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Studies on the Sensory and Microbiological Quality of Paneer Sold in and around Greater Hyderabad Municipal Corporation

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Abstract:

This study was conducted to assess the sensory and microbial quality of paneer sold in Hyderabad by cooperative, branded private and unbranded sectors. The overall sensory scores of paneer samples were high (95) in branded private, followed by cooperative sector(92) and least in unbranded (75). The total viable count, coliform count and yeast and mould counts were $5.8x10^3$, $3.2x10^3$ and $6.6x10^5$, $5.4x10^3$, $4.2x10^2$ and $4.4x10^4$, $8.6x10^3$, $3.2x10^3$ and $1.6x10^5$ per gram respectively in cooperative, private branded and unbranded samples. The incidence and counts were 57% and $8.6x10^3$ for *Escherichia coli,* 37% and $4.2x10^3$ for *Salmonella,* 54% and $7.8x10^3$ for *Klebsiella* and 45% and $4.2x10^2$ for *Listeria* in cooperative samples, 50% and $3.6x10^3$ for*Escherichia coli*, 25% and $2.6x10^2$ for *Salmonella*, 73.3% and $4.1x10^3$ for *Staphylococcus,* 46.1% and $2.1x10^3$ for *Klebsiella* and 36.3% and $2.8x10^2$ for *Listeria* in branded private samples and 100% and $2.6x10^4$ for *Escherichia coli*, 100% and $4.4x10^4$ for *Salmonella,* 100% and $3.5x10^5$ for *Staphylococcus,* 100% and $2.8x10^4$ for *Klebsiella* and 100% and $2.3x10^3$ for *Listeria.*

Keywords —Paneer, Sensory quality, Microbiological quality.

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I. INTRODUCTION

Paneer is a popular Indian dairy product also called as soft Indian cheese, widely used for the preparation of culinary dishes in India. Due to its high protein content, it is an excellent substitute for meat in diet in a vegetarian cuisine. It has been found that about 4-5% of total milk produced in India is converted into paneer. Paneer has a short life span of about 2-3 days at refrigeration, but freshness is lost after one day [2].

There are many steps in the manufacture, handling, and storage of paneer in which it will get contaminated with micro-organisms. In tropical countries like India, dairy products are responsible for many outbreaks of gastrointestinal infections. In Hyderabad which is fast acquiring cosmopolitan nature and in which social demography is changing, the paneer market is growing.However, the problem of substandard paneer being sold is always felt because paneer production is not considered as a profit generating venture. Though food inspectors strive to continuously monitor food quality in the market, indeed it is unviable due to the number of brands, number of retailers and the vulnerability of the laws. Studies on

bacteriological quality of paneer sold in Chandigarh city, New Delhi, Nagpur etc. has shown that the samples are highly contaminated [11, 9]. This study was conducted to assess the sensory and microbiological quality of paneer samples sold in Greater Hyderabad Municipal Corporation to know the situation in Hyderabad.

II. MATERIALS AND METHOD:

A total of 45 samples of paneer were collected from different sources in different areas of Hyderabad (15 samples each from co-operative sector, branded private sector and unbranded). All the samples were collected in sterile polyethene bags kept in ice basket and transported to the laboratory of Department of Veterinary Public Health and Epidemiology College of Veterinary Sciences, Rajendranagar, Hyderabad.

The organoleptic quality of paneer samples was judged on the basis of 100 marks [Flavour-45; Body and texture-35; Colour and appearance-15 and package-05] by 5 panel of independent judges. The paneer blocks were cut into 1cm cubes and tempered to room temperature and evaluated for quality. For microbiological studies, the samples were crushed finely in mortar and pestle. One gram of paneer was added to 10 ml sterile distilled water (1^{st} tube) to make 10^{-1} dilution and 1ml from 1^{st} test tube is taken and added to 9 ml of sterile distilled water in 2^{nd} test tube and so on to make serial dilutions up to 10^{-6}. For enumeration of total bacterial count dilutions of 10^{-4} to 10^{-6},for coliforms 10^{2} and 10^{3} dilutions for Yeast and Mould. For enumeration of pathogens 10^{-3} to 10^{-5} dilutions were selected. The serially diluted samples were plated by pour plate technique. Standard plate count, Total coliform count, Yeast and Mould count were done using nutrient agar, McConkey agar and Potato dextrose agar respectively. Bismuth sulphite agar[*salmonella*], Eosin methylene blue agar [*Escherichia coli*], Tryptic soy agar [for *staphylococcus*], Brain Heart Infusion agar [*Listeria*] and McConkey agar[*klebsiella*] were used for the detection of pathogens.

