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Research Article

EFFECT OF LACTATION ORDER AND STAGES OF LACTATION ON PHYSICO-CHEMICAL PROPERTIES OF SANGAMNERI GOAT MILK

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ABSTRACT

The main objectives of present investigation were to study the physico-chemical properties of Sangamneri goat milk and to study the effect of lactation order and stage of lactation on physical and chemical properties of sangamneri goat milk. During the entire study the fresh goat milk samples of Sangamneri goats according to lactation order and their 1st (Upto 30 days), 2nd (31 to 60 days) and 3rd (above 61 days) stage of lactations were analysed for colour, specific gravity, boiling point, water, fat, protein, lactose, total solids, SNF, total ash, titratable acidity and pH. The data were statistically analysed by using Factorial Completely Randomized Design (FCRD). The average specific gravity, boiling point of milk was 1.027 and 100.01, respectively and colour of milk was perfect white. The overall mean chemical composition of milk was 86.30 per cent water, 5.24 per cent fat, 3.62 per cent protein, 4.07 per cent lactose, 13.70 per cent total solids, 8.48 per cent SNF, 0.75 per cent total ash, 0.129 per cent titratable acidity and 6.42 pH. The values of milk composition were significantly affected by lactation order and stage of lactation. The mean values of specific gravity, boiling point, fat, protein, total solids, SNF, total ash, titratable acidity content of Sangamneri goat milk significantly increased from 1st to 3rd stage of lactation. While lactose and water content of milk significantly decreased during 1st to 3rd lactation order as well as stage of lactation.

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INTRODUCTION

In India Goat keeping constitutes an important rural business of small, marginal farmers and landless labourers due to multifold advantages like short generation interval, high rate of prolificacy, ease management and marketing over large ruminants in India. India ranks first in the world goat population. About 18 to 20 lakh families are involved in goat and sheep rearing with an average strength of 1 to 7 goats per household. Goat milk production would have definite boost in the near future. Goat is also known as poor man's cow. It is one of the important and multipurpose species of livestock economically maintained for meat, milk, fibre, skin and manure production. Therefore, goats are proved to be a boon to the poor, landless labourers and marginal farmers.

Goat milk has higher medicinal value and it also contains 4.4 per cent fat, 0.137 per cent Ca, 0.112 per cent P, 0.017 per cent Mg, 0.170 per cent K and 3.4 per cent milk protein (Holmes *et al.*, 1946). On an average, goat and cow milk provided approximately 72 and 67 Kcal of energy per 100 g, respectively. Smaller size of fat globules of goat milk make it almost naturally homogenized. Most of the human population

in the world is malnourished because of lack of protein energy along with minerals and vitamins. Goats appears to be best suited to overcome those problems by way of producing better nutrition in the form of goat milk. This gives much support to the contention that improved goat milk production is one of the best strategies to relieve human starvation, under nutrition and malnutrition and therefore, great market growth potential incentive and justification specially in areas where pasture conditions.

Intensive goat development programme need to be undertaken for enhancing milk and meat production. The major problem in India with acceptability and marketing of goat milk is due to a "goaty" flavour which is more of an management problem rather than the fault of animal. In view of the increasing demand for goat's milk and its products by the health conscious society due to prescription by doctors, goats milk is likely to fetch higher prices in future. In some western countries goat milk is already processed through separate channels than cow milk and is being sold at 1.5 to 2.0 times higher price than cow milk. Wide publicity needs to be given in view of the virtues of goat milk and fall will be a silver lining for both the goats and goat farmers.

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Sangamneri goat is important goat breed in Maharashtra. Sangamneri breed is a dual purpose breed (milk and meat). However, some Sangamneri goats are producing 3 lit of milk/day under field condition. The Sangamneri goats are white in colour. Goat milk has unique qualities over the milk of other livestock. It is nearest to human milk in its content of fat, protein and serves as good source of minerals, which make it complete food for infants. Goat milk rich source of various minerals and all these minerals are important as per the human nutrition.

MATERIAL AND METHODS

During the entire study the fresh goat milk sample were collected from 27 goats according to lactation order and stage of lactation. The Sangamneri goat milk samples were collected early in the morning. During this period individual goats were milked completely and after thorough mixing the milk samples were collected in 250 ml bottles and brought to the laboratory for analysis. The collected samples were kept in a refrigerator at 5^oC until they were analyzed.

