Compositional Changes in Colostrum and Milk of Hill Cows of Uttarakhand During Different Lactation Stages

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ABSTRACT

Present study was undertaken to determine the composition al changes in colostrum and milk of Hill cow of Uttarakhand during different stages of lactation period. Fifteen colostrum samples per day were collected during first five postpartum days while as six milk samples of Hill cows were collected at fortnightly interval up to 36 weeks of lactation period and were subjected to various physico-chemical analyses. Maximum mean fat, protein, total solid, ash per cent, and electric conductivity in colostrum of Hill cow was observed on first postpartum days as 6.79±0.16, 13.28±0.13, 23.02±0.27, 1.10±0.06 and 3.41±0.23, respectively and later on decreased as postpartum days advances. But lactose per cent and pH showed an increasing trend during first five postpartum days. In milk of Hill cows minimum mean fat (4.26±0.39 %), protein (3.37±0.50 %) and total solids (12.78±0.42 %) per cent were observed in III, VII and IX stage of lactation, respectively and showed an increasing trend as lactation advances. While as maximum mean lactose (4.62±0.51 %) per cent was observed in III stage of lactation and decreased during last stage of lactation. It can be concluded that colostrum of Hill cow was richer in fat, protein, lactose, total solids and ash content as while as its milk had higher content of fat, protein, SNF, total solids and lower pH, electric conductivity and somatic cell count.

Keywords: Colostrum, Milk, Compositional changes, lactation period, Hill cow

INTRODUCTION

Uttarakhand state is enriched with livestock biodiversity represented by cattle, buffaloes, goats, pigs, horses, mules and poultry. Most of the farmers of the state are having poor resource due to undulated topography, rugged terrain, cold climate, lack of production and marketing facilities for livestock and crop production. Land holding is also small; about 75% farmers had less than 20 nali (0.4 hectare) of land. About 70% income came from crop and livestock production (Shukla et al. 2007). There is large number of hill cattle in the state (more than 99% in hill districts) and are reared mainly on extensive system of management i.e. grazing from morning to evening. Animals of different farmers are pooled in a group of 25–50 animals, for grazing in the hilly terrain nearer to water source. The Hill cattle are reared mainly for bullock power, milk and manure. They are small in size, high disease resistance and are well adaptability to hilly terrains of the state (Pundir et al. 2013). Milk of indigenous breeds has better quality in respect to caesin, beta lactoglobulin, which improves resistance in humans, total solids content, ash percentage and less sterol (cholesterol and lanosterols) content than European cattle (*Bos taurus*). Thus, quality-wise, indigenous breeds have an edge over crossbreeds (Kumar and Anand, 2006). Although milk is an important diet of people of all ages, but its composition depends on lot of factors. Genotype of cows is an important factor which influences the composition of milk. Therefore, the present research work was undertaken to determine the compositional changes in colostrum and milk of Hill cow of Uttarakhand during different stages of lactation period.

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MATERIALS AND METHODS

Experimental Animals: The present research work was conducted on Hill cattle maintained under loose housing and group management system at Instructional Dairy Farm GBPUA & T Pantnagar. Nutritional requirements of the animals were met through a balanced combination of dry and green fodder (wheat straw, berseem and sorghum) with concentrate mixture supplementation at time of milking. Fifteen colostrum samples per day from Hill cows were collected during first five postpartum days while as milk samples were collected from six primiparious Hill cows, at fortnightly interval up to 36 weeks postpartum. These samples were subjected to various physico-chemical analysis, viz. pH, electrical conductivity (EC), somatic cell count (SCC) by Indian Standard Institute (1960), fat percent by Gerber method (IS: 1124, 1958), protein percent (Pyne, 1932), lactose percent (Oser, 1979), specific gravity, solids not fat, total solids (IS: 1183, 1957) and ash percent (AOAC, 1990). Statistical Analysis: All the data which expressed as Mean ± SE were analysed by using by standard methods (Graph Pad Instat, 2003; Snedecor and Cochran, 1994). A p-value of <0.05 was considered as statistically significant.

