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ANTIBIOGRAM BACTERIA ISOLATE FROM NIGERIAN CURRENCY NOTES OBTAINED FROM MEAT VENDORS, NORTH BANK MARKET MAKURDI, BENUE STATE, NIGERIA.

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ABSTRACT

*Currency is one of the most potential vehicles in the transmission of pathogens. This study was designed to isolate, identify, and determine the antibiotic susceptibility profiles of bacterial pathogens isolated from different denominations of Naira notes. A total of sixty Naira notes samples ranging from **N**50.00 to **N**1000.00 were randomly collected from meat vendors at the North Bank Market Makurdi, Benue State, Nigeria. Collected samples were analyzed using standard microbiological procedures. Antibiotic susceptibility test was done using Kirby-Bauer disc diffusion technique. The results for the morphological and biochemical tests revealed that the bacteria isolated were Pseudomonas aeruginosa (40%), Staphylococcus aureus (30%), Klebsiella spp (20 %), and Escherichia coli (10 %). The isolation of Escherichia coli (10%) is in agreement with the research of Uneke and Ogbu (2007) who obtained 13.2 % E. coli from paper currency in Nigeria. Also, the presence of E. coli, with Klebsiella spp and Staphylococcus aureus corroborates with the work of Ofoedu et al. (2021) who isolated the same bacteria in varying degrees from Naira notes collected from local food vendors. Generally, the presence of enteric organisms in Naira note samples obtained from meat vendors could be as a result of poor hygiene of the meat vendors who obviously did not wash their hands after handling the meat before touching money as these organisms are found 5818 Nigerian Journal of Microbiology, December, 2021 Available online at Nwachi et al. 2021 Nigerian Journal of Microbiology, 35(2): - 5814 – 5821 in the intestinal tracts of animals. This correlates with the findings of previous study of Yazah et al. (2012) who assessed the bacterial contamination of Nigerian currency notes and associated risk factors in Northern Nigeria. Also, the presence of Pseudomonas aeruginosa on Naira note samples as observed in this study corresponds with the research of Imarenzo et al. (2018) who isolated Pseudomonas aeruginosa, Escherichia coli, and other organisms from Naira notes used in Wukari metropolis, Taraba state. Staphylococcus aureus is the only gram-positive bacteria that were isolated from Naira notes in this study, the bacteria may have been shed from the skin of individuals as the organism is a normal flora of the human skin (Chiller and Murakawa, 2001). Antibiotics susceptibility tests carried out on the isolated bacteria revealed that, all the isolates exhibited multi drug resistance traits as all the bacteria were highly resistant (100%) to Ciproflox, Norfloxacin, Reflaxine and Streptomycin. The isolates were 31% sensitive to antibiotics tested, 28% with intermediate result and the highest percentage which is 41% of resistance from isolated organisms to the tested*

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antibiotics, this could be as a result of antibiotics abuse among the people which has led to multi drug resistance in the isolates. This study has demonstrated that Naira notes are potential vehicles in the transmission of bacterial pathogens from person to person. From the foregoing, citizens are therefore advised to wash their hands regularly with soap and water after handling Naira notes.

Key Words: Antibiogram, Bacteria, Isolate, Currency Notes and Vendors.

I. INTRODUCTION

Currency is the system of money in general use in a particular country. In Nigeria, paper currency, commonly known as Naira notes is the legal tender. World over, money is one of the most frequently exchanged material in human communities as it is used daily as a means of exchange for goods and services (Djouadi *et al.,* 2020), thus, changing hands from one person to another. As it circulates, it is exposed to different unhygienic environmental conditions which subject it to microbial contamination (Krishan, 2022). Money plays an important role in all aspects of life because every transaction is based on money usage. There is evidence that paper notes have the ability to act as fomites with the potentials of carrying pathogenic microorganisms (Awodi *et al.,* 2021). This is true because most paper notes are rough and dirty, hence, can act as reservoir for microbes with the potential of transmitting such organisms and subsequently causing diseases to the handlers (El-Daris and Hassan, 2019). A person living in an unhygienic environment with unhygienic habits can contaminate Naira notes. Habits such as keeping money inside stockings, shoes, under the carpet or rugs, and squeezing with wet hands frequently introduce microorganisms to Naira notes (Basavarajappa *et al.*, 2020).

Most people usually wet their fingers with their saliva while counting money, there by contaminating it with the normal flora of their bucalcavity and introducing harmful bacteria into the bucalcavity; others use the toilet without washing their hands to count money, this practice can introduce faecal bacteria, while others use fingers in picking their nose to count money, these practices further contaminate currency notes (Awe *et al.,* 2021). Other negative money handling practices such as placing money on the faces of individuals and throwing money on people during occasions where other individuals step on them are ways in which money can contaminated by the normal flora of people and by organisms from soil and dust (Ogo*et al*, 2022). Bacteria are members of tiny single celled micro- organisms which can either be parasitic or free living which are almost found everywhere on earth. There are members of recognized phyla- the dominant ones are: *proteobacteria, firmicutes, Actinobacteria.* The bacteria that cause health problems fall in the phylum *proteobacteria*. Examples of such bacteria are; *E. coli, Salmonella spp, vibrio spp, Helicobacteria spp* and numerous other genera (Alan, 2023). The possibility that bacteria can be found almost everywhere on earth also makes it possible in transmission on many contact surfaces. Many scientists have conducted research on transmission of microbes via Money currency. Money is used as medium of exchange for goods and services, settlement of debts and for differed payments in economic activities. It might act as formites or environmental vehicles for the transmission of potential microbes (Alan, 2023).

The use of paper and polymer currency for every type of commerce makes it susceptible for germs contamination, with the lower- denomination notes receiving the most handling and thus, the most contamination because they are exchanged frequently (Gadsby, 2021; Uneke, 2022). In Nigeria, the currency is highly abused especially in the manner in which it is

handled in transactions. Presently, it is commonly seen faded, torn, stapled, cello- taped, squeezed, and writings on them. As the result of daily transactions, money is often contaminated with germs. The contamination of the Naira notes could as well be from the atmosphere, during production, storage, usage or handling (Matur*et al.,* 2021). Daily transaction has made the naira notes to pass through many hands or is placed in a dirty environment and pathogenic organisms become imposed on them. Awodi *et al.,* (2021), reported that, the source of contamination could be as a result of poor or negative money handling or practices like spraying around during ceremonies; here the notes are sprayed on the celebrant(s) and in the process fall on the ground where a large number of people dancing, step on them with soiled shoes on bare ground Awodi *et al.,* (2021).

The Naira notes used in Nigeria are ₦5.00, ₦10.00, ₦20.00, ₦50.00, ₦100.00, ₦200.00, ₦500.00 and ₦1000.00. The ₦5.00, ₦10.00, ₦20.00, and ₦50.00 notes are made of polymer material, and based on the economic condition of the country, are not in regular use, thus, it is envisaged that their microbial load will be minimal. Several organisms have been implicated in Naira note samples and include *E. coli spp, Salmonella ssp, Citrobacter spp, S. aureussp, Pseudomonas spp, Klebsiella spp, Shigella spp,* and a host of others (Oyejola and Adebayo, 2020). Some of these organisms are commonly known to inhabit the lower intestinal tracts of warm-blooded animals and have been found to contaminate Naira notes as a result of improper handling most of these organisms are pathogenic and harbor resistant genes which has conferred antibiotic resistance on the organisms (Barolia *et al*., 2021).

