Plant Archives Vol. 17 No. 2, 2017 pp. 1311-1318 ***ISSN 0972-5210***

STUDIES ON MICROBIOLOGICAL ANALYSIS OF STREET VENDED FRESH FRUIT JUICE AND THEIR COMPARISON WITH THE PROCESSED JUICES

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Abstract

Fresh fruit and vegetable juice samples (169) and processed fruit juices (11), *viz*, (71 samples of sweet lime, 40 samples of sugarcane juice, 25 mango juice samples, 22 mixed vegetable juices and 11 pineapple juice samples) were collected during the practical analysis from different carts and shops in different areas of Allahabad city. Under processed fruit juices, readily available packed samples sold under different brand names were also analysed for their microbial load. The juices were extracted either by manual juicer or electric juicer with minimal hygienic precautions. On studying the TVC in various fruit juices highest counts were observed in case of mango juice *i.e.* (18×10^4 cfu/ml) and minimum in case of pineapple juices (13×10^4 cfu/ml). The TVC in various processed fruit juices also showed the highest counts in mango juices *i.e.* (2.0010^4 cfu/ml) and minimum in case of pineapple juice (0.33×10^4 cfu/ml). The TVC in fruit juices from carts showed highest counts in mango juice *i.e.* (17.75×10^4 cfu/ml) and minimum in case of mixed vegetable juice *i.e.* (10.66×10^4 cfu/ml). On studying the TVC in fruit juice from shops highest counts were observed in mixed vegetable juice (24.43×10^4 cfu/ml) and minimum in case of pineapple juice ($10.83\ 10^4$ cfu/ml).

Key words : Microbiological analysis, total viable count, sweet lime, sugarcane juice, mango juice, mixed vegetable juices and pineapple juice.

Introduction

The concern with a healthier diet associated with a better quality of life has produced an increase in the consumption of fruits and natural juices (Tojo *et al*., 2003; Banan and Hedge, 2005). Codex Alimentarius defines juice as the fermentable, but unfermented juice, intended for direct consumption, obtained by the mechanical process from sound, ripe fruits, preserved exclusively by physical means (FAO, 2005). They are recognized for their mineral and vitamin contents and high nutritive values which offer great taste and health benefit. They also improve blood lipid profiles in people affected by hyper-cholesterolemia and enhance consumers' health through inhibition of breast cancer, congestive heart failure (CHF) and urinary tract infection [3]. Fruit juices are common beverages in many countries of the world. In hot climate areas, cafés, restaurants and road side stalls have local facilities to extract the juice from fresh fruits (Al-Jedah, 2001).

Raw fruit juices are among the street foods that are vended in urban areas mostly in developing countries. They are prepared by low income vendors who have poor premises and facilities and lack basic needs such as portable water. Water for street food preparation is not enough resulting in vendors using little water for washing utensils hence hygiene is compromised (Mensah *et al*., 2002; Muinde and Curia, 2005). Stalls for street foods preparation and vending are also poorly constructed, such that they can not give proper protection of the foods from dust and smoke from vehicles (Mensah *et al*., 2002). The vendors can be carriers of pathogens like *Escherichia coli*, *Salmonella*, *Shigella*, *Campylobacter* and *Staphylococus aureus* who eventually transfer these food borne hazards to the consumers. Pathogens like

Salmonella, *Campylobacter* and *E. coli* can survive on finger tips and other surfaces for varying periods of time (Sharmila, 2011).

In spite of the potential benefits offered by street fruit juices, concerns over their safety and quality have been raised. Freshly squeezed fruit and vegetable juices have little or no process steps that reduce pathogen levels, if contaminated. Fruit juices have pH in the acidic range (<4.5) serving as important barrier for microbial growth. However, food borne pathogens such as *E. coli* and Salmonella survive in acidic environment of fruit juices due to acid stress response. Therefore, in the last two decades a number of food borne outbreaks associated with unpasteurized fruit juices have been documented in many countries (Raybaudi-Massilia, 2009; Ghengheshe *et al*., 2005). Most of these outbreaks involved unpasteurized juices such as apple, orange, lemon, pineapple, carrot, coconut, cane sugar, banana, acai and mixed fruit juices (Bevilacqua *et al*., 2011).

