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ASSESSMENT OF BACTERIA IN SLICED WATERMELON *(Citrullus lanatus)* Thunb. Matsum & Nakai) IN SOME SELECTED MARKET IN JOS SOUTH LOCAL GOVERNMENT AREA OF PLATEAU STATE

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ABSTRACT

In Nigeria, water melon is one of the most popular sliced fruits that is sold everywhere, especially in marketplaces. Therefore, the purpose of this study was to evaluate the different bacteria and risk factors associated to the sliced water melon fruits in some selected markets (Vom, Bukuru, Abattoir, and Building Material markets respectively) in Jos South Local Government Area, Plateau State. Three different fruit vendors were used across the four markets and a total of 24 fruits were sampled at random. Using standard microbiological techniques, the potential bacteria on the fruit samples were evaluated. Pour plate technique was used for bacterial counts and isolation after the samples had been serially diluted. Based on the findings of this study, total coliform counts ranged from 3 x 104 to 6.9 x 105 CFU/g, whereas bacterial counts ranged from 4.2 x 105 to 9.9 x 105 CFU/g. The findings showed that the freshly cut water melon contains a variety of bacteria, including Pseudomonas aeruginosa, Staphylococcus epidermidis, Klebsiella aerogenes, Enterobacter spp., E. coli, Aspergillus spp., Aeromonas spp., and Bacillus spp. The most common strain was S. epidermidis, with a prevalence of 37.5%, followed by Aeromonas spp. (42.85), K. aerogens (33.33%), E. coli, Bacillus spp. (each with a 60% prevalence), and Streptococcus spp. (40%). When comparing the number of bacteria from the different markets, the building material

market has the most, with 12 different bacteria isolated, followed by the Vom market with 11 isolates, and the abattoir market with 10 isolates. Bukuru market has the lowest number of isolated bacteria, 9 in total. Given the results, it was concluded that the water melon slices were contaminated with several kinds of bacteria that might result in bacterial infections in consumers and foodborne illnesses. Therefore, it is important to slice fruits properly and maintain a clean environment to prevent microbial infection.
Key words: Water melon, sliced fruits, bacteria, contamination,

INTRODUCTION

Citrullus lanatus, also known as watermelon belonging to the family Cucurbitaceae, is a well-liked summer fruit that is typically eaten as a dessert, fruit salad, or beverage (Alim-un-Nisa *et al.,* 2012, Perkins-Veazie *et al.,* 2013). According to Naz *et al.* (2014), watermelon is a natural source of iycopene, vitamin C, and antioxidants. Due to the presence of iycopene, which is known to regulate chronic diseases like diabetes, cardiovascular events, and some factors of cancer, watermelon aids in enhancing human health (Figueroa *et al.,* 2011).

According to Nwachukwu *et al.* (2008), "sliced fruits" are fruits that have been cut open, sliced into pieces, but are still in their fresh state and offered for sale in retail establishments. Paw-paw, pineapple, and watermelon are some of the slices of fruit that are frequently eaten in Nigeria. Typically, street vendors sell watermelons that have been sliced, packaged in polyethylene bags so that it can be consumed right away without having to be washed or rinsed. Unlicensed sellers with low educational levels and no training in food hygiene are frequently found processing and selling sliced fruits (Muinde and Kuria 2005; Barro *et al.,* 2006, 2007). Fresh cut watermelon becomes contaminated and degrades as a result of its low acidity and growing environment (Wang *et al.,* 2018; Wanwimolruk *et al.,* 2015). Due to the use of several preparation techniques such peeling, washing, cutting, and slicing, fresh cut fruits can readily become contaminated and deteriorated. (Yousuf *et al*. 2019). It is challenging to vouch for the processors' cleanliness or the hygienic conditions at the locations of preparation. Street food vendors frequently employ basic equipment like wheelbarrows, trays, mats, tables, and improvised stalls, which further increases the danger of food contamination. Furthermore, the situation is made worse by the lack of proper storage conditions used while selling sliced watermelons on the street, exposing the fruit to flies, dusts and other pathogens. The washing water is yet another significant source of contamination for the fresh produce offered by street vendors (Khali and Mazhar, 1994). According to Mensah *et al.* (1999), street produce that has not been properly prepared is a significant source of fatalities in underdeveloped nations. Sliced fruits and vegetables can become contaminated by bacteria like Salmonella spp., Shigella spp., Campylobacter spp., and Escherichia coli when they come into contact with sewage and tainted water (Beuchat, 1995).

