SPECIAL ISSUE

Bima Journal of Science and Technology, Vol. 7 (2.1) August, 2023 ISSN: 2536-6041

ASSESSMENT OF BACTERIAL LOAD OF SOME SELECTED EATING TABLES OF UDUSOK MINI MART

[1*]BELLO ABDULLAHI YUSUF, [2]JUMARE FATIMA IBRAHIM, [1]HUSSEIN RIDWAN ABDULSALAM, [1]HARUNA ZAINAB ABDULLAHI, [3]SANUSI ABUBAKAR and [2]NAFI'U ABDULKADIR

[1]Department of Basic Science and General Studies, Federal College of Forestry Mechanization afaka, Kaduna, Nigeria.
[2]Department of Microbiology, Sokoto State University, Sokoto, Nigeria.
[3]Department of Microbiology, Kebbi State University of Science and Technology Aliero, Nigeria.

Corresponding author: belloyusufabdullahi6@gmail.com

ABSTRACT

Bacteria can be found in every nook and cranny of our environment thus, food and its premises are potential mediums for causing harm to public health. A total of 13 Samples from eating tables (single table per shop) were collected in the Usmanu Danfodiyo University mini market and evaluated for total bacterial load. The moistened sterile swab stick (two per table) was swabbed on each eating table, placed in a 5ml peptone water-containing test tube, shaken, labeled, and transported to the laboratory. The eating shop-table varies by capital letter per line and a number per shop. Nutrient agar and standard plate counts were employed. The mean heterotrophic bacteria counts HBC ranged from 2.35×10^3 to 1.55×10^5, 2.6×10^5 to 3.35×10^6, 4.65×10^4 to 3.25×10^6, 2.65×10^4 to 3.65×10^6, 3.35×10^3 to 4.9×10^5 Cfu/table size for A, B, C, D and E eating-shop line respectively. Best observed colonies were re-cultured, purified and obtain pure isolates. Following the conventional procedure; cultural, morphological, microscopic and biochemical characteristics, the isolates were identified as *Listeria* spp, *Pseudomonas* spp, *Enterobacter* spp, *Klebsiella* spp, *Staphylococcus* spp, *Serratia* spp, *E. coli*, *Corynebacterium* spp, *Acinetobacter* spp, *Shigella* spp, *Helicobacter* spp, *Campylobacter* spp and *Citrobacter* spp. The bacteria occurrences in the study include *Pseudomonas* spp, *Enterobacter* spp, and *Citrobacter* spp 11.76% each, *Listeria* spp and *Staphylococcus* spp had 17.64% each while *E. coli* 29.41% had more significant occurrences. Clearly, Udusok mini-mart eating tables sanitary practices need to be improved for public health concerns.

Keywords: Food, Bacteria, Eating tables and Mini-mart

INTRODUCTION

Bacteria are unicellular prokaryotes present in our environment. Most bacteria are beneficial, and only few are parasitic causing diseases. For a disease to occur, it requires acute and particular conditions that facilitate bacteria to proliferate its virulence nature (Doron and Gorbach, 2008). Most food-borne pathogens are gram-negative bacteria that can be found on the eating tables (Mayer and Donnelly, 2013). The said bacteria may thrive on non-living objects, still, their survival and transfer on matters also play a vital role in their transmission. If conveyed to the hands of persons, the bacteria can quickly enter individual's mouth from where they disseminate inside the body (Kimutai, 2014).

The food vending trade is currently growing from its low-class image and is becoming a lucrative business that involves peddling, selling, or offering for sale of food products. Food vending has become significant public health issue and of great concern to the world due to its potential spread of food-borne diseases (Sharmila, 2011). Food

vendors are carriers of diseases including common important human pathogens like *Escherichia coli*, *Salmonella*, *Shigella*, *Campylobacter, Pseudomonas,* and *Staphylococcus,* which eventually transfer and become infection to the consumers (Sharmila, 2011). Many coliforms and other microbes (like viruses) remain viable on surfaces for some days Thus, their presence may always be recovered in a significant proportion of food and surface samples (Gitahi, 2012). Consumption of restaurants foods has witnessed phenomenal growth over the years as rapid population growth, urbanization, unemployment, and poverty; occupational pressures and change in lifestyles have created a poll of the mobile and transient population who depend almost entirely on these relatively low-cost foods for their nutrition (Martins, 2006).

