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Sensory and Microbiological Evaluation of Yoghurt Sold in and Around Hyderabad City

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Abstract:

The present study was carried out to evaluate sensory and microbiological quality of yoghurt sold in and around Hyderabad city, India. The overall sensory score of the yoghurt samples collected from cooperative sector was high (93), slightly less in branded private sector (90) and least (72) in brandless samples. The total viable counts were $7.2x10^7$/ml, $4.6x10^8$/ml and $3.8x10^{10}$/ml, coliform counts $1.2x10^3$/ml, $8.6x10^3$/ml and $8.8x10^4$/ml and yeast and mould count $3.2x10^5$/ml, $5.6x10^3$/ml and $2.8x10^3$/ml in cooperative, branded private and unbranded samples respectively. The incidence was 53%, 46% and 100% for *E.coli*, 54%, 63% and 100% for *Salmonella*, 73%, 80% and 100% for *Staphylococcus*, 75%, 75% and 100% for *Listeria* and 54%, 63% and 100% for *Klebsiella* and the counts were $5.6x10^3$, $6.8x10^4$ and $7.9x10^6$ for *E.coli*, $1.6x10^2$, $4.8x10^2$,and $5.6x10^3$ for *Salmonella*, $6.3x10^3$, $9.2x10^3$ and $1.2x10^5$ for *Staphylococcus*, $1.2x10^5$, $5.6x10^2$ and $3.4x10^3$ for *Listeria* and $1.4x10^2$, $5.6x10^2$ and $4.2x10^3$ for *Klebsiella* in cooperative, branded private and unbranded samples respectively. The microbiological incidence and counts were high in unbranded, least in cooperative and in between in branded private sectors.

Keywords- Yoghurt, Sensory Quality, Microbiological Quantity

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I. INTRODUCTION

Yoghurt is popular fermented milk in many countries of the world. It is a product having probiotic microorganisms, which enhances human health. The consumption of fermented milk by man dates back to the advent of civilization [11]. The fermented/ cultured milks prolong the shelf life of some food and milk related preparations. The probiotic microorganisms improve lactose digestion by converting into lactic acid and inhibit lactose intolerance. *Streptococcus thermophillus*__and *Lactobacillus bulgaricus* 1:1 ratio are the most used starter culture in yoghurt productions.

The contamination of yoghurt occurs due to unhygienic practices during production, unfavourable storage and defects in maintaining cold chain. Moules and yeast are the primary contaminants in the yoghurt as they utilize the acid and produce reduction of acidity resulting in favouring the growth of putrefactive bacteria. The incidence of contamination by certain pathogens such as *E.coli, Staphylococcus, Listeria and Coxiella brunetii* were reported.

Although Pasteurization is done for preparation of yoghurt, post pasteurization contamination and unhygienic condition of equipment and vessels will increase the microbial load. Considering the public health significance of the yoghurt, the quality indicators including microbial and physico-chemical evaluation should be strictly followed. Little work is available on microbial load and shelf life of yoghurt in India, the present study was undertaken to evaluate the sensory and microbiological parameters of yoghurt sold in around Hyderabad City.

II. MATERIALS AND METHODS

A total of 45 samples of yoghurt were collected from different sources which includes 15 samples each from cooperative sector, branded private sector and unbranded local manufacturers. All the samples were collected in sterile polythene bags and kept in ice baskets and transported to the laboratory of Department of Veterinary Public Health and Epidemiology, College of Veterinary Science, Rajendranagar, Hyderabad.

The sensory evaluation of yoghurt samples was judged on the basis of hundred points (Flavor-45, body and texture-30, acidity-10, colour and appearance-10 containers and closure-05). A small amount of yoghurt is taken and tempered to room temperature and evaluated for sensory acceptance. The sensory evaluation was done by 5 panels of independent judges adopting the score card. The microbiological studies include standard plate count, total coliform count and yeast and mould count were done using Nutrient agar, MacConkey agar and Potato dextrose agar respectively. For enumeration of other pathogenic micro-organism Bismuth sulphate agar (*Salmonella*), EMB for (*E.coli*) Tryptic soy agar (*Staphylococcus*), BHI (*Listeria*) and MacConkey agar (*Klebsiella*) were used.

All the media were obtained in dehydrated forms and prepared according to the manufacturer's instructions. Glassware such as Petri dishes, test-tubes, pipettes, flasks and bottles were sterilized in hot air oven at 160^0C for two hours. Distilled water and liquid media were sterilized by autoclaving at 121^0C for 15 min, at 15 lbs pressure. One ml of yoghurt was added to 9ml of sterile distilled water to make 10^{-1} dilutions and 1ml from the 1^{st} test tube is taken and added to 9ml sterile distilled water in second test tube and so on to make serial dilutions up to 10^{-8}. For enumeration of total bacterial count dilutions of 10^{-6} to 10^{-8} for coliforms and 10^{-3} for yeast and moulds were used. For enumeration of pathogens 10^{-3} to 10^{-5} dilutions were selected.

