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Effect of goat breeds on the milk composition under climatic conditions of Lalsot tahsil of Dausa district Rajasthan

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Abstract

The milk is rightly described often as near complete food in nature. It contains all five major nutrients: fat, protein, lactose (milk sugar), vitamins and minerals (salts). The research was conducted at the Lalsot tahsil of Rukmani Devi College of agriculture, Dausa district of Rajasthan during 2021-23. The specific gravity of Sirohi goat breed's milk was significant than that of Jakhrana animals. The overall fat per cent in the both breeds during 2021- 23 of all the 1200 samples was found to be 4.61±0.021, Solids Not Fat (SNF) 8.44±0.032 per cent and total solids percentage was found to be 14.31 ± 0.034. The protein per cent during 2021 - 22 conditions was significantly ($p < 0.01$) significant than that of farm rearing goat milk in both the breeds. The statistical analysis also revealed that the lactose content in 2021 – 22 has significantly higher than that of 2022 -23 in Jakhrana as well as Sirohi goat breeds at $p < 0.05$. The overall average ash content in both breed's milk during 2021 - 23 of all samples was found to be 0.814±0.007 per cent. Breed had conspicuous effects on milk com[position.

Keywords: Sirohi goat, Jakhrana goat, Milk composition, Dausa, Rajasthan

Introduction

Goat population of our country increased from 47.14 million in the year 1951 to 124.5 million during 2005 (Singh and Sharma, 2013) [5]. Goats are integer part of livestock production and play a vital role in the socio-economic structure of rural poor. The aim of this study was to project the importance and significance of goat milk with special reference to Indian field and farm rearing conditions. There are adverse ecological and physiological constraints in the Indian system of goat farming. Goat population of our country increased from 47.14 million in the year 1951 to 124.5 million during 2005 (Singh and Sharma, 2014) [7].

The global goat population currently stands at 921 million, of which over 90% are found in developing countries. Asia is home to about 60% of the total world goat population and has the largest goat breed share of 26%. Goats play a vital socioeconomic role in Asian agriculture, particularly for resource-poor people living in harsh environments. Non-cattle milk accounts for approximately 15% of the total milk consumption by humans worldwide (Singh *et al* 2014) [8]. India today, stands first in the area of milk production at the world level, with an annual growth rate of about 4%. The country's milk production in 2010 was estimated to be 110 million tones. A large quantity of milk produced in the country amounting to over 46% is being consumed as liquid milk. The production and use of animal products in the use of human diet is receiving tremendous attention. With this object in view the need for developing Animal Husbandry is recognized very well. The other objects are to provide animal power for farmings and adoption of better land use pattern (Singh *et al* 2012) [4]. The productive improvements among dairying animals can be made through proper management, feeding and handling, etc. which may influence expression of productive characters as per its heritability nature. Before identifying the animals for breeding and production purpose screening of animals shall be performed on the basis of physical traits (Singh *et al* 2013) [6]. Goats play a vital socio-economic role in Asian agriculture, particularly for resource poor people living in harsh environment (Singh *et al* 2014) [9].

Goats are more often poorly managed and this is attributed to their ability to survive under harsh conditions and also because most people in rural areas rear goats for their subsistence purposes to support their families. This benefit is often not shown in national statistics because of informal trading and slaughtering (Singh *et al* 2014) [10]. Goat milk contains less lactose than cow's milk, so is less likely to trigger lactose intolerance (Singh *et al* 2014) [11]. Goat meat

being high quality protein source is the choicest meat in domestic market (Singh *et al* 2014) [12].

