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BACTERIOLOGICAL ASSESSMENT OF PACKAGED FRUIT JUICES CONSUMED IN SOME PARTS OF ANAMBRA, NIGERIA.

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ABSTRACT: Bacteriological assessment of eighteen samples of different fruit juices consumed in parts of Anambra State was carried out using standard microbiological procedures. Both total heterotrophic bacteria count and total coliform counts were determined using 0.1ml of each serially diluted sample on nutrient and MacConkey agar plates respectively. Total heterotrophic bacteria count was of the order $x10^4$ cfu/ml while total coliform count was of the order $x10^3$ cfu/ml. Frequently isolated microorganisms were *Lactobacillus* spp, *Bacillus* spp, *Staphylococcus* spp, *Psuedomonas* spp and *Micrococcus* spp. Virtually all the sampled fruits juices had some degree of bacterial contamination.

Keywords: Bacteria, assessment, fruit juice, contamination, storage, spoilage.
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INTRODUCTION

The extractable fluid contents of fruit cells and tissues are referred to as fruit juice. It contains important food components required by man such as ascorbic acid, folic acid and various forms of vitamins especially vitamins A, B and C. Besides, sugars such as sucrose, fructose and glucose, minerals such as calcium, potassium and iron are contained in fruit juices; hence they are recognized for their nutritive value, mineral and vitamin contents (Parish and Haggins, 1997).

The stability of fruit juice depends largely on the raw material and storage conditions. Ray (1996) stated that the quality of fruit juices depends essentially on the species and maturity of the fresh fruits used. The main factors that influence quality of fruit juices are the acid: sugar ratio, the aroma volatiles, the phenolic components, ascorbic acid and vitamin C contents (Heldman and Lund, 1992). Increasing maturity or ripening of fruits causes a relative increase in its sucrose content which has been attributed to the breakdown of starch thereby making most ripe fruits starch-free (Frazier and Westhoff, 2002).

Contamination of fruit juices is traceable to either the point of harvesting of fresh and new fruits, their transportation, processing or packaging (Woodroof and Lue, 1975). Neglected parts of any food handling system, can contaminate the food. Inclusion of decayed parts of fruits can lead to contaminations of fruit juices. Though hot water blanching can reduce the number of microorganisms in food, it can as well cause a build-up of spore-forming, thermophilic bacteria which causes spoilage of canned foods and juices (Fox and Cameroon, 1989).

The number and type of microorganisms that initiate spoilage of processed fruit juice is dependent on the condition of fresh fruit used, the processing, and other possible sources (Frazier and Westhoff, 2002). In processed fruit juice, bacteria are the most diversified microorganisms causing spoilage. Due to resistance to acidity, lactic and butyric bacteria are the most common spoilage microorganisms of fruit juices. They are capable of growing at pH of 3.5 but do not thrive well at temperature below 8°C (Parish and Haggins, 1997). Ayres *et al* (1980) reported that lactic acid bacteria (e.g. *Lactobacillus brevis and Lactobacillus postorianus*) isolated from fruit juices are heterofermentative. The second major group of fruit juice – spoilage microorganisms are

the acetic acid bacteria which are commonly resident on plant and fruit surfaces. Two acetic acid bacteria generally and often isolated are *Acetobacter* spp and *Acetomonas* spp (Childer *et al*, 1995).

Fruit juices can be preserved by canning, freezing or drying. Heat processing kills juice-spoilage bacteria while freezing prevents their growth (Frazier and Westhoff, 2002). Aerobic and anaerobic endospores are heat-resistant. Of most practical concern to food Microbiologist, is the thermal resistance of potential pathogenic bacteria such as *Baccillus cereus* and *Clostriduim botulinum* as well as less heat-resistant, *Salmonella* spp. Geopfert *et al* (1982), reported the isolation of pathogenic *Bacillus cereus* spores that survived at 140^{0}C for 4 hours.

MATERIALS AND METHODS

Different samples (18) of commonly consumed package fruit juices in Anambra were randomly purchased from three different towns in Uli, Ihiala and Onitsha and subjected to microbiological analyses.

Microbiological Analysis

Analysis for total heterotrophic bacteria counts and total coliform counts were carried out on the sample fruit juices. The samples were serially diluted. For total heterotrophic bacteria counts, 0.1ml of each of the serially dilute fruit juice samples was plated using spread plate method, on nutrient agar and plates incubated at 37^{0}C for 24 hours.

Again, 0.1ml of diluted samples were plated on MacConkey agar using spread plate method to enumerate coliforms. The plates were incubated at 37^{0}C for 24 hours. All subcultures on respective media were also incubated at 37^{0}C for 24 hours.

