

## Microbiological assessment of sliced watermelon (*Citrullus lanatus*) in Oyo, Nigeria

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**Abstract:** Twelve different samples of packaged watermelon were purchased from twelve vendors in Oyo and they were assessed to determine their microbiological quality. A total of 50 isolates comprising of both bacterial and fungi were obtained from water melon samples. The isolates were *Bacillus* spp, *Escherichia coli*, *Pseudomonas* spp., *Staphylococcus aureus*, *Klebsiella aerogenes*, *Proteus mirabilis*, *Lactobacillus* spp, *Mucor* spp, *Rhizopus stolonifer* and *Saccharomyces* spp. The total bacterial count ranged from 0.3-2.9 X 10<sup>4</sup> cfu/g while the fungal count ranged from 0.5-3.1 X 10<sup>4</sup> cfu/g. The pH of the water melon samples ranged between 6.40-6.72. It is safe that good hygienic practices must be ensured especially in the selling of sliced fruits to minimize the diseases that are associated with fruits.

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### 1. Introduction

Fruits refer to the fleshy seed-associated structures of certain plants that are sweet and edible in the raw state such as watermelon. Watermelon (*Citrullus lanatus*), family (*Cucurbitaceae*) can be both the fruit of a vine- like (*scrambler and trailer*) plant originally from Southern Africa, and it's one of the most common types of melon. The water melon fruit, loosely considered a type of melon has a smooth exterior rind (green, yellow and sometimes white) and a juicy, sweet interior flesh. It is also commonly used to make a variety of salads, most notably fruit salad, fruit giving, fruit basket and fruit banquet (Motes et al., 2005).

No other fruit stays summer like the subtly crunchy, thirst quenching watermelon. Although water melons can now be found in the markets throughout the year, the season for water melon is in the summer when they are sweet and of the best quality. While many people are just accustomed to eating the juicy flesh of the water melon, both the seeds and the rind are also edible if the rind is chosen to be eaten, it is highly suggesting purchasing organic water melon (Wolford et al., 2005).

There has been a significant increase in the consumption of sliced water melon because they are nutritious, convenient, easy to obtain and they are cheaper than the whole fruits. Watermelon is usually produced in Northern states of Nigeria and brought to the markets from where they are being obtained by the street vendors. Street foods have been reported to be contaminated with pathogens and have also been implicated in food borne epidemics. It was found in most localities, the street foods remain hygienically poor since bacterial loads are moderately high. (Bhat

and Waghay, 2000). Watermelons are usually sliced, packaged in polythene bags and sold by street vendors. It is difficult for attest to the hygiene of the processors or the sanitary conditions at point of preparation. This has therefore increased the risk of disease to which consumers are exposed to and the microbiological quality of the watermelon.

The sliced watermelons are processed and sold by unlicensed vendors with poor education levels and untrained in food hygiene (Muinde and Kuria, 2005; Barro et al., 2006) pathogens may invade the interior surfaces of the produce during peeling, slicing, trimming and other processes like packaging, handling and marketing (Barro et al., 2007). Vendors usually make use of simple facilities like wheel barrows, trays, mats, tables and make -shift stalls, thus further increasing the risk of food contamination. Contamination from raw materials and equipments end equipments, additional processing conditions attributes substantially to the entry of bacterial pathogens (Mahale et al., 2008). The use of dirty utensils, as well as the open display of street food produce encourages sporadic visits by flies, cockroaches, rodents and dusts (Bryan et al., 1992). Washing water used by the vendors can also be another source of contamination. The aim of this study was to assess the microbiological quality of sold sliced watermelon and the safety of the sold watermelon.

### 2. Materials and Methods

#### *Sample collection*

Twelve different samples of packaged, sliced water-melon were purchased from 12 different street vendors in Oyo state and were placed in sterile plastic

bags. The samples were transported immediately in a cool container to the laboratory for analyses.

#### Culture media

MacConkey agar, Nutrient agar, Mann Rogosa and Shape (MRS) agar and Potatoe dextrose agar were prepared and used for the isolation and enumeration of bacteria and fungi. The media were prepared according to manufacturer's specification.

