



Original Research Article

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## Physicochemical analysis of milk collected from free-ranging indigenous breeds and zero-grazing exotic breeds of cow, goat and buffalo

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### Article Info

### Abstract

#### Keywords:

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In this study, different raw milk samples were collected from free-ranging indigenous breeds and zero-grazing exotic breeds of cow, goat & buffalo and analyzed for various physicochemical parameters and microbial activity. It was found that the milk from free-ranging cow had 0.152±0.004% acidity, 4.42±0.38% fat, 9.01±0.5% solid non fat, 13.64±0.27% total solids, 1.03±0.001 specific gravity, 6.68±0.002 pH, 5.18±0.38% protein, 4.10±0.05% lactose, 0.38±0.08% ash. Whereas, zero-grazing cow had 0.151±0.005% titratable acidity, 4.04±0.45% fat, 8.74±0.75% SNF, 12.64±0.17% TS, 1.06±0.001 Specific Gravity, 6.80±0.02 pH, 5.28±0.40% Protein, 4.45±0.06% lactose, 0.42±0.10% ash. Free-ranging indigenous breeds were found better according to this study as compared to zero-grazing exotic breeds.

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### Introduction

Milk and dairy products are a part of healthy diet which, besides cow's milk; sheep's, goats and buffalo's milk are involved. Milk is a complex colloidal dispersion. It contains fat globules, casein micelles and whey proteins in an aqueous solution of lactose, minerals and a few other minor compounds. Evaluation of some of the physico-chemical properties is used to assess the quality of milk. Milk is a foremost source of all basic nutrients required for mammals including human beings. (Bindal and Wadhwa, 1993) Milk from various mammals' cow, goat, buffalo and sheep are

used for nutritional purposes. Also used for the preparation of nutritional products such as milk cream, butter, ghee, yogurt, sour milk etc., India is the world's largest milk producer, accounting for 18.5 percent of world production (Bellal Hossain and sima 2013). In the past six and a half decades milk production in India has grown by over eight fold, from 17 MMT in 1950 to 137.7 MMT in 2013 and increased as 165.40 MMT in 2016-17 to 176.35 MMT in 2017-18, a growth rate of 6.62 percent. In India, the rural population depends heavily on the livestock for their livelihood. Among the livestock, a dairy cattle plays a pivotal role in the economy of rural poor (Patel and Mistry, 1997). Dairy

farming provides a livelihood for many people across our country (Celestino et al., 1997).

### **Breeds of cattle**

More than 800 cattle breeds recognized worldwide, in India there are 27 acknowledged indigenous breeds of cattle and 7 breeds of buffaloes. Breed, pedigree, production records and physical appearance are to be considered in the selection of suitable dairy animals (Imran et al., 2008). Aside from a large number of non-descript breeds, there are 26 well defined breeds of cattle and 6 breeds of buffaloes in our country (Talpur et al., 2009). Some of the important breeds in cows and buffaloes are Sindhi, Sahiwal, Gir, Jaffara badi, Murrah, Jersey, HF, Sunandini, Swiss brown, Red Dane etc. kanniadu, Kodiadu, Salem Black, Jamna pari, beetal, Malabari, Osmanabadi are widely used goat breeds in India (Dey and Karim 2013).

### **Free-ranging and Zero-grazing breeds**

Free-range represents a method of farming husbandry in which the animals, for at least part of the day, can roam freely outdoors. Mostly, indigenous breeds are free-ranging (Tasci, 2011) Whereas, Zero-grazing is a system where the cattle are usually kept in the farm and farmers bring the feed and water to the animals. Due to diminished communal grazing land, Zero-grazing has become a common live stock management now a day (Mehanna et al., 2001). Most of the exotic and cross breeds are used to practice Zero-grazing. Free-ranging animals are healthier than zero-grazing animals and also give healthier products because they don't treat their livestock with hormones or feed them growth-promoting additives (Hossain et al., 2010).

