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Quality and Safety Assessment of Locally Processed Fresh Fruit Juices of Restaurants, Cafes and Juice Bars in Three Divisional Secretariats (Dehiwala, Rathmalana and Moratuwa) of Colombo District

By

Loku Pothagamage Nishani Sandamali Jayawardhana

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Loku Pothagamage Nishani Sandamali Jayawardhana

Thesis submitted to the University of Sri Jayewardenepura as the partial fulfillment requirement for the award of the degree of Masters of Science in Food Science and Technology.

Department of Food Science and Technology Faculty of Graduate Studies

University of Sri Jayewardenepura

Sri Lanka

DECLARATION

This work describe in this thesis was carried by me as the partial fulfillment of the requirement for the Degree of Masters of Food science and Technology under the supervision of Professor Ranaweera .K.K.D.S, Department of Food Science and Technology, university of Sri Jayewardenepura. Report of this thesis has not been submitted in whole or in part of any University or any Institute for another degree.

Date

.....L.P.N.S. Jayawardhana.....

L.P.N.S.Jayawardhana

This is to certify that above statement made by the candidate is true and suitable for submission to the University for the purpose of evaluation,

25/1-2014

.....

Professor K.K.D.S. Ranaweera.

Department of Food Science and Technology

University of Sri Jayewardenepura

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DEFINITIONS

1. **Aerobic:** Grows in the presence of atmospheric oxygen.
2. **Aliquot:** The portion of food that is inoculated into a container of bacteriological medium in accordance with a specified method.
3. **Analytical Unit**: The amount of product withdrawn from the sample unit for analysis
4. **Coliform:** A gram-negative, facultative rod shaped bacterium that ferments lactose, producing gas.
5. **Contamination:** The effect exerted by an external agent on food so that it does not meet acceptable food hygiene standards or is unfit for human consumption.
6. **HACCP system:** An effective management tool for food safety assurance that can be applied to all sections of the food chain.
7. **Indicator:** Historically, an organism itself non-pathogenic, but often associated with pathogens, used to portray a risk of the presence of pathogens for which feasible methods of detection were not generally available (sometimes called 'index organisms').
8. **Lot:** A batch or production unit which may be identified by the same code. When there is no code identification, a lot may be considered as (a) that quantity of product produced under essentially the same conditions, at the same establishment and representing no more than one day's production; or, (b) the quantity of the same kind of product from one and the same manufacturer available for sampling at a fixed location.
9. **Mesophile:** A microorganism with a growth optimum around 20o to 45°C.
10. **Microbiological guidelines:** A microbiological criterion used by a manufacturer or regulatory agency to monitor a food, ingredient, process, or system; often used also to describe a microbiological criterion where no standard has been prescribed.
11. **Pathogens:** Organisms that cause disease.
12. **Sample Unit**: Usually a consumer size container of the product, and should consist of a minimum of 100 g (ml). A sample unit is often referred to as a subsample.

13. **Sample**: The sample units (subsamples) taken per lot for analysis.
14. **Total coliform counts (TCC):** The number of colony-forming units of gram-negative, facultative rod shaped and lactose fermenting bacteria present per gram or per ml in the analytical unit as determined by a standard method.
15. **Total viable counts (TVC):** The number of colony-forming units of aerobic mesophilic bacteria present per gram or per ml in the analytical unit as determined by a standard method

ABSTRACT

Fresh fruits are essential components of the human diet and there is considerable evidence of the health and nutritional benefits associated with the consumption of fresh fruits..However, many outbreaks of human infections have been associated with the consumption of contaminated fruit juices. During processing contamination from raw materials, equipment or food handlers could be easily transferred to the final product of fruit juices resulting foodborne illness. Common bacterial illnesses associated with contaminated fruit juices are staphylococcal food poisoning, Salmonellosis, shigellosis and diarrhea associated with enterotoxogenic E. coli. Most of the fruit juices being served had high microbial load. So that, these products could be the cause of health problems and potential vehicle of food borne outbreaks (Ketema et al, 2008). During this study it was focused on such type of hygienic problems that have impact on quality and safety of locally prepared fruit juices.

The aim of the present study was to assess the quality and safety of Locally Prepared unpasteurized fresh fruit juices sold for immediate consumption in restaurants cafes and Juice Bars in three Divisional Secretariats of Colombo district namely Dehiwala, Rathmalana and Moratuwa

Microbial quality and safety of four types of fruit juices (mangoes (*Mangifera indica*), oranges (*Citrus sinensis*), Papaya (*Carica papaya)* and pineapple (*Ananas comosus)* were determined by identifying, total viable count (ISO 4833:2003), total coliform count (ISO 4831:2006), total staphylococcal count (ISO 6888-1: 1999) and total salmonella count (ISO 6579:2002). At the same time using questionnaire, details on hygienic conditions of preparation sites, cleaning and sanitizing practices with their frequencies, fruit storage conditions, personnel hygiene practices and fruit preparation techniques prior to process also were assessed during December 2012 to June 2013. Sampling and testing were done by fully competent staff of QA department, GlaxoSmithKline pvt ltd, Sri Lanka.