#### Isolation and enumeration of microorganisms

A sterile knife was used to cut 1.0g from each sample of the watermelon and it was homogenized by using a sterile pestle and mortar. 1ml of the resultant solution was then added to 9ml of sterile distilled water in a test tube and was diluted serially to obtain dilutions up to  $10^{-6}$ . From the dilution, 1ml was plated onto the different media. The MacConkey agar, MRS agar and Nutrient agar plates were incubated at 37°C for 48hrs while the Potato dextrose agar were incubated at 28°C for 72hrs to obtain bacterial and fungal counts. Repeated streaking was done for the isolate until pure culture was obtained. Biochemical tests were carried out on the isolates. Macroscopic and

microscopic examinations were carried out on the isolates using the method of Fawole and Oso (1986).

#### Determination of $P^H$

The  $p^H$  of each of the sliced watermelon samples was determined using a calibrated  $P^H$  meter ( PHS25).

### 3. Results

#### Microbiological evaluation of sold water melon sample

A total of 50 isolates comprising of both bacterial and fungal isolates were obtained from the 12 sold sliced water melon samples. The bacteria isolates were identified as *Bacillus* (7), *Escherichia coli* (7), *Pseudomonas* (8), *Staphylococcus aureus* (3), *Klebsiella aerogenes* (2), *Proteus mirabilis* (2) and *Lactobacillus* spp. (1). The fungal isolates were *Mucor* spp. (3), *Rhizopus stolonifer* (9), and *Saccharomyces* spp. (8). The frequency of occurrence of the isolates is shown in Table 1. *Rhizopus Stolonifer* was the most frequently occurred (18%) followed by *Saccharomyces* spp. (16%) while *Mucor* spp. was the least occurred (6%) for the fungal isolates.

**Table 1: Frequency of Occurrence of Bacterial and Fungal Isolates Obtained from Watermelon samples**

ISOLATES	NUMBES OF ISOLATES	FREQUENCY OF OCCURRENCE (%)
<i>Bacillus</i>	07	14
<i>Escherichia coli</i>	07	14
<i>Pseudomonas</i>	08	16
<i>Staphylococcus aureus</i>	03	06
<i>Klebsiella aerogenes</i>	02	04
<i>Proteus mirabilis</i>	02	04
<i>Lactobacillus</i> spp.	01	02
<i>Mucor</i> spp.	03	06
<i>Rhizopus stolonifer</i>	09	18
<i>Saccharomyces</i> spp.	08	16
TOTAL	50	100

**Table 2a: Occurrence of Bacterial Isolates obtained from watermelon Samples**

Samples	<i>Bacillus</i> spp.	<i>Escherichia coli</i>	<i>Pseudomonas</i>	<i>Staph.aureus</i>	<i>Klebsiella Aerogenes</i>	<i>Proteus mirabilis</i>	<i>Lactobacillus</i> spp.
WM1	+	-	+	-	-	-	-
WM2	+	+	-	-	-	-	+
WM3	-	+	+	+	-	-	-
WM4	-	+	+	-	+	-	-
WM5	-	+	-	-	-	+	-
WM6	+	-	+	-	-	-	-
WM7	+	+	+	-	-	-	-
WM8	-	+	-	-	+	-	-
WM9	+	-	+	-	-	-	-
WM 10	+	-	-	+	-	+	-
WM 11	+	-	+	+	-	-	-
WM 12	-	+	+	-	-	-	-

WM = WATER MELON

**Table2b: Occurrence of Fungal Isolates Obtained from Watermelon Samples**

SAMPLE	<i>Mucor</i> spp.	<i>Rhizopus stolonifer</i>	<i>Saccharomyces cerevisiae</i>
WM1	-	+	+
WM2	-	+	+
WM3	-	+	-
WM4	-	+	-
WM5	+	+	-
WM6	-	+	+
WM7	+	-	+
WM8	-	-	+
WM9	-	+	-
WM10	-	+	+
WM11	+	-	+
WM12	-	+	+
WM: WATERMELON SAMPLES			