### **Materials and methods**

#### **Sample collection**

Milk samples of free-ranging indigenous breeds of cow, goat and buffalo was collected from non-dairy cattle breeds within 50 km radius of chengelpet, Tamil Nadu. The animals were free-ranging and no form of special nutrient supplement was provided. For ages, Silages of different plants, Crop residues, Straw or seed hulls were their regular feed. Red Sindhi, Kangeyam, Tharparker, Umblacherry, Gir were sampled under free-ranging indigenous cows. Surti, Murrah, Mehsana, Niliravi, Jaffarabadi were sampled under free-ranging

indigenous buffaloes. All the cow and buffaloes were in the peak stage of lactation, between weeks 4-8. Kanniaadu, Kodiadu, Black Bengal, Ramanathapuram velladu, Salem black were sampled under free-ranging indigenous goats (Park et al., 2007).

All the goats were also in the peak stage of lactation, between 4-6 weeks. Milk samples of zero-grazing exotic breeds of cow, goat and buffalo were collected from dairy cattle breeds. Oil seed meal cake, Molasses, Whey, Maize silage, Napier grass was their regular feed. Jersey, Reddane, Brown Swiss, Ayrshire, Holstein-Friesian were sampled under zero-grazing exotic cows. Bhadawari, Behri, Anatolian buffalo, Bulgarian Murrah, Pandharpuri were sampled under zero-grazing exotic buffaloes. They were also in the peak stage of lactation, between weeks 4-8. Saanen, Angora, Alpine, Boer, Anglo-Nubian were sampled under zero-grazing exotic goats with 4-6 weeks of lactation. All the milk samples were hand-milked and milk of all four quarters was pooled, mixed and subdivided for storage in 50 mL sterile bottles. No milk letting agent was administered (Jenness, 1980). Milk was kept on ice while in the field. The milk samples were then stored at -20°C until all the milk samples had been collected, which took two weeks. For analysis, milk was thawed and mixed by swirling at 39°C in a water bath (Chandrasekhar, 1951).

### **Physicochemical analysis**

The pH was measured using a digital pH-meter (HI8314 Hanna Instruments, Italy) calibrated with pH 4 and seven buffers. Specific gravity was determined by pycnometer as described by AOAC (2000). Titratable acidity was determined by titrimetric method as described by AOAC (2000) (Laxminarayana and Dastur, 1968). Total solids content was determined according to the method of AOAC (2000). Ash content was determined by gravimetric method using muffle furnace at 550°C as determined by AOAC (2000). Fat content was determined by Rose-Gottlieb method as described by AOAC (2000). Protein content was estimated by formal titration method (Chong J, 2019). Lactose was determined by using Fehling's solution method (Hossain and Dev, 2013). Methylene Blue Reduction Test [MBRT] is the interval between the placing of the tubes in the water bath at 37°C and the disappearance of the blue colour of the milk. The shorter the time interval greater is the number of active

bacteria in the milk and the lower is the quality of the milk. The MBRT evaluation table is given in Table 1.

**Table 1.** MBRT evaluation table.

Reduction time	Quality
More than 8 hours	Excellent
6– 8 hours	Good
2– 6 hours	Fair
Less than 2 hours	Poor

## Results

### Lactometer reading and specific gravity

The results of LR and specific gravity of all milk samples from free-ranging breeds are shown in Tables 2 and 3 and zero-grazing breeds are shown in Tables 4 and 5. Free-ranging cow’s milk showed the highest LR and specific gravity i.e., 30.3 and 1.03 respectively. Similarly, LR of free-ranging goat’s milk ranged from 27-30 and corresponding to specific gravities of 1.02-1.03. Moreover, the milk samples of free-ranging buffaloes showed LR values in the range of 26-29 and corresponding specific gravities of 1.01-1.03. In further comparison of zero-grazing breeds, the cow milk samples showed LR and specific gravity values as 29 and 1.03 respectively. LR and specific gravity of goat milk samples are 28.08 and 1.027 respectively. The buffalo milk samples showed LR and specific gravity values as 27.40 and 1.028 respectively. These results showed that cow and goat milk is non-significantly different but buffalo milk is significantly different from each other (Gakkhar et al., 2015).