The contamination of the naira notes could be from several sources, it could be from the atmosphere, during storage, usage, handling or production (Ogba, 2021). The contaminated currency notes go in circulation and contaminate the hands of others and across borders transmitting microorganisms in the process since money is not screened for microbes (Pope *et al.,* 2020). The survival of various microorganisms on money and other fomites, with their transmission via the hands of market men and women and other users is often overlooked as enteric disease reservoir (Michaels, 2023). Pathogenic microorganisms that may survive on currency notes may serve as a potential source of enteropathogens (Michaels, 2023; Cardoen *et al.,* 2023; Lamichhane *et al.,* 2021). Carrier micro-organisms apart from reducing the lifespan of the notes, have been documented to cause infections in the skin, eye, gastrointestinal tract, internal organs (Yildiran, *et al.,* 2017), as well as the respiratory tract (Denning, 2020) in humans. Microorganisms such as *Micrococcus spp., Corynebacterium spp., Vibrio cholerae, Mycobacterium Tuberculosis* and members of the *Enterobacteriacea* family top the list subsequently.

In Nigeria, a whole division of the Department of Treasury deals with what is termed "mutilated currency," and the department website boasts many examples of beleaguered, burned, buried, water damaged money (Siddique, 2003). The bacteria associated with naira notes are highly contagious and relatively easy to transmit bacteria disease from one person to another by sharing the money from contaminated hands to uncontaminated ones. Also, bacteria can be transmitted by keeping the money in unsafe place like wallets, pockets or holding them with a hand that is contaminated with bacteria which may cause different kinds of bacterial diseases.

II. AIM AND OBJECTIVES

The aim of this study is to isolate and identify antibiogram of bacteria/pathogens prevalent among Nigerian currency note collected from meat vendors in north bank market Makurdi, Benue State. The objectives are as follows:

i. To determine Bacterialand Pathogens in the Naira notes from meat vendors in north bank market Makurdi, Benue State.
ii. To examine the visible factors associated with the naira notes from meat vendors north bank market Makurdi, Benue State.

III. LITERATURE REVIEW

3.1 Concept of Antibiogram on Naira Notes

Money is the greatest common item swapped and emanates into contact with diverse environments and changed personalities from hand to hand ordinary during the world. It used to properties, amenities, settlement of arrears, and for diverse expenses in economic activities. Paper currency can be soiled by droplets through coughing, sneezing, tender with formerly unclean hands or other tackles and placement on dirty surface; daily businesses have read the paper currency license over many hands, and pathogens convert imposed on them beforehand they are lastly placed in banks. Potential pathogens have been secluded from currency comprising *Escherichia coli, Staphylococcus and Pseudomonas*. Cross-contamination by simultaneous handling of money and animal yields and poor sanitation observes in market, slaughter house and bistros too rise the risk of infection. Equally, simultaneous handling of food and change via servers or vendors can have solemn costs as the food they serve is equipped to eat and does not entail any additional heating. Additionally, the people ordering that food usually do not rinse their hands prior eating (Anaam Jawad Alabbasy, 2019).

According to the gossips made from numerous educations, voluminous bacterial groups source adulteration of paper currency. A study was carried out on 100 paper currency notes fitting to all – the note denominations obtained from altered chosen industrial groups in Dhaka City, Bangladesh. Documentation and classification revealed active partaking of the succeeding species of organisms in the ascending order of percentage as *E. coli 58%, Klebsiella 50%, Staphylococcus aureus 25%, Salmonella 15%, Bacillus 9%, Pseudomonas 7%, and Vibrio cholerae 5%.* One hundred and sixty-nine bacterial divorces were recovered belonging to these nominated seven species. Currency notes docile from fish sellers, meat suppliers, vegetable traders, food salespersons, office workers, students, bus conductors, beggars and shop keepers with *42.85%–85.71% Escherichia coli, 28.57%–92.85% Kleibsellae, 9.09%–53.84% S. aureus, 0%–42.85% Salmonella sp., 0%–28.57% V. cholerae, 0%–25% Bacillus sp., and 0%–28.57% Pseudomonas sp., respectively. Anaam Jawad Alabbasy (2019).*

The study suggested that Bangladesh paper currency is ordinarily tainted with pathogenic micro-organisms and this corruption may play a significant role in the transmission of potentially harmful micro-organisms or different diseases like cholera, diarrhea, skin infections and similarly poses antibiotic resistant. Alternative revision exhibited that secluded bacteria improved were *Bacillus cereus (8.33%), E. coli (48.14%), S. aureus (28.7%), Salmonella (0.92%),Listeria monocytogenes (0.92%), Yersinia entrocolitica (6.48%). A study in Egypt reported that 65%of the paper bills had bacteria like Staphylococcus albus, S. aureus and Klebsiella pneumoniae.* In an Iraqi training, bacterial impurity was shown as follows: *Bacillus sp. 41.2%, S. aureus 15.6%, coagulase-negative staphylococci 13.1%, Klebsiella sp.11.2%, E. coli 11.2%, Enterobacter sp. 3.7%, and Proteus sp. 3.7%.* Other microorganisms may infect paper currency such as parasites, which were isolated from the notes incorporated *Ascaris lumbricoides, Enterobius vermicularis, Trichuris trichiura, and Taenia species. Infection by fungi was exhibited like via Aspergillus flavus, A. niger and*

Penicillium spp., Alternaria tenuis and Trichoderma spp., Fusarium spp. and Trichoderma viride, A. paraziticus and Sporotrichum spp. Anaam Jawad Alabbasy(2019).

3.2. Bacteria Load in Naira Notes.

Worldwide, currency notes and money in general serve as means of economic exchange of goods and services, to defer payment (Ogunleye, 2022, Awe *et al.,* 2023). Between the late 1800s and early 1900s, Scientists postulated the association of handling money with disease transmission. Subsequently, by modern scientific techniques, these postulations confirmed that pathogenic organisms can be isolated from currency/money surfaces (Awe *et al.,* 2020; Alemu, Alemu, 2020). For example, *Citrobacter ssp., Escheriachia coli, Mycobacterium spp., Pseudomonas aerogenosa*, *Salmonella ssp., and Staphylococcus aureus,* are among the examples of food borne pathogenic microorganism reported on currency notes (Awe *et al.,* 2020). In Nigeria, the naira notes presently in Assessment of Bacteria Associated with Naira Notes circulation are abused by the different ways they are handled and stored which may include but not limited to squeezing, spraying, stapling, cello-taping, keeping naira notes in bassiere, socks and pockets, under the carpet or rugs, writings on them etc (Ameh and Balogun, 2023). However, there is well documented evidence suggesting that currency notes could act as fomites with enormous potential to carry microbes. The contamination of the naira notes could be from several sources, it could be from the atmosphere, during storage, usage, handling or production (Ogba, 2021).