RESULTS AND DISCUSSION

The colostrum and milk compositional changes during different stages of lactation period in Hill cow are presented in table 1 and 2.

Colostrum Composition: There was a significant (P=0.05) difference between mean fat, protein, lactose, total solid, ash per cent, pH and electric conductivity during first five postpartum days in colostrum of Hill cow. Maximum mean fat, protein, total solid, ash per cent, and electric conductivity was observed on first postpartum days as 6.79±0.16, 13.28±0.13, 23.02±0.27, 1.10±0.06 and 3.41±0.23, respectively and later on decreased as postpartum days advances. But lactose per cent and pH showed an increasing trend during first five postpartum days. Overall mean of colostrum fat, protein, lactose, total solid, ash per cent, pH and electric conductivity for first five postpartum days in Hill cow were as 5.92±0.15, 9.27±0.02, 3.35±0.31, 18.33±0.35, 0.88±0.08, 6.21±0.07 and 2.99±0.11, respectively. Georgiev (2008) investigated that the fat content of colostrum changes very rapidly with time, so that by 3rd day postpartum, it is already similar to that of normal milk. Similarly, Abd El Fattah et al. (2012) also reported that decrease in fat content, total solid and ash per cent while as increase in lactose per cent during first five days of parturition. Shailja and Singh (2008) reported significant changes in fat, protein, lactose content, pH and electric conductivity of colostrum from crossbred cows during different postpartum days which are similar to the present investigation. Tsioulpas et al. (2007) found no particular trend for fat content but ash per cent (1.18±0.46 on 1st postpartum day) and total protein content (16.1±1.64 % on 1st postpartum day) decreased as postpartum days advances. Also they reported that pH of colostrum as 6.17 (1st postpartum day) which later on increased. Kohoe et al. (2007) reported that the protein and total solids content of colostrum on 1st day postpartum as 14.0 % and 23.90 %, respectively. Present study is also in agreement with the report of Mohammad et al. (1998) who revealed that the higher values of

Table 1: Mean of colostrum components of Hill cow of Uttarakhand during different postpartum days

Post-partum Days	Fat %	Protein %	Lactose %	TS %	Ash %	pH	Electric Conductivity
1	6.79±0.16	13.28±0.13	2.74±0.21	23.02±0.27	1.10±0.06	6.10±0.12	3.41±0.23
2	6.16±0.21	10.28±0.24	2.82±0.32	20.78±0.21	0.98±0.08	6.11±0.10	3.19±0.34
3	5.86±0.20	8.76±0.21	3.36±0.21	18.42±0.25	0.89±0.11	6.26±0.09	2.92±0.31
4	5.51±0.09	7.36±0.07	3.81±0.45	15.32±0.09	0.76±0.16	6.28±0.14	2.81±0.12
5	5.29±0.11	6.68±0.04	4.06±0.40	14.13±0.11	0.70±0.08	6.31±0.23	2.62±0.24
Overall	5.92±0.15	9.27±0.02	3.35±0.31	18.33±0.35	0.88±0.08	6.21±0.07	2.99±0.11
Level of Significance	**	**	**	**	*	*	**

**Highly Significant,*Significant p=0.05. No. of observation is 15. TS=Total Solids.

Table 2: Mean of Milk components of Hill cow of Uttarakhand during different stages of lactation period