**Table 2.** Lactometer reading for different milk samples collected from free-ranging indigenous breeds.

Free-ranging indigenous breeds	LR (Range)	LR (Mean)	Standard deviation (SD)
Cow	28-34	30.3	1.89
Goat	27-30	29.1	1.24
Buffalo	26-29	27.66	0.634

**Table 3.** Specific gravities of different milk samples collected from free-ranging indigenous breeds

Free-ranging indigenous breeds	Sp. Gravity (Range)	Sp. Gravity (Mean)
Cow	1.01-1.03	1.03
Goat	1.02-1.03	1.02
Buffalo	1.01-1.03	1.02

**Table 4.** Lactometer reading for different milk samples collected from zero-grazing exotic breeds.

Zero-grazing exotic breeds	LR (Range)	LR (Mean)	Standard deviation (SD)
Cow	28-34	29.00	1.76
Goat	26-30	28.08	1.45
Buffalo	25-29	27.40	1.63

**Table 5.** Specific gravities of different milk samples collected from zero-grazing exotic breeds.

Zero-grazing exotic breeds	Specific Gravity (Range)	Specific Gravity (Mean)
Cow	1.01-1.08	1.03
Goat	1.02-1.06	1.027
Buffalo	1.01-1.06	1.028

### pH and total titra table acidity

pH and total titra table acidity was recorded at fresh stage. The titra table acidity test is a simple acid-base reaction. pH and titra table acidity values of various milk samples of free-ranging indigenous breeds and zero-grazing exotic breeds are given in Tables 6-9. The cow’s milk of both free-ranging and zero-grazing breed’s showed maximum pH value of 6.68 and 6.80 respectively, while buffalo milk samples of both free-ranging and exotic breeds showed maximum titra table acidity of 0.164% and 0.162% respectively.

The minimum pH value in free-ranging and zero-grazing breeds i.e., 6.60 and 6.64 respectively was of goat milk samples while the minimum titratable acidity in both free-ranging and zero-grazing breeds i.e., 0.142% and 0.137% respectively was of goat milk samples. The results showed that cow, goat, buffalo milk samples are non-significantly different from each other in both free-ranging indigenous breeds and zero-grazing exotic breeds. (Gemechu et al. 2015).

**Table 6.** pH of different milk samples collected from free-ranging indigenous breeds.

Free-ranging indigenous breeds	pH (Range)	pH (Mean)
Cow	6.5-6.7	6.68
Goat	6.3-6.6	6.60
Buffalo	6.6-6.9	6.64

**Table 7.** Total table acidity of different milk samples collected from free-ranging indigenous breeds.

Free-ranging indigenous breeds	TTA (Range)	TTA (Mean)	Standard deviation (SD)
Cow	0.12-0.19	0.152	0.0049
Goat	0.11-0.17	0.142	0.0150
Buffalo	0.11-0.18	0.164	0.0142

**Table 8.** pH of different milk samples collected from zero-grazing exotic breeds.

Zero-grazing exotic breeds	pH (Range)	pH (Mean)
Cow	6.5-6.8	6.80
Goat	6.3-6.8	6.64
Buffalo	6.6-7.0	6.72

**Table 9.** Total table acidity of different milk samples collected from zero-grazing exotic breeds

Zero-grazing Exotic breeds	TTA (Range)	TTA (Mean)	Standard deviation (SD)
Cow	0.12-0.19	0.151	0.0059
Goat	0.11-0.17	0.137	0.0069
Buffalo	0.11-0.18	0.162	0.0155

### Fat, solid non fat and total solids

In general, the estimation of fat contents is determining the overall quality of fresh milk. Mean values and their respective range values of different milk samples from free-ranging indigenous breeds and zero-grazing exotic breeds are given in Tables 10-15.