The contaminated currency notes go in circulation and contaminate the hands of others and across borders transmitting microorganisms in the process since money is not screened for microbes (Pope *et al.,* 2020). The survival of various microorganisms on money and other fomites, with their transmission via the hands of market men and women and other users is often overlooked as enteric disease reservoir (Michaels, 2023). Pathogenic microorganisms that may survive on currency notes may serve as a potential source of enteropathogens (Michaels, 2023; Cardoen *et al.,* 2023; Lamichhane *et al.,* 2021). Carrier micro-organisms apart from reducing the lifespan of the notes, have been documented to cause infections in the skin, eye, gastrointestinal tract, internal organs (Yildiran, *et al.,* 2017), as well as the respiratory tract (Denning, 2020) in humans. Microorganisms such as Micrococcus spp., Corynebacterium spp., Vibrio cholerae, Mycobacterium tuberculosis and members of the Enterobacteriacea family top the list subsequently.

An investigation that was reported in 2008 and that involved swabbing and culturing from various coins and paper money collected at random from doctors, laboratory staff, and other employees at a New YORK hospital resulted in the recovery of many pathogenic microorganisms, Flexible Spending Account which is also called a “flexible spending arrangement” (FSA, 2022). Many studies show that, the presence of coagulated positive *staphylococci* on the money surface was confirmed. This suggested that without hygienic intervention, human occupational activities, especially those involving simultaneous money handling, could introduce the risk of cross-contamination to foods (FSA, 2022). Oddly, publications regarding the degree to which paper money is contaminated with bacteria are few and far between, as the authors found when they conducted a Medline search in December 2005 (Michaels, 2023; Pope *et al.*, 2023, Singh *et al.*, 2023, Xu *et al.,* 2023; El-Daris and Hassan, 20021). Furthermore, the search found no documented study of the parasitological status of currency notes (as of December 2021). Scientific information on the contamination of money by microbial agents is also lacking in most sub-Saharan Africa, including Nigeria. This dearth of information may have contributed to the absence of public health policies or legislation on currency usage, handling, and circulation in many parts of Africa. Although the studies done in the United States and Australia have had no major

impact on policies or legislation on currency handling and circulation in those countries, they have fostered a higher level of public awareness about the potential for currency contamination by microorganisms (FSA, 2022).

In Nigeria, a whole division of the Department of Treasury deals with what is termed "mutilated currency," and the department website boasts many examples of beleaguered, burned, buried, water damaged money (Siddique, 2021). The bacteria associated with naira notes are highly contagious and relatively easy to transmit bacteria disease from one person to another by sharing the money from contaminated hands to uncontaminated ones. Also, bacteria can be transmitted by keeping the money in unsafe place like wallets, pockets or holding them with a hand that is contaminated with bacteria which may cause different kinds of bacterial diseases. This research aims at isolating, identifying and determining the levels of contamination of ₦100-, ₦200-, ₦500- and ₦1000-naira notes with bacteria.

3.3 Different Bacteria and pathogens on Naira Notes.

Bacteria are classified into five groups according to their basic shape: spherical (cocci), rod (bacilli), spiral (spirilla), comma (vibrios) or corkscrew (spirochartes) they can exist in single cells, in pairs, chains, or clusters. Bacteria are found in every habitat on earth; soil, rock, oceans and even arctic snow. (Wikipedia). Worldwide, currency notes and money in general serve as means of economic exchange of goods and services, to defer payments and settle debts (Awe *et al*., 2020; Ogunleye, 2022; Okon *et al*., 2003). Between the late 1800s and early 1900s, scientists postulated the association of handling money with disease transmission. Subsequently, by modern scientific techniques, these postulations confirmed that pathogenic organisms can be isolated from currency/money surfaces (Alemu, 2020; Awe *et al*., 2010). For example, Citrobacter spp., Escherichia coli, Mycobacterium spp., Pseudomonas aeroginosa, Salmonella spp., and Staphylococcus aureus, are among the examples of foodborne pathogenic microorganisms reported on currency notes (Awe *et al*., 2020). By adhering to various surfaces, food pathogens such as E. coli, S. aureus and Salmonella spp. could remain viable for hours or even days of post-contamination (Okpala and Ezeonu, 2019). However, whether it is between clean and dirty hands, the movement of currency notes especially within the agrifood supply chain would never stop. This inevitable situation potentially facilitates continued occurrence of microbial contamination and proliferation between currency notes and foodstuffs even more likely (Agarwal *et al*., 2019; Thiruvengadam *et al*., 2021). To reiterate, the process of microbial contamination and more importantly, its subsequent transmission, the latter with respect to the surface of any currency note, has been understood to be of either direct (hand-to-hand contact) or indirect (food or other inanimate objects) means (Cooper, 1999).

Even though consumers can help to prevent foodborne disease incidence, the different sources from which microorganisms are able to transfer to food is not new. For instance, microbial contamination takes place during the various stages of food preparation. Another instance, fruits on trees and vegetables grown on the soil are naturally microbiologically contaminated. Some cells of such microbes could still remain even after washing (Okpala and Ezeonu, 2019). Besides foodstuffs as well as drinking water that could get contaminated, there remains a wide spectrum of microbial pathogens that can contaminate animals and food products, all of which are among the fundamental causes of foodborne disease incidence and spread (Okpala *et al*., in press). During the food handling processes within the agrofood supply chain, the contamination of currency notes can take place, particularly involving diverse flora and fauna, aerosols generated by coughing and sneezing, anal region, wounds, to the skin, water, and soil (Agarwal *et al*., 2019; Thiruvengadam *et al*., 2021). Currency

notes, even before it would reach the bank and in the process of circulating and passing through hands during daily transactions, can equally transmit the pathogenic microbes (Awodi and Nock, 2020; Yakubu, Ehiowemwenguan and Inetianbor, 2021). Besides the large surface area of any given currency note, a number of pathogenic microorganisms, not only capable of surviving on these notes but also, can serve as useful candidates of food borne pathogens (Michaels, 2002; Podhajny, 2018) and can increase the probability of food borne disease incidence/spread. The latter can also serve as a useful indicator of poor environmental hygiene and sanitation levels, all of which remains of great public health importance (Cooper, 1999).

