

Serum lipid profile during lactation in buffalo

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ABSTRACT

Serum lipid profile was studied during gestation in 18 lactating Murrah buffaloes. The animals were grouped as early, mid and late lactation. The differences amongst 3 stages of lactation in all the lipid components studied were statistically highly significant. The serum total cholesterol, HDL cholesterol, triglycerides, phospholipids increased from early to mid stage of lactation and then decreased from mid to late stage of lactation, while LDL cholesterol increased with advancing stage of lactation. This increase may be related to the effect of estrogen on carbohydrate metabolism, which in turn causes increases in production of cholesterol in endocrine gland tissue from acetate and also due to demand of udder for fatty acid synthesis for milk fat. However, serum NEFA differed significantly with decreased level during mid lactation and this decrease from early to mid lactation is attributed to high energetic requirement during first stage of lactation that cannot be supported by dietary intake and thus buffalo must utilize body fat as source of energy. The correlation between serum lipid profile with milk fat per cent was nonsignificant with each other during all stages of lactation.

Key words: Buffaloes, Lactation, Serum lipids

The blood lipids play an important role in milk fat synthesis in dairy animals (Bauman and Davis 1974). Evidence for the utilization of blood lipids for milk fat synthesis comes from arterio venous differences. The triglycerides, phospholipids, cholesterol-esters and protein bound unesterified fatty acids are the major blood sources of milk fatty acids. Thus the role of blood lipids in milk fat synthesis is quite evident. But scanty information is available on the blood lipids during lactation in buffaloes. Hence it was decided to study lipid profile during lactation in buffaloes.

MATERIALS AND METHODS

Apparently healthy lactating Murrah buffaloes (18) in fourth to sixth lactation selected from ShriWarana Sahakari Dudh Utpadak and Prakriya Sangh Ltd, Warana Nagar, Kolhapur, were divided into 3 groups, 6 in each, based on their stage of lactation: early (days 51–65), mid (days 125–160) and late (days 198–262). At the start of the experiment, the average ages of experimental animals was 6 to 8 years and were yielding on average 6.6 to 12.5 kg milk. The

experimental animals in early lactation group were inseminated, and those in mid and late stages of lactation were pregnant in early to mid stages of gestation. The buffaloes were maintained under standard managerial and nutritional conditions. The average maximum temperature, minimum temperature and relative humidity recorded during the period of study were 23.60 ± 0.68 and 16.70 ± 0.39 °C and $95 \pm 1.29\%$ respectively.

Jugular blood samples (8–10 ml) were collected aseptically in morning hours between 8 AM and 10 AM. Clear serum was separated by centrifugation. The blood samples were collected for 6 consecutive days and milk samples were collected in plastic bottles from all the buffaloes on days 1, 3 and 5 during the experimental periods, for determination of fat content. The serum samples were stored at -20° C until used for biochemical analysis.

Estimation of serum total cholesterol, triglycerides, HDL cholesterol and LDL cholesterol were done by using an autoanalyser, phospholipids by using spectrophotometer and NEFA by copper soap formation method (Falholt *et al.* 1973). Fat content in milk was estimated using fat analyzer on fresh milk samples. The data were analysed as per Snedecor and Cochran (1998).

RESULTS AND DISCUSSION

Serum total cholesterol: The highest value of serum total cholesterol was recorded during mid lactation, least during

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Table 1. Serum lipid profile during lactation in buffaloes

Stage of lactation	Serum total cholesterol (mg/dl)	Serum HDL cholesterol (mg/dl)	Serum LDL cholesterol (mg/dl)	Serum triglycerides (mg/dl)	Serum phospholipids (mg/dl)	Serum non-esterified fatty acids ($\mu\text{mol/litre}$)
Early lactation	154.19 ^c ±1.13	80.29 ^c ±1.14	70.55 ^b ±0.29	16.66 ^c ±0.57	139.12 ^c ±1.60	454.33 ^a ±21.01
Mid lactation	198.73 ^a ±0.68	112.03 ^a ±0.94	80.96 ^a ±0.46	28.40 ^a ±0.42	196.98 ^a ±1.39	417.41 ^b ±19.39
Late lactation	173.97 ^b ±1.76	87.98 ^b ±2.35	81.65 ^{ac} ±1.66	21.80 ^b ±0.46	186.72 ^b ±3.11	460.15 ^{ac} ±23.53

Mean with atleast one common superscript do not differ significantly ($P<0.05$).

early lactation and intermediate during late lactation (Table 1). The differences in serum total cholesterol concentration amongst 3 stages of lactation were significant ($P<0.01$). Our results are in agreement with those obtained by Polat *et al.* (2002) and Grasso *et al.* (2004) who found the same trend as increased levels from early to mid lactation due to high energy requirement of animal during first stage of lactation. However decreased levels were reported by Stanley *et al.* (1991), Singh *et al.* (2003) and Jagatheesan *et al.* (2005). Higher values were reported by Setty and Razdan (1966) since the gonadal steroid which have correlation with cholesterol metabolism, are produced in much greater amount during these stages. Prakash and Tandon (1979) found the increased level of serum cholesterol and were due to the mechanism by which estrogen affected the complex interrelationship of pituitary-thyroid-adrenal function. The estrogen had an effect on the carbohydrate metabolism that in turn caused increased production of cholesterol in endocrine gland tissue from acetate.

