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Microbial Quality of already prepared fruit salad sold in Port Harcourt, Nigeria

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Abstract
The microbial quality of fifteen pre-packaged fruit salad samples containing pineapple, water melon and paw-paw was analyzed. The distribution of the bacterial isolates were *Bacillus* spp 15 (100%), *Staphylococcus aureus* 15 (100%), *Pseudomonas* spp 13 (86.67%), *Escherichia coli* 15 (100%), *Streptococcus* spp 4 (26.67%), *Alkaligenes* spp 6 (40%).The fungi isolates were distributed as follows: *Aspergillus* spp 15 (100%), *Penicillium* spp 13 (86.67%), *Fusarium* spp 8 (53.33%) and *Saccharomyces cerevisae* 6 (46.67%). The total bacterial count was in the range of 1.40×10^5 to 2.70×10^5 cfu/g, while the total coliform count ranged from 0.33×10^3 to 4.66×10^3 cfu/g. The lowest *Staphylococcal aureus* count was 6.0×10^4 cfu/g while the highest count was 11.33×10^4 cfu/g. The fungal count ranged from 2.67×10^3 to 5.67×10^3. Good personal hygiene, Proper sanitation practice and the use of clean utensils are recommended in order to avoid risks associated with the consumption of contaminated fruits.
Key words: microbial quality, fruit salad, Port Harcourt

1.0 Introduction

Over the years, there has been significant increase in the consumption of already prepared fruit salad. This is due to the fact that it is easily accessible, convenient, nutritious and most especially cheaper than whole fruits. It is composed of different kinds of fresh fruits which may include; water melon, pineapple, paw-paw, apple, berries, grapes etc. which are cut into small pieces and eaten with or without milk or syrup to give it an extra flavour (Alan, 1999). The nutritional qualities can be said to reflect the nutritional quality of the individual fruits used in its preparation. Generally, they are low in cholesterol, saturated fat and sodium and high in vitamins A, D and C, dietary fiber, manganese and copper.

In Nigeria, fruit salad is classified as a street food and so are sometimes prepared in public places and sold by vendors on streets and in other similar places in small transparent covered plastic bowls. . They may be consumed where it is purchased or can be taken away and eaten elsewhere. (Dawson and Canet, 1991; Ekanem, 1998; Nwachukwu *et al*., 2008).

Fruit salad due to its nature is of great public health concern. This is because it is prone to contamination from its preparation to the selling point due to either improper handling, contamination/ cross contamination by insects and preparation utensils, packaging materials, handling and marketing.

Contamination and cross contamination of street foods especially sliced fruits and vegetables are increased by unsanitary processing and preservation methods. Pathogens may invade the interior surfaces of the produce during peeling, cutting and other processes like packaging, handling and marketing (Barro *et al*., 2007). The use of dirty utensils as well as the open display of street produce encourages sporadic visits by flies, cockroaches, rodents and dusts (Bryan *et al*., 1992). Another major source of contamination of fresh fruits and vegetables sold by street vendors is the washing water (Khali *et al*., 1994). In addition to this, it is difficult for one to attest to the hygiene of the processors or the sanitary conditions at the point of preparation. Holding of sliced fruits that requires no further processing before consumption at ambient temperature during retail, maintains the produce at optimum temperature for proliferation/ invasion by pathogenic mesophiles (Muinde and Kuria, 2005; Barro *et al*., 2007).The use of simple facilities like wheelbarrow, trays, mats tables and make shift stalls by the street vendors further increase the risk of food contamination.

Difference in microbial profiles of various fruits and organisms result largely from unrelated factors, such as resident microflora on the soil, application of non-resident microflora via animal manures, sewage or irrigation water, transportation and handling by individual retailers (Ray and Bhunia, 2007; Ofor *et al*., 2009). In developing countries such as Nigeria, continued use of untreated wastewater and manure as fertilizers for the production of fruits and vegetables is a major contributing factor to contamination (Olayemi, 1997; Amoah *et al*., 2009).

The consumption of packaged fruit salad may thus potentially increase the risk of food-borne disease caused by a wide variety of pathogens. This study is therefore aimed at determining the microbial quality of street vended packaged fruit salad sold in Port Harcourt, Nigeria and highlighting the possible health implications of eating foods of poor microbial quality.

2.0 Materials and methods

2.1 Sample collection

A total of 15 pre-packaged fruit salad samples comprising of pineapple, water melon and paw-paw were obtained randomly from street vendors in Port Harcourt. These were transported in ice packed cooler to the laboratory where analysis commenced immediately.

2.2 Isolation and enumeration of microorganisms

Nutrient agar, Sabouraud Dextrose agar, Mannitol Salt agar, Eosin Methylene blue agar, peptone water were prepared according to manufacturer's instruction and sterilized by autoclaving at 121^{o}C for 15mins. 10grams of each fruit salad sample was blended in a sterile blender with 90mls of peptone water for two minutes. 10 fold serial dilutions were prepared and 1ml of the 10^2, $10^3$and 10^4 dilutions was inoculated on duplicate plates of the already prepared media using the pour plate technique. The plates were then incubated at 37^{o}C for 24-48h and examined for colony formation.