Relevant literature about microbial status and survival of pathogens on currency notes have been shown by many workers in Turkey, the United States, Australia, India, Egypt, and China (Xu, Moore and Millar, 2023; Goktas and Oktary, 2023; Pope *et al*., 2023; Food Science Australia, 2000; El-Daris and Hassan, 2018; Singh, Thakur and Kalpana, 2018). Other studies regarding contamination ascribed to microbial load specific to national currency notes have been reported in Bangladesh (Ahmed *et al*., 2019; Hosen *et al*., 2019), Ethiopia (Alemayehu and Ashenafi, 2019), India (Rote, Deogade and Kawale, 2022), Iran (Dehghani, Dehghani and Estakhr, 2021), Nepal (Lamichhane *et al*., 2020; Prasai, Yami and Joshi, 2022), Nigeria (Awe *et al*., 2020; Kawo*et al*., 2019; Oyero and Emikwe, 2021; Umeh, Juluku and Ichor, 2021), Saudi Arabia (Ghamdi *et al*., 2011; Rashed *et al*., 2021), South Africa (Igumbor *et al*., 2023), as well as Sudan (Saadabi *et al*., 2020). In Europe, Mändar *et al*. (2021) studied microbial contamination of euro money, whereas in the USA, Michaels (2022) reported on handling money and serving ready-to-eat food, which considered the same gloved hands or without hygiene intervention, and provided in food service establishments, would introduce the risk of cross-contamination to foods. In the global front, Vriesekoop *et al*. (2022) performed the hygiene status of some world's currencies by capturing food outlets in 10 different countries (Australia, Burkina Faso, China, Ireland, Netherlands, New Zealand, Nigeria, Mexico, the United Kingdom, and the United States). By assessing the public health risks associated with the simultaneous handling of food and money, Brady & Kelly (2022) showed that coagulase-positive Staphylococci could be present on the currency note surfaces. The environment remains a critical player in food-related microbial transmission process to humans. The environment would also compose materials that are viable candidates for the (microbial) pathogens (Anderson and May, 2019; Struthers and Westran, 2021

Besides currency note contamination with bacteria that bring about wide range of diseases (Pope *et al*., 2022), how it is able to exchange through hands especially within the food supply chain (Agarwal *et al*., 2022; Thiruvengadam *et al*., 2021), together with the poor sanitation practices that could arise in the market, restaurants, and slaughterhouses is likely to reflect how multi-resistant microbial strains are able to cross-contaminate (Emikpe and Oyero, 2021; Oyero and Emikwe, 2021). Despite the available literature about microbial contamination of Nigerian currency note (Emikpe and Oyero2021; Enemour, Victor and Oguntibeju, 2021; Oyero and Emikwe, 2021; Umeh, Juluku and Ichor, 2021; Uneke and Ogbu, 2020), relevant information regarding how microbial contamination/load differ across the denominations is still insufficient. It is reasonable to say that food handlers in Nigeria, oftentimes, after handling currency notes, do fail to properly wash or sanitize their hands and other food/food-related facilities. To better understand how (pathogenic) microorganisms get enumerated, and subsequently circulate between foodstuffs and different currency denominations/notes, should be of consumer health concern. This should be considered particularly important with respect to food handlers in Nigeria who many a times have to perform financial duties alongside foodstuffs. For the reason that foodstuffs would most

likely differ with microbial contaminants/load, however, such additional knowledge and understanding on microbial enumeration as well as circulation between foodstuffs and different currency denominations/notes could help, not only in identifying the actual sources of the food borne diseases, but also, in enlightening the food handlers, food traders, health workers, and the general public as a whole, about the inherent (public) health risks potentially associated with the currency notes, specifically when not handled in a hygienic safe manner. In this context, therefore, the current study investigated the bacterial contamination of Nigerian currency notes via a comparative study of different denomination notes recovered from local food vendors

3.4 Effects of Bacteria/pathogens on Human Health.

The body of bacteria involves more bacterial cells than human cells. Bacteria are actually essential to your overall health. Of course, not all bacteria have a good reputation. The Centers for Disease Control and Prevention estimate that 48 million people get sick yearly from bad bacteria found in food. Let's start with the good news first. You need bacteria to live. Everything you eat passes through your gastrointestinal system. This is important because your colon is lined with millions of bacteria that grow, live and metabolize to help prevent disease. These bacteria fight foreign substances, help prevent the growth of harmful bacteria, maintain your mucosal immune system, help lower serum cholesterol levels and regulate metabolism. You might have heard of gut flora before. Gut flora, which are the live microorganisms in your intestines, are beneficial to your health. For example, bifid bacteria are intestinal bacteria found in the gut that can aid in treatment of diarrhea, ulcerative colitis, atopic eczema, yeast infections and irritable bowel syndrome.

Importance of Diet on Good Bacteria The food you decide to eat affects the life of the good bacteria found in your gut. A diet high in fat can disturb your GI barrier. The GI barrier is the bacteria's local defense system. Any disturbance of the GI barrier increases your risk of infection, inflammation and disease. On the other hand, a diet consisting of complex carbohydrates supports the GI barrier and health of the good bacteria. Good sources of complex carbohydrates include fruits, vegetables, cereals and legumes. American International Journal (2019). Bad Bacteria's Effects on Health the ultimate effect of bad bacteria on your health is death. The CDC estimates that 3,000 die yearly due to food borne illnesses including deaths caused by bad bacteria. Out of the 48 million that do contract a food borne illness, 128,000 end up in the hospital. *Escherichia coli,* also known *as E. coli*, can be both good and bad. While *E.coli* does live in your intestines, it is also found in the intestines of animals and the food you eat. However, some strands of *E.coli* can be pathogenic, leading to diarrhea, respiratory illness, urinary tract infection and other illnesses. *Salmonella sp, Clostridium perfringens, listeria monocytogenes and staphyloccus aureus* are bacteria associated with the leading causes of illness, hospitalization and death in America.

Reducing Effects of Bad Bacteria Diet and food safety are crucial to reducing your risk of experiencing the harmful effects of bad bacteria. Since good bacteria aid in helping fight and eliminate bad bacteria in the gut, start by following a diet to support gut health. Harmful bacteria use protein and fat to produce toxins which are commonly found in red meats. One of the simplest actions you can do to prevent the bad effects of bacteria is to clean. Clean everything! Start by cleaning your hands, and then clean surfaces, utensils and cutting boards. Wash fruits and vegetables before you start cutting or peeling. The next step is to separate. Separate raw produce from raw meat, fish, eggs and poultry. Cook all food thoroughly, using a food thermometer if necessary. Lastly, since bacteria can grow in many foods within two hours of being cooked, refrigerate food as soon as possible. Martin Blaser of New York

University has been working to identify the various bacteria that live on the human skin and help to form a protective barrier on the outside. Before he started his research it was estimated that fewer than 100 different species of bacteria lived on the skin. Using relatively new DNA-based sequencing techniques, he and his colleagues attempted to identify the bacterial species on the forearms of healthy subjects. An initial study of six subjects identified 182 bacterial species. Subsequent studies continued to add more species to the point where Blaser now estimates the number of different bacteriaspecies living on the skin could approach 500. Despite these numbers Blaser notes that only about 10 species predominate, accounting for approximately 50% of the total population. "What was interesting about some of the other species with smaller populations is that they were host specific. We could only identify them on a single host. It is entirely possible that everyone could have a unique bacterial signature," says Blaser, much in the same way everyone has a unique DNA signature or a unique fingerprint. Blaser is also beginning to explore the role these may play in skin disease and that research may be paying off. Initial studies of patients with psoriasis suggest differences in skin bacterial populations between patients who have the disease and those who do not.