Due to their availability, ease, nutritional value, and comparably lower cost than the full fruit, watermelon slices are widely consumed on a global scale. Fruits have numerous health benefits, but they are also vulnerable to microbial contamination. It is extremely concerning that their usage has increased as well as the risk of disease to which consumers may be exposed. Therefore, the purpose of this study is to evaluate the bacterial quality of the sliced water melon sold in a few selected markets in Jos south LGA area of Plateau state.

MATERIALS AND METHODS

Experimental Site

This research was carried out in the Central Diagnostic Laboratory of National Veterinary Research Institute, Vom

Experimental Materials

Sliced watermelon, sterile blade, buffed peptone water, polythene bags, blood agar, incubator, petri-dishes, disinfectant, hand gloves, tissue, marker and masking tape.

Sample Collection

In four (4) distinct marketplaces (Vom, Bukuru, Building materials, and Abattoir, respectively) in the Jos south LGA, two (2) different samples of packed, sliced watermelon were were randomly purchased from three (3) different street sellers, and they were then put in plastic sterile bags and labeled suitably. For this investigation, twenty-four (24) watermelons in total were used.

Experimental Procedure

Culture media

For the isolation and counting of bacteria, nutrient agar and MacConkey agar were prepared and applied. The media were set up in accordance with the manufacturer's guidelines.

Bacteriological Analysis of samples

A sterilized knife was used to slice about 1g of fresh cut fruit (sliced water melon), which was then combined with 9ml of distilled water. Spread plate method was used to inoculate an aliquot of 0.1 ml from each serial dilution onto a plate, count agar nutritional agar, and macConkey agar (oxoid, Cambridge, U.K.), and the plates were incubated at 370 c for 24 hours to determine the total number of bacteria present.

Bacteria identification

In order to identify the bacteria in bacterial isolates, pure culture colonies were first obtained by sub-culturing from primary culture paste. A representative colony from each plate was selected, stained with gram stain, and then subjected to additional tests utilizing indole, methyl red, citrate oxidase, voges-prokaver tasks, urease, and coagulase tests. The method for identifying bacteria on pure culture plates was based on colonial morphology. All of the gram-negative isolates were confirmed using an APIZOE identification system (bio merieux SA, Marcy I Etoile France).

Bacteria colony Enumeration

After incausation, colonies between 30 and 300 in number from macConkey agar were taken into consideration for the total number of bacteria and total number of coliforms counted from plate count agar.

Parameters collected

The following parameters were collected: total bacteria count, total coliform count, bacteria isolation and identification.

Statistical Analysis

The data were subjected to the Analysis of Variance (ANOVA) procedure using the Statistical Tool Package (Chi Square).

RESULTS

Table 1: Mean values of microbial result for water melon in Abattoir, Bukuru, Building materials and Vom markets.

Parameters	Market				STD	SEM	P-Value
	A. B	BK	BU	VM			
TBC(CFU/g)	399090.90	678888.88	1711666.66	1574545.45	±1565275.49	238702.27^{NS}	0.125
TCC(CFU/g)	70909.9091	356666.6667	229166.6667	210909.0909	±228497.95	34845.61*	0.042
Bacterial isolate	3.9091	6.1111	6.3333	7.5455	±2.67696	0.40823*	0.010

KEYS

SEM = Standard error of mean

***** = There is significant difference

STD = Standard Deviation

A.B = Abattoir market

NS = Not significant,

BK= Bukuru Market

VM = Vom Market

BU = Building material market

The average values of the water melon's microbiological results are shown in Table 1. This showed that means within the same row for TBC were not significant, however means within the same row for TCC and Bacterial Isolates with standard errors of mean such as 34845.61* and 0.40823* respectively with distinct superscripts are substantially different at P-value 0.05.