Lactation Stage	Fat %	Protein %	Lactose %	Specific Gravity	SNF %	TS %	pH	EC (mhos)	SCC (10^5 cells/ml)	Milk Yield (kg)
I	4.64	3.56	4.56	1.032	9.13	13.97	6.45	2.32	1.18	21.40
	±0.27	±0.50	±0.41	±0.004	±0.41	±0.42	±0.13	±0.21	±0.14	±72.13
II	4.46	3.52	4.58	1.031	9.04	13.50	6.41	2.31	1.20	23.62
	±0.43	±0.44	±0.52	±0.001	±0.45	±0.35	±0.16	±0.12	±0.21	±62.45
III	4.26	3.46	4.62	1.028	8.65	13.14	6.40	2.30	1.16	32.12
	±0.39	±0.34	±0.51	±0.003	±0.34	±0.22	±0.21	±0.10	±0.13	±73.14
IV	4.28	3.44	4.59	1.030	8.75	13.08	6.39	2.29	1.41	30.76
	±0.38	±0.52	±0.20	±0.007	±0.37	±0.48	±0.35	±0.13	±0.19	±72.45
V	4.32	3.42	4.60	1.028	8.71	13.13	6.41	2.32	1.23	27.65
	±0.27	±0.18	±0.41	±0.001	±0.36	±0.37	±0.18	±0.16	±0.16	±81.34
VI	4.31	3.41	4.61	1.030	8.46	13.07	6.39	2.30	1.24	28.56
	±0.41	±0.25	±0.52	±0.005	±0.44	±0.32	±0.17	±0.08	±0.18	±63.52
VII	4.28	3.41	4.56	1.029	8.28	12.78	6.36	2.32	1.31	27.65
	±0.48	±0.53	±0.31	±0.003	±0.37	±0.42	±0.11	±0.15	±0.11	±71.34
VIII	4.30	3.39	4.55	1.030	8.27	12.80	6.37	2.31	1.24	21.78
	±0.45	±0.54	±0.42	±0.002	±0.48	±0.43	±0.18	±0.12	±0.12	±62.54
IX	4.29	3.37	4.57	1.029	8.36	12.81	6.35	2.26	1.04	20.67
	±0.27	±0.50	±0.62	±0.009	±0.31	±0.23	±0.07	±0.16	±0.21	±52.14
X	4.31	3.38	4.56	1.030	8.20	13.07	6.37	2.28	1.27	21.64
	±0.18	±0.56	±0.34	±0.008	±0.29	±0.46	±0.23	±0.21	±0.02	±73.19
XI	4.42	3.43	4.54	1.029	8.18	13.35	6.39	2.27	1.08	19.67
	±0.16	±0.67	±0.53	±0.009	±0.25	±0.35	±0.12	±0.24	±0.14	±61.34
XII	4.50	3.48	4.53	1.031	8.26	13.65	6.40	2.28	1.05	16.47
	±0.26	±0.60	±0.31	±0.002	±0.38	±0.28	±0.26	±0.15	±0.10	±70.97
XIII	4.48	3.55	4.54	1.029	8.31	13.53	6.41	2.29	1.28	10.62
	±0.23	±0.27	±0.26	±0.006	±0.37	±0.31	±0.04	±0.18	±0.15	±80.87
XIV	4.62	3.58	4.48	1.031	8.34	13.65	6.42	2.34	1.14	9.82
	±0.30	±0.23	±0.32	±0.007	±0.42	±0.40	±0.17	±0.12	±0.18	±71.45
XV	4.76	3.68	4.46	1.029	8.60	13.86	6.48	2.38	1.25	9.67
	±0.40	±0.51	±0.21	±0.001	±0.43	±0.34	±0.12	±0.11	±0.15	±78.98
XVI	4.84	3.76	4.45	1.032	8.87	14.41	6.53	2.42	1.14	8.45
	±0.34	±0.14	±0.11	±0.002	±0.36	±0.28	±0.32	±0.21	±0.17	±18.48
XVII	4.96	3.87	4.43	1.034	9.01	14.96	6.58	2.44	1.08	6.68
	±0.21	±0.45	±0.10	±0.007	±0.35	±0.37	±0.21	±0.06	±0.12	±17.52
Overall	4.47	3.51	4.54	1.030	8.55	13.46	6.41	2.31	1.19	337.23
	±0.29	±0.36	±0.26	±0.002	±0.14	±0.15	±0.04	±0.08	±0.06	±28.12
Level of Significance	*	*	*	NS	*	*	*	*	*	**

NS= Not significantly, **Highly significant,*Significant p=0.05. No. of observation is six. SNF=Solid not fat, TS=Total solids, EC=Electric conductivity, SCC=Somatic cell count.

protein on first postpartum day attributed to more concentration of IgG in colostrum and subsequently decreases to normal levels after a few days of lactation.