Daniel Frank of the University of Colorado, Boulder, is part of a team that is exploring the role bacterial communities in the human digestive tract may play in inflammatory bowel diseases. They are collecting and comparing microbial communities in samples from people with Crohn's disease, people with ulcerative colitis and healthy volunteers. "Some researchers are looking at the role a specific organism, like *E.coli*, might play in the development of inflammatory bowel disease. Our task was to look more broadly. What are the microbes we see as a whole in the gut and how might those populations change in relation to disease"" says Frank. Instead of any one particular organism associated with inflammatory bowel diseases, they observed significant shifts in microbial populations between healthy subjects and those with disease, including a loss of normally protective bacterial populations. The bacteria in the digestive tract could also play a role in obesity. Ruth Ley of Washington University in St. Louis is part of a team that has been investigating the relationship between bacteria in the gut and weight. Several years ago, they discovered that obesity was associated with changes in the relative abundance of certain types of bacteria in the digestive tract. Due to their overwhelming numbers, the fact that their byproducts can be found in most human fluids, and the evidence of their potential role in health and disease, it is quite possible that mapping and understanding the human micro biome may be as important or more important to understanding human health than mapping and understanding the human genome, says McFall Ngai. Either way, with the complexity of the system, it is definitely going to be more difficult. Recognizing its importance, the National Institutes of Health in December 2007 announced the Human Micro biome Project as part of its Roadmap for Medical Research, devoting over $100 million in grants over the next five years. Researchers will use new, comprehensive laboratory technologies to characterize the microbial communities present in samples taken from healthy human volunteers, even for microbes that cannot be grown in the laboratory. The samples will be collected from five body regions known to be inhabited by microbial communities: the digestive tract, the mouth, the skin, the nose, and the female urogenital tract. Research projects will subsequently be funded to sample the micro biomes from volunteers with specific diseases. This will allow researchers to correlate the relationship between changes in a micro biome present at a particular body site to a specific illness. Commensal Bacteria Many bacteria live within our gastrointestinal tract, on our bodies or in the environment with which we come into daily contact without there being any resulting disease. In these situations, the bacteria are non-pathogenic and are called commensal bacteria, which mean “eating at the same table.”

It is recognized, however, that many of these organisms can cause infections such as wound infections or septicaemia if they are introduced into body tissues, particularly if the person is immune compromised. Although many genera and species of heterotrophic bacteria have been isolated from water and have been found to colonize distribution systems, no outbreaks of associated human disease have been conclusively reported. Suspicions have been raised about several organisms, such as *Klebsiella spp.* and *Citrobacter spp.,* but their frequent isolation and lack of involvement in human gastrointestinal disease make them very unlikely candidates. There are concerns about the potential for *Aeromonas spp.* and *Yersinia enterocolitica* to cause *diarrhoeal* disease. In Swedish water distribution systems, sampling demonstrated counts of up to 300 cfu/100 ml in raw water and up to 750 cfu/100 ml in tap water samples (Kuhn *et al*. 2021). The significance of *Aeromonas* in drinking-water is not fully understood. It is recognized that, on occasions, the ingestion of *Aeromonas spp*. may lead to *diarrhoeal* disease, and this is associated with an enterotoxin (Janda and Duffey 2023). There are numerous reports of *Aeromonas* isolates from patients with diarrhoea, but also reports of *Aeromonas* strains that produce a heat-labile cytotoxin, have enterotoxin activity (Ljungh*et al*. 2023; Turnbull *et al*. 2023) and possess other pathogenic characteristics. It is suggested that when all are present in a strain, enteric infection may result. Human volunteer challenge trials using five enteropathogenic strains of Aeromonas hydrophila demonstrated diarrhoea in only 2 of 57 persons with administered doses ranging from 104 to 105 cfu (Morgan *et al*. 2021). A number of factors, such as age, immune competence, previously developed immunity, exposure and infective doses of the organisms, as well as the possession of virulence factors, could affect the ability of Aeromonas to establish overt infection. In the United Kingdom study of infectious intestinal disease in England, the percentage isolation rates were the same in diarrhoeal cases and in matched controls (Food Standards Agency 2000).

The absence of defined outbreaks and the low levels of infectivity in human volunteer experiments suggest that people have a relatively high degree of resistance to infection with Aeromonas. The significance of Aeromonas in drinking-water in the Netherlands has been reviewed (van der Kooij 2023), and the health authorities in the Netherlands have defined maximum values for Aeromonas present in drinking-water: i.e., 200 cfu/100 ml in water distribution systems and 20 cfu/100 ml in water leaving the production plant. However, there have not been any outbreaks of disease in the United Kingdom, even though blooms of Aeromonas occur in some distribution systems during the summer months.

3.5 Solutions to Mitigate the Effects of Bacteria on Human Health.

Antibiotics are medicines used to prevent and treat bacterial infections. Antibiotic resistance occurs when bacteria change in response to the use of these medicines. Bacteria, not humans or animals, become antibiotic-resistant. These bacteria may infect humans and animals, and the infections they cause are harder to treat than those caused by non-resistant bacteria. Antibiotic resistance leads to higher medical costs, prolonged hospital stays, and increased mortality. The world urgently needs to change the way it prescribes and uses antibiotics. Even if new medicines are developed, without behavior change, antibiotic resistance will remain a major threat. Behavior changes must also include actions to reduce the spread of infections through vaccination, hand washing, practicing safer sex, and good food hygiene.

Antibiotic resistance is rising to dangerously high levels in all parts of the world. New resistance mechanisms are emerging and spreading globally, threatening our ability to treat common infectious diseases. A growing list of infections – such as pneumonia, tuberculosis, blood poisoning, gonorrhea, and food borne diseases – are becoming harder, and sometimes

impossible, to treat as antibiotics become less effective. Where antibiotics can be bought for human or animal use without a prescription, the emergence and spread of resistance is made worse. Similarly, in countries without standard treatment guidelines, antibiotics are often over-prescribed by health workers and veterinarians and over-used by the public. Without urgent action, we are heading for a post-antibiotic era, in which common infections and minor injuries can once again kill. Antibiotic resistance is accelerated by the misuse and overuse of antibiotics, as well as poor infection prevention and control. Steps can be taken at all levels of society to reduce the impact and limit the spread of resistance by Prevent infections by regularly washing hands, preparing food hygienically.

IV. METHODOLOGY

Materials and Methods

The study area is North bank markets in Makurdi metropolis, the capital of Benue State. Benue state is in middle belt region of Nigeria. It is primarily inhabited by the major tribes, Tivs and Idoma including other tribes, and it is predominantly an agricultural region. Benue State is located within longitude 8° 44¹ 59.99" E and latitude 7° 19¹ 60.00" N with a land mass of 534,059km^2 (*en.m.wikipedia*). North bank market is one of the markets in Makurdi metropolis where both wholesalers and retailers buy goods in the market. Slaughter houses are located within the settlement of the north bank people from where meat vendors and individuals purchase meat as well as other commodities. Buying and selling is at its peak, hence, predisposing the Naira notes to contamination as it is daily exchanged.

3.2 Materials

The materials required to carry out this research work are; Naira notes, peptone water, test tubes, measuring cylinder, distilled water, agars, weighing balance, petri dish, beaker, autoclave, incubator, grand staining reagents, inoculating wire loop, bouncing burner, cotton wood, foil paper, swap stick, and filter paper.

Processing of Naira Note Samples

Using hand gloves, each Naira note sample was carefully rolled and soaked in 20ml of peptone water in test tubes and incubated at 37°C for 24 hrs.

