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Effect of Pregnancy on Milk Yield and Composition in Dairy Buffaloes

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Abstract.- Changes in milk yield and composition with pregnancy were investigated, using forty lactating buffaloes. They were grouped as high, moderate and low yielder on the basis of daily milk yield. The animals were synchronized for estrus and inseminated artificially. Milk yield was recorded daily and sampled fortnightly for analysis up to 23 week post conception. The data collected were analyzed through SPSS 11 software. Results showed a significant effect ($P<0.05$) of production groups, pregnancy, weeks post conception, ration and their interaction on post conception milk yield. Among the three production groups milk yield decline was maximum in high yielder (49.41 liters) followed by moderate (38.26 liters) and low yielder (28.08 liters), respectively. In pregnant animals the mean milk yield was lower (37.143 liters) then the non pregnant buffaloes (40.46 liters). Decline in milk yield became significant after week 8th post conception. Present study reported significant effect ($P<0.05$) of production groups, pregnancy, weeks post conception, ration and their interaction on post conception milk fats contents. Effect on other milk constituents was non significant. However, Pregnancy and weeks post conception had a significant ($P<0.05$) effect on SNF (%), milk protein (%) and lactose (%). The mean milk fats (%) for non pregnant buffaloes was higher (7.84 %) as compared to pregnant buffaloes (7.09 %). Feed supplementation of pregnant animals significantly ($P<0.05$) increased milk fats (7.87 vs 7.09) and lactose (5.26 vs 5.22) contents while the rest of contents did not respond. Milk fats contents increased significantly ($P<0.05$) and linearly with pregnancy weeks in all the three production groups. It was concluded that milk yield started decreasing with advancement in pregnancy and got pronounced ($P<0.05$) on week 8$^{th.}$ Milk fat contents in buffaloes decreased with advancement in weeks post conception as compared to their non pregnant counter part.

Key words: Pregnancy, milk yield, milk composition, dairy buffalo.

INTRODUCTION

Under the traditional farming system in Pakistan buffaloes are not bred due to the fear of milk yield decline and remain open for longer period (Qureshi *et al*., 2002). Borman *et al*. (2002) reported a decline in the yield of milk, from approximately 90 days in pregnant cows, compared with non pregnant cows. The difference in production was particularly noticeable during the third trimester of gestation. The report suggests that there is a milk production cost of pregnancy well in advance of 190 days. However, the significance of the difference between milk yields of pregnant and non pregnant cows was not reported. The greater effect of pregnancy on lactation was attributed to the decreasing power of galactopoietic hormones as lactation advanced. Sharma *et al*. (1990) reported that chloride percentage showed an initial decline and then a rise after 2 months. Lee *et al*. (1997) found that pregnant cows produced 265 kg less milk, 9.8 kg less fat, and 9.2 kg less protein than non-pregnant cows.

In above studies the effects of pregnancy on milk yield and composition have been investigated on the basis of data from dairy cows. This information can not be applied directly to dairy buffaloes due to the difference in species, climate, and socio-economic conditions of the farmers. The present study was therefore conducted to determine the effect of pregnancy on milk yield and composition in dairy buffaloes.

MATERIALS AND METHODS

Study regarding the effect of pregnancy on milk yield and composition was conducted in a commercial dairy farm located at Peshawar, Pakistan, lying at 31 to 37 °N and 65 to 74°E. Forty lactating Nili-Ravi buffaloes, 2-3 months postpartum were selected and grouped as high yielders (HY) 66 to 75 liters/week, moderate yielders (MY) 56 to 65 liters/week and low yielders 46 to 55 liters/week on the basis of daily milk yield.

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Feeding of experimental animals

All the animals were provided green fodder *ad libitum*. The experimental period lasted for 23 weeks. The rations were grouped into:

Traditional ration

In addition to the green fodder, the non-pregnant and one group of pregnant animals were provided commercial concentrate (18% crude protein and 72% TDN on dry matter basis) at the rate of 1.5 kg per animal irrespective of its lactation stage, milk yield level and pregnancy stage, as practiced under the conventional farming system in the region.