Isolation, identification and characterization of bacteria colonies were based on Bergy's manual of determinative bacteriology.

RESULTS

Total heterotrophic bacteria count of all the sampled fruit juices were of the order x10^4 cfu/ml while the total coliforms count were of the order x10^3 cfu/ml. However, pure Heaven apple fruit juice and Five alive juice recorded highest number (28.0 x 10^4 cfu/ml) and lowest number (3.3 x10^4 cfu/ml) of total heterotrophic bacteria counts respectively while Pure heaven pineapple juice and Five alive juice recorded highest number (15.0 x 10^3 cfu/ml) and lowest number (3.0 x10^3 cfu/ml) of total coliform count respectively (Table 1).

The frequently isolated bacteria from the sample fruit juices included *Micrococcus* spp, *Staphlylococcus* spp, *Pseudomonas* spp, *Streptococcus* spp, *Lactobacillus* spp *and Bacillus* spp, with their frequencies of isolation (Table 2).

Table 1: Total Bacterial Counts of Fruit Juice Samples

Fruit Juice Brand	Total Heterotrophic Bacteria Count (cfu/ml) x 10^4	Total Coliform Count (cfu/ml) x 10^3
Five Alive	3.3	3.0
Frutta Apple	5.0	3.5
Frutta Orange	6.5	4.8
Frutta Cocktail	11.0	3.2
Chivita Pineapple	4.4	3.0
Chivita Apple	4.4	3.9
Chivita Mango	7.0	7.8
Chivita Orange	6.8	5.8
Dansa Mango	8.0	5.5
Dansa Apple	6.0	4.5
Dansa Tropical	7.5	7.8
Pure Heaven Orange	18.0	8.0
Pure Heaven Apple	28.0	12.0
Pure Heaven Pineapple	25.0	15.0
Milan Pure Orange	9.5	8.0
Vogue Cocktail	9.0	7.0
Fruit Squeeze	21.0	10.0
Exotic Coconut	22.0	9.8

Table 2: Frequently Isolated Bacteria in different fruit juices

Fruit Juice Brands	Isolated Bacterium	Frequency
Five Alive, Dansa Mango	*Micrococcus* spp	2
Frutta Apple, Dansa Tropical, Milan Pure Orange and Pure Heaven Pineapple	*Staphylococcus* spp	4
Frutta Orange Chivita Orange, Pure Heaven Apple and Exotic Coconut	*Pseudomonas* spp	4
Frutta Cocktail, Chivita Mango and Vogue Cocktail	*Streptococcus* spp	3
Chivita Pineapple and Dansa Apple	*Lactobacillus* spp	2
Chivita Apple, Pure Heaven Orange and Fruit Squeeze	*Bacillus* spp	3

DISCUSSION

In this study, lactic acid bacteria, *Streptococcus* spp and *Lactobacillus* spp were isolated from some of the fruit juices which agrees with the fact that high acidity and sugar concentration of their concentrates, favoured the growth of acid - and sugar – tolerant *Lactobacillus* spp (Frazier and Westhoff, 2002). The presence of *Staphylococcus* in some of the juices is indicative of human contamination, probably during processing as the organism, is the normal flora of skin, mouth and upper nasopharyngeal cavity and is capable of producing enterotoxin in man when ingested with contaminated juice. This agrees with Ikine (1983), who observed the isolation of *Staphylococcus spp* in fruit juice drinks sold in Port Harcourt, Nigeria. Poor handling during production (mixing of sugar or flavour) can as well be possible source of contamination. Use of partially sterilized containers may as well contribute to the result obtained.

The presence of *Bacillus* spp in some of the juice may be from machines used during processing and production, due to poor sanitation and sterilization associated with some fruit juice packaging industries (Prescott *et al*, 2002). *Pseudomonas* spp are known to persist and multiply in moist places as it is always the case with production equipment. This may be the reason for its isolation in some fruit juice brands.

The absence of *Salmonella* spp and *Shigella* spp shows improved hygienic and sanitary conditions. Production of safe food products requires good agricultural practices (GAPs) and good manufacturing practices (GMPs).

Generally, nutrient compositions of the juice are capable of supporting the growth of the isolated bacteria. Furthermore, the level of quality control and assurance observed by different fruit juice packaging industries plus other factors may have contributed to the disparity in the number of both heterotrophic and coliform bacteria obtained in different brands of fruit juice assessed.

Consequently, the National Agency for Food and Drug Administration and Control (NAFDAC) and other related Agencies, should as a matter of urgency ensure strict adherence to good manufacturing practices (GMPs) and established food laws and standards.

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