Major population of India is primarily depends on agricultural based system for their daily life including goat keeping that constitute an important rural business of small marginal farmers and landless labours (Singh *et al* 2014) [13]. Reproductive management of an animal is governed through a number of parameters, *viz*. age at first conception, age at first calving and first gestation length etc. (Singh *et al* 2014) [14]. Goat milk contains less lactose than cow's milk, so is less likely to trigger lactose intolerance (Singh and Sharma, 2015) [15]. It has since played a significant socioeconomic role in the evolvement of human civilization around the world (Singh and Sharma, 2015) [16]. Farmers felt that grass is more useful to fill the animals' stomachs and would therefore come before crop stover as a feed. Farmers preferred Deda over Kona because it has more biomass (Singh and Sharma, 2015) [17].

Fig 1: Jakhrana and Sirohi Goat

Fig 2: Electronic Milk Analyzer

A very important aspect in this regard is the awareness of risk by resource-poor farmers and their emphasis on minimizing it (Singh and Sharma, 2016) [18]. The country is endowed with large and biologically diverse population of goats. (Singh and Sharma, 2016) [19].

The nutritional value of milk is closely related to its composition, which is affected by factors such as breed, diet, stage of lactation, season etc. Goat milk has more calcium (Ca), phosphorus (P), potasium (K), magnesium (Mg) and chloride (Cl) and less sodium (Na) and sulphur (S) contents than cow milk (Singh and Sharma, 2016) [20]. Livestock production is backbone of Indian agriculture contributing 7% to national GDP and source of employment and livelihood for 70% population in rural areas. India ranks first in terms of milk production (129.7 million tons) (Singh *et al* 2017) [21]. Animals reared in intensive production systems consume a considerable amount of protein and other nitrogen-containing substances in their diets (Singh *et al* 2017) [22]. This benefit is often not shown in national statistics because of informal trading and slaughtering (Singh and Sharma, 2017) [23].

Goats play a vital socio-economic role in Asian agriculture, particularly for resource-poor people living in harsh environments (Singh *et al* 2018) [24]. Jamnapari (or Jamunapari) is a breed of goat originating from Indian subcontinent. Since 1953 they have been imported to Indonesia (popular as Etawa goat, and its mixture with a local goat called "PE", *peranakan Etawa* or Etawa mix) where they have been a great success (Singh *et al* 2017) [25].

These breeds or types were distributed across the world as a result of the migration and translocation of humans, usually due to changing climatic conditions and natural resources (Singh and Sharma, 2017) [26]. Milk-secreting tissues and various ducts throughout the udder can be damaged by bacterial toxins, and sometimes permanent damage to the udder occurs (Singh and Singh, 2020) [28]. Livestock has become an integral part of all interventions aimed at reducing rural poverty and enhancing food and nutrition security (Singh and Somvanshi, 2020) [29]. India is endowed with a significant share of the world's livestock population growing steadily and continuously (Singh, G. 2019) [27, 30]. The goat is thought to have been the earliest domesticated ruminant and of all the species of domesticated animals except dog, has the widest ecological range (Singh, G., 2024) [31]. Man, Animal and Nature are in symbiotic relationship for their survival and sustenance (Singh et. al., 2024) [32].

Materials and Methods

The research has conducted at the Lalsot tahsil of Rukmani Devi College of agriculture, Dausa district of Rajasthan with broad objective, as 'Effect of goat breeds on the milk composition under climatic conditions of Lalsot tahsil of Dausa district Rajasthan during 2021-23. The milk samples collected from Sirohi (05) and Jakhrana (05) goat breed during the lactation at different villages of Lalsot tahsil of dausa district throughout two years. Total 1200 (600 samples collected from Jaumnapari and 600 samples from Jakhrana) samples collected from both goat breed of Lalsot tahsil. All samples were analyzed by electronic milk analyzer. Data were analyzed using the ANOVA procedure of RBD (at 5% and 1% significance levels) for the statistical analysis of all milk samples.

Results and Discussion

1. Effect of Goat breeds on Specific gravity of the milk

The data obtained on specific gravity in the present study of Jakhrana and Sirohi goat breed milk are presented in Table 1.

Table 1: Effect of Goat breeds on Specific gravity of the milk.