The quality of fruit juices is strictly maintained in developed countries under several laws and regulations, but in many developing and underdeveloped countries, the manufacturer are not concerned about the microbiological safety and hygiene of fruit juices because of lack of enforcement of the law. Thus, the transmission of certain human diseases through juice and other drinks in recent years is a serious problem (FDA, 2001). In view of the demand for fresh fruit juices throughout the year and threat of emerging food borne outbreaks associated with consumption of fruit juices, one of the aim of present study was to investigate the microbiological examination of freshly prepared juices commonly consumed in Allahabad.

Materials and Methods

The laboratory work of this study entitled "Studies on microbiological analysis of street vended fresh fruit and vegetable juices and their comparison with processed juices" was carried out in the research laboratory of the Department of Food Science and Dairy Technology, SHUATS, Allahabad. A total of 169 fresh fruit and vegetable juice sample and 11 processed fruit juice samples were collected from various shops and carts of Allahabad city. The juices collected included sweet lime (71 samples), sugar cane (40 samples), mango (25 samples), mixed vegetable (22 samples) and pineapple (11 samples). Under processed fruit juices, readily available packed samples sold under different brand names were analyzed for their physicochemical properties and microbial load. Fresh fruit and vegetable juices, which are sold all over our country can also be seen in the city of Allahabad. For the present study heavily crowded carts and shop were randomly selected. Six location *viz,* three carts (College campus, Khan Chouraha and Gaughat) and three shops (Meerapur, Kareli and Noorullah Road) were chosen for the study. These carts and shops have on site facility for extraction of juices. Being easily accessible and cost effective large crowds are drawn particularly during the summer season.

Microbiological analysis

Total viable count (TVC)

The total viable count of the samples was detected by the pour plate technique. The sample were appropriately diluted in sterilized Ringer's solution, plated on nutrient agar plates in triplicates and incubated at 37±0.5^{0}C for 24–48 h. the plates showing countable number of colonies were counted and the data used to calculated the cfu/ml of bacteria present in the sample.

Total and fecal coliform test

The three – tube procedure of most probable number method using lactose broth was used to detect the coliform bacteria and to determine the most probable number (Hammad Dirar, 1982; Fawole *et al*., 2002; Bakare *et al*., 2003).

Isolation of various pathogens

a) Isolation of *Escherichia coli*, *Klebsiella* and *Enterobacter* spp.

To 5m1 of Mac Conkey broth, 0.5 ml of the undiluted juice sample was inoculated and incubated for 24 h at 37°C. Tubes showing a change of colour from purple to yellow and the presence of gas in the Durham's tube, were considered positive and a loopful of inoculum from these was inoculated into Brilliant green lactose bile broth (BGLB) tubes. After subsequent incubation, a loopful of inoculum from BGLB positive tubes, *i.e.* tubes showing the presence of gas in the Durham's tube, was streaked on Eosin Methylene Blue (EMB) Agar for isolation of E. coil and Mac Conkey agar for the isolation of Klebsiella and Enterobacter spp. After incubation at 37±0.5°C for 24 hours, isolated colonies showing the typical green metallic sheen on EMB agar, characteristic of *E. coil*, and pink (lactose fermenting), mucoid colonies on Mac Conkey agar, characteristic of *Klebsiella* and *Enterobacter* spp. were selected, purified and identified.

b) Isolation *Salmonella*, *Shigella* and *Proteus* spp.

Twenty-five milliliters of the fruit juice sample was inoculated into 225 ml of Mannitol Selenite broth (MSB), enrichment medium, and incubated for 18-24 h. A loopful of the enrichment culture was streaked on to Salmonella Shigella agar (Bergey's Manual, 1984). Non-lactose fermenting colonies showing blackening 042S production), were selected as probable *Salmonella* or *Proteus* spp., while non-lactose fermenting (cream coloured) colonies without 1-12S production were selected as probable *Shigella* spp. isolates.

Identification of various pathogens

The bacterial isolates obtained were purified using pure culture techniques and identified on the basis of cultural, morphological and biochemical characteristics.

a) Morphological characteristics Gram's staining

The pure culture of the isolates was subjected to Gram's staining (Cappucino and Sherman, 1999). The stained smears were observed under oil-immersion microscope and the cell structure, arrangement and Gram reaction was studied.

b) Cultural characteristics

The bacterial culture was streaked on nutrient agar plates and other specific media. The growth after incubation was examined to determine the cultural characteristics of each isolate.

Results and Discussion

Total viable count (TVC) in various fresh fruit juice samples (table 1) shows that the average total viable count was recorded highest in Pineapple juice (193.67) followed by Mango juice (179.87), Mixed vegetable juice (159.38), Sweet lime juice (149.63) and Sugar cane juice (129.69).