Supplemented ration

In addition to the basal ration of green fodder, the same commercial concentrate was provided @ 1 kg per 2 liters of milk as recommended by Ranjhan (1994) for lactating buffaloes under tropical conditions. This ration was provided to only one group of pregnant animals.

Estrus synchronization, milk sampling and analysis

The selected animals were synchronized with Lutalyse (Pfizer, Belgium) @ 5 ml per animal and inseminated. Pergnancy was diagnosed per rectum after two months. Animals remained open were used as control. Daily milk yield was recorded. Individual milk samples (10 ml each) were collected fortnightly and analyzed for milk fats, protein, lactose and SNF contents using milk analyzer (Ekomilk, Total Ultrasonic Milk Analyzer, Bulltech 2000, Stara Zaqora, Balgharia). Ash was calculated by subtracting the sum of milk lactose and protein from SNF (Khan *et al.*, 2008b).

Statistical analysis

The data was analyzed for analysis of variance (ANOVA) to compare means of various groups. Means were ranked using Duncan multiple range test and T test.

RESULTS

Effect of pregnancy on milk yield

Significant effect (P<0.05) of production groups, pregnancy, weeks post conception and ration was found on post conception milk yield. Milk yield decline was maximum in high yielder followed by moderate yielder and low yielders. In pregnant animals the mean milk yield was lesser then than non pregnant buffaloes (Table I). Decline in milk yield was observed in a linear pattern with advancement in weeks post conception. The Decline became significant after week 8th post conception and decreased (Table II).

Table I.- Mean comparison for milk yield and composition across production pregnancy ration groups.

Group	Milk yield (L/wk)	Fats (%)	Solid-not-fat (%)	Protein (%)	Lactose (%)	Ash (%)
Production group						
HY	49.41^{a}	7.36^{a}	9.30	3.30	5.23^{b}	0.771
MY	38.26^{b}	7.46^{a}	9.33	3.31	5.25^{a}	0.769
LY	28.08^{c}	7.58^{b}	9.32	3.31	5.24^{ab}	0.770
Pregnancy group						
Pregnant	37.14^{b}	7.09^{b}	9.30^{b}	3.30	5.23^{b}	0.769
Non-pregnant	40.46^{a}	7.84^{a}	9.34^{a}	3.31	5.25^{a}	0.771
Ration Groups						
Traditional	36.33^{a}	7.09^{b}	9.28	3.30	5.22^{b}	0.77
Supplemented	38.53^{b}	7.87^{a}	9.33	3.30	5.26^{a}	0.77

Means with different superscripts with significant difference (P<0.05); HY = High Yielder; MY = Moderate yielder; LY =Low yielder; $^{a, b, c}$ The means with different superscripts in the same column, are different from each other.

Table II.- Mean comparison for milk yield and composition across pregnancy weeks.

Weeks post-conception	Milk yield (L/wk)	Fats (%)	SNF (%)	Protein (%)	Lactose (%)	Ash (%)
2	45.90^{a}	6.27^{k}	9.59^{a}	3.50^{a}	5.37^{a}	0.72
4	44.90^{a}	6.24^{jk}	9.56^{a}	3.47^{a}	5.33^{ab}	0.76
6	45.30^{a}	6.34^{j}	9.52^{a}	3.39^{b}	5.37^{a}	0.76
8	43.55^{b}	6.54^{h}	9.49^{a}	3.35^{cd}	5.38^{a}	0.76
10	42.25^{c}	7.34^{g}	9.33^{ab}	3.36cd	5.19^{bc}	0.78
12	40.10^{d}	7.59^{f}	9.27^{b}	3.34^{de}	5.15^{ab}	0.78
14	38.15^{e}	8.09^{e}	9.18^{b}	3.29^{def}	5.11^{c}	0.78
16	36.20^{f}	8.21^{d}	9.20^{b}	3.23^{g}	5.19^{cd}	0.78
18	33.50^{g}	8.38^{c}	9.29^{b}	3.28^{fg}	5.23^{de}	0.78
20	29.74^{h}	8.52^{b}	9.26^{b}	3.23^{g}	5.26^{e}	0.77
22	26.90^{j}	8.70^{a}	9.32^{ab}	3.26^{g}	5.29^{ef}	0.77