Table 2: A Cross-tabulation of bacterial isolates in each study market

	Market				
Bacterial isolates	**A. B(%)**	**B. K(%)**	**BUL(%)**	**V. M(%)**	**Total**
Klebsiella aerogenes	1(100)	0(0%)	0(0%)	0(0%)	1
Bacillus sublilis	1(100)	0(0%)	0(0%)	0(0%)	1
Bacillus spp	3(60%)	0(0%)	2(40%)	0(0%)	5
Staphylococcus epidermidis	3(37.5%)	2(25%)	3(37.5%)	0(0%)	8
K. aerogens	1(16.67%)	2(33.33%)	2(33.33%)	1(16.67%)	6
E. coli	0(0%)	1(20%)	1(20%)	3(60%)	5
Aeromonas spp	2(28.57%)	2(28.57%)	0(0%)	3(42.85%)	7

Microccus spp	0(0%)	1(50%)	1(50%)	0(0%)	2
Streptococcus spp	0	1(25%)	1(25%)	2(50%)	4
Proteus mirahilis	0(0%)	0(0%)	0(0%)	1(100%)	1
Enterobacter spp	0(0%)	0(0%)	1(100%)	0(0%)	1
Psendomonas aeruginosa	0(0%)	0(0%)	1(100%)	0(0%)	1
Total	**10**	**9**	**12**	**11**	**43**

A cross-tabulation of the bacterial isolation in the study is shown in Table 2. Micro-organisms were discovered in watermelon slices from different markets. Bacillus sublilies has (100%) from abattoir and (0%), Bukuru, building, and Vom market, while Klessicula aerogenes has (100%) from abattoir and (10%) from Vom. Staphylococcus is present in the abattoir at 37.5%, in Bukuru at 20%, in buildings at 35.7%, and in the Vom market at 0%. There are 60% of Bacillus spp. in the abattoir market, 40% in buildings, and 0% in the Bukuru and Vom markets. E. coli is present in 0 percent of abattoir sales, 20 percent of Bukuru and building material sales, and 60 percent of Vom sales. There are (28.57%) of Aeromonas spp. in the abattoir and bukuru markets, 0% in the construction material industry, and 42.83% in the vom market.

In building materials and Bukuru markets, Micrococcus spp. had a (50%) prevalence compared to 0% in abattoir and Vom markets. Streptococcus spp. has a market share of 0% in the abattoir market, 25% in the Bukuru and building materials markets, and 50% in the Vom market. In abattoir, Bukuru, and building material markets, Poteau's mirabilis has a 0% prevalence rate, whereas Enterobacter spp. has a 10% prevalence rate in the abattoir, Bukuru, and Vom markets, While Aerugino has (100%) in the market for building materials and 0% in the market for Vom. Psendomonas has 0% in both the abattoir and the Bukuru markets.