Total viable count (TVC) in fresh fruit juice samples collected from carts (table 2) shows that the average total viable count was recorded highest in Pineapple juice (211.33) followed by Mixed vegetable juice (199.22), Mango juice (161.41), Sweet lime juice (151.15) and Sugar cane juice (111.08). The significant difference thus obtained was further analyzed statistically to find out the Critical different between and within type of juice (treatments). The value of critical difference was computed as CD (5%) = 51.68.

Total viable count (TVC) in fresh fruit juice samples collected from shop shows (table 3) shows that the average total viable count was recorded highest in Pineapple juice (210.05) followed by Mixed vegetable juice (199.22), Mango juice (161.41), Sweet lime juice (151.13) and Sugar cane juice (111.08). The significant difference thus obtained was further analyzed statistically to find out the Critical difference between and within type of juices (treatments).

Total viable count (TVC) in processed fruit juice samples shows table 4 shows that the average total viable count was recorded highest in Apple juice (S_7T_{10}) (22.67) followed by Orange juice (S_7T_9) (20.00), Pineapple juice (S_7T_7) (16.00), Orange juice (S_7T_3) (15.67), Apple juice (S_7T_6) (15.33), Mango Juice (S_7T_2) (14.67), Mixed fruit (S_7T_{11}) (14.67), Pineapple juice (S_7T_5) (14.00), Mango juice (S_7T_4) (12.00), Apple juice (S_7T_1), (11.00), Mixed fruit (S_7T_8) (10.67).

The total number of viable bacteria in the food is also an adequate index of the bacteriological quality of the raw material used, cleanliness in the food processing area and the storage condition (Silliker, 1963; Manja and Sankaran, 1994). The total viable count in various fresh fruit juice ranged from pine apple juice 193.067 to sugar cane juice 129.69). While for sample from carts it ranged from pine apple juice (211.33 to sugar cane 111.08). Whereas the maximum total viable count in apple juice (S_7T_{10}) (22.67) and the minimum total viable count in mixed fruit juice (10.67) was recorded in processed fruit juice samples. However, the result were similar to those obtained by Al-Jedah Hatcher *et al*. (1992), Al-Jedah and Robinson (2002), Nagalakshmi and Reddy (1999), Ghenghesh *et al*. (2005), Kumar *et al*. (2006).

The total coliform and fecal cloiform in the various fruit juice samples was estimated using the MPN method. The results thus obtained are summarized in tables 5 and 6. The total coliform count in the various fresh fruit juice sample was estimated using the MPN method. Almost all type of juices *viz*, sweet lime (67.60%), sugar cane juice (72.27%), mango juice (56.00%) and pineapple juice (54.54%) showed values more than 50% at MPN count 10-100/100ml, except mixed vegetable juice, which showed highest value (42.58%) at MPN count 101-1100/100ml, which is less than 50% of MPN count. Whereas feacal cliform count depicted a little different picture. Sweet lime juice samples showed highest value (39.43%) of MPN count range of 10-100/100ml, which is also highest among different types of juices. Mango juice (24%) and mixed vegetables juice (45.45%) samples also had highest value in the MPN count range of 10-100/100ml.

On comparing total coliform count analyzed in the carts and shops (table 7) of different areas, it was found that the highest range were recorded at MPN count 10-100/100ml for two samples of cart *viz*., khan chauraha (73.91%), meerapur (50.08%) and college campus (44.44%). Whereas all the samples of shop *viz*., gaughat (63.63%), kareli (59.25%) and nooruallh road (58.33%) showed MPN count highest in the range of 10-100ml/100ml. While Feacal coliform count when observed in carts of khan chauraha (47.82%), meerapur (31.25%) and college campus showed highest (16.66) MPN count

Table 1 : Total viable count (TVC) in various fresh fruit juice samples.

Types of juice	No. of sample	Mean TVC × 10^4 cfu/ml	Range		S.Em	S.Ed.
			Max	Min		
Sweet lime juice	71	149.63	170.67	137.00	7.08	10.01
Sugar cane juice	40	129.69	139.46	111.76		
Mango juice	25	179.87	187.12	169.37		
Mixed vegetable juice	22	159.38	163.71	155.00		
Pineapple juice	11	193.67	201.25	110.00		

Table 2 : Total viable count (TVC) in fresh fruit juice samples collected from carts.