**Table 10.** Fat percentage of different milk samples collected from free-ranging indigenous breeds.

Free-ranging Indigenous breeds	Fat % (Range)	Fat % (Mean)	Standard deviation (SD)
Cow	4.0-5.0	4.42	0.389
Goat	3.9-5.7	4.53	0.486
Buffalo	4.0-6.5	4.84	0.709

**Table 11.** Solid non-fat percentage of different milk samples collected from free-ranging indigenous breeds.

Free-ranging indigenous breeds	SNF% (Range)	SNF % (Mean)	Standard deviation (SD)
Cow	8.43-10.14	9.01	0.50
Goat	8.53-9.47	8.96	0.27
Buffalo	8.28-9.40	8.70	0.41

**Table 12.** Total solids percentage of different milk samples collected from free-ranging indigenous breeds..

Free-ranging indigenous breeds	TS% (Range)	TS% (Mean)	Standard deviation (SD)
Cow	13.43-14.34	13.64	0.27
Goat	12.60-15.17	13.56	0.80
Buffalo	12.73-15.90	14.02	1.17

**Table 13.** Fat percentage of different milk samples collected from zero-grazing exotic breeds.

Zero-grazing exotic breeds	Fat% (Range)	Fat% (Mean)	Standard Deviation (SD)
Cow	4.0-5.0	4.04	0.450
Goat	3.9-5.7	4.26	0.750
Buffalo	4.0-6.5	4.74	0.293

**Table 14.** Solid non-fat percentage of different milk samples collected from zero-grazing exotic breeds.

Zero-grazing exotic breeds	SNF% (Range)	SNF% (Mean)	Standard deviation (SD)
Cow	8.43-10.14	8.74	0.75
Goat	8.53-9.47	8.54	0.30
Buffalo	8.28-9.40	8.47	0.37

**Table 15.** Total solids percentage of different milk samples collected from zero-grazing exotic breeds.

Zero-grazing exotic breeds	TS% (Range)	TS% (Mean)	Standard deviation (SD)
Cow	13.43-14.34	12.64	0.17
Goat	12.60-15.17	12.56	0.70
Buffalo	12.73-15.90	13.02	1.07

The fat and total solid contents of the buffalo's milk of both free-ranging and zero-grazing breeds were 4.84 and 14.02% and 4.74 and 13.02% respectively. Similarly, the fat and total solid contents of the goat's milk of both free-ranging and zero-grazing breeds were

4.53 & 13.56% and 4.26 and 12.56% respectively. The fat and total solid contents of the cow's milk of both free-ranging and zero-grazing breeds were 4.42 and 13.64% and 4.04 and 12.64% respectively. The results of fat%, protein % and Nitrogen showed that buffalo, cow and goat are non-significantly different from each other in both free-ranging indigenous breeds and zero-grazing exotic breeds (Tables 16-19) (Saxena and Rai, 2013).

**Table 16.** Protein% of different milk samples collected from free-ranging indigenous breeds

Free-ranging indigenous breeds	Protein% (Range)	Protein% (Mean)	Standard deviation (SD)
Cow	4.34-5.66	5.18	0.38
Goat	1.08-3.08	2.26	0.65
Buffalo	3.10-4.10	3.64	0.25

**Table 17.** Total nitrogen% of different milk samples collected from free-ranging indigenous breeds.

Free-ranging indigenous breeds	TN% (Range)	TN% (Mean)	Standard deviation (SD)
Cow	0.75-0.95	0.84	0.04
Goat	0.25-0.45	0.35	0.06
Buffalo	0.55-0.65	0.60	0.02

**Table 18.** Protein% of different milk samples collected from zero-grazing exotic breeds.

Zero-grazing exotic breeds	Protein % (Range)	Protein % (Mean)	Standard deviation (SD)
Cow	4.34-5.74	5.28	0.40
Goat	1.08-3.11	2.68	0.72
Buffalo	3.10-4.20	3.84	0.50

**Table 19.** Total nitrogen% of different milk samples collected from zero-grazing exotic breeds.

Zero-grazing Exotic breeds	TN% (Range)	TN % (Mean)	Standard deviation (SD)
Cow	0.75-0.95	0.90	0.08
Goat	0.25-0.45	0.40	0.06
Buffalo	0.55-0.65	0.64	0.04

However, the results of SNF found in this study showed significant difference among the milks of

buffalo and goat. SNF% in free-ranging and zero-grazing cows had the maximum value of 9.01 and 8.74% respectively. Free-ranging and zero-grazing buffaloes had the minimum value of 8.70 and 8.47% respectively. Free-ranging and zero-grazing goat shad was 8.96 and 8.54% respectively (Singh and Pratap, 2014).