Treatment details

Factor	Interaction(L + S)
A. Lactation order (L)	L ₁ S ₁
L ₁ - Lactation order first	L ₁ S ₂
L ₂ - Lactation order second	L ₁ S ₃
L ₃ - Lactation order third	L ₂ S ₁
B. State of lactation (S)	L ₂ S ₂
S ₁ - Stage of lactation first	L ₂ S ₃
S ₂ - Stage of lactation second	L ₃ S ₁
S ₃ - Stage of lactation third	L ₃ S ₂
	L ₃ S ₃

Replications: 3

Proximate analysis

The samples of sangamneri goat milk were analyzed for their proximate composition of physical and chemical properties they are given below;

Determination of physical properties

The Sangamneri goat milk samples were analyzed for physical parameters by adopting standard procedure given below. Colour of milk samples was determined by comparing it with different colour shades in charts of book and matching colour code is noted. Specific gravity of milk was determined by using Zeal Lactometer according to the procedure described in as per IS: 1183, (1965). Boiling point of milk sample by using hot water bath method.

Determination of chemical properties

The Sangamneri goat milk samples were analyzed for chemical parameters by adopting standard procedure given below. Water (%) was determined by procedure as per the BIS Part-XI (1981). Fat was determined by Gerber method as per procedure stated in IS: 1224 (Part-I), 1977. Protein content of milk was determined as per procedure stated in BIS: Part-XI (1981) by digestion and distillation method. Lactose was determined as per Lane-Eynon's method given in IS: 1479 (Part-II) 1961. Total solids were determined as per procedure of gravimetric method given in IS: 1479 (Part II), 1961. SNF was calculated by using formula. Ash content was estimated as per procedure

given in IS: 1479 (Part II), 1961. Acidity of milk samples were determined as per procedure stated in IS: 1479 (Part I) 1961. pH of milk determined by using digital pH meter following the procedure stated in IS: 1479 (Part-II) 1961.

Statistical design

The observations were statistically analysed using Factorial Completely Randomized Design (FCRD) to study the effect of lactation order and stage of lactation on Sangamneri goat milk (Panse and Sukhatme, 1985).

RESULT AND DISCUSSION

Physical properties of milk

Milk colour

No significant difference in the colour pattern due to lactation order and stage of lactation was noticed.

Specific gravity

The overall specific gravity for milk samples was 1.027 g/ml. The specific gravity was increased significantly with advancement of lactation order and the stage of lactation. The differences in the specific gravity due to interactions were also significant. These result are in agreement with the finding of Agarwal and Sharma (1961).

Table 1 Average physical properties of Sangamneri goat milk

Treatment	Physical properties of Sangamneri goat milk		
	Milk colour	Sp. Gravity	Boiling point
L ₁	-	1.026	99.88
L ₂	-	1.027	100.08
L ₃	-	1.029	100.09
S ₁	-	1.026	99.83
S ₂	-	1.027	100.07
S ₃	-	1.029	100.14

Table 2 Average chemical properties of Sangamneri goat milk

Treatment	Chemical properties of Sangamneri goat milk								
	Water	Fat	Protein	Lactose	T.S	SNF	Ash	Titration Acidity	pH
L ₁	86.54	5.01	3.51	4.13	13.47	8.44	0.73	0.123	6.55
L ₂	86.38	5.20	3.59	4.07	13.62	8.46	0.75	0.129	6.36
L ₃	85.98	5.52	3.74	4.00	14.02	8.55	0.77	0.134	6.34
S ₁	86.75	4.90	3.45	4.18	13.25	8.42	0.74	0.125	6.37
S ₂	86.22	5.28	3.64	4.09	13.78	8.51	0.75	0.127	6.41
S ₃	85.91	5.56	3.75	3.94	14.09	8.53	0.77	0.133	6.47

(Note: L= Lactation order, S = Stage of lactation)

Boiling point

The overall boiling point in milk samples was 100.01^oC and boiling point during different lactations ranged between 99.50 to 100.17^oC. The boiling point of milk showed inclining trend from 1st to 3rd lactation order as well as stage of lactation. The differences in boiling point due to lactation order, stage of lactation and its interaction were found to be significant. The result are in agreement with the Anonymous (2009).

Chemical properties of Sangamneri goat milk

Water

The overall water in milk was 86.30 per cent and average values of water in milk lies between 85.48 to 86.96 per cent in

milk. The water content of milk was decreased significantly from 1st to 3rd lactation order, stage of lactation and their interactions. The results are in close agreement with the Devendra (1980).