Milk Composition: There was a significant (P=0.05) difference between mean fat, protein, lactose, SNF, TS per cent, specific gravity, pH, EC (mhos), SCC (10^5 cells/ml) and milk yield (kg) during different stages of lactation period in cow of Hill cow. Minimum mean fat (4.26±0.39 %),

protein (3.37±0.50 %) and TS (12.78±0.42 %) per cent were observed in III, IX and VII stage of lactation, respectively and showed an increasing trend as lactation advances. While as maximum mean lactose (4.62±0.51 %) per cent was observed in III stage of lactation and showed a decreasing trend during last stage of lactation. Similar trend was observed by Sarkar et al. (2006) in Sahiwal, Barbosa et al. (2008) in Holstein x Gir crossbred and Jadhav and Patange (2009) in Phule Triveni

cows. Minimum mean pH (6.35±0.07) and electric conductivity (2.26±0.16 mhos) value were observed in X stage of lactation and thereafter showed an increasing trend as lactation advances. Gurmessa and Melaku (2012) observed increased pH during late stages of lactation. Jadhav et al. (2008) reported that with advancing stage of lactation electric conductivity increases which may be due to increase in sodium content of milk in late stages of lactation. No trend was observed in specific gravity, SNF and somatic cell count during different stage of lactation. Maximum milk yield (32.12±73.14 kg) was observed in III and showed a decreasing trend as lactation advances. Overall mean of fat, protein, lactose, SNF, TS%, specific gravity, pH, EC (mhos), SCC (10^5 cells/ml) and milk yield (kg) in milk of Hill cow during 36 weeks of lactation period were as 4.47±0.29, 3.51±0.36, 4.61±0.26, 8.55±0.14, 13.46±0.15 %, 1.030±0.002, 6.41±0.04, 2.31±0.08 mhos, 1.19±0.06 x10^5 cells/ml and 337.23±28.12 kg, respectively. Gupta (2010) reported overall mean fat per cent of 4.58 in Hill cow of Palampur which is in close agreement with present finding of Hill cows. Muhuyi et al. (2004) reported overall mean fat, protein, SNF and total solid per cent as 4.56±0.62, 2.99±0.72, 8.96±1.05 and 14.32±3.07 in Sahiwal cows. Venkatachalapathy and Iype (1998) reported overall mean SNF per cent of 8.89±0.12 in the milk of Vechur cows. Jenness et al. (1976) reported pH of cow milk varying from 6.45 to 6.71 which are in agreement with the present study. Shailja and Singh (2008) reported pH value of 6.78 and electrical conductivity of 2.54±0.09 mhos in cows. Singh and Ludri (2001) reported overall mean of SCC in Tharparkar, Sahiwal and Karan Swiss cows as 1.26±0.06, 1.31±0.04 and 1.54±0.07 x 10^5 cell/ml, respectively, which is in close agreement to the present findings.

Production trait: In present investigation lactation yield, daily milk yield, lactation length, peak milk yield and days for days to attain peak milk yield were recorded as 340.12±27.45 kg (15), 1.35±2.45 kg (30), 270.56±6.78 days (30), 2.51±6.71 kg (10) and 38.75±12.23 days (10). Gupta (2010) reported an average lactation and daily milk yield as 533.8 and 1.4 to 1.8 kg in Hill cows of Palampur which is higher than present findings of Hill cows. Pundir et al. (2013) reported average daily milk yield is 1.14 liters in Bargur cows of Tamil Nadu. Iqbal (1996) reported peak yield in Sahiwal cows as 8.5 kg. Gaur et al. (2003) reported

average peak yield and days to attain peak milk yield as 10±0.10 kg and 47.00±0.83 days in Gir cows.

CONCLUSION

The results indicate that there were considerable changes in the colostrum and milk composition of Hill cow during different stages of lactation period. Colostrum was richer in fat, protein, lactose, total solids and ash content as while as its milk had higher content of fat, protein, SNF, total solids lower pH, electric conductivity and somatic cell count.

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