### Lactose and ash contents

Lactose is the principal carbohydrate of milk. Lactose content of various milk samples collected from free-ranging indigenous breeds and zero-grazing exotic breeds are given in the Tables 20 and 21.

**Table 20.** Lactose% of different milk samples collected from free-ranging indigenous breeds.

Free-ranging indigenous breeds	Lactose % (Range)	Lactose % (Mean)	Standard deviation (SD)
Cow	3.0-4.5	4.10	0.050
Goat	4.0-5.5	4.68	0.035
Buffalo	3.1-4.8	4.02	0.005

**Table 21.** Ash % of different milk samples collected from free-ranging indigenous breeds

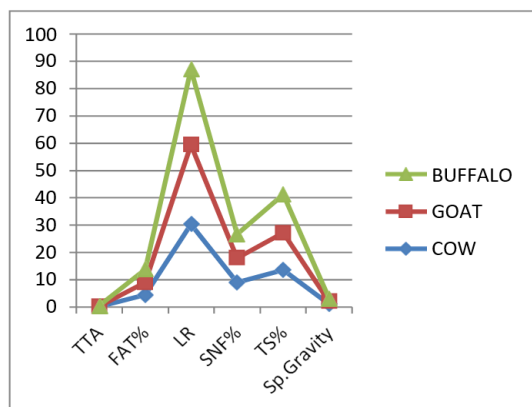
Free-ranging indigenous breeds	Ash % (Range)	Ash % (Mean)	Standard deviation (SD)
Cow	0.25-0.45	0.38	0.08
Goat	0.20-0.40	0.30	0.65
Buffalo	0.35-0.45	0.40	0.02

**Table 22.** Lactose% of different milk samples collected from zero-grazing exotic breeds.

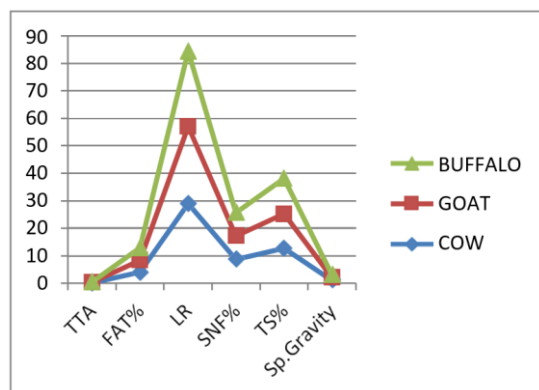
Zero-grazing exotic breeds	Lactose % (Range)	Lactose % (Mean)	Standard deviation (SD)
Cow	3.0-4.5	4.45	0.060
Goat	4.0-5.5	5.12	0.045
Buffalo	3.1-4.8	4.23	0.007

Milk samples collected from free-ranging and zero-grazing breeds of goat showed the minimum value of 4.02 and 4.23% respectively and the goat milk samples collected from the free-ranging and zero-grazing breeds showed the maximum value of 4.68 and 5.12% respectively. Free-ranging and zero-grazing cow had 4.10 and 4.45% respectively. The results showed that goat was significantly different from each other and buffalo and cow are non-significantly different from

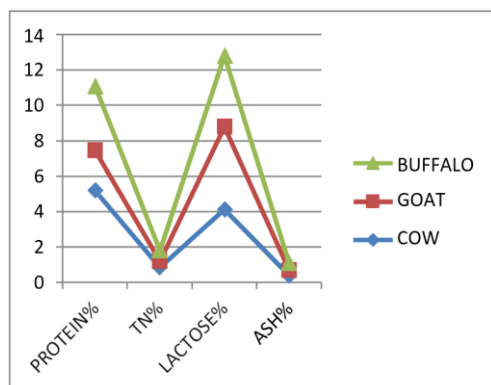
each other in both free-ranging and zero-grazing breeds. Physical and chemical parameters of different milk samples collected from zero-grazing exotic breeds of cow, goat and buffalo were analyzed and figuring out in Figs. 1-4.



