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Quality Of Raw Milk Of Goat At The Consumers End In Some Villages In Shirala Taluka

Pravin Pawar[1], Madhuri Patil[2], Snehal Masurkar[3], Girish Pathade[4]

[1,2,3,4]Krishna Institute of Allied Sciences, Krishna Vishwa Vidyapeeth (Deemed to be University), Karad [Formerly known as Krishna Institute of Medical Sciences, (Deemed to be University)] Karad 415539, Maharashtra, India

*** Corresponding Author**

Email ID: pawarpj777@gmail.com

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ABSTRACT

In rural areas, in some places, there is Practice of consumption of raw goat-milk. Raw milk contains many microorganisms including yeast, bacteria, viruses, Molds and other pathogens Raw milk consumption may spread diseases. In view of this, work was undertaken with the objective of Physicochemical and microbiological analysis of raw milk, Five raw goat milk samples were collected from five different villages in Shirala Taluka, Dist- sangali, Maharashtra (India). The raw milk samples of goat were subjected for different tests including platform test, physico-chemical analysis, Ts, SNF, Proteins, fats, pH (6.5) and bacteriological examination, including bacterial SPC and MPN test for coliforms and wherever applicable confirmed and completed tests. The milk samples examined showed average SPC of mesophilic bacteria in the range of, 1.5 × 10^2 to 6.5 x 10^2 cfu/mL, respectively the average MPN for coliform was right the figure PH 6.0(acidic) 3.5% sugar, 4.0% , 5.5% fats Ts 7.5%, SNF 1.8% Most of the milk samples were contaminated, although apparently appearing normal in physico-chemical and platform test examination. The consumption of such goat milk seems to be risky for the health, it could be due to the improper methods of milking, unhygienic condition of milking area, unsafe methods of handling, The study concluded that the raw milk should not be directly consumed, it can be consumed only after pasteurization or boiling at home.

Keywords: *Raw milk of goat, SPC, MPN, Platform test*

1. INTRODUCTION

Milk is whole fresh, clean lactal secretion obtained by the complete milking of one or more healthy milk animals, properly fed and kept, excluding that obtained within 15 days before and 5 days after calving or such long period as may be necessary to render the milk particular colostrums free and containing the minimum prescribed percentages of milk fat and milk solid not fat (Varma and Sutherland, 2001).

Milk is consumed as a complete food to nourish and provide immunological protection for the mammalian young. Milk is considered as substrate, because nutritional value of milk is high. All species of mammals produce milk, these include man, cow, buffaloes, sheep. Goat, camel, and whale. The domestic animals excreting milk used for the production of milk used for the production of milk for human consumption. Farmers from rural areas have their own cows and buffaloes and selling raw milk. Some people in rural areas considered that fresh udder drawn milk is good for health. (O' Mahony and Fox, 2014)

The local milk production may lack concern, especially for goat milk as well as yet it is one of the potential industries to develop. Proximate analysis helps to determine the principal constituents of milk include fat, protein total solid, lactose and ash. Additionally, milk contains hundreds of minor constituents include fat, vitamins, metal ion and flavour compounds. Which contributes massive impact on the nutritionally technological and sensory properties of dairies. In comparison with cow milk has a better digestibility, buffer capacity and its particular therapeutic value in medicine and human nutrition. It has been clearly proven that consuming of goat milk improves the state of health and wellness of the human body, reduce the risk of developing disease especially allergies (Zakaria, *et al*., 2020).

One of the most important contributions of goat milk to human nutrition is the calcium as well as phosphate that it supplies. Goat milk contains about 1g phosphate and 1.2 g calcium per Liter; these concentrations are similar to those in cow milk. Human milk contains much less of these minerals with only one-sixth as much phosphate and one-fourth as much calcium. Thus, goat milk provides a great excess of calcium and phosphorus in relation to energy to human infant, both calcium and phosphorus of goat milk are absorbed by the human infant. (Getaneh, *et al*.,2016).

Goat milk has been recommended as a replaced for the patients allergic to cow milk. Between 40-100% of patients allergic

to cow milk protein tolerate goat milk. Medium chain length fatty acid or else Medium Chain Triglycerides (MCT) which are more in goat milk have been recognized as unique lipid with unique health benefits in mal-absorption syndromes, hyperlipoproteinemia, chyluria steatorrhea and in cases of intestinal resection, premature infant feeding, coronary bypass, gallstones and childhood epilepsy. MCT also inhibits or limits cholesterol deposition, contributes to normal growth of infants and dissolve cholesterol gallstones. Goat's milk is the most complete food known which is extremely compatible and nourishing natural food. So, it is highly nutritious that it can actually serve as a replace for a meal. It is also prepared due to its low-fat content and its capability to neutralize the acids and toxins present in the body. (Mohammed, & jimma, 2018).