Determination of Bacterial Load in the Naira Note Samples

Standard spread plate method was use to inoculate 1mL of the 24hrs old peptone water into the appropriate media and incubated for 24hrs at 37 °C. After the incubation period, distinct colonies were counted using the colony counter and expressed in CFU/ML. Pure culture was obtained by sub – culturing onto the appropriate media and stored at 4°C for future use. The isolates were Gram stained and subjected to motility test. Biochemical tests were carried out on the isolates to further identify the organisms (Cheesbrough, 2006).

Phenotypic characterization

The phenotypic characterization of all isolates studied was performed and compared to phenotypic data of known organisms described in the Bergey's Manual of systematic Bacteriology. The phenotypic features characterized are as follows: Cultural and Morphological characteristics: The colony morphology, cell morphology, and the motility of bacterial isolates from fresh cultures will be evaluated. For Aerobic and Anerobic cultivation and incubated at 37°C in anerobic jar. After 24-48 h growth was observed.

Biochemical Tests

A number of biochemical tests was performed for the identification of bacterial isolates with the help of Bergey's Manual. The principal tests used for this purpose are Lactose Fermentation Test (LAC), H_2S production, coagulase, motility and Catalase Test (CAT).

Catalase Test

A microscope slide was placed inside a petri dish, using a sterile inoculating loop or wooden applicator stick, small amount of organism from a well-isolated 18- to 24-hour colony was collected and place onto the microscope slide. Using a dropper or Pasteur pipette,1 drop of 3% $H_2O_2$was placed onto the organism on the microscope slide. Immediate bubble formation (O2 + water = bubbles) was observed for.

Coagulase Test

The slide test was performed by preparing a suspension of bacterial cells mixed into a drop of rabbit plasma on a microscope slide to check for coagulation.

Lactose Test

Lactose broth was inoculated and incubated at 37°C for 24 h. After incubation, a positive result was noted as change of color to yellow while no color change was observed in negative results.

Antibiotics Susceptibility Tests

The antibiotics susceptibility patterns of the isolates were tested using the modified Kirby Bauer disc diffusion method on Mueller Hinton agar and interpreted according to the guidelines recommended by the Clinical Laboratory Standard Institute (CLSI, 2017). Susceptibility/ resistance of the organisms to each of the test antibiotics wias determined on the basis of the size of the zone of growth inhibition. A 24hrs old suspension of the identified test bacteria was standardized by diluting to 0.5 Mcfarland's turbidity standard. A sterile swab stick was dipped into the standardized test inoculums, and drained by rotating firmly against the sides of the tube to remove excess inoculums load and inoculated by spreading evenly across the surface of the already prepared Mueller-Hinton agar plates.

The inoculated plates were allowed to dry for few minutes at room temperature with the lid closed. After the agar plates had dried, sterile forceps were carefully used to place antibiotic impregnated discs of known concentrations on the already inoculated Mueller-Hinton agar plates. The plates were then incubated for 24hrs at 37°C. After the incubation period, the diameters of zones of inhibition were measured in millimeter using a ruler and recorded.

V. RESULTS AND DISCUSSION

The following table presents the results of microbial analysis and antibiotic sensitivity texts conducted on microbes isolated from naira notes handled by meat vendors in North Bank Market, Makurdi, Benue. The data presented reflects our finding and their implementations for public health and hygiene.

Table 1: Total Viable Counts of Bacteria Obtained from Different Naira Note Samples.

S/N	Currency Type	CFU/mL
1.	50	$1.0x10^4$
2.	100	$2.3x10^4$
3.	200	$1.4x10^4$
4.	500	$1.0x10^4$
5.	1000	$1.2x10^3$

The above table 1 shows the total viable counts of bacteria from Naira note samples (CFU/mL) for goat meat currency.

Table 2: Total Viable Counts of Bacteria Obtained from Different Naira Note Samples.

S/N	Currency Type	CFU/mL
1.	50	$1.0x10^4$
2.	100	$2.3x10^4$
3.	200	$1.4x10^4$
4.	500	$1.0x10^4$
5.	100	$1.2x10^3$

Table 2 shows total viable counts of bacteria from Naira note samples (CFU/mL) for cow.

Table 3: Shows the Gram Reaction of Organisms Isolate from Naira Note from Goat Meat Vendors.

S/N	Currency Type	Isolate	Gram-stain Reaction
1.	50	Klebsiella Spp	Gram-negative
2.	100	Staphylococcus aureus	Gram-positive
3.	200	Staphylococcus aureus	Gram-positive
4.	500	Escherichia coli	Gram-negative
5.	1000	Pseudomonas Spp	Gram-negative

Table 4: Shows the Gram Reaction of Organisms Isolated from Naira Note from Cow Meat Vendors.

S/N	Currency Type	Isolate	Gram-stain Reaction
1.	50	Pseudomonas Spp	Gram-negative
2.	100	Pseudomonas Spp	Gram-negative
3.	200	Pseudomonas Spp	Gram-positive
4.	500	Klebsiella Spp	Gram-negative
5.	1000	Staphylococcus aureus	Gram-positive

Table 5: Biochemical Test for Organisms Isolated from Goat Meat Currencies.

S/N	Sample	Catalase	Coagulase	Lactose	MT	H_2S	Isolate
1.	50	+	-	+	-	+	*Klebsiella Spp*
2.	100	+	+	N/A	-	N/A	*Staphylococcus aureus*
3.	200	+	+	N/A	-	N/A	*Staphylococcus aureus*
4.	500	+	-	+	+	+	*Escherichia coli*
5.	1000	+	-	-	+	-	*Pseudomonas spp*

KEY: + = Positive, - = Negative, MT = Motility Test, H_2S = Hydrogen sulfide, N/A= Not applicable

Table 6: Biochemical Test for Organisms Isolated from CowMeat Currencies.

S/N	Sample	Catalase	Coagulase	Lactose	MT	H_2S	Isolate
1.	50	+	-	-	+	-	*Pseudomonas spp*
2.	100	+	-	-	+	-	*Pseudomonas spp*
3.	200	+	-	-	+	-	*Pseudomonas spp*
4.	500	+	-	+	-	-	*Klebsiella Spp*
5.	1000	+	+	N/A	-	N/A	*Staphylococcus aureus*

KEY: + = Positive, - = Negative, MT = Motility Test, H_2S = Hydrogen sulfide, N/A= Not applicable.

Table 7: Susceptibility Pattern of the *Pseudomonas spp*Organisms Isolated from Goat MeatNaira Notes.

Isolate	Antibiotics	Zone of Inhibition (mm)	Result Interpretation
Pseudomonas spp			
	OFX	18	S
	PEF	11	R
	CPX	8	R
	AU	19	I
	CN	10	R
	S	15	I
	CEP	19	I
	NA	6	R
	SXT	17	I
	PN	19	S

KEY: OFR = Tarivid, PEF = Reflacine, CPX = Ciproflox, AU = Augmentin, CN = Gentamicin, S = Streptromycin, CEP = Ceporex, NA = Nalidixin Acid, SXT = Septrin, PN Amplicin, S = Susceptible, I = Intermediate, R = Resistance.

