Assessment of Microbial Load in Fruit Juices

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ABSTRACT: Introduction: Fruit juices are regarded as the most preferred non-alcoholic beverage worldwide to all age groups. In general, microbial growth in fruit juice is restricted by using preservatives and also through other environmental factors during production. Still, the presence of some indicator organisms in fruit juice is responsible for causing food-borne diseases. So, from a public health point of view, it is quite important to know the microbiological quality of the fruit juices available in the market.
Aim and Objective: To assess the microbial load in fresh fruit juices from 0 to 8 hrs and to get information on the incidence of food borne diseases related to street vended juices and to estimate the level of contamination.
Materials and Methods: 2 different fresh fruit juice extracts were collected and system sure ATP test swabs were used along with a bio luminometer to assess microbial load and the calibrated readings were noted.
Results and Conclusion: Statistical analysis was done using Mann Whitney test. If the p value is less than or equal to 0.05 , it is considered significant. Here the value is 0.013 which is less than 0.05 so there is a significant difference in microbial load in the two different juice samples taken. In conclusion, the ATP bioluminescence could be considered a practical, useful method to assess street food hygiene, performing better than visual inspection if properly adopted.

Keywords: Novel method, microbial load ,fruit juice, bio luminometer, ATP, innovative technique.

1. INTRODUCTION

Juice is any concentrated form of the aqueous liquid or puree from one or more fruits or vegetables, as well as any purée made from the edible components. Fruit juices are used for their nutritive content, refreshing qualities, and medicinal benefits.These juices are regularly consumed unpasteurized(1). During fruit growth and harvest, pathogenic microorganisms might enter through punctures and damaged surfaces. Microbes from raw materials, juice machines, handlers, and unsanitary circumstances could infect juices.(2).The presence of microorganisms such as bacteria, yeasts, and moulds in fruit juices is what causes

doi.org/10.31838/hiv23.03.11 Received: 28.10.22, Revised: 30.11.22, Accepted: 31.12.22

food deterioration, fermentation, and food-borne illnesses.(3).

The public's health is being severely harmed by microorganisms that are resistant to antibiotics.A small number of new antibiotics are being created compared to the rising rates of bacterial resistance.The creation of new antibacterial tactics is urgently needed.(4)
There is frequently a paucity of knowledge regarding the prevalence of food borne illnesses associated with the street-vended meals in nations where this practice is prominent. However, microbiological analyses of these meals conducted in American, Asian, and African nations have found elevated levels of bacterial pathogens. Human disease outbreaks have been linked to the intake of unpasteurized fruit and vegetable juices and fresh products in reported cases.(5) Unpasteurized fresh orange juice tainted with Salmonella was discovered to be responsible for an epidemic in a Florida theme park in 1995. More than 60 visitors experienced problems.(6)The street-sold sugarcane juice in Pune, India, that contained ice which was contaminated with Vibrio cholerae was the cause of a cholera epidemic there.(7)

Thus in the light of the following uneventful incidents and in the increasing demand and consumption of fresh fruit juices, there is a need to assess the microbial load in freshly prepared fruit juices.In the food business, ATP bioluminescence monitoring has been frequently utilised to identify microbial contamination.(8). Earlier, the only methods for doing such evaluations were visual and tactile inspections, supplemented by conventional microbiological swabbing or plating procedures.However, starting in the 1990s, ATP-based bioluminescence assays have been employed more frequently in the food industry and more recently in the medical industry as important means of hygienic assessment, either alone or in conjunction with traditional microbiological and inspection methods.(9) Our team has extensive knowledge and research experience that has translate into high quality publications (10–19))(20–29)).

The main aim of this study was to assess the microbial load in different fresh juices from different fruit juice stalls from 0 to 8 hours on a hourly basis using a bio luminometer and to get information on the incidence of food borne diseases related to street vended juices and to estimate the level of contamination.