One ml of selected dilution is transferred in to petri dish and sufficient amount of respective liquid media was poured into the plates. After proper solidification of the culture media, the plates were inverted and kept in incubator at 37^0C for 24 to 48 hours. The colonies were counted at the end of incubation period. For enumeration of yeast and mould, plates were incubated at 25^0C for 3 to 5 days and colonies were counted. The plates were observed for typical colonies of each microorganism and colonies were counted with the help of colony counter. The results were recorded as CFU/g. Specific biochemical tests were performed like grams staining, catalase test, urease test, sugar formation test, oxidase test etc. to confirm pathogens.

III. RESULTS AND DISCUSSIONS

The sensory evaluation of the yoghurt samples collected from different sources was presented in the table 1. The overall sensory score of the yoghurt samples collected from cooperative sector was high (93), slightly less in branded private sector (90) and least (72) in the unbranded samples. Flavour, body and texture and acidity scores were higher in cooperative sector, moderate in branded private sector and least in unbranded samples. The colour and

appearance score were slightly higher (9) in branded private sector samples.

Table- 1: Sensory evaluation of yoghurt, collected from different sources

	Cooperative sector		Branded private		Unbranded sector	
	Score	Range	Score	Range	Score	Range
Flavour(45M)	43	39-44	42	37-45	36	30-40
Body& Texture(30M)	28	24-30	26	25-31	24	22-28
Acidity(10M)	9	7-10	8	7-9	7	6-9
Color, Appearance(10 M)	8	6-10	9	8-10	7	5-9
Container (5M)	5	5	5	5	4	3-5
Total	93		90		72	

The total viable count (TVC), Coliform, Yeast and Moulds of yoghurt collected from different sources was presented in table 2

Table-2 : TVC, Coliform, Yeast and Moulds of yoghurt collected from different sources

	SPC		Coliforms		Y & M	
	Count/ml	Range	Count/ml	Range	Count/ml	Range
Coop Sector	$7.2x10^7$	$4.6x10^6$-$3.2x10^8$	$1.2x10^{31}$	$2.6x10^2$-$3.6x10^4$	$2.8x10^3$	$2.2x10^2$-$4.6x10^4$
Branded Private	$4.6x10^8$	$3.6x10^7$-$4.8x10^9$	$8.6x10^3$	$4.5x10^3$-$6.9x10^4$	$5.6x10^3$	$3.6x10^3$-$4.4x10^4$
Unbranded Sector	$3.8x10^{10}$	$2.7x10^9$-$4.3x10^{11}$	$8.8x10^4$	$6.8x10^3$-$7.1x10^5$	$3.2x10^5$	$2.1x10^3$-$4.6x10^6$

The total viable count in the samples of cooperative sector was least ($7.2x10^7$/ml), high ($3.8x10^{10}$/ml) in unbranded and in between ($4.6x10^8$/ml) in samples from branded private sector. The TVC in the yoghurt samples collected was within the limits of microbiological standard (10^7/ml) whereas the counts in branded private samples was slightly higher than the recommended values and in the unbranded samples it was very high. The counts ($5.5x10^7$-$8.6x10^8$/ml) observed [14] in Egypt were almost similar to the counts observed in the study, from samples of cooperative and branded private sector. Higher counts in branded samples ($1.54x10^9$/ml) and very high counts ($1.68x10^{12}$/ml) in unbranded samples reported [20] in Bangladesh than the counts in the present study. A very low count of $8.2x10^4$cfu/ml was reported in Nigeria [5]. Very high counts indicate post pasteurization contamination due to inadequate hygienic measures during production [19].

The total coliform counts were $1.2x10^3$/ml, $8.6x10^3$/ml and $8.8x10^4$/ml in the samples from cooperative, branded and unbranded samples respectively. The counts of $4.0x10^3$ and $1.2x10^3$ reported [15,20] were almost similar to the counts observed in the cooperative samples in the present study. Very low counts of 4.6-3.15x 10^2/ml in the factory samples was reported [12] in Sudan. A coliform count of 10^3-10^4/ml in small scale and 10^1-10^2/ml in large scale sectors were reported [8]. No coliform counts were observed in the yoghurt samples [13]. A coliform count of $5.5.x10^4$cfu/ml reported [9] was similar to the counts in the brandless samples in the present study. The higher counts in unbranded samples indicate low level of hygiene and improper sanitary conditions during/after the manufacturing process [3].

Yeast and mould counts were high unbranded ($3.2x10^5$/ml), least ($2.8x10^3$/ml) in cooperative samples and moderate ($5.6x10^3$/ml) in branded private samples. The yeast and mould counts observed [2,9] were almost similar to the counts in the cooperative sector in the present study. A count of $6.3x10^3$/ml [1] was similar to the counts observed in the present study in branded private samples. A count of $4.5x10^5$cfu/ml reported [2] was similar to the counts observed in brandless samples in the present study. Very low counts of 1-5cfu/ml, $3.9x10^2$cfu/ml and $2.5x10^2$cfu/ml were reported [16,8,2] respectively, whereas very high counts of 6log10 cfu/ml was reported [17]. A count of $4.3x10^4$cfu/ml reported [9] was almost similar to the counts observed in unbranded samples in the present study. Since milk is pasteurized before yoghurt preparation, the presence of yeast and moulds is caused by

inappropriate pasteurization and/or recontamination during manufacture [17].

