



Influence of season and stage of lactation on the milk composition of Berari goat

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ABSTRACT

The study was planned to obtain gross composition of milk and investigate the influence of season and stage of lactation on composition of milk in Berari goats. Milk samples were collected from the goats reared at Berari Goat and Deccani Sheep Research, Demonstration and Training Centre, Borgaon Manju, Dist. Akola during different season and stages of lactation. The milk samples analyzed using the milk analyzer Lactoscan SL showed fat % (5.32 ± 0.10), protein % (3.26 ± 0.02), lactose % (5.18 ± 0.05), TS % (14.95 ± 0.10), SNF % (9.63 ± 0.06) and density (1032.33 ± 0.35 Kg/cm³). The results from this study show that the season had a significant effect on protein %, lactose %, solid not fat %, total solid % and density and a non-significant effect on fat %; whereas the stage of lactation had a significant effect on all the milk constituents of Berari goat. The protein, lactose, solid not fat, total protein and density content were higher in rainy season and lower in summer season. Fat per cent was higher during late lactation and lower during early lactation whereas the protein, lactose and solid not fat content was higher during early and late lactation, and lower during mid lactation.

Keywords: Berari goat, Lactation, Milk composition, Season

India is an agriculture-based country. The rural economy mainly depends upon the farming and animal rearing. Goat farming is an important business of landless labourers, small and marginal farmers. Goat rearing is one of the most important sources of income for the majority of rural families and is preferred due to its short generation interval, high rate of prolificacy, ease of management and marketing over large ruminants. According to the 20th Livestock Census (2019), the total goat population of India was 148.88 millions, with an increase of 10.14% over previous Livestock Census (2012). The total milk production in India is 209.96 million tonnes (Provisional) of which 3% milk production is contributed by goats (GoI 2022).

Berari is recognized as 23rd goat breed of India with accession number INDIA_GOAT_1100_BERARI_0623 (Kuralkar *et al.* 2013). The Berari goat, a breed of central region of India (Vidarbha region of Maharashtra), is low yielding prolific meat breed thriving well in tropical wet and dry climate.

The variation in the compositions of milk within a species depends on different factors. The aim of this study was to obtain gross composition of milk and investigate the influence of season and stage of lactation on the composition of milk in Berari goats.

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MATERIALS AND METHODS

The study was carried out at Berari Goat and Deccani Sheep Research, Demonstration and Training Centre, Borgaon Manju, Dist. Akola (MS). The geographical location of the area falls within longitude 20°43'10"N and latitude 77°9'10"E with an altitude of about 299 m above sea level. The lactating animals available at the farm were selected for the experiment. The milk samples were collected from morning and evening milking at fortnightly interval by hand milking.

Total 415 milk samples were collected from the 64 lactating Berari goats in different season during 2020 and 2021 and analyzed for fat, protein, lactose, solids not fat, total solid and density using milk analyzer Lactoscan SL (Manufactured by Milkotronic Ltd., Bulgaria). The data on various physio-chemical traits of milk samples was classified according to stage of lactation (Early, mid and late) and different seasons viz. rainy (16th June- 15th October), winter (16th October to 15th February) and summer (16th February to 15th June). Generalized linear model was used to study the effect of season, stage of lactation and season × stage of lactation interaction on milk constitute using SPSS version 22. Duncan's Multiple Range (DMRT) post hoc test was used to compare means of different milk constitutes to see the significant differences.

RESULTS AND DISCUSSION

The results on different milk constitute of Berari goat milk during different season and stage of lactation is given in Table 1.

