Research Article

Microbial Analysis of Street Vended Fruit Juices and the Hygienic Knowledge, Attitude and Practice of Fruit Juice Vendors

Srisangavi Ramesh T, Sivapriya Thiyagarajan*

Department of Home Science, SDNB Vaishnav College for Women, Chrompet, Chennai, Tamil Nadu, INDIA.

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ABSTRACT

Food borne diseases caused by improper food handling practices bring about dreadful diseases that has an adverse effect on human life. The study was conducted to assess the microbial quality of street vended fruit juices and to investigate the knowledge, attitude and practice of street vendors who sell fruit juices. Microbial population of selected fruit juices were assessed by total viable count and total coliform count. Knowledge, attitude and practices of the street vendors were assessed by using a check list. Among the 5 samples collected, Sample C was contaminated by more colonies of *E. coli* – 180 CFU/ml. Paired *t* Test" was used to analyze the pre and post-test knowledge of street juice vendors towards food borne illness, p value was found to be 0.000 (< .001) which is highly significant. Street vendors should take food safety training given by the government, so that they will gain knowledge about hygienic practices. Consumers should be made aware of foodborne illness like hepatitis, typhoid, cholera etc.

Key words: Fruit Juices, Food safety, Foodborne Diseases, Microbial colony count, Hygiene, Public health.

Correspondence:
Dr. T Sivapriya
Assistant Professor, Department of Home Science, SDNB Vaishnav College for Women, Chrompet, Chennai, Tamil Nadu, INDIA.

Phone no: +91 9789066088
Email: sivaamanick@gmail.com

INTRODUCTION

Street vended fresh fruit juices are on high demand because of their stunning nutritive value, taste and flavour. Fruit juices are rich in water, fiber, vitamins, sugar, proteins and phytochemicals which are of great benefits to mankind.[1] Their high cellulose and fibre contents also help in the regulation of the digestive system.[2] Regular intake of fruits and vegetables has been associated with low incidence of chronic diseases such as cancer, cardiovascular diseases, chronic obstructive pulmonary diseases, osteoporosis, etc.[3] Fruit and vegetable juices play role in detoxification of human body and also have a great role in improvement of blood lipid profile in patients of hyper-cholesterolemia.[4] The demand of fresh juices has increased day by day and is preferred throughout the world. Also, fruit juices are an instant source of thirst quenchers for travellers.[5]

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The concern on food safety is very high in street vended fruit juices due to improper handling practices of raw materials, unhygienic water, unclean utensils and hands, preparation process, environment in which the juices are sold, swarming of flies on place of preparation, and poor hygienic knowledge among the juice sellers promote the contamination of juices.[6]

Fruit juices sold on road side were found to be contaminated with faecal coliforms like *Escherichia coli*, Staphylococcus *aureus*, *Shigella* spp. This higher incidence of fecal coliforms in fruit juices shows that water and ice used for juice preparation may be of poor quality. Thus, there have few been instances of food poisoning in fruit juices but microbial spoilage is very common.[7]

Bacteria isolated from fruit juice samples included *Escherichia coli*, *Micrococcus* spp., *Staphylococcus aureus*, Salmonella spp., *Shigella* spp., *Pseudomonas* spp., *Enterobacter aerogenes*, *Streptococcus* spp. and *Bacillus* spp. Fungi isolated included *Aspergillus* spp., *Rhizopus*,

Saccharomyces spp, *Penicillium* spp., *Rhizopus* spp., *Fusarium* spp., and *Neurospora* spp. Parasite found were *Ascaris lumbricoides*, *Trichuris trichiura*, hookworms, *Schistosoma* spp., *Giardia lamblia* and *Entamoeba hartmani*.[8] The pathogens of main concern are *Salmonella* spp. and *Escherichia coli* O157:H7.[9]

The microbial quality assessments and preventions measures are the utmost needs to improve the quality of fresh fruit juices to avoid the contaminations. Street vendors should be given education based on the standard operating procedures of FSSAI so that microbial contamination and food poisoning can be reduced to a great extent. The present study was therefore undertaken to assess the microbial quality of various types of fresh juices and to assess the knowledge, attitude and practice among fresh fruit juices vendors along the road side.