Types of juice	Mean TVC × 10^4 cfu/ml	Range		S.Em	S.Ed.
		Max	Min		
Sweet lime juice	151.15	160.36	140.53	**15.84**	**22.41**
Sugar cane juice	111.08	124.25	100.25		
Mango juice	161.41	169.00	155.21		
Mixed vegetable juice	199.22	219.83	167.57		
Pineapple juice	211.33	244.75	159.00		

Table 3 : Total viable count (TVC) in fresh fruit juice samples collected from shop.

Types of juice	Mean TVC × 10^4 cfu/ml	Range		S.Em	S.Ed.
		Max	Min		
Sweet lime juice	151.13	160.06	140.33	**8.610**	**12.76**
Sugar cane juice	111.08	124.75	100.25		
Mango juice	161.41	169.00	155.25		
Mixed vegetable juice	199.22	219.83	167.50		
Pineapple juice	210.05	218.33	202.5		

Table 4 : Total viable count (TVC) in processed fruit juice samples.

Types of juice	Mean TVC × 10^4 cfu/ml	S.Em	S.Ed.
Apple Juice (S_7T_1)	11.00	1.99	2.81
Mango Juice (S_7T_2)	14.67		
Orange juice (S_7T_3)	15.67		
Mango juice (S_7T_4)	12.00		
Pineapple juice (S_7T_5)	14.00		
Apple juice (S_7T_6)	15.33		
Pineapple juice (S_7T_7)	16.00		
Mixed fruit (S_7T_8)	10.67		
Orange (S_7T_9)	20.00		
Apple (S_7T_{10})	22.67		
Mixed fruit (S_7T_{11})	14.67		

in the range of 10-100/100ml (table 8). Whereas among shop samples gaughat (24.24%), kareli (25.92) and nooruallah road (25%) showed highest values in the range of 10-100/100 ml of MPN count. The presence of coliform in fruit juice it not allowed by the safe food consumption standard (Andres *et al.,* 2004). Coliform were identified as *E. coli*, *Entrobacter* and *Klebsiella*. Coliforms are a functional group of micro organisms presence of which in food materials is a definite indicator of fecal contamination and gross unhygienic conditions. Coliform and fecal colifomrs were found present in all types of fruit juice samples. However, it was found that more than 50% sample from fresh fruit juice had MPN in the range of 10-100/100ml.

Cultural and biochemical characteristics of the isolated bacteria fresh juice and processed juice

Out of the total isolates obtained 188 were selected for further studies. This included 4 isolates of enterobacter

Table 5 : Total coliform in various fresh fruit juice samples.

MPN Count range/100ml	Number of sample with in the range (%)				
	Sweet lime juice (71)	Sugarcane juice (40)	Mango juice (25)	Mixed vegetable juice (22)	Pineapple juice(11)
<0	3 (4.22)	0 (0.00)	0 (0.00)	1 (1.40)	0 (0.00)
0-10	9 (12.67)	2 (9.09)	0.00	9 (22.5)	2 (18.18)
10-100	48 (67.60)	17 (72.27)	14 (56.00)	14 (35.00)	6 (54.54)
101-1100	9 (12.67)	3 (13.63)	11 (44.00)	17 (42.50)	3 (27.27)
>1100	1(1.408)	0 (0.0)	(0.00)	0 (0.00)	0 (0.00)

Table 6 : Feacal coliform analysis in various fresh fruit juice samples.

FC MPN Count range/100ml	Number of sample within the range (%)				
	Sweet lime juice (71)	Sugarcane juice (40)	Mango juice (25)	Mixed vegetable juice (22)	Pineapple juice (11)
<0	5 (7.04)	2 (5.00)	3 (12.00)	8 (36.36)	0 (0.00)
0-10	8 (11.26)	3 (7.00)	0 (0.00)	1 (4.54)	0 (0.00)
10-100	28 (39.43)	8 (20.00)	6 (24.00)	10 (45.45)	2 (18.18)
101-1100	3 (4.22)	10 (25.00)	5 (20.00)	1 (4.54)	2 (18.18)
>1100	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)

Table 7 : Total coliform analysis in various fresh fruit juice samples collected from shops and carts.

MPN Count range/100ml	Number of sample within the range (%)					
	Carts			Shop		
	College campus 18	Khan Chauraha 23	Meerapur Pur 32	Gaughat 33	Kareli 27	Noorullah road 36
<0	2 (11.11)	1 (4.34)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
0-10	3 (16.66)	3 (13.04)	5 (15.62)	2 (6.06)	3(11.00)	6 (16.66)
10-100	8 ((44.44)	17 (73.91)	16 (50.00)	21(63.63)	16(59.25)	21 (58.33)
101-1100	5((27.77)	2 (8.69)	11 (34.37)	9 (27.27)	8 (29.62)	9 (25.00)
>1100	0	0	0	1 (3.03)	0	0

Table 8 : Feacal coliform analysis in various fresh fruit juice samples collected from carts and shops.