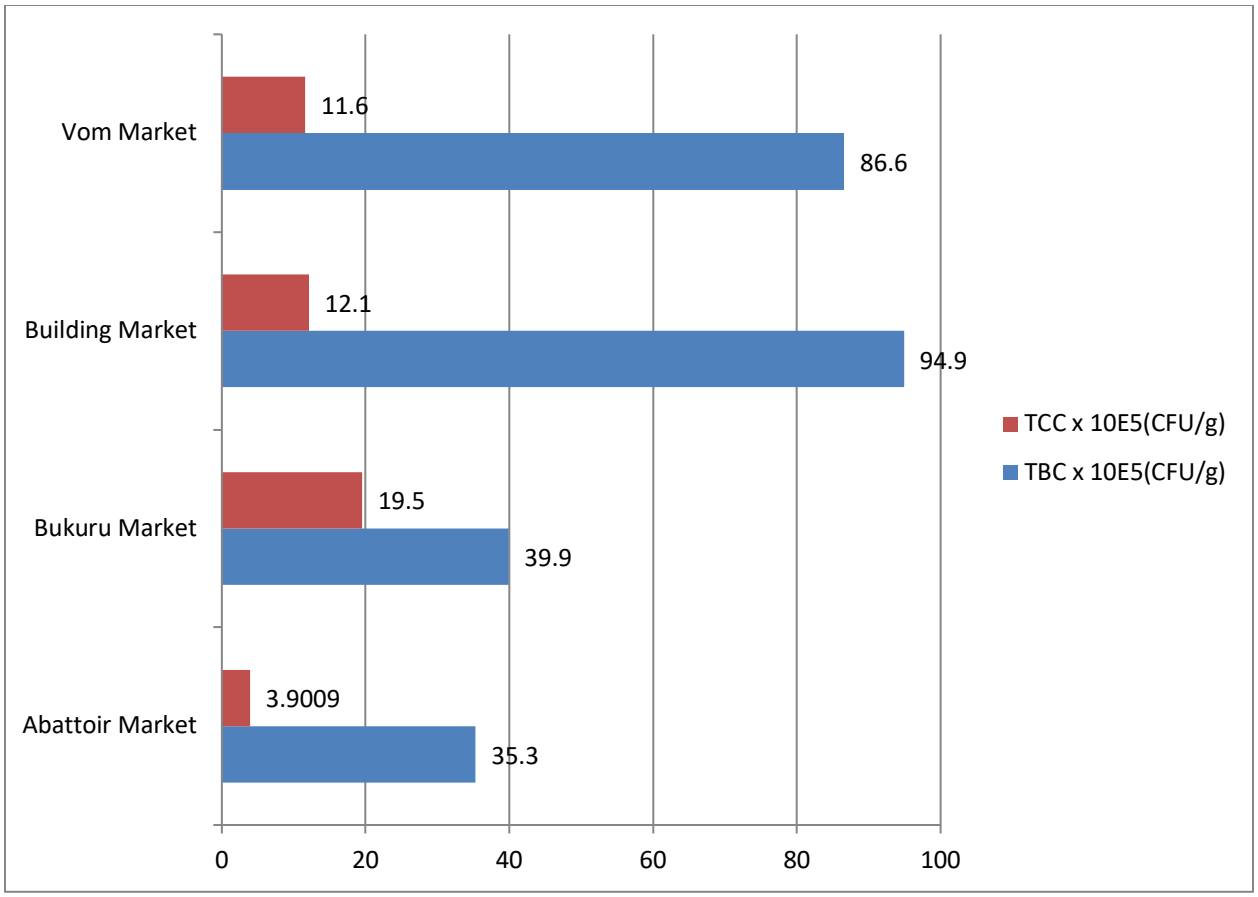

Figure 1: A chart showing Total Coliform and Bacteria count.

As shown in Fig. 1, the building material market has the highest bacteria count (94.9), followed by Vom market (86.6), Bukuru market (39.9), and abattoir market (35.5). The market in Bukuru has the highest coliform count (19.5), followed by the markets in building materials and Vom, which has coliform counts of 12.1 and 11.6, respectively. Abattoir market had the lowest coliform count, 3.90.

DISCUSSION

The outcome of the study reveals that watermelon contamination with total coliform, plate count bacteria, and other microorganisms were found in the sample of sold, sliced watermelon. The presence of these microorganisms in the sold sliced watermelon sample was primarily attributed to a number of issues, including poor handling, poor cleanliness, and incorrect processing. Use of filthy processing tools, such as knives, wrappers, and trays, contaminated water when washing, as well as cross-contamination from rotting fruits are all examples of practices that contribute to food contamination (Khali and Mazhar, 1994).