MATERIALS AND METHODS

The study was carried out in Greater Chennai city after getting approval from the Independent Human Ethics Committee (IHEC) dated: 04/09/2019 (Protocol No. SDNBVC/HSC/IHEC/2019/25), conducted by the Department of Home science, SDNB Vaishnav college for women, Chromepet, Chennai-44. A cross-sectional study was conducted to find out the most popular fruit juice sold in Chennai city. Based on stratified sampling, Chennai city was divided into five zones and five samples of sugar cane juice was collected and investigated for microbial population. A total of fifty fruit juice vendors were assessed for knowledge, attitude and practice, given food safety education and the impact of food safety education was assessed using a validated check list.

Experimental design was carried out to analyse the microbial population of selected fruit juices From each zone, freshly extracted fruit juice (150 ml each) were collected in sterile containers and transported to the laboratory through ice box by maintaining 4°C temperatures and processed within an hour after collection. In this process, pH of all undiluted samples were measured immediately after getting the samples to the laboratory.

The chemicals and reagents used in the study were of analytical grade and bought from standard manufacturers, Himedia laboratories, Merck India Ltd., Rankem Pvt Ltd. All the glassware utilized in the present study was of Borosilicate quality and purchased from Schott Duran and Riviera glass Pvt. Ltd. India. Various media and distilled water used in present study were sterilized in the autoclave. Forceps, loop and spreader were flame sterilized prior to use. All inoculated plates were incubated under aerobic conditions at 37°C for 24 hr. The mean number of colonies counted was expressed as log colony forming units (CFU)/ml.

A pretested interview schedule and check list was administered on juice vendors to obtain data on general profile, knowledge, and practices. Observational check list was used to assess the behavior and personal hygiene of juice vendors. Data was analyzed by latest SPSS version Software. *P*-value less than 0.01and 0.05 was considered statistically significant.

RESULTS

A survey was done among one hundred street vended fruit shops throughout Chennai to know about the most popular fruit juice that was consumed by the customers. Sugarcane juice was the most popular fruit juice sold throughout Chennai city. Sugarcane juice was sold more in number because of its nutritional benefits, taste and cost effectiveness. Among 100 fruit juice shops surveyed sugarcane juice was sold in 71 shops. Hence in the present study, sugarcane juice was selected to carry out the microbial analysis.

Among the collected 5 samples, (Table 1) the total viable content of sample A was 1520 CFU/ ml when compared to the other samples. Sample A was collected in the north zone of Chennai- Vepery. Since 1000 CFU/ ml is the safer limit for the micro-organism.[11] Sample

Table 1: Shows Total viable count and coliform count of freshly prepared sugarcane juice.

Sample	Location	TVC CFU/ml	Yeast CFU/ml	Fungi CFU/ml	Mould CFU/ml	Ecoli CFU/ml	Acceptablity
A	Vepery	1520	20	275	10	85	Acceptable
B	Parry's corner	765	15	650	10	235	Unsatisfactory
C	Guindy	520	5	725	5	180	Unsatisfactory
D	T.Nagar	935	15	625	5	75	Acceptable
E	Nungambakkam	525	5	420	5	35	Acceptable

(Acceptable limits as per the guidelines of NSW food authority, 2009).[10]

A, (Figure 1) had 1520 CFU/ml. and indicated higher contamination. Further analysis was carried out to study the coliform count of the samples. Presence of coliform bacteria in samples indicate faecal contamination.

Among the 5 collected samples, (Figure 2) sample B contained 235 CFU/ml of *E. coli*. Sample C (Figure 3) contained 180 CFU/ml of *E. coli*. The remaining samples A, D and E contained *E. coli* below 100 CFU/ml of *E. coli*.