It differs from cow or human in higher digestibility, distinct alkalinity, higher buffering capacity, and certain therapeutic value in medicine and human nutrition. The nutritional and health benefits of goat milk are related to a number of medical problems, for most being food allergies and also a substitute for those who suffer from cow milk allergy. (Soetan, *et al.*, 2010).

In general, cow milk is subjected to strict hygiene and quality regulations controlled while microbiological quality standards for production and distribution of goat milk are seems to be more relaxed. There is unlikely similarity between goat milk composition from other milk sources, and thus the quality standards for the milk from small ruminant animal should be evaluated based on the individual milk source. Raw goat milk sample were collected from 5 different farms in some village. and number of tests was done on these milk samples to obtain the general figures to represent standard quality of raw goat milk. (Nayik, *et al*., 2021).

2. MATERIALS AND METHODS

A) Platform tests: The Platform test's, included organoleptic test, C. O. B. test, and alcohol test.

i. Organoleptic test:

In organoleptic test, texture, colour and smell of the milk sample were being observed. Firstly, milk sample was smell for any off or sour aroma, then followed by visually observing on the appearance of the milk to check whether there was coagulation or no coagulation. The milk sample were also tested for temperature by using a thermometer in which milk sample should not be warmer than 4°C (Esendağli 2019).

ii. C. O. B. test: (clot on boiling test)

In COB test, take10 mL of milk sample ware boiled in the test tube in a water bath for 5 minutes. If there was clotting, coagulation or precipitation, the milk sample failed the test and therefore would be rejected (Lai *et al.*, 2016).

iii. Alcohol test:

The alcohol test depends on the instability of the proteins if the levels of acid are increased and acted upon by the alcohol. The measured25 ml of milk sample was mixed with an equal amount of diluted 68% ethanol solution in a small bottle or test tube. A good quality of milk sample shall have precipitation, no clotting, and small clumps (Lai *et al.*, 2016).

B) Physico-chemical analysis:

i. **pH:** Using electronic pH meter, pH of the milk samples was determined. Milk sample should range from pH 6.5-6.7 and sample out of the pH range towards acid side was considered acid milk and rejected (Lai *et al*., 2016)

ii. **Carbohydrate test**: The carbohydrate content in the milk sample was determined. 20 ml milk sample was taken in volumetric flask. In this 12 mL of 10% sodium tungstate solution was added and then 2 ml of 3N H_2SO_4 was mixed with it (Al-Abdulkarim *et al.,2013).* The mixture was diluted with water to make volume 200 mL, mixed well and filtered. Filtrate obtained was further used for estimation of lactose sugar as carbohydrates. The Burette was filled with filtrate. 25 mL of quantitative Benedict's reagent was taken in an evaporating dish. 2 gm of sodium carbonate crystals (Na_2CO_3) were added anti-bumping agent like glass beads, were added benedict reagent in evaporating dish and boiled, filtrate was added in it slowly. The end point of filtrate was blue to colourless (Matteson, (2017).

Milk fat test:

1. The Gerber butyrometer was filled with 10 mL of sulfuric acid: H_2SO_4

2. 11 ml. of raw milk was sucked and released into butyrometer containing sulfuric acid so that milk layer was formed above sulfuric acid.

3. 1 mL of iso-amyl alcohol was added into the Gerber butyrometer.

4. Gerber butyrometer was tightly sealed with a rubber plug and shaken well for 2 min to digest milk with sulfuric acid.

5. Gerber butyrometer was kept in the Gerber's centrifuge where rubber plus ends towards centre and rotated at 1000 rpm for 5 min.

6. After rotating for 5 min, it was immersed the in the water bath at 57°C to 60°C for 5 min, reading of percentage of milk fat was determined by holding by Gerber butyrometer in the vertical direction in order that the zero reading was the lowest level of the fat column or at the nearest. The thickness of the fat column from the top layer to the bottom layer to indicate the percentage of milk fat was read (Gillani, 2015).

C) Bacteriological examination:

i) Determination of coliforms: Multiple Tube Fermentation Technique for Members of the Coliform Group:

In this standard method 15 fermentation tubes each containing 10 mL brilliant green lacto bile broth (BGLB) strength MacConkey's broth was used containing double strength MacConkey's broth. The 0.1 mL sample inoculated in 5 tubes of the single strength, 1 mL samples inoculated in 5 tubes of single strength and 10 mL samples inoculated in double strength tubes. Those were incubated at 37°C and examined for acid and gas production after 24 and 48 h was taken as presumptive evidence of coliforms. The MPN of coliforms was determined from the combinations of number of tubes which showed acid and gas production and Na production in consultation with Mac Crady's tables (machuki 2022).

Confirmed test:

The typical colonies are sub-cultured in lactose containing broth and incubated at 37°C for 24 h. The presence of *E. coli* is confirmed by production of gas (Feng, *et al.*,1982).