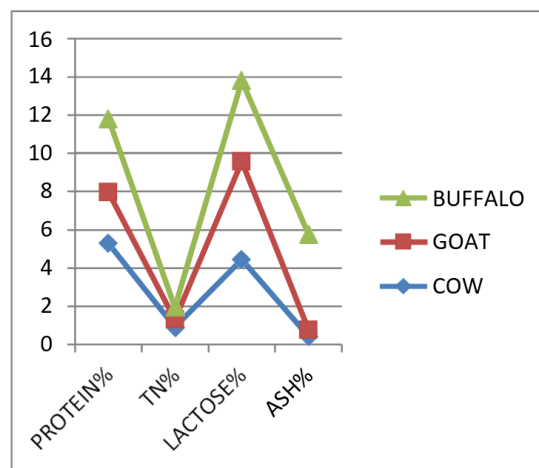
**Fig. 1:** Physical parameters of different milk samples collected from free-ranging indigenous breeds of cow, goat and buffalo.



**Fig. 2:** Physical parameters of different milk samples collected from zero-grazing exotic breeds of cow, goat and buffalo.



**Fig. 3:** Chemical composition of free-ranging indigenous breeds.



**Fig. 4:** Chemical composition of zero-grazing exotic breeds.

The values of ash contents of various milk samples collected from free-ranging indigenous breeds and zero-grazing exotic breeds are given in the Table 23.

**Table 23.** Ash% of different milk samples collected from zero-grazing exotic breeds

Zero-grazing exotic breeds	Ash % (Range)	Ash % (Mean)	Standard deviation (SD)
Cow	0.25-0.45	0.42	0.10
Goat	0.20-0.40	0.34	0.68
Buffalo	0.35-0.45	0.44	0.06

The results showed that the free-ranging and zero-grazing breeds of buffalo had the maximum ash content of 0.40 and 0.44% whereas, free-ranging and zero-grazing goat had the minimum ash content of 0.30 and 0.34% respectively.

Free-ranging and zero-grazing cow had 0.38 and 0.42% respectively. These results are partly confirmed to normal range of ash contents in milk obtained from various species (Manso and Lopez-Fandio 2004).

### Methylene blue reduction test

The MBRT results for raw milk samples collected from free-ranging indigenous breeds and zero-grazing exotic breeds of cow, goat and buffalo showed good and fair reduction time. Free-ranging indigenous breeds have better reduction time than zero-grazing breeds. Pasteurized milk samples of both free-ranging and zero-grazing breeds had good reduction time (Markoska *et al.*, 2019) reported excellent quality milk both in raw

and pasteurized samples. But, the chance for excellent quality milk in cases of raw milk samples is less because of the environmental conditions and the cattle feed. In this work, no such excellent quality milk was determined (Tassew and Seifu, 2011).

### Cloton boiling test

The clot on boiling test showed Negative results for all samples. There is no Precipitation or coagulation in both free-ranging indigenous breeds and zero-grazing exotic breeds of cow, goat and buffalo (Tesfey *et al.* 2015)

### Phosphatase test

The test is used to judge the efficiency of pasteurization of milk. According to the accepted practice in the country, milk for liquid trade is pasteurized by the holding method (63 to 66°C) for 30 minutes or by the high temperature short time (72.2 to 72.8°C) for 15 seconds (Nieuwoudt 2016).

To test whether the heat treatment by either of these methods was properly carried out, the treated milk is subjected to the phosphatase test, which helps to indicate the presence or absence of phosphatase enzyme. All the milk samples collected from various free-ranging indigenous breeds and zero-grazing exotic breeds of cow, goat and buffalo showed negative results (Woldemariam and Asres, 2017)

### Chemical analysis

The presence of sulphate, urea, sodium chloride and starch in both free-ranging indigenous breeds and zero-grazing exotic breeds of cow, goat and buffalo was analyzed according to AOAC (2000). The result was showed in Tables 24-29 (Sodi *et al.*, 2008).