2. MATERIALS AND METHODS:

Two different fresh juice extracts were collected from two different fruit juice vendors, namely muskmelon juice(juice 1) from one fresh fruit juice vendor and watermelon juice (juice 2) from another fresh fruit juice vendor. These two juice samples were selected in particular because of the high customer demand in the locality. After collection of the fresh juices they were tested separately for microorganisms by using ATP swabs. UltraSnap is a user friendly ATP test used for assessing the cleanliness of food contact surfaces and other processing equipment after cleaning. Together, with SystemSURE Plus ATP bio luminometer we can measure the ATP present in a sample. Test results are delivered in 15 seconds and are expressed in Relative Light Units or RLUs. An RLU result is directly proportional to the amount of ATP collected from the sample,so the greater the amount of ATP, the greater the RLU number, and the dirtier the surface. UltraSnap’s pre-moistened swab bud breaks through biofilms and ensures maximum sample collection for accurate results.

The bio luminometer is turned on before beginning testing to allow time for the systems calibration, self-check to run. Remove the first swab from the tube. Swab

a 4x4 in the muskmelon juice first. Apply sufficient pressure to maximise sample collection and improve the accuracy of test. Be sure not to touch the swab shaft when collecting sample. This could contaminate the test and cause inaccurate results. Rotate the swab tip while swabbing to ensure maximum sample collection. Replace the swab in the tube. The easiest way to activate UltraSnap is by holding the device in the fist and using the thumb and forefinger to break the Snap-Valve by bending the bulb forward and backward. Next, the bulb is squeezed twice to expel liquid into the tube. Then it is shaken for 5 seconds. Then the swab is inserted into the read chamber and close the lid. Then the luminometer is held upright and OK is pressed to initiate measurement. Results were displayed in 15 seconds. This process was repeated for the other juice sample. The same steps were repeated once for every hour for both the juice samples and the observations were noted down.

3. RESULTS AND DISCUSSION

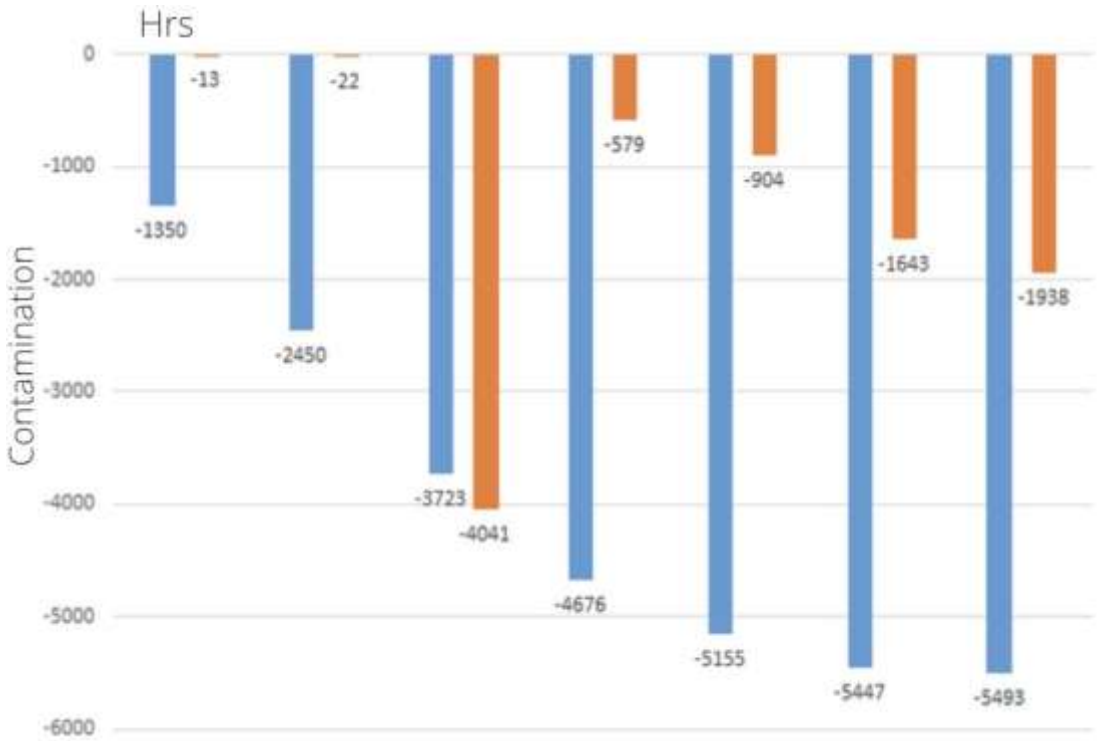

Figure 1: Microbial load in fruit juices.