Fat

The overall fat content in milk was 5.24 per cent and maximum fat content was recorded in 3rd lactation order and 3rd stage of lactation, the fat content in milk ranged from 4.63 to 5.90 per cent. The lactation order and stage of lactation affected the fat content in the milk significantly ($P < 0.05$). The fat content in milk increased as the lactation order and stage of lactation advanced with significant effect. However the non-significant effect due to interaction of stage and order of lactation was noticed in fat content of the milk. These results are in agreement with Chakraborty (1979), Mittal and Pandey (1971).

Protein

The mean protein content in milk was 3.62 per cent and it ranged from 3.37 to 3.93 per cent which was ascendant with advancement of lactation order and stages of lactation. Maximum protein (3.93 %) content was observed in 3rd lactation order and 3rd stage of lactation. It was noticed that lactation order, stage of lactation and their interaction had significant ($P < 0.05$) effect on protein content of milk. These results are corroborated with the findings of Mittal and Pandey (1971).

Lactose

The mean lactose content in milk was 4.07 per cent and it was varied in different lactation order and also during the different stages of lactation. The maximum lactose (4.24 %) content was observed in first lactation order and first stage of lactation which decreased gradually with each advanced order and stage of lactation. The lactation order and the stage of lactation had significant ($P < 0.05$) effect on lactose content of milk. While interaction of its had non-significant effect on this constituent. These results are corroborated with the findings of Mittal and Pandey (1971).

Total solids (TS)

The overall mean TS content in milk was 13.70 per cent and it was the differences in TS content of milk due to the lactation order, stage of lactation and their interaction were significant ($P < 0.05$). The TS in the milk samples increased linearly with the advancing lactation order and stage. The mean values of total solids during different lactations ranged from 13.06 to 14.52 per cent. These results are similar with the findings of Prakash and Jenness (1968).

Solids-not-fat (SNF)

The overall SNF content in the milk of the Sangamneri goat was 8.48 per cent and it was ranged from 8.40 to 8.62 per cent. Effect of lactation order, stage of lactation and their interactions on the SNF content in milk was significant ($P < 0.05$). The SNF content in the milk increased with the advancing lactations. These findings were in agreement with the observation of Saini and Gill (1991).

Total ash

The total ash content in the milk was 0.75 per cent and it was revealed that the minimum in first lactation order and stage of

lactation and increased with advancement of lactation and stage (1st to 3rd). The ash content was ranged from 0.72 to 0.78 per cent. The mean ash content during lactation order and stage of lactation differ significantly while the interaction effect of the two factors was non-significant. The result are in confirmation with Devendra (1972).

Titrateable acidity

The titrateable acidity of milk was 0.129 per cent and it was ranged from 0.121 to 0.139 per cent, which varied in different lactation order and also during different stages. Maximum titrateable acidity of milk was observed in 3rd lactation order and stage of lactation. The titrateable acidity of milk gradually increased with 1st to 3rd lactation order and also stages. It was noticed that lactation order and stage of lactation had significant effect on it. However, the interaction effect of these two factors was non significant. These results are in confirmation with the results reported by Boros and Stevankova (1988).

pH

The mean pH value of the milk was 6.42 and its were 6.55, 6.36 and 6.34 during 1st, 2nd and 3rd lactation, respectively. It was decreased from 1st to 3rd lactation. On the contrary it was increased (6.37, 6.41 and 6.47) during 1st, 2nd and 3rd stage of lactation, respectively. The values of pH in 1st and 2nd stages of lactation were at par though the values of pH increased with stage of lactation. The interaction effect of two factors affected the pH significantly ($P < 0.05$). These results are in agreement with Chakraborty (1979).

CONCLUSION

The colour of Sangamneri goat milk was perfect white in all lactation order and stage of lactations. The specific gravity and boiling point of milk increased significantly from 1st to 3rd lactation order and also during stage of lactation. The overall mean composition of Sangamneri goat milk i.e. water, milk fat, protein, lactose, total solids, SNF, total ash, titrateable acidity and pH was 86.30, 5.24, 3.62, 4.07, 13.70, 8.48, 0.75, 0.129 per cent and 6.42, respectively. The chemical properties viz., milk fat, protein, total solids, SNF, total ash and titrateable acidity of milk was increased significantly in advanced lactations and stage of lactation except, pH, water and lactose which showed declining trend.

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