Sl. No.	Breeds	2021 - 22	2022 -23	Overall average	Test of significance	Table value (t) 5% 1%
1.	Jakhrana	1.0121±0.0004	1.0123±0.0004	1.0122±0.0004	3.51^{+}	1.540 2.143
2.	Sirohi	1.0196±0.00015	1.0163±0.0004	1.0179±0.00015	3.40^{+}	
	Overall mean	1.0159±0.00015	1.0147±0.00015	1.0250±0.00015		

Note: + = Significant at 5% level of significance

It is observed from Table 1 that the specific gravity of Jakhrana and Sirohi goat breeds has found to be 1.0121±0.0004 and 1.0196±0.00015, respectively with an average of 1.0159±0.00015. It is observed from above table that specific gravity of Sirohi goat breed's milk has significant than that of Jakhrana animals. The overall specific gravity per cent in the both breeds during 2021- 23 of all the 1200 samples has found to be 1.0250±0.00015. The results of the present investigation on specific gravity content of Jakhrana and Sirohi goat breeds are in consonance with the observation of Singh and Sharma (2015) [15].

2. Effect of Goat breeds on Fat % of the milk

The result obtained for the fat percentage of milk of Jakhrana and Sirohi goat breed are presented in Table 2.

Table 2: Effect of Goat breeds on Fat % of the milk.

Sl. No.	Breeds	2021 - 22	2022 -23	Overall average	Test of significance	Table value (t) 5% 1%
1.	Jakhrana	4.44±0.034	4.71±0.033	4.51±0.032	2.987^{+}	1.547 2.311
2.	Sirohi	4.82±0.087	4.82±0.023	4.82±0.012	2.354^{++}	
	Overall mean	4.61±0.060	4.71±0.043	4.62±0.021		

Note: + = Significant at $p < 0.05$
++=Significant at $p < 0.01$

The average percentage of fat in the milk of Jakhrana and Sirohi goat breeds has found to be 4.44±0.034 and 4.82±0.087 respectively with an average value of 4.61±0.060 per cent during 2021 - 22 Similarly, fat content in 2022 - 23 of Jakhrana and Sirohi goat breeds has found to be 4.71±0.033 and 4.82±0.023, respectively with an average value of 4.71±0.043 per cent. The overall fat per cent in the both breeds during 2021- 23 of all the 1200 samples has found to be 4.62±0.021. The results of the present investigation on fat content of Jakhrana and Sirohi goat breeds are in consonance with the observation of Singh and Sharma (2015) [16], Lower values have been reported by Agnihotri et. al. (2002) [1] However, Prasad *et al*. (2005) [3] reported a higher fat percentage in goat milk.

3. Effect of Goat breeds on Protein % of the milk

The data on Protein percentage in the present investigation of Jakhrana and Sirohi goat breed's milk during 2021 - 23 are recorded in Table 3.

Table 3: Effect of Goat breeds on Protein % of the milk

Sl. No.	Breeds	2021 - 22	2022 -23	Overall average	Test of significance	Table value (t) 5% 1%
1.	Jakhrana	3.41±0.028	3.23±0.034	3.34±0.032	5.875^{++}	1.960 2.576
2.	Sirohi	3.40±0.027	3.24±0.036	3.33±0.032	4.51^{++}	
	Overall mean	3.40±0.028	3.23±0.034	3.33±0.31		

Note: ++ = Significant at $p < 0.01$

It is observed from the Table 3 that the protein percentage in the Jakhrana and Sirohi goat breeds during 20 – 21 has found to 3.40±0.028 and 3.41±0.027, respectively with an average of 3.40±0.028 per cent. The protein content of aforesaid breeds during 2022 - 23 found to be 3.23±0.034 and 3.24±0.036 per cent respectively with an average value of 3.23±0.034 per cent. It is clear from the above table that protein per cent during 2021 - 22 has significantly ($p < 0.01$) greater than that of 2022 -23 goat milk in both the breeds. The statistical analysis revealed that protein content of Jakhrana goat breed has significantly higher than that of Sirohi goat breed during 2021 - 22. The analysis of variance of these data (Table 3) revealed that protein content variation either Jakhrana or Sirohi goat breeds had significant ($p < 0.05$) effect during 2021 - 23.