All media were obtained in dehydrated forms and prepared according to manufacturers' instructions. Glassware such as petri dishes, test tubes, pipettes, conical flasks and bottles were sterilised in a hot air oven at 1600C for 2 hours. Distilled water and liquid media are sterilized by autoclaving at 1210C for 15 minutes at 15 lbs pressure.1ml of selected dilution is transferred into a petri dish and sufficient amount [10-15 ml] of respective liquid media was poured into plates. After the proper solidification of the culture media, the plates were inverted and were incubated at 370C for 24 to 48 hours, except for Yeast and Mould plates which were incubated at 250C for 3-5 days. After incubation period, the plates were observed for typical colonies of each micro-organism and colonies were counted with the help of colony counter. The results were recorded as CFU/gm. The specific biochemical tests performed like gram staining, catalase test, urease test, sugar fermentation test, oxidase test etc.

III. RESULTS AND DISCUSSION:

The sensory evaluation of the paneer samples collected from different sources was presented in table 1. The overall sensory scores of the paneer samples collected from branded private sector was high (95), slightly less in co-operative sector (92) and least in unbranded (75) samples in the present study. Flavour, body, and texture scores were high in branded private, moderate in cooperative sector and least in unbranded samples in the present study. The Colour and appearance scores were slightly higher in branded private sector samples. [10] reported a sensory score of 6.7 to 8 out of 9 sensory score for the paneer samples sold in Varanasi city.

The organoleptic evaluation of paneer samples collected from different sources was presented in table 1.

Table:1 Organoleptic evaluation of paneer collected from different sources

Organoleptic Characteristics	Co-operative sector		Branded Private		Unbranded	
	Score	Range	Score	Range	Score	Range
Flavour [45]	42	39-44	43	37-45	35	25-40
Body and Texture [35]	32	28-33	33	31-33	29	25-34
Colour and Appearance [15]	13	12-15	14	9-15	12	9-14
Package [05]	05	05	05	05	03	2-5
Total	92		95		75	

The total viable count, coliform and yeast and mould counts of paneer collected from different sources was presented in table 2.

Table: 2 TVC, Coliform and Y&M counts of paneer collected from different sources

Sector	TVC (per g)		Coliforms (per g)		Yeast and Mould (per g)	
	Count/ml	Range	Count/ml	Range	Count/ml	Range
Co-operative sector	$5.8x10^3$	$2.2x10^2$- $3.8x10^4$	$5.4x10^3$	$4.4x10^2$ to $5x10^4$	$8.6x10^3$	$2x10^2$ to $3x10^4$
Branded Private	$3.2x10^3$	$1.4x10^2$-$2.4x10^4$	$4.2x10^2$	$2.2x10^1$ to $8.6x10^3$	$3.2x10^3$	$4x10^2$ to $5x10^4$
Unbranded	$6.6x10^5$	$4.2x10^4$-$5.3x10^6$	$4.4x10^4$	$2.8x10^3$ to $4x10^5$	$1.6x10^5$	$1.2x10^4$ to $2.2x10^6$

The total viable counts in the samples of branded private sector were least ($3.2x10^3$), high ($6.6x10^5$) in unbranded and in between ($5.8x10^3$) in samples from cooperative sector. A count of $1x10^4$ to $224x10^5$ CFU/g reported by [1] was almost similar to the counts observed in unbranded samples in the present study. Higher counts of 10^8 CFU/g were reported by [10] in the market samples. Very high counts of $8.2x10^6$ CFU/g was reported by [4] in market sample collected in Nagpur city. Counts of $4.1x10^5$ CFU/g and $8.6x10^4$ CFU/g were reported by [3, 12] respectively which werealmost similar to the counts observed in unbranded samples in the present study.