The present study evaluated bacterial profile of locally prepared fresh fruit juices. And also through this study it was assessed the hygienic conditions of processing and handling of locally prepared unpasteurized juices. As a major achievement it was helpful to assess quality of locally prepared unpasteurized fresh juices in terms of basic hygienic problems associated with and in order to recommend remedial action for identified problems. Finally it enabled to identify juice types that are more susceptible to contamination.

CHAPTER 01 - INTRODUCTION

Fruit juices are well recognized for their nutritive values, minerals and vitamin contents. In many tropical countries they are common beverages and are sold at all public places and roadside shops which are widely consumed by millions of people. These juices provide a source of readily available and affordable source of nutrients to many sectors of the population. Unpasteurized juices are consumed owing to consumer preferences for fresher, more nutritious foods that also happen to meet the needs of busier lifestyles and hence, in recent times, their demand has increased.

Fresh fruit juices have no artificial color, sweetness is natural, and that is why they are preferred over bottled or canned juices (Addo *et al* 2008; Melbourne, 2005).

Freshly squeezed fruit juices have little or no process steps that reduce pathogen levels, if contaminated, such as no kill step. Freshly squeezed juices are simply prepared by extracting, usually by mechanical means, the liquid and pulp of mature fruits. The final product is an unfermented, unclarified, untreated juice, ready for consumption.

Fruits usually require some preparation before being fed into the juicer. Fruits such as, mangoes (*Mangifera indica*), oranges (*Citrus sinensis*), Papaya (*Carica papaya)* and pineapple (*Ananas comosus)* will need prior preparation due to the bitterness of the skin or to remove large pips and stones. Once prepared, the fruit can be feed into the juicer / mechanical blender. The juice will be extracted and any pulp will be simultaneously removed. During the process, contamination from raw materials, equipment or food handlers could be easily transferred to the final product.

There are differences in the handling of each type of fruit intended for juice. Overall, unpasteurized juice manufacturing includes several processing steps, such as receiving, storing, washing, grinding and extraction, separation/centrifugation, blending of ingredients, and storage. The first processing step is a receiving protocol which includes fruit inspection and grading. After fruits are received and hand-sorted on a conveyer belt, they are mechanically scrubbed and washed with a sanitizing solution, rinsed with water, and ground into a pulp that is consistency of sauce. There are many ways to extract juice depending on the type of

fruit and they include squeezing, pressing, grinding, etc. A hydraulic press squeezes/pressed the pulp to extract juice, which flows into refrigerated thanks. The pressing operation can range from manual to mechanical with complete automated system common in the juice industry. A simple example of a flow chart for juice processing can be seen in Figure 1.

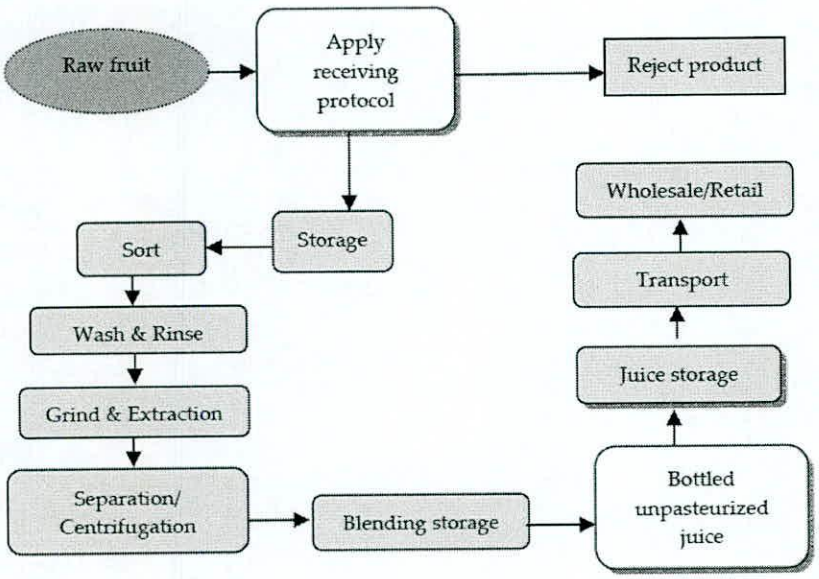

Figure 1.1: Flow chart of Juice Processing

Source: Qualitative Microbiological Risk Assessment of Unpasteurized Fruit Juice and Cider (Biljana *et al*, 2013).

However, it is well known fact that food serves as very good medium for growth of microorganisms especially when the principles of hygiene and sanitation are not met the food becomes contaminated by pathogens from humans or from the environment during production, processing or preparation. Pathogenic organisms can enter fruits through damaged surfaces, such as punctures, wounds, cuts, and splits. This damage can occur during maturation or during harvesting and processing. A pathogen that has become internalized within a fruit must be able to survive in the product until it reaches the consumer in order to become a public health hazard. Most fruit juices are sufficiently acidic to inhibit the growth of pathogenic organisms (Melbourne, 2005).

Studies conducted on the survival, or growth of microorganisms in produce and juices have shown a number of pathogenic organisms can be present and survive in a wide range of