Fecal coliform test (Eijckman's test / Elevated temperature test)

Tubes showing gas were sub cultured into EC medium and incubated at 45°C for 2 h. The gas and indole production in test is indicated fecal coliforms. Colonies from solid medium were sub cultured to lactose broth and if gas was produced in those were further sub cultured into EC broth as above (Feng, *et al., 2002*). And taken as completed test for fecal coliform (*E. coli*)

ii) Standard Plate Count:

Serial dilutions of milk were prepared in sterile 1% peptone water. 0.1 mL of each dilution (10^{-1}. 10^{-2} to 10^{-6}) was spread on sterile nutrient agar plates in triplicates and incubated at 37°C for 48 h and incubation at 37°C for 48 hours and colony count were taken in triplicate.

Proteolytic total plate count was determined on skimmed milk agar plate and incubated at 37°C for 48 h colony count were taken.

Psychotropic bacterial colony count were taken colony was determined by spreading the serial dilutions on nutrient agar plates in triplicates and incubating at lower temperature (4°C) for 48 h (Abdulkareem, 2022).

4) Identification of isolates from milk sample:

Identification was based on growth on selective agar and broth, colony morphology, Gram's reaction, biochemical test results and criteria for disregarding negative cultures. Results were analysed using Cowan and Steel manual, and other methods for the identification of medical bacteria (Dimri, *et al.*,2020).

3. RESULTS AND DISCUSSIONS

1) Sample collection:

Fresh goat milk samples were collected from 5 different villages as detailed below:

Table 1

Sample	Name of villages (Take shirala Dist-Sangli Maharashtra India)
G 1.	Kapari
G 2.	Padali
G 3.	Ingrul
G 4.	Shirala
G 5.	Red

All raw milk samples were obtained under aseptic conditions from healthy goat, to avoid any contamination which can influence the analysis. Sample were collected in a sterile glass bottle and delivered to laboratory and stored under refrigeration condition for further analysis of milk.

Milk sample were divided into 3 groups to perform different tests, including platform test, physico-chemical analysis and bacteriological analysis (Bonilla-Luque *et al.*, 2023).

2) Platform tests:

The platform tests of all goat milk samples designed as GM 1 to GM 5.

Table 2: Results of the platform tests (Organoleptic, C.O.B. and Alcohol tests)

Milk sample no.	Place of collection	Results of the organoleptic test	Results of C.O.B. test	Results of Alcohol test
1.	Kapari village	Normal white milky good colour, white natural smell, no any off or sour aroma and no coagulation.	No clotting / coagulation/ precipitation was observed.	No clotting / precipitation / small clumps were observed.
2.	Padali village	Normal white milky good colour, natural smell, no any off or sour aroma and no coagulation.	No clotting/ coagulation/ precipitation was observed.	No clotting/ precipitation / small clumps were observed
3.	Ingrul village	White milky colour, no any off or sour aroma	No clotting/ coagulation/ precipitation was observed.	No clotting / precipitation / small clumps. were observed.
4.	shirala	Normal white milkya colour, good natural smell, no ant off or sour aroma and no coagulation	No clotting/ coagulation/ precipitation was observed.	No clotting / precipitation / small clumps were observed.
5.	Red village	Normal milky good white colour, natural smell, no any off or sour aroma and no coagulation.	No clotting / coagulation /precipitation was observed.	No clotting / precipitation / small clumps were observed.

In organoleptic tests, the raw milk samples of goat showed normal white milky colour, good natural smell and no sediment contamination indicating appeared normal milk sample.

In C. O. B test, all milk samples were found to be normal precipitation after boiling in the water bath. Abnormal milk samples or sour milk developed acid (>0.2% acidity) and showed coagulation.

Alcohol test is mainly based on the instability of the proteins when the concentration of acid and rennet raised and thus acted upon by the alcohol (Saha, *et al.,* 2022). Thus, all raw's milk sample of goats were appeared normal on the basis of platform tests.

Table 3: Results showing physico-chemical analysis of the goat milk samples:

Analysis	Sample number				
	GM_1	GM_2	GM_3	GM_4	GM_5
pH	6..6	6.7	6.5	6.2	6.7

Fat (%)	4.5	4.2	3.9	4.1	4.3
Carbohydrate	3.7	4.5	3.9	4.0	4.2

The pH fat contents carbohydrate of all the form milk samples were with in the range of normal values in milk.

Table 4: MPN test for coliform:

Milk Sample	Place of Collection	MPN/100ml of coliforms
GM 1.	Karapi	12
GM 2 .	Padali	9
GM 3.	Ingrul	2
GM 4.	Shirala	17
GM 5.	Red	<2

Samples GM2 & GM3 were within the range of normal test but GM1, GM2, & GM4 show ≤ 2.0 conform MPN and hence, tested further for confirm and completed test.