The total coliform counts were $5.4x10^3$, $4.2x10^2$ and $4.4x10^4$ in the samples from cooperative, branded, and unbranded samples respectively. No coliform counts were observed in the paneer samples by [5, 7]. A count of $3x10^3$ CFU/g was reported by [12] which was almost similar to the coliform counts observed in the cooperative sector samples in the present study. Very high coliform counts of $4x10^6$ CFU/g were reported by [6] in the market samples collected from Guwahati city. A count of 3.95 to $7.65x10^1$ CFU/g was reported by [3] in the samples collected from processing centres, New Delhi, which was very less than the samples from all the three sources in the present study. The higher counts in unbranded samples indicate low level of hygiene and improper sanitary conditions during/after the manufacturing process.

The yeast and mould counts were high in unbranded ($1.6x10^5$), least in branded private ($3.2x10^3$) and moderate in cooperative ($8.6x10^3$) sector samples. The counts of unbranded samples were similar to those ($1x10^5$) reported by [4]. The count of branded private sector sample was similar to the counts of $2.3x10^3$ reported by [8]. A count of $1.4x10^4$ CFU/g was reported by [12] which was similar to the counts observed in unbranded samples in the present study. Very high count ($6.4x10^8$CFU/g) in the market samples was reported by [10] which was very high compared to the counts observed in the present study from all the three sources. A count of $2.09x10^2$ CFU/g was reported by [3] which was very less than the counts observed in the present study from all the three sources.

The incidence of pathogens in paneer samples collected from different sources was presented in table 3.

Table:3 Incidence of pathogens in paneer samples collected from different sources

Organisms	Co-operative sector		Branded Private		Unbranded	
	Number of Positive	Percentage	Number of Positive	Percentage	Number of Positive	Percentage
Escherichia coli	08	57	07	50	14	100
Salmonella	03	37	02	25	08	100
Staphylococcus	12	80	11	73.3	15	100
Klebsiella	07	54	06	46.1	13	100
Listeria	05	45	04	36.3	11	100

The incidence of *Escherichia coli* was 100% in unbranded samples ,57% in co-operative sector and 50% in branded private samples. An incidence of 72% *Esherichia coli* in paneer samples was reported by [4], which was higher than the incidence observed in branded private and cooperative samples and lower than the incidence in unbranded samples in the present study. The incidence of *salmonella* was highest (100%) in unbranded, least in branded private (25%) and moderate in co-operative sector (37%) samples. The incidence of 34% reported by [4] was similar to the incidence of cooperative sector samples in the present study. The incidence of *staphylococcus* was 100%,80% and 73.3% in unbranded, cooperative, and branded private samples respectively in the present study. The incidence of *staphylococcus* (97%) reported by Godbole *et al* (2013) which was almost similar to the incidence of unbranded samples in the present study.

The incidence of *klebsiella* was found to be least in branded private (46.1%) moderate in cooperative sector (54%) and highest in (100%) unbranded samples. The incidence of *Listeria* was 36.3%, 45% and 100% in branded private, cooperative, and unbranded samples respectively.

The counts of pathogenic microorganisms in paneer samples collected from different sources was presented in table 4.

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

Organisms	Co-operative sector		Branded Private		Unbranded	
	Count/ g	Range	Count/ g	Range	Count/ g	Range
Escherichia Coli	$8.6x10^3$	$2.8x10^2$ to $4.8x10^4$	$3.6x10^3$	$2.9x10^2$ to $5x10^4$	$2.6x10^4$	$1.1x10^3$ to $2.3x10^5$
Salmonella	$4.2x10^3$	$6.7x10^2$ to $7.7x10^4$	$2.6x10^2$	$6.1x10^1$ to $8.1x10^3$	$4.4x10^4$	$2.5x10^3$ to $4.6x10^5$
Staphylococcus	$4.5x10^4$	$4x10^3$ to $5.5x10^5$	$4.1x10^3$	$3.2x10^2$ to $1.4x10^4$	$3.5x10^5$	$5.0x10^4$ to $7.0x10^6$
Klebsiella	$7.8x10^3$	$6.6x10^2$ to $7.6x10^4$	$2.1x10^3$	$1.1x10^2$ to $3.1x10^4$	$2.8x10^4$	$2.4x10^3$ to $3.4x10^5$
Listeria	$4.2x10^2$	$4.1x10^1$ to $5.4x10^3$	$2.8x10^2$	$1.7x10^1$ to $1.9x10^3$	$2.3x10^3$	$6.6x10^2$ to $7.4x10^4$

