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Bacteriological Assessment of Pre-Cut Fruits Sold At Igbona Market, Osogbo, Osun State

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Abstract: *Carbohydrates, proteins, vitamins and minerals are certain essential components found in fruits which are beneficial to human health. Presently, most fruits sold to consumers in Nigeria are pre-cut and packaged by vendors and market women. However, the process involves during cutting and packaging of such fruits may introduce some microorganisms that are detrimental to human health. The present study is aimed at assessing the bacteriological quality of pre-cut fruits. Three samples (Pawpaw, Pineapple and Water Melon) were purchased from vendors at Igbona Market, Osogbo, Osun State. Isolation was carried out through serial dilution. Total plate count, Salmonella counts, Coliform count and Escherichia coli were enumerated on nutrient agar, Salmonella Shigella agar, Plate Count Agar (PCA) and Eosin methylene blue agar. Staphlococcus aureus and non E.coli coliforms were detected through Mannitol salt agar and MacConkey agar. Bacterial isolates were identified through Morphological, Biochemical and sugar fermentation tests. The total plate count ranged from 3.6×10^4 to 6.4×10^5 while total Coliform count is between 1.8×10^3 and 6.4×10^5. Watermelon had highest total plate count of 6.4×10^5, followed by pineapple, 5.2×10^4, while Pawpaw had the least, 3.6×10^4. Pineapple had the highest coliform count of 3.8×10^4, followed by watermelon, 2.7×10^4 while Pawpaw has the least coliform count of 1.8×10^3. The predominant genera of bacteria observed were Staphylococcus sp, Klebsiella sp, Pseudomonas sp, Enterobacter sp, Micrococcus sp, Escherichia coli, Salmonella sp and Proteus sp. Staphylococcus sp has the highest occurrence 5(25%), followed by Klebsiella sp 4(20%), Pseudomonas sp and Enterobacter sp had 3(15%) while Micrococcus sp. had 2(10%). The least occurrence 1(5%) were recorded by Escherichia coli, Salmonella sp. and Proteus sp respectively. The results recorded in this study revealed that fresh cut fruits are of poor bacteriological quality.*

Keywords: Bacteriological Quality, Precut fruits, Pawpaw, Pineapple, Watermelon

1.1 INTRODUCTION

Cut fruit products are becoming more popular both locally and globally as they are more popular both locally and globally as they are handier, accessible, and economical (Nwachukwu and Osuocha, 2014). Fruits that have been cut open or sliced open, packaged in small white polyethylene bags, and carried around by streets sellers or hawkers at local markets or streets are known as retailed cut fruits. Such fruits can be eaten right away without needing to be sliced, peeled or rinsed.

Cut fruits are commonly exhibited entirely exposed for sale at Nigerian shopping malls, markets, and congested roads/ major streets, security checkpoints, and poor sections on highways where cars are forced to slow down (Allamin *et al*., 2015). Pineapple, watermelon, and pawpaw are among the most regularly sold cut fruits. The increased consumption of cutfruits, as well as the illness risk that customers are exposed to when doing so, should be a major source of concern for society (Obeta *et al*., 2021). In most circumstances, confirming the hygienic state and sanitary condition of processing by an uninformed vendor who knows little or nothing about good manufacturing standards and food hygiene might be challenging (Obeta *et al*., 2021).

When cut fruits are produced without proper storage conditions, they are exposed to flies, ants, dust, and other microbiological diseases, making the situation much worse (Barro *et al*., 2006). Pathogens such as bacteria (*Salmonella spp*., *Staphylococcus aureus*, *Enterobacteriaceae*), fungi, viruses, and parasites cause some of these disorders, which increase the risk of food-borne diseases (Orji *et al*., 2016). As a result, microbial contamination of such fruits is widespread due to contact with soil, dust, air, and water, as well as poor harvest and postharvest management techniques. Punctures, wounds, and cuts may potentially allow pathogenic germs to enter the fruits through damaged surfaces (Edeghor *et al*., 2019).