**Table 3: Total Viable Counts (Cfu/g) X 10<sup>4</sup> of Watermelon Samples**

SAMPLE	Fungal count (10 <sup>4</sup> )	Bacteria count (10 <sup>4</sup> )
WM1	2.0	2.4
WM2	2.1	1.6
WM3	0.5	0.8
WM4	0.8	0.9
WM5	2.6	2.4
WM6	2.6	2.9
WM 7	1.5	1.3
WM8	0.8	0.6
WM9	0.5	0.6
WM10	3.1	2.9
WM11	0.5	0.3
WM12	2.9	2.7
WM = WATERMELON SAMPLES		

**Table 4: P<sup>H</sup> of Watermelon Samples Obtained From Street Vendors**

SAMPLES	P <sup>H</sup>
WM1	6.40
WM2	6.50
WM3	6.42
WM4	6.44
WM5	6.60
WM6	6.58
WM7	6.72
WM8	6.70
WM9	6.45
WM10	6.70
WM11	6.48
WM12	6.56
WM = WATERMELON SAMPLES	

All values are means of three replicates

For the bacterial isolates, *Pseudomonas* was the most frequently occurred (16%) while *Lactobacillus* spp. had the lowest occurrence (2%).

Tables 2a and 2b also show the occurrence of the isolates obtained from the 12 watermelon samples. The total bacterial and fungal count were determined for each of the 12 watermelon sample, the result is shown in Table 3. The total viable bacterial count ranged from 0.3 – 2.9 x 10<sup>4</sup>cfu/g while the total fungal count ranged from 0.5 -3.1 x 10<sup>4</sup>cfu/g. The pH of the water melon samples ranged between 6.40-6.72 as shown in Table 4

#### 4. Discussions

In this study, different microorganisms were obtained from the sold watermelon sample. The presence of these microorganisms in the sold sliced watermelon sample can be linked to a number of factors such as improper handling and processing, use of contaminated water during washing and dilution, cross contamination, the use of dirty knives, cross contamination from rotten fruits and vegetables or the use of dirty processing utensils like knife, wrappers and trays (Khali et al., 1994)

The presence of *Klebsiella aerogenes* and *Escherichia coli* might be due to water used for washing the watermelon which was contaminated with faecal coliforms. The presence of *Staphylococcus aureus* may be explained by the fact that it forms the normal microflora present on/in several parts of the human body (Nester et al., 2001). The *Staphylococcus aureus* can be introduced into the sliced sold watermelon during handling, packaging or vending.

The presence of *Bacillus* spp. in the watermelon implicated the ubiquitous nature of bacterial spores especially in dusty road side locations. The presence of *Bacillus* spp in foods is associated with food poisoning. The number of *Lactobacillus* spp. is low in water melon because it is known that *Lactobacillus* grow well in an acidic medium and the pH is close to 7.0 which is

neutral. The presence of *Mucor* spp, *Rhizopus stolonifer* and *Saccharomyces cerevisiae* might be due to the use of unhygienic dusty environment, often swarming with flies and fruit flies, other insects, airborne dust, mixing of rotten water melon with fresh one can also act as potential sources of contamination. Their presence is also in agreement with the report of Splittstoesser (1987) who implicated fungi as contaminants of fresh fruits, especially in the presence of injuries like slicing. The presence of respiratory pathogen such as *Klebsiella* spp. in sliced watermelon samples might be attributed to the bacterial aerosols generated due to sneezing and coughing in public places. Handling of soiled notes and currencies by the street food vendors might also act as vector for transmission of *Pseudomonas* into the sliced watermelon samples (Barro et al., 2003)

In conclusion, this study has shown that sold sliced watermelon could be contaminated from different sources. To reduce the microbial contamination of sold sliced water melon, proper hygiene must be maintained. However, good sanitation must be practiced by food vendors, and these include the use of clean water, utensil, maintenance of good personal hygiene etc. The food vendors must also be trained properly. In conclusion, the governments must send out sanitary inspectors to educate and monitor the activities of food vendors so that diseases that are associated with foods that are being sold on the streets will be minimized.

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