Klebsiella aerogenes and *Escherchia coli* could have been present because the water used to wash the watermelon was contaminated with fecal coliforms, which is not recommended in any edible or drinkable substance and is similar to a study conducted by Abubakari *et al., (*2015). The fact that staphylococcus makes up the typical micro-floral found in/on a number of areas of the human body may help to explain its existence (Nester et al., 2001). The presence of this bacteria can be linked to the exposure of the sliced watermelon to the environment. The staphylococcus can be introduced into the

sliced sold watermelon during handling, packaging, and vending.

Indicating the pervasiveness of bacterial spores, particularly in dusty roadside locations, the presence of Bacillus spp. in the watermelon was significant. Food poisoning is linked to Bacillus spp. being present in foods. The existence of epidermises in sliced fruit was previously observed by Chukwu et al. (2019), who also suggested that this could be due to contamination from hands used in the slicing and packaging of the fruit. Streptococcus may be contracted through skin contact with infected wounds or sores, direct contact with discharges from the sick person's nose and throat, or both. Streptococcus was also found in pawpaw in a prior study done in Accra, Ghana (Michael-Olu Taiwo *et al.,* 2021). The presence of Bacillus spp. in the watermelon demonstrated the pervasiveness of bacterial spores, particularly in dusty roadside environments. Food poisoning is linked to the presence of Bacillus species in certain meals. According to a prior study (Chukwu *et al.,* 2010), epidermises in sliced fruit may have been contaminated by hands employed in the handling and packaging of the fruit. Streptococcus may be contracted through direct contact with bodily fluids such as discharges from the nose and throat of an infected individual or through skin contact with infected wounds or sores. Michael-Olu Taiwo *et al.* (2021) claimed that a prior investigation carried out in Accra, Ghana, similarly discovered streptococcus in pawpaw.

In Oman, Al-Kharousi *et al.* (2019) study on fruit and vegetables found that 60% of fruits and 1% of vegetables were enterobacteria-contaminated. Pseudomonades, Uginosa, protein, and enterobacteria are bacteria frequently connected to plants, dairy products, human skin, animals, and plants. These bacteria may have been introduced to the sliced watermelon during the washing and processing of the precut fruits by the tainted water. Additionally, the results indicate that bukuru market has a high total coliform count (19.5) and that building materials market has a higher number of isolated bacteria (12,94.9). The presence of various bacteria, including Klebsiella spp., does not prove that there is fecal contamination..

The knife used to cut the watermelon before packaging was seen being kept in a polythene bag rather than being washed as it was used repeatedly throughout the day. This observation was made while purchasing fruits from the vendors. When the tools used to process the fruits are not cleaned properly and adequate hygiene is not observed, the sliced watermelon can become infected with the bacteria from these practices.

CONCLUSION AND RECOMMENDATION

Conclusion

According to this study, bacteria such as *Staphylococcus epidermidis, Klebsiella aerogenes, Enterobacter spp., E. coli,* and *Aspergillus* were discovered to be present in ready-to-eat sliced watermelon sold in some selected markets in Jos South Local Government Area. Fruit contamination could be the result of numerous sources and careless handling during preparation. Therefore, good hygiene must be practiced to enhance the microbiological quality of fruits sold on the street in order to reduce contamination of the watermelon slices being sold.. Fruit vendors must, however, also follow excellent sanitation, which include using clean water, utensils, and other things.

Recommendation

It will be fantastic if the government creates a department in charge of assisting fruit street sellers in gaining vending authorization, which should also include a development and building permit. In order to ensure that

diseases associated with fruits sold on the street are kept to a minimum, a business operating permit health inspection should also be conducted by the Environmental Health Department and valid health personnel issued by a recognized health institution. To lessen microbial contamination, fruit vendors should also receive sufficient training in personal hygiene and hygienic fruit preparation.

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