Table 8: Susceptibility Pattern of the *Staphylococcus aureus*Organisms Isolated from Goat Meat Naira Notes.

Isolate	Antibiotics	Zone of Inhibition (mm)	Result Interpretation
Staphylococcus aureus			
	CPX	15	I
	NB	18	S
	CN	20	R
	AML	14	I
	S	19	S
	RD	12	R
	E	17	S
	CH	33	S
	APX	22	S
	LEV	10	R

KEY: CPX = Ciproflox, BB =Norfloxacin, CN = Gentamicin, AM = Amoxil, S = streptomycin, RD = Rifampicin, E = Erythronmycin, CH = Chloramphenicol, APX = Ampiclox, EV = Levofloxacin, S = Susceptible, I = Intermediate, R = Resistance.

Table 9: Susceptibility Pattern of the *Staphylococcus aureus*Organisms Isolated from Goat Meat Naira Notes.

Isolate	Antibiotics	Zone of Inhibition (mm)	Result Interpretation
Staphylococcus aureus			
	CPX	10	R
	NB	8	R
	CN	11	R
	AML	20	S
	S	6	R
	RD	14	I
	E	11	R
	CH	17	I
	APX	19	S
	LEV	12	I

KEY: CPX = Ciproflox, BB =Norfloxacin, CN = Gentamicin, AM = Amoxil, S = streptomycin, RD = Rifampicin, E = Erythronmycin, CH = Chloramphenicol, APX = Ampiclox, EV = Levofloxacin, S = Susceptible, I = Intermediate, R = Resistance.

Table 10: Susceptibility Pattern of the *Klebsiella spp* Organisms Isolated from Goat Meat Naira Notes.

Isolate	Antibiotics	Zone of Inhibition (mm)	Result Interpretation
Klebsiella spp.			
	OFX	10	R
	PEF	8	R
	CPX	11	R
	AU	28	S
	CN	10	R
	S	12	R
	CP	14	I
	NA	18	S
	SXT	22	R
	PN	20	S

KEY: OFR = Tarivid, PEF = Reflacine, CPX = Ciproflox, AU = Augmentin, CN = Gentamicin, S = Streptromycin, CEP = Ceporex, NA = Nalidixin Acid, SXT = Septrin, PN Amplicin, S = Susceptible, I = Intermediate, R = Resistance.

Table 11: Susceptibility Pattern of the *Escherichia coli* Organisms Isolated from Goat Meat Naira Notes.

Isolate	Antibiotics	Zone of Inhibition (mm)	Result Interpretation
Escherichia coli			
	OFX	25	S
	PEF	9	R
	CPX	12	R
	AU	22	S
	CN	17	I
	S	21	S
	CP	10	R
	NA	17	I
	SXT	19	I
	PN	21	S

KEY: OFR = Tarivid, PEF = Reflacine, CPX = Ciproflox, AU = Augmentin, CN = Gentamicin, S = Streptromycin, CEP = Ceporex, NA = Nalidixin Acid, SXT = Septrin, PN Amplicin, S = Susceptible, I = Intermediate, R = Resistance.

Table 12: Susceptibility Pattern of the *Pseudomonas spp* Organism Isolated from Cow Meat Naira Notes.

Isolate	Antibiotics	Zone of Inhibition (mm)	Result Interpretation
Pseudomonas spp			
	OFX	22	S
	PEF	9	R
	CPX	11	R
	AU	20	I
	CN	25	S
	S	10	R
	CP	19	I
	NA	21	S
	SXT	19	I
	PN	12	R

KEY: OFR = Tarivid, PEF = Reflacine, CPX = Ciproflox, AU = Augmentin, CN = Gentamicin, S = Streptromycin, CEP = Ceporex, NA = Nalidixin Acid, SXT = Septrin, PN Amplicin, S = Susceptible, I = Intermediate, R = Resistance.

Table 13: Susceptibility Pattern of the *Pseudomonas spp* Organism Isolated from Cow Meat Naira Notes.

Isolate	Antibiotics	Zone of Inhibition (mm)	Result Interpretation
Pseudomonas spp			
	OFX	30	S
	PEF	6	R
	CPX	10	R
	AU	28	S
	CN	16	I
	S	11	R
	CP	14	I
	NA	11	R
	SXT	22	S
	PN	8	R

KEY: OFR = Tarivid, PEF = Reflacine, CPX = Ciproflox, AU = Augmentin, CN = Gentamicin, S = Streptromycin, CEP = Ceporex, NA = Nalidixin Acid, SXT = Septrin, PN Amplicin, S = Susceptible, I = Intermediate, R = Resistance.

Table 14: Susceptibility Pattern of the *Pseudomonas spp*Organism Isolated from Cow Meat Naira Note.

Isolate	Antibiotics	Zone of Inhibition (mm)	Result Interpretation
Klebsiella spp.			
	OFX	18	I
	PEF	10	R
	CPX	9	R
	AU	19	I
	CN	17	I
	S	12	R
	CP	19	I
	NA	12	R
	SXT	22	S
	PN	20	S

KEY: OFR = Tarivid, PEF = Reflacine, CPX = Ciproflox, AU = Augmentin, CN = Gentamicin, S = Streptromycin, CEP = Ceporex, NA = Nalidixin Acid, SXT = Septrin, PN Amplicin, S = Susceptible, I = Intermediate, R = Resistance.

Table 15: Susceptibility Pattern of the *Staphylococcus aureus* Organism Isolated from Cow Meat Naira Notes.

Isolate	Antibiotics	Zone of Inhibition (mm)	Result Interpretation
Staphylococcus aureus			
	CPX	25	S
	NB	12	R
	CN	25	S
	AML	15	I
	S	10	R
	RD	21	S
	E	15	I
	CH	11	R
	APX	10	R
	LEV	21	S

KEY: CPX = Ciproflox, BB =Norfloxacin, CN = Gentamicin, AM = Amoxil, S = streptomycin, RD = Rifampicin, E = Erythronmycin, CH = Chloramphenicol, APX = Ampiclox, EV = Levofloxacin, S = Susceptible, I = Intermediate, R = Resistance.

Table 16: Susceptibility Pattern of the *Staphylococcus aureus* Organism Isolated from Cow Meat Naira Notes

Isolate	Antibiotics	Zone of Inhibition (mm)	Result Interpretation
Pseudomonas spp			
	OFX	30	S
	PEF	12	R
	CPX	10	R
	AU	28	S
	CN	16	I
	S	8	R
	CEP	14	I
	NA	11	R
	SXT	22	S
	PN	10	R

KEY: OFR = Tarivid, PEF = Reflacine, CPX = Ciproflox, AU = Augmentin, CN = Gentamicin, S = Streptromycin, CEP = Ceporex, NA = Nalidixin Acid, SXT = Septrin, PN Amplicin, S = Susceptible, I = Intermediate, R = Resistance.

Plate 1: Denomination currency Sample.

Plate 2: Process of Inoculation.

Plate 3: Antibiotics disk on prepared media

Plate 4: Inoculum after 24hrs of Inoculation.