Cucumbitaceae includes watermelon (Citrullus lanatus). It is found in Nigeria's northern area (Chukwu *et al*., 2010). The mesocap of a watermelon is reddish or yellowish and contains seeds. The fruits have a smooth, firm rind with dark green stripes or yellow

specks on the outside. Lycoprene, phytofluene, phytoene, beta carotene, Lutein, and nuerosprene are some of the carotenoids found in it. Cucurbitacin E contains triterpene, an anti-inflammatory phytonutrient, and citruline, whereas carotene from water melon has antioxidant activity and free scavenging properties that aid to reduce cancer risk and cardiovascular disorders such as artericlerosis. Vitamins A and C, potassium, magnesium, sodium, fatty acids, and amino acids are all abundant in watermelon (Nwachukwu *et al*., 2008). Watermelon has roughly 6% sugar content and 91% water content (Adedeji and Oluwalana, 2013).

Pawpaw (carica papaya), on the other hand, is a Caricaceae family member with various variations. Aside from the shape, the color of the endocarp can be utilized to differentiate some kinds. The endocarp comes in a variety of colors, including red, orange, and yellow. Pawpaw, like watermelon, is high in vitamin A and C, as well as other minerals like potassium, calcium, and iron. Pawpaw contains sugar (10-13%), protein (0.6%), and moisture (85%) and has been used in the manufacturing of canned foods such as jam (Nwachukwu *et al*., 2008).

Melon and pawpaw have been shown to have significant health benefits (Oranusi and Oluwafemi, 2011). As a result, many people, both elderly and young, consume these fruits in both rural and urban settings. The price of this fruit in refined form (that is, fruit juice) or as a whole fruit is exorbitant in several Nigerian cities, thus fruit dealers often wash, peel, and slice it for a lower price. As a result, fruit slicing prior to sale has become more popular. This could be owing to their convenience, nutrition, and affordability (Chukwu et al., 2010). The consumption of sliced fruits, according to Oranusi and Olorunfemi (2011), is due to economic factor, like majority living on less than one dollar a day.

Pineapple fruit is noted for its high vitamin, sugar, and fiber content (Nwachukwu and Ezejiaku, 2014; Lima et al., 2019). It is one of the fruits that is commonly peeled, cut, sliced, wrapped in transparent polythene bags, and sold at lower prices in markets because consumers may not have enough time or money to prepare the fruit themselves or may not have enough money to buy the whole fruit, which is always more expensive than the sliced ones (Lima *et al*., 2019).

Fruits are sometimes sliced to maximize surface area, exposing them to contamination. Microorganisms are known to be ubiquitous, and some microbes promote fermentation processes on sugary substrates. Fruits are known to contain non-pathogenic microorganisms in their natural state, although contamination from the environment happens throughout the preparation and handling stages. These ready-to-eat fruits sold in Nigeria have not been identified as possible sources of foodborne disease by food monitoring and regulatory organizations.

Fruits that have been trimmed, peeled, and/or cut into 100 percent usable product that is bagged or pre-packaged to provide consumers with excellent nutrition, convenience, and flavor while retaining freshness are known as pre-cult fruit (Piano and Castillo-Israel, 2019; Wiafe-Kwagyan *et al*., 2019). Freshly chopped fruits and vegetables have a lower shelf life than entire fruits and vegetables. This is due to increased respiration rate and ethylene generation, as well as increased sensitivity to microbial spoilage, which is induced by cutting, which leads in tissue injury (Piano and Castillo-Israel, 2019). Salmonella is the most connected to foodborne disease outbreaks among numerous foodborne infections that have been traced back to fresh vegetables and fruits.

Despite the health benefits of eating fruits on a regular basis, they are susceptible to microbial contamination, as well as the danger of disease transmission to which customers are exposed. Furthermore, as indicated by their isolation from different fruits and vegetables, various pathogenic bacteria species have been linked to contamination of fruits and vegetables (Michael Olu-Taiwo *et al*., 2021)

The consumption of pre-cut fruits has increased significantly in Nigeria over the years. This is due to the fact that they are easy to find, handy to use, and, most importantly, they are less expensive than whole fruits. Modern lifestyle, industrialization, economic slump, materialism, and a lack of time to make a healthy meal are among the other factors (Okechukwu *et al*., 2016). Increased consumption, as well as the risk of disease to which consumers may be exposed, is a major source of concern. Most of the time, determining the hygiene of the processors or the sanitary conditions during preparation is challenging. This is made worse by the fact that pre-cut fruits are stored in insanitary conditions, exposing them to flies, dust, and other infections (Okechukwu *et al*., 2016).