The surface we eat food, and the tables in the eating hall may be cleaned with a moistened cloth or dried cloth, which does not abolish all the pathogens. In some places, the tables may appear visually clean, yet they still contain microorganisms, hence, pathogens are exposed to those taking or eating food (Kimutai, 2014). Recently, researchers in Nigeria have pointed out food vendors as prospective sources of communicable diseases. The group said food might represent a medium through which diseases can be transferred from one individual to another and serve as a medium for microbial growth that can cause food poisoning. Hence, in reducing the implication of food-related diseases in Nigeria, the experts have called for the ‘’medical screening and training of food handlers’’ (Obayendo, 2022).

In this study, heterotrophic bacteria were Counted (HBC) and identified from the eating tables of the mini-mart of Usmanu Danfodiyo University Sokoto. The eating shops has been patronized by many students and staffs.

MATERIALS AND METHODS

Sample Collection

Samples were collected from thirteen (13) different eatery shops at the Udusok mini-mart. Duplicate samples were used from each shop per eating table (about137 by 244 cm). The method by Yepiz-Gomez *et al*. (2006), and Kimutai, (2014) was adopted during sample collection with a little modification. Clean and sterile swab sticks were placed in each clean and sterile test tube (34) containing 5ml sterile peptone water. The moistened swab sticks from each test tube were swabbed on each separate eating table from each shop and placed back into the test tubes containing peptone water. They were shaken gently, covered with aluminum foil, and each labelled for easy identification of the sample. These were immediately transported in an ice box to the laboratory.

Media Preparation

The media used include Eosyne Methylene blue, Nutrients agar, and violet red bile (VRB) agar. They were processed according to the manufacturer's direction for use. The dissolved and sterilized media was allowed to cool to a certain level and then poured into clean and sterile Petri dishes and bijou bottles. These were allowed to solidify.

Isolation of Bacteria

The sample (peptone water plus swabbed sticks) was re-shaken and each swab stick from each sample was directly streaked on the surface of the sterile solidified media containing Petri dishes. The Petri plates were incubated at 37°C for 36hrs. The observed colonies were counted and reported as colony forming unit CFUs. Best-grown colonies were re-cultured again to obtain pure isolates.

Characterization and Identification of Bacterial Isolates

Bacteria were identified based on the macroscopic, microscopic, and biochemical

characteristics observed as described by Mohammed *et al*. (2018).

Macroscopic and Microscopic Characteristics

Among the macroscopic growth characteristics observed include colony color, shape, margin, elevation, produced pigment, surface, and texture. Incontrast, microscopic characteristics were followed after gram staining (Bello *et al*., 2020) of the various colony observed; the color of the stain (purple/blue or pink/red), Shapes (Rod or round) and arrangements (singly, pairs, groups or in clusters) were observed.

Biochemical Characteristics of Bacterial Isolates

The biochemical characterizations were observed based on the procedures described by Oyeleke and Manga, (2008), Mohammed *et al*. (2018), and Bello *et al*. (2020). The parameters observed include sugar fermentation (glucose, sucrose, lactose, and maltose), methyl red and Voges-Proskauer, Triple sugar iron test, indole test, citrate utilization, and catalase test.

Statistical Analysis of Data

Data was analysed by comparing mean and standard deviation.

RESULTS AND DISCUSSION

The Total Heterotrophic Bacterial Counts

The study covered a total of thirteen (13) eating shops, from which one table per shop was sampled and processed. The eating shops can be identified by a given capital letter which determine each shop line (A, B, C, D and E). The mean heterotrophic bacterial counts (HBC) were presented in Figure 1. The A-line shop had the mean range of bacterial counts 2.35×10^3 to 1.55×10^5 CFU per table size. The B line shop bacterial counts range, from 2.6×10^5 to 3.35×10^6 CFU/table size. The line C shop bacterial counts were 4.65×10^4 to 3.25×10^6 CFU/table size and D was 2.65×10^4 to 3.65×10^6 CFU/table size. More significant bacterial counts were found on the line E shop eating table ranging from 3.35×10^3 to 4.9×10^5 CFU/table size. The heavy counts on the tables may result from inadequate hygienic practices. The tables were observed to be exposed directly to air/breeze coming from outside. Another possible explanation may be due to table contact with an unsterile dirty cloth, human hands, unsterile eating plates, and others. These high counts of bacteria observed correspond to the study reports by Al-Aejroosh *et al*. (2021) who determined microbial load in the kitchen work environments, utensils, eating tables, and other surfaces. Among the regular-standard practices in most eating shops the use of dried or moist cloth for cleaning tables, which can also serve as a medium of contamination from one table, hands, surfaces, or objects to another.