The incidence and counts of pathogens were presented in the table 3 and 5 respectively.

Table-3: Incidence of pathogens in yoghurt samples collected from different sources.

Organisms	Cooperative Sector		Branded Private		Unbranded Sector	
	No. of positive	Percentage	No. of positive	Percentage	No. of positive	Percentage
E.coli	8	53	7	46	15	100
Salmonella	6	54	7	63	11	100
Staphylococcus	11	73	12	80	15	100
Listeria	6	75	6	75	8	100
Klebsiella	6	54	7	63	11	100

Table-4: Counts of pathogens in yoghurt samples collected from different sources.

Organisms	Cooperative sector		Branded private		Unbranded sector	
	Count	Range	Count	Range	Count	Range
E.coli	$5.6x10^3$	$3.4x10^2$-$6.2x10^4$	$6.8x10^4$	$4.8x10^2$-$7.2x10^5$	$7.9x10^6$	$2.2x10^3$-$4.4x10^7$
Salmonella	$1.6x10^2$	$1.1x10^2$-$2.4x10^3$	$4.8x10^2$	$1.5x10^2$-$6.2x10^3$	$5.6x10^3$	$2.5x10^2$-$1.5x10^4$
Staphylococcus	$6.3x10^3$	$2.5x10^2$-$4.5x10^4$	$9.2x10^3$	$3.2x10^2$-$6.2x10^4$	$1.2x10^5$	$4.8x10^3$-$6.9x10^6$
Listeria	$1.2x10^2$	$0.8x10^2$-$4.2x10^2$	$5.6x10^2$	$2.3x10^2$-$6.8x10^2$	$3.4x10^3$	$2.4x10^2$-$4.8x10^4$
Klebsiella	$1.4x10^2$	$0.9x10^2$-$3.6x10^3$	$5.6x10^2$	$2.2x10^2$-$7.6x10^2$	$4.2x10^3$	$2.8*10^2$-$5.6*10^4$

The incidence and counts of *E.coli* was 100% and $7.9x10^6$cfu/ml in unbranded samples, 46% and $6.8x10^4$cfu/ml in branded private samples and 53% and $5.6x10^3$cfu/ml in cooperative sector samples in the present study. A low incidence (33.3%) of *E.coli* was reported in the market samples by [12]. The counts of 10^6cfu/ml reported [21] was similar to the counts observed in unbranded samples in the present study whereas $1.7x10^4$cfu/ml and $1.58x10^4$cfu/ml counts [1,4] were almost similar to the counts observed in branded private samples. A count of $2x10^3$cfu/ml in large scale samples reported [1] and $5x10^3$cfu/ml reported by [14] were similar to the cooperative samples.
A count of $4.4x10^5$cfu/ml was reported [7] was higher than the counts in branded private and lower than brandless samples in the present study. High counts of *E.coli* in unbranded might be caused by poor environmental conditions and contaminated water used in production [18].

Salmonella counts of $1.6x10^2$cfu/ml, $4.8x10^2$cfu/ml and $5.6x10^3$cfu/ml and the incidence of 54% 63% and 100% observed in the samples from cooperative, branded private and brandless samples respectively in the present study. A low incidence (33.3%) of *Salmonella* was reported in the market samples [12]. A count of $6x10^3$ reported [14] was similar to the count observed in brandless samples in the present study.

The incidence and counts of *Staphylococcus* were 73% and $6.3x10^3$, 80% and $9.2x10^3$ and 100% and $1.2x10^5$cfu/ml from cooperative, branded private and unbranded samples respectively in the present study. A count of $9x10^6$cfu/ml reported [15] was almost similar to the counts observed in unbranded samples. The *Staphylococcus* count observed in cooperative samples in the present study ($6.3x10^3$ cfu/ml) was similar to the counts of $1.7x10^3$ reported [1] and the count ($9.2x10^3$cfu/ml) observed in unbranded samples in the present study was similar to the count of $8.5x10^3$cfu/ml reported [8] in small scale samples. Very low counts of $9.4x10^2$cfu/ml in large scale samples were reported [8].

The incidence and counts of *Listeria* were 75% and $1.2x10^2$cfu/ml, 75% and $5.6x10^2$cfu/ml and 100% and $3.4x10^3$cfu/ml in the samples of cooperative, branded private and brandless in the present study. Very low count of 6cfu/g was reported [6] in the market samples. The incidence and counts of *Klebsiella* was 54% and $1.4x10^2$cfu/ml, 63% and $5.6x10^2$cfu/ml and100% and $4.2x10^3$ in the samples of cooperative, branded private and unbranded samples.

Higher microbiological counts including certain pathogens in fermented milks due to inappropriate temperature and thermal

processing, unsafe formulation, insufficient fermentation and post processing contamination such as during transportation or storage, in addition to inadequate quality control during manufacture [10].

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