 x 10 ¹	6.5 x 10 ¹
Total	3.72x10 ²	3.69x10 ²	4.72x10 ²	5.16x10 ²	9.60x10 ²

KEY: Absolute figures

Table 4: Percentage Occurrence of Bacteria in Each Subsite in the Three Markets

	Modern Market	Wurukum Market	Wadata Market
Meat subsite	8.93%	24.54%	13.80%
Fish subsite	28.02%	17.39%	13.70%
Vegetable subsite	27.32%	22.67%	17.50%
Provision subsite	12.61%	17.39%	19.20%
Cloth subsite	23.12%	18.01%	25.70%
Total	100%	100%	100%

Table 5: Cultural Characteristics, Gram Reaction, and Biochemical Characteristics of Bacterial Isolates

CLED Test	Nutrient Test	Gram Test	Catalase Organism	Coagulase	Oxidase	Suspecte	Agar	Agar	Reaction
1.	Yellow opaque colonies	Flat and creamy with slightly deeper centers	uneven edge	Negative rods	Positive	ND	ND	<i>Escherichia coli</i>	
2.	Tiny yellow opaque colonies	Tiny milk colonies	Negative diplo-	Positive	ND	Positive	<i>Neisseria spp</i>		
3.	Flat blue mucoid opaque and shiny colonies with rough	Smooth and flat creamy colonies	slender and periphery scattered	Negative rods	Negative	ND	<i>Salmonella species</i>		
4.	Yellow to blue opaque with pale periphery	Flat creamy smal and slightly rough	shiny colonies	Positive cocci	Positive	Negative	ND	<i>Staphylococcus spp</i> colonies	
6.	Smooth and grayish yellow and shiny colonies	Creamy rough, brown	Positive cocci	Negative	Negative	ND	<i>Streptococcus spp</i> colonies	flat	

Key: ND = Not done

DICUSSION

From the results of this research (chapter four), tables 1, 2, and 3 show the bacteria isolated from each of the three markets (Modern market, Wurukum market, and Wadata market) respectively. Table 1 shows that four types of bacteria (*Escherichia coli*, *Salmonella species*, *Staphylococcus species*, and *Streptococcus species*) were isolated from Modern market, while tables 2 and 3 show that five types of bacteria (*Escherichia coli*, *Neisseria species*, *Salmonella species*, *Staphylococcus species*, and *Streptococcus species*) were isolated from Wurukum and Wadata markets respectively. These bacteria are pathogenic and known to be causative agents of various diseases as follows; Acute and persistent diarrhoea in children and adults in industrial and developing countries in Europe, America, Asia, and Africa which is associated with a particular category of *Escherichia coli* (Enteroaggregative *Escherichia coli*). Also Enteroinvasive *Escherichia coli* (EIEC) typically invade and destroy the bowel mucosa with characteristic attaching and effacing lesions mediated by a protein encoded by a gene called the attaching and effacing locus. Meningitis which is the inflammation of the meninges (the membranes covering the brain and spinal cord) is caused by a species of the bacteria *Neisseria* (*Neisseria meningitidis*) and bacterial meningitis is the most serious form of meningitis and can be rapidly fatal unless treated.

Another specie- *Neisseria gonorrhoeae* is responsible for the infection gonorrhoea. Salmonellosis are diseases caused by species of *Salmonella* including enteritis and septicemia with or without enteritis. *Salmonella typhi*, *Salmonella paratyphi* A, B, and C cause particular types of septicemia called typhoid and paratyphoid fever respectively; while all other types may cause enteritis or septicemia or both together. Skin infections are the most common type of diseases produced by *Staphylococcus*. *Staphylococcus* infections of the skin can progress to impetigo (a crusting of the skin) to cellulitis (inflammation of the connective tissues under the skin leading to swelling and redness of the area). In breast feeding women, *Staphylococcus* can result in mastitis (inflammation of the breast) or in abscess of the breast. *Staphylococcal* food poisoning is an illness of the bowels that cause nausea, vomiting, diarrhea and dehydration. Also toxic shock syndrome is an illness caused by toxic secreted by a species of the bacteria. *Staphylococcus aureus* Scarlet fever, wound infections, "strep throat" and infections of the skin, ear, lungs and other tissues are all caused by a specie of the bacteria *Streptococcus* (*Streptococcus pyogenes*) it may also be responsible for delayed effects occurring after the actual infections, examples include glomerulonephritis (a kidney disease) and rheumatic fever (a disease of the heart and other tissues) to mention a few of the diseases caused by the various bacteria.

Also, after comparing tables 1, 2, and 3, it was observed that *Neisseria* was not found at any of the subsites in modern market while it was found at some of the subsites in both Wurukum and Wadata markets. It was also noticed that Wadata market had the highest sum of all the organisms from each subsite as compared with Modern market which had the lowest while that of Wurukum market was moderate. The high and moderate levels of contaminations in Wadata and Wurukum markets respectively may be due to poor sanitary conditions such as lack of good refuse dumps or authorized places for dumping of

refuse which can also lead to poor drainage channels as the channels are blocked by refuse when the refuse are carried by wind or water when it rains. It may also be due to dust being carried by wind from the ground into the air because the ground is not floored. The case is not so in modern market where there are refuse dumps, drainage channels, and the ground is floored.

CONCLUSION

It is therefore concluded that the air in markets within Makurdi metropolis is contaminated. Therefore, this study emphasizes the need for the Provision of refuse dumps for proper refuse disposal, creation of drainage channel for free flow of waste water, proper sanitation should be carried out within the markets from time to time and laws should be put in place by market authorities to ensure strict adherence and punish defaulters, market authorities in conjunction with the government should see it that the markets, Wurukum and Wadata markets are floored like Modern market as this will help reduce the number of soil borne bacteria being carried into the air by wind.

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