Identification of Bacterial Species

Each culture plate represented a single table shop. Also, only single identifiable bacteria from a particular growth plate were picked and considered in this study. A list of some identified bacteria was presented in table 1. The bacteria, *Listeria* was found in a 3/24 and 12.5% frequency. Their growth colonies are small-sized, and very light blue. They are gram-positive, short-chain coccobacilli. The biochemical characterization confirmed the isolates are catalase and MRVP positive, oxidase, indole, and urease negative. The *Pseudomonas* specie was found in a 2/24 and frequency of 8.33%. The growth colony of *Pseudomonas* specie on the Nutrient agar (NA) plate appeared large, smooth, and greenish accompanied by smell and pigments and gram-negative rods arranged in pairs. These isolate of *Pseudomonas* are catalase and oxidase positive, MRVP positive, lactose and maltose negative while citrate, glucose, ribose as well as cetrimide were positive. The *Enterobacter* specie was found in a 2/24 and 8.33% frequency. The *Enterobacter* specie on violet red bile (VRB) agar appeared circular, large, and red. They

are gram-negative, rod-shaped bacteria. They are oxidase and indole negative, citrate and urease positive, MR negative, and VP positive.

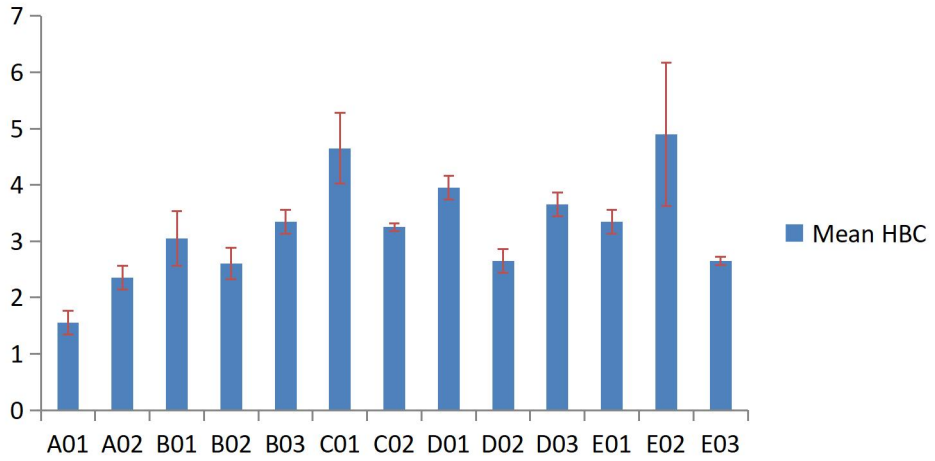

Figure 1: Mean heterotrophic bacteria counts of the eating tables from various shops

Table 1: List of isolated bacteria species

S/N	Specie Isolated	Positive number	% of Occurence
1	*Listeria* spp	3/24	12.5
2	*Pseudomonas* spp	2/24	8.33
3	*Enterobacter* spp	2/24	8.33
4	*Klebsiella* spp	1/24	4.16
5	*Staphylococcus* spp	3/24	12.5
6	*Serratia* spp	1/24	4.16
7	*Escherichia coli*	5/24	20.83
8	*Corynebacterium* spp	1/24	4.16
9	*Acinetobacter* spp	1/24	4.16
10	*Shigella* spp	1/24	4.16
11	*Helicobacter* spp	1/24	4.16
12	*Campylobacter* spp	1/24	4.16
13	*Citrobacter* spp	2/24	8.33

The *Klebsiella* specie was among the least number of bacteria 1/24 and 4.16% frequency found during the study. Other members include *Serratia* specie, *Corynebacterium* specie, *Acinetobacter* specie, *Shigella* specie, *Helicobacter* specie, and *Campylobacter* specie. The growth of *Klebsiella* specie on NA appeared large and white. They are gram-negative with pairs of rods. They are catalase and citrate positive, oxidase negative, MR and VP positive, and sucrose and lactose positive. The *Staphylococcus* specie was found on an eating table on 3/24 with a frequency of 12.5%. The *Staphylococcus* growth colonies observed were large, smooth, and yellow on NA. They are gram-positive cocci, arranged in clusters. They are catalase and citrate positive, oxidase and indole negative, MR and VP positive. The *Escherichia coli* had the highest number 5/24 with a frequency of 20.84% observed in the study. The *E. coli* had flat and greenish colonies on Eosine methylene blue. They are gram-negative straight rods, arranged in pairs. They are Indole and MR positive, VP, citrate, catalase, and urease negative. The *Citrobacter* was found with 2/24 and 8.33% frequency.

