

MILK FAT GLOBULE SIZE OF INDIGENOUS GOAT BREEDS IN KERALA

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ABSTRACT

Thirty newly kidded does of Attappady Black and ten newly kidded does of Malabari goats were selected for this study. Milk fat globule size and distribution were studied in selected lactating does. Milk fat globule size (μ) of 2.83 and 2.94 were noticed in Attappady Black and Malabari goats, respectively. Fourth (3.88 μ) and seventh (3.98 μ) week of lactation had highest fat globule size in Attappady Black and Malabari goats respectively. The smaller size fat globules proportion was increased in later stage of lactation in both the breeds.

Key words: Milk, fat globule size, lactation, Attappady black, Malabari goat

INTRODUCTION

The Attappady black goat has its origin from the Attappady hills of Western Ghats which is located in the north eastern part of Palakkad district in Kerala. This region is inhabited by the major tribal communities of the State known as Irulas, Mudukas and Kurumbas. The tribal economy and development is mainly dependent on goat rearing and associated agricultural activities. Attappady black goats are

medium sized, lean slender bodied and black in colour. They have bronze colour eyes and black horns with curved backward oriented tips. The ears are black, pendulous and the tail is curved and bunchy. Milk production of Attapady black goats ranges from 200-400 ml per day and is prolific meat purpose breed. The Malabari goats are mainly reared in the Malabar region of Kerala. They are medium to small sized animals having various goat colours from white to admixtures and black with an average milk yield of 0.5 to 1 litre / day.

One of the main constituent of milk fraction is fat. In the last few years, knowledge of the milk composition and properties of the milk fat globule size had increased significantly (Stahy and Argaman, 2014). Because the milk fat globule size plays a major role in nutritional value and technological properties of dairy products to churning of cream, cheese making and separation of fat. Fat globule size also determines the optical and rheological properties, emulsion stability of product and protein absorption per unit area (Hoda and El-Zeini, 2006). Goat milk has better digestibility because of the lower curd tension in goat milk (Puri *et al.*, 1952). The creaming rate is important in

milk and milk products while processing and the creaming rate is lesser in goat milk rather than in bovine milk because of smaller fat globules (Parkash and Jenness, 1968). Total fat content and fat globule size distribution affects the viscosity of milk and has an application in the processing and manufacture of milk products.

MATERIALS AND METHODS

The research was carried out in the ex-situ conservation units of Attappady black goats in Kerala Veterinary and Animal Sciences University. The units are, University Goat and Sheep farm, Mannuthy. The station is located at longitude of 76°15' E and latitude of 10°31' N and at altitude of 30 m above the sea level and Livestock Research Station, Thiruvazhamkundu which is located at longitude of 76°36' E and latitude of 11°03' N and at altitude of 35 m above the sea level. Milk samples (10 ml) from individual goats were collected first at seventh day of lactation then every three weeks interval of the does till the end of lactation to study the fat globule size and distribution. The milk sample of 1 ml was diluted to 10 ml with distilled water. The diameter of fat globules was measured as per Rangappa (1964) by using ocular micro meter, the scale of which being previously determined by a 1/100th stage micrometer. The average diameter was obtained by multiplying the number of globules in each group by its group average, summing the products and dividing it by the total number of globules in all groups as per Kuchroo and Narayanan (1977).

RESULTS AND DISCUSSION

The milk fat globule size of Attappady Black and Malabari goats during different stages of lactation were represented in

Table 1 and the microscopic structure of milk fat globules were illustrated in Plate 1. The mean diameter of fat globule size in Attappady Black and Malabari goats were 2.83 and 2.94, respectively. The results obtained were similar to George (1981) who stated the milk fat globule size of Sannan x Malabari goats were $2.70 \pm 0.03 \mu$. In contrary to this result, Narangerel *et al.* (2016) reported the average size of fat globules in Mongolian goat milk was $2.43 \pm 0.12 \mu$ and Venkatachalapathy and Iype (1997) reported the average milk fat globule size of Malabari cross breed was 2.60, which were lower than the present findings. Attaie and Richtert (2000) reported the individual fat globules of goat milk ranged from 0.73 - 8.58 μ .