After incubation, colonies were counted using a colony counter (Gallencamp), while pure cultures of isolates were obtained by sub-culturing in fresh medium using the streak plate method.

2.3 Identification of isolates

Bacterial isolates were identified based on standard microbiological cultural, morphological and biochemical characteristics as described by Buccanan and Gibbons, (1974) while the fungal isolates were identified based on the taxonomic schemes described by Fawole and Oso, (1988)

3.0 Results and Discussion

The microbial quality of already prepared fruit salad samples was investigated and different microorganisms were isolated; *Bacillus, Staphylococcus aureus, Pseudomonas* spp, *Escherichia coli, Streptococcus* spp, *Alkaligenes* spp *Penicillium* spp, *Aspergillus* spp, *Saccharomyces cerevisae, Fusarium* spp. Most of the bacteria isolated are almost always readily available in our environment. The presence of these organisms can be linked to a number of factors such as improper handling and processing, use of contaminated water during washing, cross contamination from other fruits and vegetables or the use of dirty processing utensils like knives and trays (Khali *et al*., 1994; Eni *et al*., 2010; Oranusi and Olorunfemi, 2011). Bryan *et al*., (1992), Beuchat, (1996) and Ekanem (1988) isolated species of bacteria which include *Bacillus* spp., *Salmonella* spp and *Escherichia coli* from street vended foods and the presence of these organisms were thought to be as a result of inappropriate processing.

From the results obtained, the total bacterial count falls within the range of 1.40×10^5 and 2.70×10^5 cfu/g, with sample 12 showing the highest count of 2.70×10^5cfu/g and sample 1 showed the lowest count of 1.40×10^5cfu/g (Table 1). It is assumed that most of these bacterial isolates have the capacity to cause disease and the nature of fruit salad is such that no further treatment is required before eating so control of the microbial load or flora is difficult. This in turn implies that consumers of these foods are inadvertently exposed to dangers of food borne diseases.

The high coliform count is very disturbing with the least count of 0.33×10^3cfu/g (Table 1). It is important to observe that the presence of *E. coli* as an enteric bacteria with established pathogenicity in man poses a risk to young children, the elderly and the immunocompromised persons if as low as 10^1-10^2/g(infective dose) is found (ICSMF, 1974). *E. coli* is a part of the normal flora of the intestine of humans and other vertebrates and its presence indicates unsanitary conditions and warrants investigation of the conditions of preparation. Some strains of *E. coli* can cause gastroenteritis and urinary tract infection as well as diarrhea in infants.

The staphylococcal count was in the range of 6.00×10^4 cfu/g and 11.33×10^4 cfu/g (Table 1). It is important that the presence of *S. aureus* in the fruit salad for human consumption should be checked as count of 10^5/g are highly suggestive of the possibility of food poisoning occurring.

Among the bacteria, *Staphylococcus aureus* and *Bacillus* spp both had 100% occurrence (Table 2). *S. aureus* being a normal flora of the skin and mucous membranes have the vendors as the probable source of contamination of the fruit salad samples. *Bacillus* might have entered by soil contamination due to its ubiquity.

Aspergillus spp and *Penicillium* spp among the fungi had 100% and 87% respectively. *Fusarium* spp had 53.33% followed by *Saccharomyces* spp (46.67%). See Table 3. Unlike the bacterial isolates, the fungal isolates presented a

safer ground since *Saccharomyces cerevisae* is not pathogenic and *Fusarium* spp. is relatively pathogenic to plants than animals. However, *Aspergillus* spp. is known to be pathogenic to man.(Okonko *et al*., 2009; Eni *et al*., 2010)

4.0 Conclusion

This study shows that already prepared fruit salad can contain some pathogenic organisms that could be harmful to man and pose a severe public health problem on the consumers if not properly handled hygienically.

References

Alan Davidson (1999) Oxford companion to food. Oxford University Press: Oxford p.323

Amoah, P., Drechse,l P., Abaidoo R.C. and Abraham, E.M. (2009). Improving food hygiene in Africa where vegetables are irrigated with polluted water. Regional Sanitation and Hygiene Symposium, 3-5 Nov. 2009, Accra, Ghana.

Barro, N., Bello A. R., Itsiembou, Y., Savadogo A., Quattara, C.A.T., Nikiema, A.P., De Souza C. and Traore, A.S. (2007). Street vended foods improvement: contamination mechanism and application of food safety objective strategy: Critical review. *Pakistan Journal of Nutrition*. 6, 1-10

Beuchat, L. R. (1996) Pathogenic microorganisms associated with fresh produce. *Journal of Food Protection*. 59, 204-216,

Bryan, F. L., Riaz, S.,Teufel, P., Rooh, S., Quadar, F and Malik, Z. (1992) Hazards and critrical control points of street-vended chat, a regionally popular food in *Pakistan Journal of Food Protection* 55, 708-713

Buchanan, R.A. and Gibbons, N.E. (1974). Bergey's Manual of Determinative Bacteriology. 8th edition. Williams and Wilkins Co. Baltimore, USA

Dawson, R. J. and Canet, C. (1991) International activities in Street foods. *Food control*. 2, 135-139

Ekanem, E. O. (1998). The street food trade in Africa: Safety and socio environmental issues. *Food Control*. 9,211-215

Eni, A.O., Oluwawemitan, I.A. and Oranusi, U.S. (2010). Microbial quality of fruits and vegetables sold in Sango Ota, Nigeria. *African Journal of food Science.* 4(5), 291-296.