Unlicensed vendors or local hawkers who have little or no expertise of food hygiene sell precut fruits such as watermelon, pineapple, carrots, cucumber, and tiger nuts (also known as aki hausa). As a result, a wide range of pathogens, including bacteria (*Salmonella sp., Staphylococcus aureus, Enterobacteriaceae*), fungi, viruses, and parasites, are more likely to cause food-borne disorders. These pathogens may infiltrate these fruits throughout the washing, peeling, slicing, trimming, packaging, handling, and marketing processes (Okechukwu *et al*., 2016).

It is necessary to analyze the microbiological quality and safety of precut fruits as part of the process of checking and ensuring their quality. The current study examines the bacteriological quality of precut fruits offered in Osogbo's Igbona market. The goal of this research is to determine the total plate count and coliform count of precut fruits (pineapple, pawpaw, and watermelon), isolate

bacteria contaminants from precut fruits, identify bacteria isolated from contaminants from precut fruit samples, and calculate the percentage frequency distribution of bacteria isolated from precut fruits.

2. METHODOLOGY

2.1Materials and Reagents

The following items and reagents were used in this study: weighing balance, beakers, conical flasks, autoclave, petri-dishes, 70 percent ethanol, non-absorbent cotton wool, aluminium foil, test tubes, wire loops, incubators, microscope, blender, nutrient agar, potato dextrose agar, mannitol salt agar, salmonella-shigella agar, MacConkey

2.2 Collection of samples

Pawpaw, Pineapple, and Water Melon samples were taken from Igbona Market in Osogbo, Osun State. All samples were collected aseptically in sterile universal containers and immediately placed in pre-cooled containers with ice packs before being transported to the lab for analysis.

2.3 Media preparation

The nutrition agar, Mannitol salt agar, Eosin methylene blue agar, MacConkey agar, Salmonella-shigella agar, and peptone water were all made according to the manufacturer's instructions.

2.4 Isolation of micro-organisms from the vended fruit samples

10g of precut fruit samples were weighed and homogenized in 90mL sterile distilled water, then blended in a sterile blender, and 1 mL of the homogenate was constituted in 9 mL sterile peptone water. Then, using the pour plate technique, 0.1 mL of the last two dilutions (10^{-4} and 10^{-6}) was inoculated in triplicate on properly prepared media. After that, the plates were incubated at 37°C for 24 hours.The plates were checked after incubation for the presence of distinct colonies. The colony counter was used to count colonies, which were then expressed as colony forming units per gram (CFU/g) of sample homogenate. On nutritional agar, a total aerobic count was done, whereas Escherichia coli was counted on Eosin methylene blue agar. According to Oranusi and Olorunfemi, mannitol salt agar and MacConkey agar were used to count *Staphlococcus aureus* and non *E.coli* coliforms, respectively, while Salmonella Shigella agar was used to count Salmonella after 24 hours of pre-enrichment in Selenite-Flouch (2011). Discrete colonies on various media were separated and purified through repeated subculturing on the same media. For further characterisation, pure colonies were kept on agar slants at 4ºC.

2.5 Purification and Maintenance of Isolates

Using a sterile inoculating loop, each separate colony on a petri dish was moved into plates containing freshly prepared nutritional agar and cultured at 37°C for 24-48 hours. The colonial morphologies (Cultural traits) of the isolates were documented after incubation and compared to Holt *et al.* (1995) descriptive's features. After that, the isolates were conserved on nutrient agar slants and kept at 4 ºC in the refrigerator.

2.6 Biochemical characterization and Identification of Isolates

The bacteria isolates were identified using the method developed by Oranusi et al. (2004). Catalase, methyl red, oxidase, citrate utilization, and coagulase and indole assays were among the biochemical tests utilized to further describe the bacteria. The gram negative isolates were also subjected to an oxidase test to determine whether they were oxidase positive or negative. The identities of coliforms and bacteria were then confirmed using the Bergy's Manual for Determinative Bacteriology's identification procedures (Holt et al., 1994)

2.6.1 Identification of Isolates

Cheesbrough's method was used to perform Gram staining and other biochemical assays (2006). Each bacterial isolate's colonial appearance on the plate was inspected and classified using the following criteria: color, shape, edge, elevation, surface, and opacity (Olutiola *et al*., 200).