VI. DISCUSSION OF RESULTS

The results for the total viable counts (TVC) of different denominations showed that N100.00 notes had the highest colony counts (Table 2), this agrees with the report of Kawo *et al*. (2009) who attributed the high bacterial counts to higher frequency of usage in daily transactions; this was followed by N200.00 notes with TVC of $1.4x10^4$. The lowest TVC was observed in N1000.00 notes. This could be as a result of the fact that lower denominations are frequently exchanged among individuals of the lower class, hence, are prone to contamination; while the N1000.00 notes are handled by members of the social class with sophisticated lifestyle which reduces rate of contamination. This result agrees with the research of Usman *et al*. (2021) who obtained highest TVC of bacteria in smaller denominations and lowest TVC in bigger denominations of Naira notes. This result disagrees with the research of Ofoedu *et al*., (2021) who obtained about 95% higher denominations that were more contaminated than lower denominations obtained from meat sellers and fish sellers in Owerri, Imo State, Nigeria, the reason is attributed to poor handling of Naira currency by the vendors The results for the morphological and biochemical tests revealed that the bacteria isolated *were Pseudomonas aeruginosa (40%), Staphylococcus aureus (30%), Klebsiella spp (20 %), and Escherichia coli(10 %). The isolation of Escherichia coli (10%)* is in agreement with the research of Uneke and Ogbu (2007) who obtained 13.2 % E. coli from paper currency in Nigeria. Also, the presence of *E. coli*, with *Klebsiella spp* and *Staphylococcus aureus* corroborates with the work of Ofoedu *et al*. (2021) who isolated the same bacteria in varying degrees from Naira notes collected from local food vendors, Generally, the presence of enteric organisms in Naira note samples obtained from meat vendors could be as a result of poor hygiene of the meat vendors who obviously did not wash their hands after handling the meat before touching money as these organisms are found 5818 Nigerian Journal of Microbiology, December, 2021 Available online at Nwachi *et al*. 2021 Nigerian Journal of Microbiology, 35(2): - 5814 – 5821 in the intestinal tracts of animals. This correlates with the findings of previous study of Yazah *et al*. (2012) who assessed the bacterial contamination of Nigerian currency notes and associated risk factors in Northern Nigeria. Also, the presence of Pseudomonas aeruginosa on Naira note samples as observed in this study corresponds with the research of Imarenzo *et al*. (2018) who isolated Pseudomonas aeruginosa, Escherichia coli, and other organisms from Naira notes used in Wukari metropolis, Taraba state. Staphylococcus aureus is the only gram-positive bacteria that were isolated from Naira notes in this study, the bacteria may have been shed from the skin of individuals as the organism is a normal flora of the human skin (Chiller and Murakawa, 2001) Antibiotics susceptibility tests carried out on the isolated bacteria revealed that, all the isolates exhibited multi drug resistance traits as all the bacteria were highly resistant (100%) to Ciproflox, Norfloxacin, Reflaxine and Streptomycin. The isolates were 31% sensitive to antibiotics tested, 28% with intermediate result and the highest percentage which is 41% of resistance from isolated organisms to the tested antibiotics, this could be as a result of antibiotics abuse among the people which has led to multi drug resistance in the isolates.

VII CONCLUSION

Money is the greatest common item swapped and emanates into contact with diverse environments and changed personalities from hand to hand ordinary during the world. It used to properties, amenities, settlement of arrears, and for diverse expenses in economic

activities. Paper currency can be soiled by droplets through coughing, sneezing, tender with formerly unclean hands or other tackles and placement on dirty surface; daily businesses have read the paper currency license over many hands, and pathogens convert imposed on them beforehand they are lastly placed in banks. Potential pathogens have been scheduled from currency comprising *Escherichia coli*, *Staphylococcus and Pseudomonas*. Cross-contamination by simultaneous handling of money and animal yields and poor sanitation observes in market, slaughter house and bistros too rise the risk of infection. Equally, simultaneous handling of food and change via servers or vendors can have solemn costs as the food they serve is equipped to eat and does not entail any additional heating. Additionally, the people ordering that food usually do not rinse their hands prior eating (Anaam Jawad Alabbasy, 2019).

It is recognized, however, that many of these organisms can cause infections such as wound infections or septicaemia if they are introduced into body tissues, particularly if the person is immune compromised. Although many genera and species of heterotrophic bacteria have been isolated from water and have been found to colonize distribution systems, no outbreaks of associated human disease have been conclusively reported. Suspicions have been raised about several organisms, such as *Klebsiella spp.* and *Citrobacter spp.*, but their frequent isolation and lack of involvement in human gastrointestinal disease make them very unlikely candidates. There are concerns about the potential for *Aeromonas spp.* and *Yersinia enterocolitica* to cause *diarrhoeal* disease. In Swedish water distribution systems, sampling demonstrated counts of up to 300 cfu/100 ml in raw water and up to 750 cfu/100 ml in tap water samples (Kuhn *et al*. 2021). The significance of *Aeromonas* in drinking-water is not fully understood. It is recognized that, on occasions, the ingestion of *Aeromonas spp*. may lead to *diarrhoeal* disease, and this is associated with an enterotoxin (Janda and Duffey 2023). There are numerous reports of *Aeromonas* isolates from patients with diarrhoea, but also reports of *Aeromonas* strains that produce a heat-labile cytotoxin, have enterotoxin activity (Ljungh *et al.* 2023; Turnbull *et al.* 2023) and possess other pathogenic characteristics. It is suggested that when all are present in a strain, enteric infection may result. Human volunteer challenge trials using five enteropathogenic strains of Aeromonas hydrophila demonstrated diarrhoea in only 2 of 57 persons with administered doses ranging from 104 to 105 cfu (Morgan *et al*. 2021). A number of factors, such as age, immune competence, previously developed immunity, exposure and infective doses of the organisms, as well as the possession of virulence factors, could affect the ability of Aeromonas to establish overt infection. In the United Kingdom study of infectious intestinal disease in England, the percentage isolation rates were the same in diarrhea cases and in matched controls (Food Standards Agency 2000).

VIII. RECOMMENDATIONS

Money is one of the most frequently exchanged material in human communities as it is used daily as a means of exchange for goods and services (Djouadi *et al.*, 2020), thus, changing hands from one person to another. As it circulates, it is exposed to different unhygienic environmental conditions which subject it to microbial contamination (Krishan, 2022). There is evidence that paper notes have the ability to act as fomites with the potentials of carrying pathogenic microorganisms (Awodi *et al.*, 2021). This is true because most paper notes are rough and dirty, hence, can act as reservoir for microbes with the potential of transmitting

such organisms and subsequently causing diseases to the handlers (El-Daris and Hassan, 2019). Therefore, the following recommendations were drawn to mitigate the effect of contaminating Naira notes in other to prevent transmission of pathogens and other bacteria;

1. Naira Note is an acceptable means of business transaction that has to be handle with care or else any contamination may lead to a breakout of various affections in a society.
2. Government should as a matter of urgency implement cashless transaction to minimized people from coming in contact with Naira Note to avoid bacteria transmission.
3. Polymer Notes should be encourage knowing fully well it has less transmission of pathogens and bacteria.
4. Government should come up with a proper way of handling Naira Note and also punish defaulters.

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