Based on the guidelines given by NSW food authority, 2009. Samples B and C sold at Parry's corner and Guindy were unsatisfactory for human consumption while A, D and E are acceptable for consumption.

Demographic profile of street vendors

Study on the demographic characteristics of street fruit juice vendors exposed that, among the selected subjects 46% were under the age group of 31 - 40, 32% were under the age group of 41 - 50 and 22% were under the age group of 51 - 60. Among the vendors, 72% were male vendors and remaining 28% were female vendors. When information about the educational status of vendor's were elicited, 34% of vendors have finished their higher secondary education, 20% had completed their elementary school, while 20% of them are done with high school. Among the selected vendors, 30% of them were illiterates.When the street food vendors were enquired about food safety practices, it was shocking to find that none of them had underwent food safety training. (Table 2) During food safety education, the vendors were stressed about the importance of food safety education and the impact of it to the public. They were also told about FSSAI, and the various courses it conducts to the street food vendors.

Among the vendors, (Table 3) 86% of the vendors were vigilant about wearing clean clothes and during the time of observation, they were dressed neatly. The remaining 14% were not wearing clean clothes. When they were asked about the reasons, a few of them were unaware about the adverse effect of wearing dirty clothes. Some of the vendors replied that they were wearing clean clothes when they started from home and standing on the dusty roads, for the whole day had made their dresses dirty and unclean.

Only 40% of vendors were using the hair cap and gloves during their work, other 60% were not using hair cap and gloves. Among these 40% of vendors 18% were using only hair caps and 22% were using only gloves. About 74% of workers cut their nails while remaining workers 26% do not cut their nail. Only 14% of vendors had the habit of chewing betel and remaining 86% did not chewing betel. 4% of vendors were smoking during their work and 96% did not smoke. Majority of the vendor 86% did not spit near the work place and remaining 14% were spitting near the work place.

In the present study, (Table 4) a "Paired *t* Test" was used to analyze the pre and post-test knowledge of street juice vendors towards food borne illness.

In paired t test, p value was found to be 0.000 (< .001) which is highly significant. It is proved that after the post food safety education there is an increase in knowledge among the vendors when compared to pre food safety education about the food borne illness

DISCUSSION

Street food safety is highly dependent on the handling of raw food to the cooking of food till its consumption. The fact that street food vendors possess the underprivileged local infrastructure in general, lack of sanitary facilities, no proper training about food hygiene, poor sanitation and limited knowledge of personal hygiene have posed

Table 2: Knowledge, attitude and practice of the street fruit juice vendors.

	PRE			POST		
Statement	**Yes**	**No**	**Don't Know**	**Yes**	**No**	**Don't Know**
Children, Pregnant women, elderly and healthy individual are at risk for food poisoning.	33(66)	9(18)	8(16)	46(92)	2(4)	2(4)
Hepatitis A virus is a food born pathogen.	15(30)	5(10)	30(60)	35(70)	3(6)	12(24)
Salmonella typhoid fever is transmitted food born pathogen.	33(66)	7(14)	10(20)	43(86)	2(4)	5(10)
Washing hands before and after work reduce contamination.	44(88)	3(6)	3(6)	47(94)	1(2)	2(4)
Improper washing of fruits, utensils increase food contamination.	32(64)	8(16)	10(20)	43(86)	3(6)	4(2)

A validated checklist was used to find the knowledge attitude and practice of the fruit juice vendors before and after food safety education. A total of fifty vendors were selected form different locations as per stratified sampling and were elicited the following questions.

countless problems.[11] Many studies conducted to assess the quality of street foods in various countries show that most of the times such food is not up to the safety standards, many are responsible for various foodborne diseases[12] and known to be the greatest challenges of the 21st century.[13] Food borne infections and intoxications are very common in developing countries. Quality of drinking water and juice is very important because it directly influences the health status of a particular locality. Juices can transmit pathogenic microorganisms which can be incorporated by different ways like raw materials used in juice preparation, fruit quality, equipment and hygiene of preparation area as well as the juice makers.[14]

In a study conducted by,[15] Most Probable Number (MPN) method was performed by three consecutive steps including presumptive test, confirmed test and completed test. Out of fifteen fruit juice and fifteen water samples tested, it was found out that only one juice sample and two water samples were non-potable. Other samples were potable in the sense that they were free from faecal contaminations. Such result indicates that the overall quality of fresh fruit juices is good. The processing method, maintenance of hygiene, quality of water and ice used here were followed properly which reflected on the results.