4. Effect of Goat breeds on Lactose % of the milk

The lactose per cent in the milk of Jakhrana and Sirohi goat breeds during 2021 - 23 in the present investigation are presented in Table 4.

Table 4: Effect of Goat breeds on Lactose % of the milk.

Sl. No.	Breeds	2021 - 22	2022 -23	Overall average	Test of significance	Table value (t) 5% 1%
1.	Jakhrana	4.28 ±0.021	4.20±0.022	4.25±0.021	1.859^{+}	1.960 2.576
2.	Sirohi	4.27 ±0.020	4.26±0.025	4.21±0.022	1.243^{+}	
	Overall mean	4.26±0.0205	4.25±0.0235	4.24±0.014		

Note: + = Significant at $p < 0.05$

It is clear from Table 4 that the lactose content in Jakhrana and Sirohi goat breed's milk during 2021 – 22 has found 4.28 ±0.021 and 4.27 ±0.020 per cent, respectively. Similarly, the lactose content in above both breed milk during 2022 – 23 has found 4.20±0.022 and 4.26±0.025 per cent, respectively. The overall average lactose per cent in Jakhrana and Sirohi goat breed's milk during 2021 - 23 also calculated and found to be 4.24±0.014 for all 1200 samples. The statistical analysis also revealed that the lactose content in 2021 – 22 has significantly higher than that of 2022 -23 in Jakhrana as well as Sirohi goat breeds at $p < 0.05$. Our results on lactose percentage in above goat breed's milk are in fair agreement with those reported by Prasad et. al. (2002) [3] and Agnihotri (2002) [1] have reported higher values on it.

5. Effect of Goat breeds on Ash % of the milk

The results obtained for ash content of Jakhrana as well as Sirohi goat milk during 2021 - 23 are presented in Table 5.

Table 5: Effect of Goat breeds on Ash % of the milk.

Sl. No.	Breeds	2021 - 22	2022 -23	Overall average	Test of significance	Table value (t) 5% 1%
1.	Jakhrana	0.89±0.008	0.88±0.007	0.81±0.008	3.879^{+}	1.960 2.576
2.	Sirohi	0.88±0.008	0.84±0.005	0.88±0.006	3.654^{++}	
	Overall mean	0.81±0.008	0.88±0.006	0.814±0.007		

Note: + = Significant at $p < 0.05$
++ = Significant at $p < 0.01$

The average percentage of ash during 2021 – 22 Jakhrana and Sirohi goat breed's milk has found to be 0.89±0.008 and 0.88±0.008, respectively with an average value of 0.81±0.008 per cent. Similarly, ash content in 2022 -23 of aforesaid breed's milk has found to be 0.88±0.007 and 0.84±0.005, per cent with an average of 0.88±0.006 per cent. The overall average ash content in both breed's milk during 2021 - 23 of all samples has found to be 0.814±0.007 per cent. It is also clear from the above table that ash content in the milk of Jakhrana or Sirohi goat breed 2022-23 has significant effect than that of 2021-22. The analysis of variance table showed that ash content of Jakhrana goat breed's milk during 2022- 23 has significantly more than that of Sirohi goat breed milk. The results of present investigation on the level of ash in Jakhrana and Sirohi goats' milk during 2021 - 23 are slightly higher by the findings (0.78 ± 0.01) of Agnihotri et. al. (2002) [1] and Singh and Sharma (2015) [17].

6. Effect of Goat breeds on Total Solids % of the milk

The results obtained for total solids percentage in milk of Jakhrana and Sirohi goat breed during 2021 - 23 are presented in Table 6.

