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Research Article

Seasonal variation in the Composition of Milk in Different Breeds of Cow, at Dindigul District, Tamilnadu, India

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Abstract

The Research was performed to examine the effect of seasonal variation on the milk components in four breeds of cow at Dindigul District, Tamilnadu, India. Four different cow milk samples, Kangayam, Jersey, Red Sindhi, and Holstein Friesian were collected and examined in four different seasons, winter, post monsoon, monsoon and summer periods. No significant variation found in the percentage of water, SNF, and Acidity, pH of four breeds of cow in four different seasons. But the fat and protein content was significantly differ in each season in all experimental breeds of cow. The fat percentage was higher in Kangayam cow in summer season and protein content was higher in Jersey cow in post-monsoon period.

Introduction

The consumption of milk and dairy products is often faced as a prerequisite for a well-balanced diet due to their beneficial health effects, especially with respect to the high biological values of milk proteins and vitamin contents. Vitamin A is the most abundant, but

Vitamins E, D, and β-carotene are also present [1]. Milk contains a wide array of proteins with biological activities ranging from antimicrobial ones to those facilitating absorption of nutrients, as well as acting as growth factors, hormones, enzymes, antibodies and immune stimulants [2]. Despite small contribution of camel and goats, almost 97 % of milk is coming from cows. About 3.2 billion litres of milk is produced daily. In addition to its nutritional value, it is also a means of generating income [3].

The composition of milk is of great importance for dairy industry and there is great interest in changing the composition of milk [4]. The variation in milk and milk yield of different species depends on several factors are stage of lactation, genetics, different types of diet, udder health, parity, season, location, temperature, animal age, Disease, climate, breed and species etc. Production of cow milk and dairy products has greatly grown to appeal to consumers looking for differentiated nutritional and functional quality besides special characteristic and taste.

The main objective of the present work is to analyse the seasonal variations in the composition of milk in different breeds of cow, Kangayam, Jersey, Sindhi and Holstein Frisian cow at Dindigul District in TamilNadu, South India. The research has been under taken during different seasons, winter, summer, monsoon and post-monsoon.

Materials and Methods

The cow milk samples were collected from 4 different breeds of cows respectively Kangayam, Jersey, Sindhi, and Holstein Frisian at Dindigul District, Tamil Nadu, and South India. The study of four different breeds of cows with an average age of 3.5 years was used for this research. The research was carried out in four periods. The first periods was the winter period covering January - February months, the second one was the summer period covering March - May months, third period was a Monsoon covering June - September months and the fourth period was covering Post- Monsoon, October - December months. Milk samples were collected according to seasons, monthly twice once in 15 days. Fresh milk samples were collected from the cows with separate sterilized containers used for sample collection. The collected samples were immediately transferred directly in an ice-box to the laboratory without delay for determination of their chemical composition, protein, fat, water, SNF ,Acidity and pH content were determined.

Fat

The fat percentage in milk was estimated by Gerber's method [5].

Protein

Total protein content in milk was estimated by the dye-binding method [6].

Total Solids

The percentage of total solids in milk was estimated by the Gravimetric method [7].

Solids-not-fat

Solids-Not-Fat (SNF) content of milk was determined by finding the difference between solids content and fat content of milk.

Water

Water content was analysed by the method [8].

pH

The electrode of the pH meter was dipped in to the fresh milk sample kept in a beaker to find pH of the milk samples.

Acidity of Milk

The total titratable acidity was determined by using the titration method.

Results

Table 1 depicts the influences of season on milk composition in the Kangayam cattle at farmers' herd. The fat content of milk was higher during summer season than winter and post monsoon season during first parity in Kangayam cattle. The percentage of fat showed significant difference at $p<0.05$ level. Influences of season on milk composition in the first parity of Red Sindhi cattle at farmers' herd are presented in the Table 2. A significant ($P<0.05$) effect of season on milk fat was observed but the other milk constituent traits were not significantly different.

The perusal of Table 3 reveals that milk fat percentage in Holstein Friesians cross cattle were significant ($P<0.05$) during summer and monsoon than the winter and post monsoon season in the first lactation. The protein, SNF, water, acidity and pH changes during different season were not significantly different. Milk composition in Jersey cross cattle at farmers' herd were presented in Table 4. In the present study the milk fat percentage was significantly ($P<0.05$) affected by the environmental effect in different season. The other milk constituents' protein, SNF, water, acidity and pH were not affected significantly by the season.