Fawole, M.O. and Oso, B.A. (1988). Laboratory manual of Microbiology, Spectrum books Ltd, Nigeria, pp 26-31

ICSMF (International Commision on Microbiological Specification for Food) (1974). Sampling for Microbiological analysis: Principles and Specific applications. University of Toronto Press, Toronto. pp 1-18

Khali, L. G. B., Mazhar, K. B. (1994) Files and water as reservoirs for bacterial enteropathogens in urban and rural areas in and around Lahore, Pakistan..*Epidemiology and Infection* 133, 435-444

Muinde, O.K. and Kuria, E. (2005). Hygienic and sanitary practices of vendors of street foods in Nairobi, Kenya,*AJFAND* 5:1-3

Nwachukwu, E, Ezeama, C. F. and Ezeanya, B. N. (2008) Microbiology of polyethylene-packaged sliced watermelon (citrullus lanatus) sold by street vendors in Nigeria. *African Journal of Microbiology* 2, 192-195.

Ofor, M.O., Okorie, V.C, Ibeawuchi, I.I., Ihejirika, G.O., Obilo, O.P., Dialoke, S.A. (2009). Microbial Contaminants in Fresh Tomato Wash Water and Food Safety Considerations in South-Eastern Nigeria. *Life Science Journal*.1, 80-82.

Okonko, I.O., Adejoye, O.D., Ogun, A.A., Ogunjobi, A.A., Nkang, A.O. and Adebayo, B.C. (2009) Hazard analysis critical control points (HACCP) and Microbial qualities of sea foods as affected by handler's hygiene in Ibadan and Lagos, Nigeria. *African Journal of food science* 3(2), 35-50

Olayemi, A.B. (1997). Microbiological hazards associated with agricultural utilization of urban polluted river water. International Journal of Environmental Health Research. 7(2), 149-154

Oranusi, S. and Olorunfemi, O.J. (2011). Microbial safety evaluation of street vended ready to eat fruits sold in Ota, Ogun State, Nigeria. *International Journal of Research in Biological Science*. 1(3), 27-32

Ray, B. and Bhunia, A.K. (2007). Fundamental Food Microbiology, 4th ed. CRC Press, USA. p. 492

Table 1: The microbial count of the fruit salad samples

Sample	Total viable count	Total coliform count	Staphylococcal count	Total fungal count
		(cfu/g)		
	$\times 10^5$	$\times 10^3$	$\times 10^4$	$\times 10^3$
1	1.40	3.67	9.33	5.00
2	1.63	4.67	10.33	5.33
3	1.67	3.33	8.33	4.67
4	1.57	1,67	8.67	4.00
5	1.43	3.67	6.33	3.33
6	2.60	3.33	11.33	2.67
7	2.00	0.67	8.67	5.67
8	1.93	3.33	9.00	4.67
9	1.83	4.00	8.00	5.67
10	1.97	3.67	6.33	4.00
11	1.43	4.33	6.00	4.33
12	2.70	3.67	9.00	2.67
13	1.53	1.00	9.33	5.33
14	1.67	0.33	9.67	3.67
15	2.13	1.67	10.67	2.67

Table 2: Percentage occurrence of the bacterial isolates

Samples	*Bacillus* spp	*Staphylococcus aureus*	*Pseudomonas* spp	*Escherichia coli*	*Streptococcus* spp	*Alkaligenes* spp
1	+	+	+	+	_	+
2	+	+	+	+	+	_
3	+	+	_	+	_	+
4	+	+	+	+	_	_
5	+	+	_	+	+	_
6	+	+	+	+	_	_
7	+	+	+	+	_	+
8	+	+	+	+	_	_
9	+	+	+	+	_	+
10	+	+	+	+	_	_
11	+	+	+	+	+	_
12	+	+	+	+	_	+
13	+	+	+	+	_	_
14	+	+	+	+	_	_
15	+	+	+	+	+	+
% occurrence	100	100	86.67	100	26.67	40.00

Table 3: Percentage occurrence of the fungal isolates

Sample	*Aspergillus* spp	*Penicillium* spp	*Saccharomyces cerevisae*	*Fusarium* spp
1	+	+	+	+
2	+	+	_	+
3	+	+	+	_
4	+	_	_	+
5	+	+	_	_
6	+	+	_	+
7	+	+	_	+
8	+	+	+	+
9	+	+	+	_
10	+	+	_	_
11	+	+	+	_
12	+	_	_	_
13	+	+	_	+
14	+	+	+	_
15	+	+	+	+
% occurrence	100	86.67	46.67	53.33