The higher size fat globule size was noticed in the 4th (3.88 μ) and 7th (3.69 μ) week of lactation in Attappady Black and Malabari goats, respectively and the smaller size fat globules was noticed in the 10th (2.01 μ) and 16th (2.26 μ) week of lactation in Attappady Black and Malabari goats, respectively. This reveals that lower fat globule size was observed in late lactation period compared to early lactation period in goats. The present finding was in agreement with the results obtained by Venkatachalapathy and Iype (1997), Carriquiry *et al.* (2009) and Stahy and Argaman (2014).

The per cent distribution of fat globule size in Attappady Black and Malabari goats during different stages of lactation were documented in Table 2. The observation on the distribution of fat globules in different classes of 0-3, 3-6, and 6-9 μ revealed that 75.245, 21.01 and 4.97 per cent of fat globules, respectively in Attappady Black and 64.98, 31.3 and 3.43 per cent of fat globules, respectively in Malabari

goats. The proportion of 0-3 μ size fat globules was highly noticed in 10th (93.33 per cent) and 16th (67.8 per cent) week of lactation in Attappady Black and Malabari goats, respectively. These findings are in accordance with the findings of George (1981) and Venkatachalapathy and Iype (1997).

The smaller size fat globules in the milk are associated with greater surface area and higher phospholipids content. The phospholipid content is an important factor in the development of brain and

nervous tissues and plays a vital role in the fat absorption and digestion. The smaller size of fat globules had less coagulative properties and its leads to better digestion for infants and elder people (Kulkarni and Dole, 1956). In the present result, the increased smaller size fat globules was noticed in late lactation because of higher concentration of long chain fatty acids and negative energy balance in early lactation and positive in late lactation and also the volume of membrane material is lower in early and mid-lactation.

Table 1. Milk fat globule size of Attappady Black and Malabari goats during lactation

Stages of lactation (in weeks)	Fat globule size (μ)		t-value	p-value
	Attappady Black (n=30)	Malabari (n=10)		
1	2.50 \pm 0.11 ^c	2.36 \pm 0.13 ^{cc}	0.689	0.495
4	3.88 \pm 0.17 ^a	3.69 \pm 0.21 ^a	0.565	0.575
7	2.93 \pm 0.12 ^b	3.98 \pm 0.31 ^a	3.870**	<0.001
10	2.01 \pm 0.06 ^d	2.68 \pm 0.10 ^{bd}	5.764**	<0.001
13		2.64 \pm 0.20 ^{bc}		
16		2.26 \pm 0.17 ^{dc}		
F-value	56.070**	19.891**		
p-value	<0.001	<0.001		
Mean	2.83 \pm 0.09	2.94 \pm 0.12	0.727	0.468

Means with different superscripts differ significantly; **($P < 0.01$); *($P < 0.05$)

Table 2. The per cent distribution of fat globule size in Attappady Black and Malabari goats during lactation

Stages of lactation (in weeks)	Attappady Black (n=30)			Malabari (n=10)		
	0-3 μ	3-6 μ	6-9 μ	0-3 μ	3-6 μ	6-9 μ
1	70.46	28.26	1.26	83	17	0
4	65.26	21.86	12.86	44.8	48.2	7
7	71.93	27.26	0.8	40.8	46.2	12.8
10	93.33	6.66	0	67.8	31.4	0.8
13				69.8	30.2	0
16				85.2	14.8	0
Mean	75.24	21.01	4.97	65.23	31.3	3.43

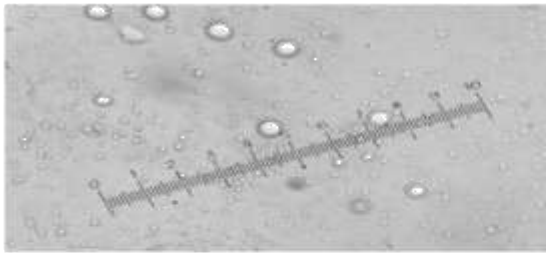


Plate 1. Microscopic structure of milk fat globules

SUMMARY

This study reveals that the size of the milk fat globule was smaller and proportion of smaller size fat globule was more in later stage of lactation in both indigenous goat breeds. These characteristics of the fat globules can affect the milk quality and digestive parameters. In addition, the smaller size fat globules may be used for cheese making which will increase the quality of cheese as well as it is beneficial for human health in terms of lipid and protein content of milk. More studies are still required for finding the factors affecting the milk quality and quantity as well as exploring the use of goat milk for human consumption.

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