**Table 24.** Chemical analysis of free-ranging breeds of cow.

Free-ranging indigenous breeds of cow	Sulphate	Urea	Sodium chloride	Starch
Redsindhi	-	-	-	-
Kangeyam	-	-	-	-
Tharparker	-	-	-	-
Umblacherry	-	-	-	-
Gir	-	-	-	-

**Table 25.** Chemical analysis of free-ranging breeds of goat.

Free-ranging indigenous breeds of goat	Sulphate	Urea	Sodium chloride	Starch
Kanniaadu	-	-	-	-
Kodiaadu	-	-	-	-
Blackbengal	-	-	-	-
Ramanathapura mvelladu	-	-	-	-
Salemblack	-	-	-	-

**Table 26.** Chemical analysis of free-ranging breeds of buffalo

Free-ranging indigenous breeds of buffalo	Sulphate	Urea	Sodium chloride	Starch
Surti	-	-	-	-
Mehsana	-	-	-	-
Niliravi	-	-	-	-
Murrah	-	-	-	-
Jaffarabadi	-	-	-	-

**Table 27.** Chemical analysis of zero-grazing breeds of cow.

Zero-grazing exotic breeds of cow	Sulphate	Urea	Sodium chloride	Starch
Jersey	-	-	-	-
Reddane	-	+	-	-
Brownswiss	+	-	-	-
Ayrshire	-	+	-	-
Holsteinfrie stan	-	-	-	-

**Table 28.** Chemical analysis of zero-grazing breeds of goat.

Zero-grazing exotic breeds of goat	Sulphate	Urea	Sodium chloride	Starch
Saanen	-	-	-	-
Angora	-	-	-	-
Alpine	-	-	-	-
Boer	-	-	-	-
Anglo-Nubian	-	-	-	-

**Table 29.** Chemical analysis of zero-grazing breeds of buffalo

Zero-grazing exotic breeds of buffalo	Sulphate	Urea	Sodium chloride	Starch
Bhadawari	-	-	-	-
Beheri	-	-	-	-
Anatolian buffalo	-	-	-	-
Bulgarian	-	-	-	-
Murrah	-	-	-	-
Pandharpuri	-	-	-	-

### Microbial analysis

A result of IMVIC Test for the bacteria 1 isolates about indole, methyl red citrate content are shown in Table 30.

**Table 30.** IMVIC results.

Bacterial isolates	Indole	Methyl red	Voges-Proskauer	Citrate
<i>E. coli</i>	+	+	-	-
<i>S. aureus</i>	-	+	+	-
<i>B. cereus</i>	+	-	-	+
<i>P. aeruginosa</i>	-	-	+	-

### Discussion

MBRT results of both free-ranging indigenous breeds and zero-grazing exotic breeds showed good and fair results for all the samples of cow, goat and buffalo. (Schulz H 2018) With reference to physicochemical analysis, LR is usually ranges from 25-29, specific gravity is between 1.01-1.08, pH is ranging between 6.5-6.9, TTA is between 0.11-0.19, Fat is between 4.0-6.5, SNF is between 8.2-10 and TS is between 12.7-15.9. Protein is ranging between 3.1-5.4, TN is between 0.25-0.95, Lactose is between 3-5.5, and Ash is between 0.25-0.45 (Spanghero and Susmel, 1996). Further, the pasteurized milk samples were subjected to Phosphatase test in order to test the efficiency of pasteurization (Ahmad et al., 2008). This showed that the pasteurization was up to the mark. The confirmatory test was done to confirm the presence of bacteria. The IMVIC test was done to check the

biochemical properties of the isolates (Dubey et al., 1997).

### Conclusions

From the results, it was observed that most of the tested parameters were similar in cow and goat milk samples. Buffalo milk samples are significantly different from each other. Free-ranging indigenous breeds of cow showed the better results in physicochemical analysis than goat and buffalo. Free-ranging indigenous breeds and zero-grazing exotic breeds are non-significantly different from each other. Though zero-grazing breeds were not differed much from free-ranging breeds, milk samples from free-ranging animals provided better results in all parameters when compared to zero-grazing animals. Hence, milk from free-ranging animals was found better.

### Conflict of interest statement

Authors declare that they have no conflict of interest.

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