Fat: The overall fat per cent in milk sample of Berari goat was 5.32 ± 0.10 (Table 1) which was in accordance with Kharkar *et al.* (2014) but higher than observed by Agnihotri and Rajkumar (2007) in Sirohi, Marwari, Katchi and Jakharna goat breeds, and Jaafar *et al.* (2018) in Jamnapari-type goat in Malaysia. The stage of lactation had a significant effect on the fat content in this investigation. The fat content was significantly lower during the early stage of lactation and significantly higher during late stage of lactation. The findings of these investigations are in close agreement with the result of Noutfia *et al.* (2014) in Draa goat milk. Whereas non-significant effect of stage of lactation on fat content of milk was reported by Msalya *et al.* (2021) and El-Tarabany *et al.* (2018) in local and Baladi goat respectively. On the contrary, higher fat per cent was reported during early stage of lactation and lower during late stage of lactation in Nguni and Boer goat (Idamokoro *et al.* 2017) and (Agnihotri and Rajkumar 2007), which declined as the advancing lactation period followed by a steady increase in last stage.

The season had non-significant effect on fat content of the Berari goat milk whereas Bhatta *et al.* (2015) and Mioc *et al.* (2008) reported significantly lower fat content during pre-monsoon than post monsoon in black Bengal goat milk, and slight increase in fat content in winter than in spring season in Alpine and Saanen goat. The interaction showed highest fat % in winter season and late stage of lactation, while lowest fat % in summer season and early stage of lactation.

Protein: The overall protein per cent in Berari goat in present study was 3.26 ± 0.02 (Table 1). The results of

the present investigation on protein content of Berari goat breed milk is in agreement with the observations of Singh *et al.* (2014) in Jakharna and Jamunapari goat, and Yasmin *et al.* (2020) in Beetal goats. The stage of lactation had significant effect on protein per cent with higher value in early lactation, lower in mid lactation and increase in late lactation. On the contrary, Kljajevic *et al.* (2018) reported significantly higher values in late lactation, lower in mid lactation than early lactation in Saanen goat. Singh *et al.* (2014) also observed that the stage of lactation had significant effect on protein per cent. Whereas, El-Tarabany *et al.* (2018) reported a stable protein per cent at different stages of lactation.

The season has significant effect on protein in Berari goat milk with higher protein content in rainy season and lower in summer season. This may be due to availability of lush green pasture for grazing. Mioc *et al.* (2008) reported non-significant effect of season on protein content of Alpine and Saanen goat milk whereas Brodziak *et al.* (2014) observed significant season effect on protein content of Alpine goat milk and non-significant effect on Saanen goat milk.

Lactose: The overall lactose per cent investigated in this experiment was 5.18 ± 0.05 (Table 1) which is higher than that reported by Singh *et al.* (2014) in Jamanpari and Jakharana goats; El-Tarabany *et al.* (2018) in Baladi goats and Rashid *et al.* (2012) in Beetal goats. The lactose per cent was significantly higher during early lactation, decreased during mid lactation and again, increased during late lactation. Similar observations are reported by Kljajevic *et al.* (2018) in Saanen goats. Whereas Singh *et al.* (2014) reported a significant decrease in lactose per cent