Pineapple juice samples showed the high bacterial contamination with all samples positive for fecal coliforms and *Shigella* spp. (100%). Significant difference among fruit juices for prevalence of microorganisms was seen only for *Escherichia coli* ($P = 0.03$) with least count in Grape juice (20%).[16]

Study by Orji and co-workers evaluated the total bacterial and fungal counts of 17 ready-to-eat vended fruits in Abakpa State and revealed the isolation of 5 bacterial species (*Staphylococcus aureus*, *Salmonella* spp., *Escherichia coli*, *Shigella* spp. and *Pseudomonas* sp.), as well

Table 3: Assessment of fruit juice street vendor's hygienic practices by observation check list. Vendor's hygienic practices were assessed through an observation check list.

S.No	Practices	Yes	No
1.	Wearing clean clothes	43(86)	7(14)
2.	Use hair cap and gloves	20(40)	30(60)
3.	Nails cut	37(74)	13(26)
4.	Washing hands before preparation	31(62)	19(38)
5	Chewing betel	7(14)	43(86)
6	Smoking during work	2(4)	48(96)
7	Spitting near by	7(14)	43(86)

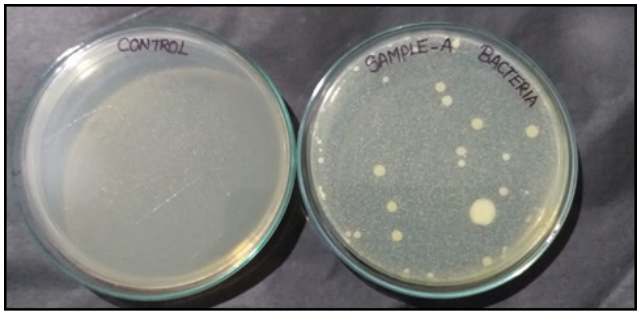

Figure 1: Sample A- Total viable count.

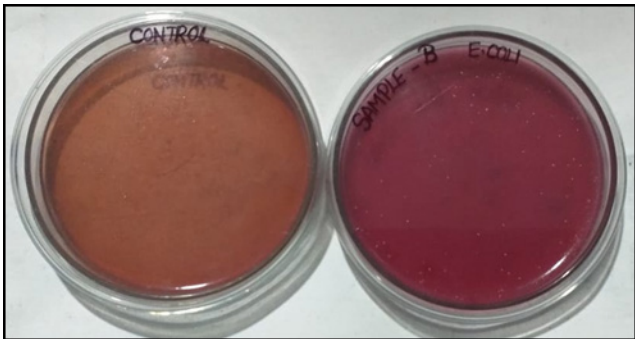

Figure 2: Sample B - Total Coliform count.

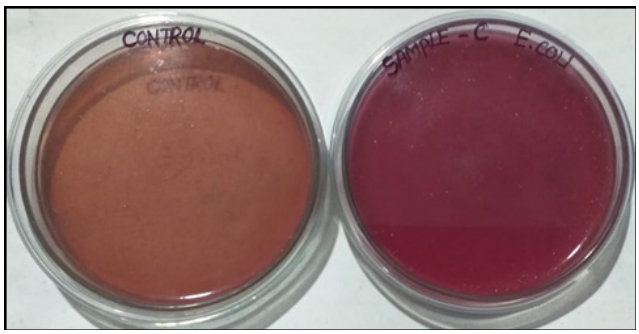

Figure 3: Sample C- Total Coliform count.