3.6.2 Biochemical tests

2.6.2.1 Catalase test

With a wooden stick, the isolates' distinct colonies were collected and emulsified in a drop of hydrogen perioxide (H2O2). According to Cheesbrough (2006), gas bubbles suggested a positive result.

2.6.2.2 Indole test

A small amount of each isolate was injected into 5ml of sterilized prepared peptone water, which was kept separate in test tubes by a wire loop. The test tubes containing the organisms were then incubated for 48 hours at 37°C. After the incubation period, 3-4 drops of Kovac's reagent (indole reagent) were added and gently shaken. According to Cheesbrough (20060, a positive result resulted in a red surface layer after 10 minutes, whereas a negative result resulted in no red surface layer after 10 minutes.

2.6.2.3 Oxidase test

In a clean petri plate, a piece of filter paper was inserted, and 2-3 drops of freshly made oxidase reagent were added. Distinct colonies of the isolates were collected individually and smeared on the filter paper using a wooden stick. According to Cheesbrough (2006), a positive result resulted in a purple-blue colouring after 10 seconds, while a negative result resulted in no such coloration after 10 seconds.

2.6.2.4 Coagulase test

On each end of a slide, a drop of distilled water was inserted, and a colony of the test organism was emulsified in each drop to make a thick suspension. Then a loopful of plasma was gently swirled into one of the suspensions. According to Cheesbrough, a positive result revealed clumping after 10 seconds, whereas a negative result showed no clumping after 10 seconds (2006).

2.6.2.5 Citrate Test

Citrate permease which is produced by citrate-consuming organisms, aids in the transport of citrate into the cell, allowing the organism to use it as its only carbon source. After 48 hours of incubation, the isolates were implanted into the test tubes' slopes; a positive result was indicated by a color change from green to vivid blue (Okoro *et al*., 2017).

2.6.2.6 Catalase Test

Using a sterile loop, a smear was formed from the pure culture (18-24 hours old pure culture) on clean glass slides. A small portion of the bacterial colony was put to a dry, clean glass slide, along with a drop of 3 percent hydrogen peroxide. A positive result is shown by rapid oxygen evolution within 5-10 seconds, whereas a negative result is indicated by no bubble at all (Olutiola *et al*., 2007).

2.6.2.7 Methyl red (MR) test

5 mm glucose phosphate broth (1 g glucose, 0.5 percent KH2PO4, 0.5 percent peptone, and 100 mL distilled water) was poured and sterilized into clean test tubes. After inoculating the tubes with the isolated test organisms and incubating them at 37°C for 48 hours, a few drops of methyl red solution were added to each test and color changes were observed. A good reaction is denoted by the color red (Olutiola *et al*., 2000).

2.6.3 Gram staining

. With the use of a wire loop, a thin smear of the isolates was produced on several slides and allowed to dry before being heat fixed and allowed to cool. The crystal violet stain was then applied to the various stains for 30-60 seconds before being quickly wiped away with clean water. The smears were then covered in Lugol's iodine for 30-60 seconds before being quickly rinsed away with clean water. The smears were quickly decolorized with alcohol and rinsed out with clean water.

The smears were then coated in safaranine for 30-60 seconds before being rinsed in clean water. After that, the stained smears were left to dry on their own. After drying, a few drops of oil immersion were poured on the stained smears and examined under a microscope (100 oil objective lens) for microscopic features of the organisms such as the Gram response and morphology (Cheesbrough, 2006).

2.6.4 Sugar fermentation

The goal of the sugar fermentation test was to see if organisms could ferment sugars (Lactose, Glucose, and Sucrose) and produce acid and gas. Peptone water medium with 1 percent fermentable sugar and 0.01 percent phenol red was used to make sugar indicator broth. Each test tube received around ten milliliters of sugar broth, and the Durham tube, which would trap the gas if it was created, was gently inverted. The test tubes were autoclaved and inoculated with a loopful of 24 hour old test organism culture, then cultured for 2-7 days at 361 °C and acid and gas production monitored daily. The presence of yellow colouring suggests acid generation, whilst displacement of the medium in the Durham tube shows gas production (Fawole and Oso, 2004).