Table 1. Mean $\pm$ SE for various composition of milk in Berari Goat

Classes	N	Fat (%)	Protein (%)	Lactose (%)	Solid Not Fat (%)	Total Solid (%)	Density (Kg/cm ³)
Overall mean (μ)	415	5.32 ± 0.10	3.26 ± 0.02	5.18 ± 0.05	9.63 ± 0.06	14.95 ± 0.10	1032.33 ± 0.35
Season		NS	**	**	**	**	**
Rainy	65	5.23 ± 0.25	3.44 ± 0.07^a	5.61 ± 0.15^a	10.16 ± 0.21^a	15.39 ± 0.27^a	1033.60 ± 0.95^a
Winter	229	5.34 ± 0.15	3.31 ± 0.03^a	5.23 ± 0.08^b	9.71 ± 0.06^b	15.05 ± 0.15^b	1032.92 ± 0.53^a
Summer	121	5.32 ± 0.14	3.08 ± 0.03^c	4.86 ± 0.04^c	9.21 ± 0.08^c	14.53 ± 0.12^c	1030.19 ± 0.36^b
Stage of lactation		**	**	*	**	**	**
Early	190	4.11 ± 0.18^c	3.35 ± 0.03^a	5.33 ± 0.07^a	9.89 ± 0.09^a	14.01 ± 0.17^c	1034.05 ± 0.42^a
Middle	117	5.26 ± 0.19^b	3.20 ± 0.04^b	4.99 ± 0.05^b	9.42 ± 0.09^b	14.68 ± 0.18^b	1031.10 ± 0.46^b
Late	108	6.09 ± 0.13^a	3.25 ± 0.04^c	5.21 ± 0.10^a	9.59 ± 0.09^b	15.69 ± 0.15^a	1031.76 ± 0.66^b
Season $\times$ Stage of lactation Interaction		**	**	**	**	**	*
Rainy $\times$ Early	31	4.49 ± 0.49^{cd}	3.59 ± 0.09^a	6.01 ± 0.23^a	10.57 ± 0.24^a	15.06 ± 0.51^{bc}	1036.39 ± 1.13^a
Rainy $\times$ Middle	25	5.50 ± 0.36^b	3.23 ± 0.07^{cd}	5.09 ± 0.10^c	9.61 ± 0.19^{bcd}	15.11 ± 0.32^{bc}	1032.09 ± 0.92^{bc}
Rainy $\times$ Late	19	5.74 ± 0.30^b	3.38 ± 0.13^{bc}	5.44 ± 0.22^b	10.00 ± 0.38^{bc}	15.74 ± 0.39^b	1031.80 ± 1.67^{cd}
Winter $\times$ Early	72	4.03 ± 0.20^d	3.29 ± 0.03^{bcd}	5.17 ± 0.06^c	9.75 ± 0.09^{bcd}	13.78 ± 0.17^d	1033.48 ± 0.49^b
Winter $\times$ Middle	71	5.21 ± 0.23^{bc}	3.19 ± 0.05^d	4.96 ± 0.06^c	9.38 ± 0.11^{dc}	14.59 ± 0.21^c	1030.87 ± 0.55^{cd}
Winter $\times$ Late	86	6.79 ± 0.26^a	3.47 ± 0.06^{ab}	5.62 ± 0.21^b	10.03 ± 0.11^b	16.85 ± 0.26^a	1034.82 ± 1.45^{ab}
Summer $\times$ Early	87	3.94 ± 0.41^c	3.26 ± 0.05^{cd}	5.05 ± 0.06^c	9.60 ± 0.12^{cd}	13.54 ± 0.33^d	1033.19 ± 0.74^{bc}
Summer $\times$ Middle	21	5.42 ± 0.35^b	3.22 ± 0.09^{cd}	5.12 ± 0.11^c	9.56 ± 0.03^{cd}	14.98 ± 0.38^c	1031.88 ± 0.99^{cd}
Summer $\times$ Late	13	5.64 ± 0.14^b	3.02 ± 0.04^c	4.78 ± 0.05^c	9.06 ± 0.09^c	14.71 ± 0.16^c	1029.21 ± 0.39^d

N = No. of Observation. Means bearing same superscript for particular effect in a column do not differ significantly. **, Significant at 1%; *, Significant at 5%; NS, non-significant.

during late stage of lactation in comparison with early and mid-stages.

The season had significant effect on lactose content with higher value in rainy season and lower in summer season. This may be due to availability of lush green pasture for grazing. Salari *et al.* (2016) also reported significant effect of season on lactose content of Garfagnina goat milk whereas Brodziak *et al.* (2014) and Mioc *et al.* (2008) reported a non-significant effect of season on lactose content in Saanen and Alpine goats.

Solid not fat: The study revealed the significant effect of season and stage of lactation on solid not fat content in Berari goat with overall value of $9.63 \pm 0.06\%$ (Table 1). The value observed in this study is in agreement with that reported by Yasmin *et al.* (2020) in Beetal goat. Bhatta *et al.* (2015) reported a lower SNF value in black Bengal goat.