Table 5: Result of the confirmed and completed test of the raw goat milk sample showing MPN tests for coliforms positive:

Isolate of sample	**Result of confirmed test**	**Result of completed test**
GM1	Positive	Negative
GM2	Positive	Negative
GM4	positive	positive

Samples GM 1 & GM 2 were negative completed test but sample GM 4, was positive and hence was subjected to confirm test.

Table 6: Result of completed test:

Sample 4 subjected to completed test for coliforms and results as shown in table.

Isolate of sample number	**Test**	**Result**	**Growth of 45^0C**	**Remark**
GM 4	Indole	+ve	+ve	It is fecal coliform
	Methyl red	+ve	+ve	
	Voges Proskauer	-ve	+ve	
	Citrate	-ve	+ve	

It indicated that GM4 contained faecal coliforms and that to outside normal range and hence milk (raw) is unsuitable for raw consumption

Results of the standard plate count of mesophilic bacteria, mesophilic proteolytic bacteria and psychrotrophic bacteria are presented in table 6

Table 7: Results of SPC of different groups types of bacteria in raw milk samples of goats:

Milk sample	Place of collection	SPC of mesophilic bacteria	SPC of mesophilic proteolytic bacteria	SP of psychotropic bacteria
GM1	Karapi	2.5×10^2	1.5×10^2	No growth
GM2	Padali	6.8×10^3	5.3×10^3	No growth
GM3	Ingrul	2.5×10^2	1.9×10^2	No growth
GM4	Shirala	7.5×10^3	6.5×10^3	No growth

GM5	Red	2.49×10^2	1.9×10^2	No growth

It can be seen from the table 6 the SPC for mesophilic bacteria range between 2.49×10^2 to 7.5 $x10^3$. Similarly, the SPC of mesophilic proteolytic bacteria ranged in between 1.5×10^2 to 6.5×10^3. It is also seen from the table that was no growth of psychrotrophic bacteria in all the samples It further indicated that mesophilic bacteria include proteolytic are significant in number and also found that of fine milk samples G1, G2, and G4 were coliform MPN test positive but any G4 sample was Positive faecal forms i.e 60% samples were coliform positive coliforms indicated organisms which indicate pressure of faecal pathogens in milk Hence Raw milk is potentially risky for raw consumption.

Results of colony characteristics of coliforms on EMB agar:

Table 7: Colony characteristics of isolate:

Size	Shape	Colour	Margin	Elevation	Consistency	Opacity	Gram nature	Spore staining
1 mm	Circular	White	Entire	Convex	Moist	Opaque	Gram nature rod	Non spore forming

Table 8: Results of biochemical tests of isolate:

Sr. No.	**Tests**	**Result**
1.	Indole	+
2.	Methyl Red	+
3.	Voges Proskauer	-
4.	Citrate Utilization	-
5.	Nitrate Reduction	+
6.	Catalase	+
7.	Oxidase	-
8.	Gelatin Liquefaction	-
9.	Hydrolysis of starch	-
10.	Urease	-
11	Sugar	
12.	Dextrose	+
13.	Lactose	+
14.	Sucrose	+
15.	Maltose	+
16.	Mannitol	+

Tentative Identify: E.Coli.(table 7 and 8)

+ indicates positive test

- Indicates negative test

It can be seen from the tables and 8, the isolate G4 was gram-negative, rod-shaped organism and non-spore forming. From result of cultural, morphological and biochemical characteristics and it was tentatively identified as *Escherichia coli*. from Bergey's Manual of Determinative Bacteriology volume 1.

Photoplate 1: A set of presumptive tests of sample of raw milk of goat of MPN for coliforms in BGLB broth at 37^0 C for 48 h. The set of tubes of BGLB broth show acid of gas production.

Photoplate 2: SPC plates of a set of raw milk sample of goat at 37ºC for 72 h. It shows growth bacteria.

4. CONCLUSION

Five milk samples of goats were collected from five different villages in Shirala Taluka, Dist- Sangli. The raw milk samples were subjected for different tests, including platform test, physico-chemical analysis and bacteriological examination, including SPC and MPN test for coliforms and wherever applicable confirmed and completed test. The milk samples examined showed SPC of mesophilic and mesophilic proteolytic bacteria in the range of 2.49 x 10 to 7.5 x 10^3, 1.5 x 10 to 6.5 × 10^3 respectively. Most of the milk samples were contaminated, although apparently appearing normal in physio-chemical and platform test examination. The consumption of such raw goat milk seems to be unsafe for the health. The significant microbial counts of immense of coliforms could be due to the improper methods of milking, unhygienic condition of milking area, unsafe methods of handling. The clear conclusion is that the raw milk of goats is unsafe for direct consumption It must be either pasteurised or boiled (regular frame method) before consumption.

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