3. RESULT AND DISCUSSION

3.1Microbial counts of fresh-cut fruits

Table 1 shows the result of the average microbial load of the retailed precut fruit samples in colony forming unit per g (CFU/g). It shows that the watermelon had highest total plate count of 6.4×10^5, followed by pineapple, 5.2×10^4, while Pawpaw had the least, 3.6×10^4 (Table 1). Moreover, in the coliform count pineapple had the highest of 3.8×10^4, followed by watermelon, 2.7×10^4 while pawpaw has the least 1.8×10^3 (Table 1). *Escherichia coli growth* was observed on Eosin Methylene blue plate for watermelon while no growth was observed in both pineapple and pawpaw. Also No growth was observed for Salmonella on Pineapple and pawpaw except watermelon (Table 1).

The acceptable limits of microbial quality of most foods is < 5.0 log10 cfu/g for total counts, < 3.0 log10 cfu/g for Enterobacteriaceae (WHO, 2009); the UK Public Health Laboratory Services requirement (6 to < 7 log cfu/g) (PHLS, 2002).

Table 1: Microbial counts from fresh-cut fruits purchased from Igbona, Osogbo, Osun State

S/N	Samples	Total plate count (CFU/g)	Total Coliforms (CFU/g)	*Escherichia coli*	*Salmonella*
1	Watermelon	6.4×10^5	2.7×10^4	+	+
2	Pineapple	5.2×10^5	3.8×10^4	-	-
3	Pawpaw	3.6×10^4	1.8×10^3	-	-

Key: (-) = No growth, (+) = Growth

4.2 Morphological and Cultural characteristics of bacterial Isolates

All isolates obtained from Watermelon, Pineapple and pawpaw appears in circular form except isolates in group B (Table 2). The surfaces of isolated organisms are smooth on plates apart from isolates in group B and G that are glistening (Table 2). Isolates in group A, B,E and H appear in white colour, group C isolates are grey white, group D and F are yellow while only group G isolates are cream in colour (Table 2). Most of the isolates are entire in margin except isolates in group B that are filiform. The elevation of group A, E and H are convex, isolates in group C, D and G are raised while isolates in group B and F are undulate and flat respectively (Table 2). Group A, C, and E isolates are translucent while isolates in group F and G are transparent. Isolates in group B and D are opaque while only group G isolates are moist. Group B, E, F, G and H are motile while isolates in group A, C and D are non motile (Table 2).

Table 2: Morphological and Cultural characteristics of bacterial Isolates obtained from fresh fruits cut purchased at Igbona Market, Osogbo, Osun State

Isolate Group	Form	Surface	Colour	Margin	Elevation	Opacity	Motility
A	Circular	Smooth	White	Entire	Convex	Translucent	Non-motile
B	Filamentous	Glistening	White	Filform	Undulate	Opaque	Motile
C	Circular	Smooth	Grey White	Entire	Raised	Translucent	Non Motile
D	Circular	Smooth	Yellow	Entire	Raised	Opaque	Non Motile
E	Circular	Smooth	White	Entire	Convex	Translucent	Motile
F	Circular	Smooth	Yellow	Entire	Flat	Transparent	Motile
G	Circular	Glistening	Cream	Entire	Raised	Transparent	Motile
H	Circular	Shinny	White	Entire	Convex	Moist	Motile

4.3 Gram Reaction of Bacterial isolated from fresh fruits

All the bacterial isolates in group A, B, E, F, G, and H are rod-shaped and gram negative except for group C and D that are Gram negative rods (Table 3). Only arrangement of isolate in D group are not single but in group, all others groups (A, B, C, E, F, G and H) are single in arrangement (Table 3).