Table 6: Effect of Goat breeds on Total solids % of the milk.

Sl. No.	Breeds	2021 - 22	2022 -23	Overall average	Test of significance	Table value (t) 5% 1%
1.	Jakhrana	14.27±0.032	14.16±0.034	14.09±0.032	1.21^{+}	1.960 2.576
2.	Sirohi	14.24±0.036	14.26±0.039	14.55±0.037	1.985^{NS}	
	Overall mean	14.14±0.033	14.51±0.037	14.31 ± 0.034		

Note: NS = Non Significant
+ = Significant at $p < 0.05$

According to above Table 6, the average total solids percentage in milk of Jakhrana and Sirohi goat breed during 2021 – 22 has found to be 14.27±0.032 and 14.24±0.036, respectively with an average value of 14.14±0.033. Similarly, the total solids percentage in the milk of above goat breeds during 2022 – 23 has found to be 14.16±0.034 and 14.26±0.039, respectively with an average value of 14.14±0.037 per cent. The overall average total solids percentage of all 1200 samples has found to be 14.31 ± 0.034. It has observed from above table that Jakhrana goat breed's milk total solids were significantly ($p < 0.050$) higher in 2021-22 than 2022-23 whereas in case of Sirohi goat breed an insignificant difference has observed in total solids content. The analysis of variance in the table revealed that the breed variation during 2021 -22 has non-significant but it has significant during 2022 -23 at 5% level of significance.

The level of total solids percentage in the milk of above goat's breeds as obtained in the present study, Compared favorably with the results of Pal et. al. (2012) [2] and Agnihotri (2002) [1]. Prasad et. al. (2005) [3] have however, reported higher values of Singh and Sharma (2015) [15].

7. Effect of Goat breeds on Solids-Not-Fat % of the milk

The data on solids-not-fat percentage in Jakhrana and Sirohi goat breed's milk during 2021 - 23 are recorded in Table 7.

Table 7: Effect of Goat breeds on Solids-Not-Fat % of the milk.

Sl. No.	Breeds	2021 - 22	2022 -23	Overall average	Test of significance	Table value (t) 5% 1%
1.	Jakhrana	8.44±0.036	8.44±0.024	8.44±0.032	3.659^{++}	1.960 2.576
2.	Sirohi	8.44±0.034	8.48±0.026	8.47±0.032	3.854^{++}	
	Overall mean	8.43±0.034	8.46±0.025	8.45±0.032		

Note: ++ = Significant at $p < 0.01$

It is observed from the Table 7 that the solids-not-fat percentage in the milk of Jakhrana and Sirohi goat breeds during 2020 – 21 has found to be 8.44±0.036 and 8.44±0.034, respectively with an average value of 8.43±0.034 per cent. The solids-not-fat content of above breeds during 2022 - 23 samples has also calculated and found to be 8.44±0.024 and 8.48±0.026 per cent, respectively with an average of 8.44±0.025 per cent. The overall average solids-not-fat percentage of above samples in 2021-22 and 2022 - 23 of all 1200 samples has 8.45±0.032 per cent. The statistical analysis showed that the solids-not-fat percentage has significantly ($p < 0.01$) higher in 2022-23 either Jakhrana or Sirohi goat breed than that of 2021-22. It is due to higher fat percentage and lower percentage of protein, lactose and ash in 2022-23 of Jakhrana as well as Sirohi goat breeds. The analysis of variance table on these data also revealed that significantly breed variation on solids-not-fat content has observed either 2021-22 or 2022-23. The results of the present investigation on solids-not-fat content of Jakhrana and Sirohi goat breed's milk 2021-23 are in consonance with the slightly higher observations of Singh and Sharma, (2015) [16].

Conclusion

The goat's breed of has conspicuous effects on milk quality of goats. The specific gravity and fat percentage in the milk of Jakhrana has significantly higher than milk of Sirohi goat breed's milk samples.

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