MPN Count range/100ml	Number of sample with in the range (%)					
	Carts			Shop		
	College campus 18	Khan Chauraha 23	Meerapur Pur 32	Gaughat 33	Kareli 27	Noorullah road 36
<0	4 (22.22)	2 (8.69)	5 (15.62)	3 (9.09)	2 (7.04)	2 (5.55)
0-10	2 (11.11)	1 (4.34)	3 (9.37)	1 (3.03)	1 (3.70)	2 (5.55)
10-100	3 (16.66)	11 (47.82)	10 (31.25)	8 (24.24)	7 25.92)	9 (25.00)
101-1100	2 (11.11)	1 (1.34)	9 (28.12)	3 (9.09)	3 (11.11)	5 (13.88)
>1100	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)

spp, 70 isolates of streptococcus lactis, 26 isolates of klebsiella spp, 39 isolates of micrococcus luteus, 5 *E. coli* isolates, 11 stophylococus aureus isolates, 14 isolates of bacillus cereus and 19 isolates of other unidentified organisms. Identification of total isolates obtained in processed juices were 27 out of which 10 isolates were of micrococuss luteus, 15 isolates of streptococcus lactis and 2 isolates of klebsiella spp were identified.

Incidence of pathogen in fresh fruit juice samples

The percent incidence of *Enterobacter* spp., *Klebsiella* spp, *E. coli*, *Staphylococcus aureus* and *Bacillus cereus* were 2.36, 15.38, 2.95, 6.50 and 8.28

Table 9 : Total Incidence of pathogen in fresh fruit juice samples.

Incidence of pathogen	Sweet lime juice (71)	Sugar cane juice (40)	Mango juice (25)	Mixed vegetable juice (22)	Pineapple juice (11)	Total no. of isolates (169)	Total incidence pathogen percentage
***Enterobacter* spp.**	4 (5.63)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	4	2.36
Streptococcus lactis	**29 (40.84)**	**7 (17.50)**	**19 (76.00)**	**14 (63.63)**	**1 (9.09)**	**70**	**41.42**
Klebsiella spp.	11 (15.49)	9 (22.5)	0 (0.00)	2 (9.09)	4 (36.36)	26	15.38
Micrococcus luteus	**13 (18.30)**	**11 (27.5)**	**5 (20.00)**	**4 (18.18)**	**6 (54.54)**	**39**	**23.07**
E. coli	4 (5.63)	1 (2.5)	0 (0.00)	0 (0.00)	0 (0.00)	5	2.95
Stophylococcus aureus	6 (8.45)	2 (5.00)	1 (4.00)	2 (9.09)	0 (0.00)	11	6.50
Bacillus cereus	4 (5.63)	10 (25.00)	0 (0.00)	0 (0.00)	0 (0.00)	14	8.28

Table 10 : Total Incidence of pathogen in fresh fruit juice samples from carts and shops.

Incidence of pathogen	Total incidence of pathogen									
	Carts			Total no. of isolate (73)	Total incidence pathogen percentage	Shops			Total no. of isolates (96)	Total incidence pathogen percentage
	College campus 18	Khan Chauraha 23	Meerapur pur 32			Gaughat 33	Kareli 27	Noorullah road 36		
Enterobacter spp.	4 (22.22)	0.00	0.00	4	5.47	0.00	0.00	0.00	0 (0.00)	0.00
Streptococcus lactis	3(16.67)	14(60.87)	7(21.88)	24	32.87	12(36.36)	18(66.67)	16(44.44)	46	44.16
Klebsiella spp.	3(16.67)	2(8.70)	7(21.88)	12	8.76	8(24.24)	1(3.70)	5(13.89)	14	13.44
Micrococcus luteus	2(22.22)	3(13.04)	10(31.25)	15	10.95	7(21.21)	6(22.22)	10(27.78)	23	22.08
E. coli	2(11.11)	0.00)	1(3.13)	3	2.19	2(6.06)	0.00	0.00	2	1.92
Stophylococcus aureus	2(11.11)	1(4.35)	2(6.25)	5	3.65	2(6.06)	1(3.70)	3(8.33)	6	5.76
Bacillus cereus	0(0.00)	3(13.04)	10(31.25)	13	17.80	1(3.03)	0.00	0.00	1	1 3.03