The fat content in milk was higher in kangayam cow (3.679%) compared to other breeds of cow. Jersey cow milk showed increased protein content (3.394%) than other breeds milk. Water percentage showed increased level (89.537%) in HF cow in winter season. There was no significant difference noted in the acidity in four breeds of cow it was ranged from 0.138 to 0.140. The pH of milk ranged from 6.553 to 6.6 and it was higher in summer and lower in monsoon period. SNF level was ranged from 7.542% to 7.771%. The higher level was found in different season in four breeds of cow.

Table 1: Influence of season on milk composition in the Kangayam cattle at farmers' herd.

Subclass Season / Parity	Fat %	Protein %	SNF %	Water %	Acidity	pH
1st lactation	*	NS	NS	NS	NS	NS
Winter	$3.797^{a} \pm 0.155$ (34)	$3.303^{a} \pm 0.060$ (34)	$7.722^{a} \pm 0.059$ (34)	$88.298^{a} \pm 0.149$ (34)	$0.139^{a} \pm 0.001$ (34)	$6.579^{a} \pm 0.007$ (34)
Post Monsoon	$3.936^{ab} \pm 0.159$ (33)	$3.303^{a} \pm 0.057$ (33)	$7.721^{a} \pm 0.057$ (33)	$88.159^{a} \pm 0.165$ (33)	$0.140^{a} \pm 0.001$ (33)	$6.567^{a} \pm 0.008$ (33)
Monsoon	$4.108^{ab} \pm 0.145$ (37)	$3.280^{a} \pm 0.056$ (37)	$7.698^{a} \pm 0.055$ (37)	$88.014^{a} \pm 0.140$ (37)	$0.139^{a} \pm 0.001$ (37)	$6.570^{a} \pm 0.007$ (37)
Summer	$4.276^{b} \pm 0.160$ (36)	$3.259^{a} \pm 0.056$ (36)	$7.676^{a} \pm 0.057$ (36)	$87.861^{a} \pm 0.173$ (36)	$0.139^{a} \pm 0.001$ (36)	$6.581^{a} \pm 0.008$ (36)

Figures in parentheses are the number of observations; SNF: Solids-not-fat; NS – not significant; *p<0.05

Means with at least one common superscript within classes do not differ significantly (p>0.05).

Table 2: Influences of season on milk composition in the Red Sindhi cattle at farmers' herd.

Subclass Season / Parity	Fat %	Protein %	SNF %	Water %	Acidity	pH
1st lactation	*	NS	NS	NS	NS	NS
Winter	$3.569^{a} \pm 0.209$ (17)	$3.241^{a} \pm 0.090$ (17)	$7.657^{a} \pm 0.088$ (17)	$88.568^{a} \pm 0.181$ (17)	$0.1390^{a} \pm 0.0002$ (17)	$6.582^{a} \pm 0.010$ (17)
Post Monsoon	$3.782^{ab} \pm 0.208$ (17)	$3.355^{a} \pm 0.078$ (17)	$7.771^{a} \pm 0.079$ (17)	$88.241^{a} \pm 0.227$ (17)	$0.1398^{a} \pm 0.0003$ (17)	$6.571^{a} \pm 0.011$ (17)
Monsoon	$3.968^{ab} \pm 0.205$ (17)	$3.336^{a} \pm 0.082$ (17)	$7.752^{a} \pm 0.082$ (17)	$88.079^{a} \pm 0.205$ (17)	$0.1392^{a} \pm 0.0004$ (17)	$6.553^{a} \pm 0.012$ (17)
Summer	$4.242^{b} \pm 0.221$ (17)	$3.304^{a} \pm 0.078$ (17)	$7.720^{a} \pm 0.080$ (17)	$87.838^{a} \pm 0.262$ (17)	$0.1394^{a} \pm 0.0003$ (17)	$6.600^{a} \pm 0.009$ (17)

Figures in parentheses are the number of observations; SNF: Solids-Not-Fat; NS – Not Significant; *p<0.05.

Means with at least one common superscript within classes do not differ significantly (p>0.05).