The results of the present investigation on SNF content of Berari goat breed milk in different stages of lactation are in fair agreement with Singh *et al.* (2014) who observed significant effect of stage of lactation on SNF content of Jakharna and Jamunapari goat milk. Sharaf *et al.* (2017) reported a significant decrease in SNF content with the advancing stage of lactation. In this study, SNF content in Berari goat milk was significantly affected by the season showing higher value during rainy season and lower value in summer season which may be due to availability of lush green pasture for grazing. Bhatta *et al.* (2015) reported non-significant effect of season on SNF content of Black Bengal goat.

Total solid: The overall total solid content in Berari goat milk was 14.95 ± 0.10 per cent (Table 1) which was at par with the value recorded by Ferro *et al.* (2017) in Boer goat. Ferro *et al.* (2017) reported lower values in Damascus goats, Alpine, and Saanen goat breeds. The experiment shows a significant effect of stage of lactation on total solid content with lower values in early lactation and higher in late lactation. Similar findings are reported by El-Tarabany (2018) and Singh *et al.* (2014) in Baladi goats and in Jakharna and Jamnapari goats respectively. The total solid in goat milk varied significantly during different stages of lactation, with high values in the early and late lactation periods (Guler *et al.* 2007) in Damascus goats. On the contrary, Msalya *et al.* (2021) reported non-significant effect of stage of lactation on total solid content.

In the current investigation, the total solid content of the Berari goat milk was significantly affected by the seasons with a higher value in the rainy and lower in the summer season which may be attributed to scarcity of green fodder. Kim *et al.* (2013) and Bhatta *et al.* (2015) also reported a significant effect of season on the total solid content of milk. Kim *et al.* (2013) tabulated lower values in summer and higher in winter season as compared to spring and fall seasons whereas Bhatta *et al.* (2015) reported a significantly ($p < 0.05$) lower total solid content of the Black Bengal goat milk during the season of pre-monsoon than the post-monsoon season.

Density: The effect of different season and stage of

lactation on density of Berari goat milk was significant (Table 1) with overall density of 1032.33 ± 0.35 (Kg/cm³), which was in congruence with that reported by Kljajevic *et al.* (2018) in Saanen goats and in close estimate with that reported by Shuvarikov *et al.* (2021) in Saanen, Alpine and Nubian breeds of goats. Kaskous *et al.* (2015) reported lower density of milk in local mountain goats. Gabas *et al.* (2012) mentioned density of goat milk ranged from 991.7 to 1232.4 Kg/cm³.

During different stage of lactation, the Berari goat milk density was significant between early and mid stage of lactation whereas non-significant between mid and late stage of lactation. Msalya *et al.* (2021), Kljajevic *et al.* (2018) and Idamokoro *et al.* (2017) reported non-significant effect of stage of lactation on milk density in Norwegian Dairy Goats, Saanen and Nguni, Boer goats respectively. It is quite logical, that density varies in an inversely proportional manner to the fat content, because fat content increases during lactation. During different season, the Berari goat milk density was non significant between rainy and winter season whereas significant between winter and summer; rainy and summer season. Kljajevic *et al.* (2018) reported non-significant effect of season on density of milk in Saanen goats.

The season had significant effect on lactose, solid not fat, protein, total solid and density except fat content. The lactose, solid not fat, total solid and protein content were higher in rainy season and lower in summer season. This might be due to scarcity of feed. Similarly, stage of lactation had significant effect on all milk components of Berari goat milk. The lactose and protein content was higher during early and late lactation and lower during mid lactation. Fat per cent was higher during late lactation and lower during early lactation whereas solid not fat was lower during early stage of lactation as compared to mid and late lactation. The fat %, solid not fat %, lactose % was higher in Berari goat as compared to other breeds given in the literatures, whereas, values for all the parameters were within the normal range.

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