respectively (table 9). In the samples of sweet lime juice highest percentage of incidence was found to be of *Streptococcus lactis* (40.84%) followed by *Micrococcus luteus* (18.30%), *Klebsiella* spp. (15.49%), *Staphylococcus aureus* (8.45%) and *Enterobacter* spp., *E. coli* and *Bacillus cereus* both showed (5.63%) incidence. On observing the sugar cane juice sample highest percentage value was recorded for *Micrococcus leutus* (25.5%), which was closely followed by *Bacillus cearus* 25%. While lower percentage of incidence of pathogens was recorded for *Klebsiella* spp. (22.5%), *Streptococcus lactis* (17.50%), *Staphylococcus aureus* (5%) and *E. coli* (2.5%) and no isolates of *Entrobacter* spp. While observing mango juice sample highest no. of isolates were recorded for *Streptococcus lactis* (76%). 20% incidence was recorded for *Micrococcus luteus* and 4% for *Staphylococcus aureus* no. isolates of *Entrobacter* spp., *Klebsiella* spp., *E. coli* and *Bacillus cereus* were isolated from mango juice sample. In mixed juice sample highest incidence was recorded for *Streptococcus lactis* (63%) whereas as *Micrococcus luteus*, *Klebsiella* spp. and *Staphylococcus aureus* showed (18.18%), (9.09%) and (9.09%), respectively. No incidence of *Entrobacter spp*, *E. coli* and *Bacillus* of entrobacter spp., *E. coli* and

Bacillus cereus was observed in the samples. The total no. of incidence of pathgoens in pineapple juice shows that the highest occurance of *Micrococcus luteus* was (54.54%) followed by *Klebsiella* spp., (36.36%) *Streptococcus lactis* (9.09%). All other isolates were not found in pineapple juice sample.

Incidence of pathogen in fresh fruit juice samples from Carts and shops

On studying the incidence of pathogens in various localities, it was evident that incidence of *streptococcus* lactis spp was the highest (66.67) in shops (Kareli) followed by carts (Khan Chauraha), which was (60.87) respectively (table 10). On comparing the incidence of pathogen in carts and shops it was found that the incidence of *Streptococcus* lactis was higher in shops (44.16) than carts (32.87%), the highest being obtained din kareli sample (66.67). Occurance of *Klebsiella* in both carts and shop were 8.76 and 13.44, respectively. Whereas incidence of *Entrobacter* (22.22) can be observed only in carts and not in shops. *Microccous luteus* showed higher incidence rate in shops (22.08) than in carts (10.95) 10 pathogen each were isolated from meerapur area and noorullah road locality. Marginal variation can be observed in the incidence of *E. coli* and *Staphylococcus aureus*, which was a little higher in carts 2.9 and 3.65 respectively than in shops. Previous works also highlight sugar cane juice as being the most contaminated among various juices studied (Daw *et al*., 1994; Nagalakshmi *et al*., 1999; Shankhla *et al*., 1999). The high presence of the studied microbes in all the juices samples might be due to those originating from the sugarcane itself or from the soil. Incidence of pathogens has also been reported by previous workers (Al-Dedah and Robison, 2002; Lateef *et al*., 2004; Ghenghesh *et al*., 2005; Kumar *et al*., 2006; Kumar *et al*., 2011; Abadias *et al*., 2008 and Tambekar, 2009). However, while these high counts were well in excess of any reasonable specification, it is important that they may not necessarily pose a hazard to the health of the consumer. Many of the pathogens isolated are capable of causing various disease and therefore their presence in fruit juice cannot be justified. Their presence even in small number results in such food being of unacceptable quality and potentiality hazardous (PHLS, 2000).

Conclusion

The study revealed that freshly squeezed mango juices were unsafe for human consumption. Generally, the results in the present study clearly indicate the poor hygienic conditions of these juices and the consumers are at risk of contacting food borne infections. The vendors were unaware of food regulations as well as lack supportive services such as water supply of good and adequate quality, waste disposal systems that enhance their ability to provide safe food. In addition to these the intensive and incorrect use of antimicrobial agents leads to the emergency of antimicrobial-resistant bacteria. The comparative study anticipated the safe consumption of commercially packed juice than the freshly packed juice marketed locally. This might be the reason of using automated machine and also some preservatives during fruit juice processing. But some preservatives of higher concentrations can be harmful for our health. Therefore, studies on preservative concentrations should also be carried out.

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