HDL cholesterol: The serum HDL cholesterol followed the similar trend to that of serum total cholesterol. The differences in serum HDL cholesterol concentration amongst 3 stages of lactation were statistically significant ($P<0.01$). During early lactation the levels were lower than mid lactation and late lactation. Basoglu *et al.* (1998) also found HDL cholesterol activity significantly high in late lactation than early lactation and prepartum. The decreased level of HDL cholesterol during early and late lactation may be related to the lower cholesterol level during same period as HDL consists of about 60% cholesterol (Sevinc *et al.* 2003).

LDL cholesterol: Serum LDL cholesterol concentration gradually increased from early to late lactation. The highest values were recorded during late lactation, least during early

lactation and intermediary during mid lactation. The increase in serum LDL cholesterol concentration amongst the early and mid, and in early and late stages of lactation were statistically highly ($P<0.01$) significant. During late lactation the levels were highest as compared to early and mid lactation. Similar trend was observed by Basoglu *et al.* (1998) during lactation but the values were lower than the present study. However the lower levels of LDL cholesterol during early lactation are due to increased LDL catabolism or the reduced transformation of VLDL into LDL (Sevinc *et al.* 2003).

Triglycerides: The serum triglycerides exhibited the identical trend to that of serum total cholesterol and HDL cholesterol. The lowest serum triglycerides concentration was recorded during early lactation followed by increase during mid stages of lactation and then decreased during late lactation. The differences in serum triglycerides concentrations amongst 3 stages of lactation were statistically significant ($P<0.01$). The observation of the present study are in accordance with Varman and Schultz (1968) and Basoglu *et al.* (1998) who observed similar trend during early and mid lactation. Sevinc *et al.* (2003) reported high triglycerides levels during 1 - 6 weeks of lactation as compared to present study and according to them low triglycerides can be thought to be caused by an influx of free fatty acids from adipose tissue near the time of parturition and a low out put of lipoprotein by liver. The rapid increase in the triglycerides during lactation may be attributed to increase demand of the udder for fatty acid synthesis for milk fat, and also to lowest level of circulatory estrogen and thyroxin profile which influence the lipid metabolism (Tainturier *et al.* 1984).

Phospholipids: The serum phospholipids exhibited the

Table 2. Correlation of fat content in milk with lipid components in serum in buffaloes

Stage of lactation	Serum lipid components					
	Total cholesterol	HDL cholesterol	LDL cholesterol	Triglycerides	Phospholipids	Nonesterified fatty acids
Early	0.16 ^{NS}	0.22 ^{NS}	-0.516 ^{NS}	-0.099 ^{NS}	0.592 ^{NS}	0.106 ^{NS}
Mid	-0.018 ^{NS}	-0.103 ^{NS}	0.396 ^{NS}	-0.579 ^{NS}	-0.206 ^{NS}	-0.45 ^{NS}
Late	0.22 ^{NS}	0.378 ^{NS}	-0.594 ^{NS}	0.235 ^{NS}	-0.556 ^{NS}	0.617 ^{NS}

identical trend to that of serum total cholesterol and HDL cholesterol. The lowest serum phospholipids concentration was recorded during early lactation followed by increases during mid stages of lactation and then decreased during late lactation. The differences in serum phospholipids concentrations amongst 3 stages of lactation were statistically highly ($P < 0.01$) significant. The observations of the present study are in accordance with Varman and Schultz (1968) who observed the same increasing trend from early lactation to late lactation. The highest concentration of phospholipids during mid and late lactation could be due to increased demand of nutrients for milk fat synthesis during lactation.

Non esterified fatty acids: There was a significant ($P < 0.01$) difference in the serum non-esterified fatty acids concentrations in the early lactation and mid lactation and in the early lactation and late lactation. The result revealed that the levels decreased from early lactation to mid lactation and again increased during late lactation. These results are in agreement with those obtained by Grasso *et al.* (2004) who observed the same trend as decreased levels from early to mid lactation and this decreased level during mid lactation may be attributed to high energetic requirement during first stage of lactation that cannot be supported by dietary intake. As a result the buffalo must utilize body fat as a source of energy. But this result was not in agreement with Varman and Schultz (1968) who observed the increased level of free fatty acids during early lactation as compared to late lactation. They postulated that this unusual observation at this particular time of lactation (early lactation and under certain circumstances) may be due to greatly enhanced mobilization of the depot fat and also a possible change in the ability of the mammary gland secretory tissue to remove and metabolize higher amounts of plasma free fatty acids. However, the low levels were observed by Hayashi *et al.* (2005) and high level were observed by Vanzquez anon *et al.* (1994) during early pregnancy.

The correlation (Table 2) between serum total cholesterol, HDL cholesterol, LDL cholesterol, triglycerides, phospholipids and NEFA levels with milk fat during early, mid and late lactation was nonsignificant.

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