After the observations were noted a graph was plotted by taking contamination on the X axis and the hours on the Y axis. The blue bar represented the muskmelon juice sample and the orange sample represented the watermelon juice sample (Figure 1). . The more the negative value is, the more is the contamination. It was observed that the muskmelon sample had a value of -1350 on the first 0-1 hour of observation itself whereas the watermelon juice had a contamination value of -13 only and on subsequent hours of observation it was found that the negative value of the muskmelon and watermelon juice sample increased considerably as bacterial infestation is bound to increase. At the end of 8 hours , the muskmelon juice sample had a contamination value of -5493 whereas the watermelon juice sample had a contamination value of -1938.

The mean values were taken and it was calculated to be -4042.0 for muskmelon

juice and -1305.71 for watermelon juice. The standard deviation was calculated to be 1612.61 for muskmelon juice and 1414.44 for the watermelon juice sample. The significant value or p value was calculated to be 0.013. Mann Whitney U test was used for significance testing, if the p value is less than or equal to 0.05, it is considered significant. Here the value is less than 0.05 so there is a significant difference in microbial load in the two different juice samples taken. Our team has extensive knowledge and research experience that has translate into high quality publications (30), (31), (32), (33), (34), (35,36), (37), (38), (39), (40).

Previously a study was done assessing microbiological quality of some drinks sold in the streets of Dhaka University Campus in Bangladesh. For the study purpose papaya juice, sugarcane juice, tukmaria sherbet, lemon sherbet and wood apple sherbet were taken as samples. The study showed a high microbial load in the drinks. The range of average total viable count (microbial load) and total coliforms were 7.7×103 - 9×108 cfu/ml and 210–1100 cfu/100 ml, indicated the heavy presence of microorganisms in all the drinks analysed in this study. The study revealed that tukmaria sherbet was most contaminated with a count of 9×108 cfu/ml. The least contamination was observed in lemon sherbet.(41)

4. CONCLUSION

The above research along with other previously done research on assessment of microbial load in fruit juices proves that there is still an impending need for development in hygienic and working conditions of fresh fruit stalls since the juices seem to have high microbial load which may pose a major health threat to consumers. New applications are now trying to make use of the light from bioluminescence for various purposes such as to effect healing in the form of bioluminescence based photodynamic therapy (PDT) or using the light for bioluminescence-induced photo-uncaging of small molecules and the use of bioluminescence to control neurons.Exciting recent blue-sky research is also discussed such as the engineering of a light emitting plants of various types.

In conclusion, the ATP bioluminescence could be considered a practical, useful method to assess street food hygiene, performing better than visual inspection,if properly adopted.

Conflict of Interest :

The authors hereby declare that there is no conflict of interest in this study.

Acknowledgement :

The authors express their gratitude to Saveetha Dental College & Hospitals for supporting and for successful completion of this project.

Source of funding:

The present project is funded by

1. Saveetha Institute of Medical and Technical Sciences
2. Saveetha Dental College and Hospitals
3. Saveetha University
4. Leo Dental Clinic

Author Contribution :

A) Sabrina Leon - contributed in designing the study, execution of the project, statistical analysis, manuscript drafting.

B) Dr. Jayalakshmi Somasundaram - contributed in designing the study, execution of the project, statistical analysis, manuscript drafting.

C) Dr.V.Vishnupriya - contributed in study design, guiding the research work, manuscript correction.

D) Dr. Gayathri R - study design, statistical analysis, manuscript proofreading and correction.

E) Dr. Kavitha S - study design, statistical analysis, manuscript proofreading and correction.

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