Table 4.3: Gram Reaction of Bacterial isolated from fresh cut fruits purchased at Igbona Market, Osogbo, Osun State

Isolate Group	Positive/Negative (+/-)	Shape	Arrangement
A	-	Rod	Single
B	-	Rod	Single
C	+	Cocci	Single

D	+	Cocci	Group

4.4 Biochemical characteristics and sugar fermentation of the bacterial isolates from fresh-cut fruits

Table 4 shows the result of the biochemical characteristics and sugar fermentation of the microbial isolates from fresh-cut fruits. It reveals that a total of six (8) bacteria were isolated. They were categorized in eight groups A, B, C, D, E, F, G and H (Table 4).

Group A isolates are oxidase, coagulase, Methyl Red, Indole and citrate negative while catalase, glucose, sucrose, maltose and arabinose are positive. The above stated biochemical and sugar fermentation shows that the isolates are related to properties of *Klebsiella sp.* when compared with Bergy's manual for bacterial identification (Table 4).

Catalase, coagulase, methyl red, indole, citrate, glucose are Sucrose are negative while oxidase, Maltose and L-arabinose are positive for group B isolates. This is an indication that the isolates under this group are *Pseudomonas sp.* as determine through identification by Bergy's manual (Table 4).

Isolates in group C had positive oxidase, catalase and coagulase, while methylred, Indole, citrate, glucose, Sucrose, Maltose, and L-arabinose are negative. This attributes obtained in this isolates is in similarity with Micrococcus as depicted in Bergy's manual for identifying bacteria. This implies that the isolates in group C are *Micrococcus sp.* (Table 4).

Group D isolates had negative Oxidase,Coagulase, Methyl Red, Indole, Citrate, Glucose, Sucrose but catalase, Maltose and L-arabinose are positive. The above biochemical and sugar properties confirmed isolates as *Staphylococcus sp*. in reference to Bergy's manual (Table 4).

Oxidase, Coagulase, citrate and sucrose are negative for isolates in group E while catalase, methyl red, indole, glucose, Maltose and L-arabinose are negative (Table 4). The result observed is similar to biochemical and sugar test of *Escherichia coli* in Bergy's manual.

Group F isolates had negative oxidase, citrate sucrose and L-arabinose while catalase, coagulase, methyl red, indole, glucose and maltose are positive. The above biochemical and sugar examination indicate that the isolates are similar to *Salmonella sp*. (Table 4)

Group G isolates are *Proteus sp*. because the Catalase, coagulase, methylred, Maltose and L-arabinose are negative but oxidase, indole, Citrate, glucose and Sucrose are positive (Table 4). The isolates are similar to *Proteus sp.*

Oxidase, Methyl Red, Indole are negative for isolates in group H while Catalase, Coagulase, Citrate, glucose, sucrose, maltose, and L-arabinose are positive (Table 4). The results recorded for biochemical and sugar tests shows similarity to *Enterobacter sp*. as we have it in Bergy's manual for bacterial identification.

The majority of the organisms isolated in this study may have been introduced into these samples through the use of water from a poorly maintained storage tank or water from untreated boreholes for washing, and the fruits may not be washed before being cut or the same water is used to wash the fruits multiple times (Edusie *et al*., 2016; Asante *et al*., 2019).

The presence of *Staphylococcus aureus, Pseudomonas sp, Salmonella sp* and *Escherichia coli* in this study was in line with the work of Odebisi-Omokanye *et al.,* (2015) from pre-cut fruits sold in Ilorin. Enteric bacteria, E. coli, and Staphylococcus have all been recovered from ready-to-eat pineapple, pawpaw, and watermelon in previous research. *E. coli, S. aureus,* and P*roteus* were among the germs found on pre-cut sliced fresh fruits sold in Kano, Bida, and Yenegoa, according to Daniel *et al*., (2014), Izah *et al*., (2015), and Asante *et al*., (2019). These facts are supported by the findings of this study, which show that these pineapple samples may cause diarrhea and gastrointestinal disturbances in both adults and children because they exceed microbiological limits and are prepared in an unhealthy manner, as opposed to the control, which has a much lower count because it was prepared under aseptic conditions (Izah *et al*., 2015). The discovery of substantial amounts of Escherichia coli and *Staphylococcus aureus* in the fruits samples suggests contamination from human sources. This could result in gastrointestinal issues.