The isolated bacteria observed if ingested into the body would present a potential danger to the body system and this puts patrons, especially university students and staff at risk of infection. The bacteria *Staphylococcus* specie. are normal flora

colonizing external human body parts. Unless they gain access to the internal body parts and therefore, they stand as a threat to human health because it may lead to food poisoning or intoxication (Argudin *et al*., 2010). Among the external human body parts, the hand has been recognized as the basis of contamination since it serves as a houseful of microbes (Afunwa *et al*., 2019). Table contacts by hands or other external body parts may deposit *Staphylococcus* specie. The presence of bacteria *Listeria* species on the eating table may be from the sources; water used to moisten the cleaning cloth, served vegetables or meat, and others. Several species of *Listeria* can lead to dangerous infections. A portion of food contaminated with *Listeria* may pose a foodborne disease (Diriba *et al*., 2021). *Escherichia coli* had the highest occurrences on the eating tables in this study. Service food workers are in the habit of using the same water to clean the serving dish plates, cleaning towels/cloth, spoons, and eating tables. The source of the water used may be unhealthy right from the source and may carry contaminants up to the eating tables. Hence, the presence of *E. coli* may arise from the water source. Studies have shown multiple numbers of bacteria including *E. coli* that can survive and remain for hours or even days on clothes, hands, sponges, and many objects. Hence, they are a significant medium in cross-contamination (Kimutai, 2014, Mohammed *et al*., 2018, Igwe *et al*., 2019). The bacteria *E. coli* was found on eating tables by Yepiz-Gomez *et al*. (2006), Kimutai (2014), Mohammed *et al*. (2018), and Igwe *et al*. (2019). Unlike this study, the *E. coli* occurrences on eating tables reported by Yepiz-Gomez *et al*. (2006) and Mohammed *et al*. (2018) were very low while a greater number was reported by Kimutai, 2014 and Igwe *et al*. (2019) when compared to the study.

Among the isolated bacteria, only a few identical numbers were found present on each table shop and some different shops carried the same entity of multiple isolate (s). Percentage occurrences of some commonly isolated species of bacteria were presented in figure 2. The bacteria *Pseudomonas, Enterobacter,* and *Citrobacter* had the same 11.76% occurrences each in the study. The other bacteria *Listeria* and *Staphylococcus* species had similar 17.64% occurrences of bacteria in the study while *E. coli* 29.41% had greater occurrences in the study. Contamination of the eating table surfaces may result from poor cleaning and sanitization as well as poor personal hygiene of the food handlers. This may lead to the contamination of food and its surrounding/surfaces and may serve as a medium for foodborne infection.

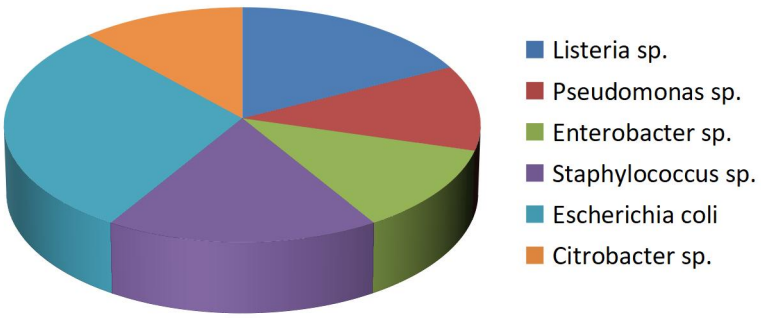

Figure 2: Percentage Frequancy of Most Commonly Isolated Bacteria

CONCLUSION

This study reveals eating tables are another source of food contamination that may posed danger after consumption. Many identified bacteria were public health-related. Therefore, eating tables can be a reservoir of infection and there is a need to constantly clean tables after eating.

REFERENCES

Adewunmi, A. R., Ajayi, J. O. and Omotoso, B. O. A. (2014). Assessment of the Hygienic Practices of Food Vendors and Government Intervention in Selected Secondary Schools from Abeokuta South Local Government Area of Ogun State, Nigeria. *Journal of Sciences and Multidisciplinary Research*, 6(1): 70-81.