Table 3: Influences of season on milk composition in the Holstein Friesians cross cattle at farmers' herd.

Subclass Season / Parity	Fat %	Protein %	SNF %	Water %	Acidity	pH
1st lactation	*	NS	NS	NS	NS	NS
Winter	2.892[a] ± 0.140 (26)	2.984[a] ± 0.064 (26)	7.577[a] ± 0.067 (26)	89.531[a] ± 0.123 (26)	0.1384[a] ± 0.0003 (26)	6.577[a] ± 0.008 (26)
Post Monsoon	3.058[b] ± 0.124 (21)	2.956[a] ± 0.069 (21)	7.542[a] ± 0.072 (21)	89.400[a] ± 0.119 (21)	0.1385[a] ± 0.0004 (21)	6.581[a] ± 0.009 (21)
Monsoon	3.002[b] ± 0.126 (24)	3.028[a] ± 0.069 (24)	7.598[a] ± 0.069 (24)	89.400[a] ± 0.139 (24)	0.1380[a] ± 0.0003 (24)	6.567[a] ± 0.010 (24)
Summer	3.108[b] ± 0.201 (20)	3.076[a] ± 0.067 (20)	7.644[a] ± 0.067 (20)	89.248[a] ± 0.219 (20)	0.1385[a] ± 0.0003 (20)	6.575[a] ± 0.010 (20)

Figures in parentheses are the number of observations; SNF: Solids-not-fat; NS – not significant; *p<0.05.

Means with at least one common superscript within classes do not differ significantly (p>0.05).

Table 4: Influences of season on milk composition in the Jerseycross cattle at farmers' herd.

Subclass Season / Parity	Fat %	Protein %	SNF %	Water %	Acidity	pH
1st lactation	*	NS	NS	NS	NS	NS
Winter	2.986[a] ± 0.148 (29)	3.388[a] ± 0.065 (29)	7.739[a] ± 0.064 (29)	89.276[a] ± 0.158 (29)	0.1383[a] ± 0.0003 (29)	6.583[a] ± 0.007 (29)
Post Monsoon	3.177[a] ± 0.119 (26)	3.394[a] ± 0.069 (26)	7.712[a] ± 0.070 (26)	89.312[a] ± 0.138 (26)	0.1387[a] ± 0.0003 (26)	6.581[a] ± 0.008 (26)
Monsoon	3.449[b] ± 0.123 (29)	3.342[a] ± 0.064 (29)	7.730[a] ± 0.069 (29)	89.020[a] ± 0.136 (29)	0.1380[a] ± 0.0003 (29)	6.562[a] ± 0.009 (29)
Summer	3.679[b] ± 0.110 (30)	3.341[a] ± 0.065 (30)	7.670[a] ± 0.067 (30)	89.051[a] ± 0.133 (30)	0.1382[a] ± 0.0003 (30)	6.587[a] ± 0.006 (30)

Figures in parentheses are the number of observations; SNF: Solids-Not-Fat; NS – Not Significant; *p<0.05.

Means with at least one common superscript within classes do not differ significantly (p>0.05).

Discussion

Milk is the best base of nutrition and a part of daily diet, easily accepted and consumed by all age group in rural as well as in city areas. Seasonal variation affects milk composition is related with several factors and Nutritional factors associated with changing availability and quality of pasture through the year, physiological changes associated with the stages of lactation and pathological factors. Milk fat was most variable component among the milk content. The amount of fat in milk composition was affected by a bundle of factors including breed and species, milk system, animal age and size, environment, climate, temperature and diet composition thus influence the quality of milk products [9]. Heat stress is one of the factors to decrease milk protein content [10]. During periods of heat stress the cow prefer to use amino acids for energy production instead of protein synthesis. So the protein content was decreased in summer. The protein level decreased in hot month mainly due to the decreased casein level especially β- casein and αs-caesin level [11]. In our study also the protein content was decreased in summer in four breeds of cow. Hence cow milk production and composition can be influenced directly by the season [12]. In the present study the percentage of fat in four breeds of cow showed higher percentage during summer season and low percentage observed in winter season. And also the fat content was higher in kangayam cow in summer period and Jersey milk has the increased protein percentage in post-monsoon period compared to other breeds of cow. The other milk quality parameters didn't show any significant difference.

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