Table 4: Biochemical characteristics and Sugar fermentation of bacterial isolated from fresh cut fruits purchased at Igbona Market, Osogbo, Osun State

Isolate Group	Ox	Cat	Co	Met	In	Cit	Gl	Su	Ma	Ara	Probable Identity
A	-	+	-	-	-	-	+	+	+	+	*Klebsiella sp*

B		+	-	-	-	-	-	-	-	+	+	*Pseudomonas sp*
C		+	+	+	-	-	-	-	-	-	-	*Micrococcus sp*
D		-	+	-	-	-	-	-	-	+	+	*Staphylococcus sp*
E		-	+	-	+	+	-	+	-	+	+	*Escherichia coli*
F		-	+	+	+	+	-	+	-	+	-	*Salmonella sp*
G		+	-	-	-	+	+	+	+	-	-	*Proteus sp*
H		-	+	+	-	-	+	+	+	+	+	*Enterobacter spp*

Key: (-) = Negative, (+) = Positive Ox= Oxidase, Cat= Catalase, Co = Coagulase, Met =Methyl Red, In = Indole, Cit = Citrate, Gl = Glucose, Su = Sucrose, Ma = Maltose, Ar = L-arabinose

4.5 Frequency of Occurrence of Bacterial isolated from Pre-cut Fruits

The percentage frequency of occurrence of the bacterial isolates in fresh-cut fruits samples were shown below. It shows that *Staphylococcus sp* has the highest occurrence, 5(25%), followed by *Klebsiella sp*, 4(20%), *Pseudomonas sp and Enterobacter sp* had 3(15%) while *Micrococcus sp*. had 2(10%) (Table 5). The least occurrence 1(5%) were recorded by *Escherichia coli Salmonella sp* and *Proteus sp* respectively

Table 5: Frequency of Occurrence of Bacterial isolated from fresh cut fruits purchased at Igbona Market, Osogbo, Osun State

Isolate Group	Isolate Code	Bacterial Isolates	Frequency	Percentage
A	W_6, A_4,P_5, W_7	*Klebsiella sp*	4	20
B	W_5,P_4, A_3	*Pseudomonas sp*	3	15
C	A_2, P_3	*Micrococcus sp*	2	10
D	P_2, P_1, W_2, A_1, A_2	*Staphylococcus sp*	5	25
E	W_1	*Escherichia coli*	1	5
F	W_9	*Salmonella sp*	1	5
G	W_4	*Proteus sp*	1	5
H	W_8, A_5, P_6	*Enterobacter sp*	3	15
			20	100

W_1-W_9 = Isolates obtained from Watermelon
A_1-A_5 = Isolates obtained from Pawpaw
P_1-P_6 = Isolates from Pineapple

4. CONCLUSION

This research demonstrates that the precut fruits studied are potential vehicles for the transmission of diseases, particularly those transmitted via the faecal-oral route. The sort of isolates found and their distribution pattern revealed that pre-cut fruits become contaminated throughout the slicing, rinsing, and display for sale processes. As a result, it is recommended that fruit dealers follow sanitary measures.

Microbes are found in every type of substance, with the exception of sterilized bodies and environments. This indicates that microorganisms are an unavoidable part of life on Earth, as they may be found practically everywhere. Their many shapes enable them to thrive in a wide range of conditions. It's not unexpected that they're discovered on fresh fruits and vegetables because they're found in all unsterilized surroundings. Fresh fruits and vegetables are consumed all around the world, with a growing need as the world's population grows.

Today's never-ending stream of activities has made many people busy all of the time, affecting their diets and prompting a switch to the consumption of fruits and vegetables to save time, but the nutritional content of vegetables is the main contributor to their increased consumption and utilization worldwide. Fresh fruits have become well-known and acknowledged as a healthy diet that aids in the correction of various dietary imbalances. Because of the increased demand for fresh fruits and vegetables, manufacturers have turned to low-cost, quick-turnaround techniques of production, causing them to be less concerned about food safety.

Numerous possible dangers in the food chain of pre-cut fruits processing include contamination during production, in the field at harvest, post-handling, storage and distribution, and consumer handling. As points or sources of contamination are difficult to establish, the best strategy to minimize potential contamination and risks is to guarantee appropriate hygiene practices in conjunction with Hazard Analysis and Critical Control Point (HACCP) (Ismaiel and Papenbrock, 2015).

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