Afunwa, R.A., Igwe, G.O., Afunwa, E.C., Ezebialu, C.U., Unachukwu, M.N., and Okoli, C.E. (2019). Bacteriological Examination of Utensils and Hands of Food Vendors in aUniversity Cafeteria in Enugu, Nigeria. *Journal of Biology and Life Sciences*, 10(1): 98-106.

AL-Aejroosh, H.A., Al-Sowayan, N.S. and Abd El-razik, M.M. (2021). Heavy Microbial Load in the Work Environment, Utensils and Surfaces of Domestic Kitchens. *Journal of Biological Sciences*, 21(1): 38-44.

Argudin, M.A., Mendoza, M.C. and Rodicio, M.R. (2010). Food Poisoning and Staphylococcus aureus Enterotoxins. *Toxins*, 2(7): 1751-1773.

Bauer, A.W., Kirby, W.M., Sherris, J.C. and Turck, M. (1966). Antibiotic Susceptibility testing by a standardized single disk method. *American Journal of Clinical Pathology*, 45: 493-496.

Bello, A.Y., Nafi'u, A., Haruna, Z.A., Ridwan, A.H., Mohammed, A. and Ibrahim, M.T. (2020). Bacteria Screening with Sufficient Nitrate Extraction from Wastewater. *Journal of Applied Life Sciences International,* 23(12): 52-58.

Diriba, K., Awulachew, E. and Diribsa, K. (2021). The Prevalence of Listeria species in different food items of animal and plant origin in Ethiopia: a systematic review and meta-analysis. *European Journal of Medical Research*, 26(1): 1-9.

Doron, S. and Gorbach, S.L. (2008). Bacterial Infections: Overview. *International Encylopedia of Public Health*, Accessed from https://www.ncbi.nlm.nih.gov on 28/08/2022. Pg. 273-282.

Gitahi, M. G., Wangoh, J. and Njage, P. M. K. (2012).Microbial Safety of Street Foods in Industrial Area, Nairobi. *Research Journal of Microbiology*, 7: 297-308.

Kawo, A.H. and Bello, A.M. (2016). Antimicrobial susceptibility profile of listeria species isolated From some ready-to-eat foods sold in kano, north-western Nigeria. *Bayero Journal of Pure and Applied Sciences*, 9(1): 217 – 222.

Kimutai, K.K. (2014). Determination Of Bacterial Contamination Of Tables In The Main Dining Hall Within Jkuat's Main Campus. B.Sc. Research Report, Jomo Kenyatta University of Agriculture and Technology. Juja, Kenya.

Martins, J. H., (2006). Socio - Economic and Hygiene Features of Street Food Vending in Gauteng. *South African Journal of Clinical Nutrition*, 19(1): 396-402.

Mayer, J. and Donnelly, T.M. (2013). ''Stomatitis, Bacterial'', clinical veterinary advisor: Birds and Exotic Pets, *Elsevier*, USA, Pg.145-147.

Michaels, B., Keller, C., Blevins, M., Paoli, G. and Ruthman, T. (2004). Prevention of Food Worker Transmission of Foodborne Pathogens: Risk Assessment and

Evaluation of Effective Hygiene Intervention Strategies. *Food Service Technology Journal*, 4: 31-49.

Mohammed, S.S.D., Ayansina, A.D.V., Mohammed, S.R., Oyewole, O.A. and Shaba, A.M. (2018). Evaluation Of Food Contact Surfaces In Selected Restaurants Of Kaduna State University For The Presence Of *Escherichia Coli* and *Staphylococcus aureus*. *Science World Journal*, 13(3)*:* 45-50.

Obayendo, T. (2022). Food Vendors are Potential Carriers of Infectious Diseases. Accessed from https://pharmanewsonline.com. On 20/08/2022.

Onyeneho, S. N. and Hedberg, C. W. (2013). An Assessment of Food Safety Needs of Restaurants in Owerri, Imo State, Nigeria. *International Journal of Environmental Resource and Public Health,* 10: 3296-3309.

Sharmila, R. (2011). Street Vended Food in Developing World: Hazard Analyses. *Indian Journal of Microbiology,* 51(1): 100–106.

Yepiz-Gomez, M.S., Bright, K.R. and Gerba, C.P. (2006). Identity and Numbers of Bacteria Present on Tabletops and in Dishcloths used to Wipe down Tabletops in Public Restaurants and Bars. *Food Protection Trends*, 26(11): 786-792.