Table 4: Paired *t*-Test to compare the pre and post knowledge attitude and practices.

	Paired Difference					T	df	Significance (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1Post – Pre	1.820	1.637	.232	1.355	2.285	7.859	49	.000*

as 1 fungal species (*Mucor* sp.). A range of 3. 5×105-1. 0 3×106 CFU/ mL, total aerobic plate count was recorded.[17] Research conducted by Wadamori on 20 samples fruit juice samples revealed high microbial load up to 90% non-fecal coliform (80%) fecal coliform, (60%) molds, (70%) yeasts, and (90%) heterotrophic bacteria. Total and faecal coliform counts ranged from 3.7×105 to 6. 8×105 cfu/g and from 3. 2×105 to 5. 8×105cfu/g respectively.[18] Fresh squeezed juices of sugarcane, lime and carrot sold by street vendors in Mumbai city were analysed for their microbial contents. The total viable counts of all 30 samples were approximately log 6.5 cfu/100ml with significant load of coliforms, faecal coliforms, Vibrio and Staphylococcal counts.[19]

Contrary to our study, all the respondents (n = 50) were male subjects in a study conducted by.[20] About 30% and 46% of vendors have completed their secondary education and primary education respectively which are comparable with the studies conducted in Bahirdar and Malaysia.[21]

About 60% of vendors had knowledge on contamination of food, of which 44% of them were able to recognize contaminated food by various senses like smell (16%), appearance (14%), and taste (8%). Around 36% of the vendors thought that the consumption of spoiled fruits can cause diarrhea or vomiting, but none of them knew the reason for contamination. About 92% of vendors thought that hand washing is necessary before preparation of fruit juice, but our observational studies indicated that only 10% of the vendors were followed it to practice. About 86% of vendors were aware about the necessity of washing utensils with soap and water but only 4% of them translated it into practice.[22]

In a study carried out by Omemu, 2008,[23] few vendors (12%) acquired the knowledge of food preparation by formal training. Only 31% of the respondents had the annual medical health certificate to indicate that they have carried out the recommended physical and medical examination.

The study revealed that most of the vendors practiced to sell their food items without wearing gloves similar to the study done in Uganda, where the majority did not wear gloves. Majority of them did not cover their head and 76.8% did not wear an apron with a significant relationship with the type of food [24]

Iyoha and Agoreyo in their study recommended that the government should make law persuading hawkers or venders of ready to eat fruits to use cool temperature controlled system or cabinet or cupboard.[25] In addition, Orji *et al.* recommended that government health officials should carry continual inspections to production, harvesting, processing and marketing sites of fruits and vegetable to ensure that the source of water that they use in washing their fruits and vegetables, packaging materials and personal hygiene of venders is appropriate.[26] Results demonstrate the urgent need for government participation in developing suitable intervention measures to improve microbial quality of juices. Important aspect of the study was that, vendors were willing to have food safety training and learn about the key traits of food safety.

CONCLUSION

There is an immense need to impose education on the food safety knowledge and practices before vendors are allowed to trade. Government should legalize the standards of food safety in the light of recommendations of WHO and monitor the sanitary and hygienic conditions on a regular basis. Food safety training programs should be initiated on ground level to mass level. Media can also play the role of raising awareness on hand washing and proper food safety handling practices necessary for food handling and preparation

ABBREVIATIONS

FSSAI: Food safety and standards authority of India; **CFU:** Colony forming units; **TVC:** Total viable count; **MPN:** Most probable number; **WHO:** World health organisation; **NSW:** New south Wales.

SUMMARY

The nutrients and benefits provided by fresh fruit juices are unique and cannot be furnished by any food stuff. Hence Public should be encouraged to have fresh fruit juices instead of packed beverages. Fruit juice vendors should be provided food safety education and the quality of juices sold on road side should be strictly monitored by means of mobile quality control units. So that vendors will be vigilant enough and the incidence of infectious diseases can be controlled.

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