The counts of *Escherichia coli* were $2.6x10^4$, $8.6x10^3$ and $3.6x10^3$ ranging from highest to least in unbranded, cooperative sector and branded samples respectively. The counts ($4.5x10^3$ CFU/g) of *Escherichia coli* reported by [6] were almost similar to the counts in branded private samples in the present study. The counts of *salmonella* were least in branded private ($2.6x10^2$ CFU/g), moderate in cooperative sector ($4.2x10^3$ CFU/g) and highest in unbranded samples ($4.4x10^4$). The counts ($2.4x10^2$ CFU/g) of *salmonella* reported by [6] were found similar to those of branded private samples in the present study.

The counts of staphylococcus were highest in unbranded samples ($3.5x10^5$), moderate in cooperative sector ($4.5x10^4$) and least in branded private samples ($4.1x10^3$) in the present study. The counts ($4.0x10^3$) reported by [6] were almost similar to those of branded private samples in the present study. The counts of *Klebsiella* were $2.1x10^3$, $7.8x10^3$ and $2.8x10^4$ ranging from least to highest in branded private, cooperative, andunbranded samples respectively. The counts ($2.0x10^3$) of *Klebsiella* observed by [6] were almost similar to the counts of branded private samples in the present study.

REFERENCES

[1] Desale RJ, Dhole PT, Deshmukh AR and Nimase RG: 2009 Studies on quality evaluation of market paneer. *Asian Journal of Animal Science* 4(1): 73-74.

[2] Dhankhar 2014 Qualitative comparative assay of different paneer samples. International Journal of Engineering Science Invention; 3(3):27-30.

[3] Girdharwal N 2018 Microbiological study of Indian paneer-a case study of Delhi city. International journal of pharmaceutical sciences and research 9(9) :4008-4014.

[4] Godbole, S., Dabholkar, P. and Pachbudhe, A. 2013 Evaluation of Bacteriological quality of Indian cheese (paneer) sold in Nagpur city.*J.Glob Biosci*; 2(2):53-56.

[5] Khobragade SP, Padghan PV and Deshmukh AP 2021. Bacterial count of *paneer* prepared from blends of raw turmeric extract and buffalo milk. The Pharma Innovation Journal. 10(1):146-148.

[6] Krishna Gogoi and Sabrin Sultana, 2018 Bacteriological assessment of paneer sold in Guwahati. Assam, International Journal of Creative Research Thoughts (IJCRT), 6(1):476-479, ISSN:2320-2882.

[7] Omveer Singh, Puneet Arora, Parimita, Shimar Mishra, Binod Kumar Bharati and Prafull Kumar 2018.Studies on physico-chemical and microbiological analysis for preparation of paneer by using buffalo milk and mint. Journal of Pharmacognosy and Phytochemistry:7(5):1198-1202.

[8] Rani M, Dabur RS, Garg SR and Jadhav V 2014 Preparation, storage and microbiological quality of ready-to-serve low cholesterol masala paneer, Veterinary world 7(6):443-447.

[9] Rajorhia, G.S., Dharmpal and Arora, K.L. Quality of *paneer* marketed in Karnal and Delhi., *Ind J. Dairy Sci.* 1984; 37: 274.

[10] Sudhir Kumar, Dilip Kumar and Reeta 2016, Evaluation of the Bacteriological Quality of Indian Cheese (*Paneer*) Sold in Some Locations Within Varanasi City, *J. Pure Appl. Microbiology*.; 10(2): 1633-1636.

[11] Vaishnavi C, Singh S, Grover R and Singh K 2001. Bacteriological study of Indian cheese (paneer) sold in Chandigarh. Indian J Med Microbiology. 19(4):224-226.

[12] Vineet Kumar, Puneet Arora, and Mohammad Ibrahim 2015. Studies on microbiological quality of milk and milk products sold in Allahabad city. International Journal of Applied Research:1(9):232-234.