Means with different superscripts in same column were significantly different (P<0.05)

Effect of pregnancy on milk composition

Significant effect (P<0.05) of production groups, pregnancy, weeks post conception and ration was found on post conception milk fats (%). Pregnancy affected milk SNF (%) and lactose (%). Milk fats (%) were maximum in low yielding (7.58%) and non-pregnant buffaloes. Feed supplementation of pregnant animals significantly ($P<0.05$) increased milk fats (7.87 vs 7.09) and lactose (5.26 vs 5.22, Table I). Weeks post-conception affected all milk components except ash. Milk fats contents increased significantly ($P<0.05$) and linearly with the advancement of pregnancy weeks in all the three production groups (Fig. 1). However the rapid increasing pattern was seen in low yielder followed by moderate and high yielder. For milk protein a decline pattern was observed (Fig.2) along the post conception weeks. The decline was comparatively slower in low yielding buffaloes as compared to moderate and high yielding buffaloes. For lactose an initial decline fallowed by a small rise was observed almost all the three groups (Fig. 3).

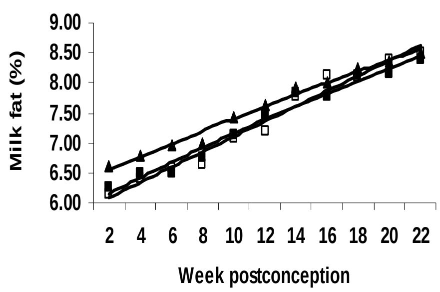

Fig. 1. Changes in milk fat (%) with the advancing pregnancy in high (□), medium (■) and low (▲) yielding dairy buffaloes. (R^2 =0.97, 0.98 and 0.98).

DISCUSSION

Decline in milk yield with pregnancy

Present study reports significant decline in milk yield on week 8th post conception and a linear decline thereafter with advancement of pregnancy weeks. Similar to the present findings Barman *et al.* (2002) reported a decline in the yield of milk, from approximately 90 days in pregnant cows, compared with non pregnant cows. Brother Stone *et al.* (2004) also reported a milk yield decline from as early as month 3 of pregnancy. The difference in production was particularly noticeable during the third trimester of gestation. The report of Borman *et al.* (2002) suggests that there is a milk production cost of pregnancy well in advance of 190 days. However, the significance of the difference between milk yields of pregnant and non pregnant cows was not reported. Pregnancy also caused a significant decline in milk yield of dairy cows in late lactation from month 5 of gestation onwards (Olori *et al.*, 1997). Placental lactogen peaks during the last third of pregnancy and may influence mammogenesis and lactogenesis, and alter the maternal metabolism to accommodate the growth and development of the fetus (Akers, 2002).

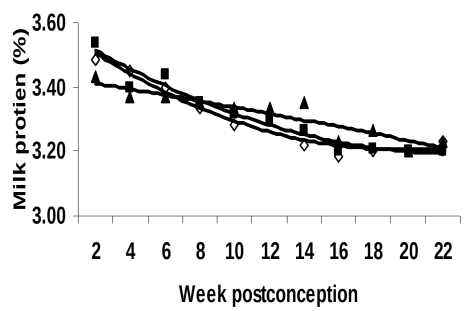

Fig. 2. Changes in milk protein (%) with the advancing pregnancy in high (□), medium (■) and low (▲) yielding dairy buffaloes (R^2 =0.95, 0.95 and 0.85).

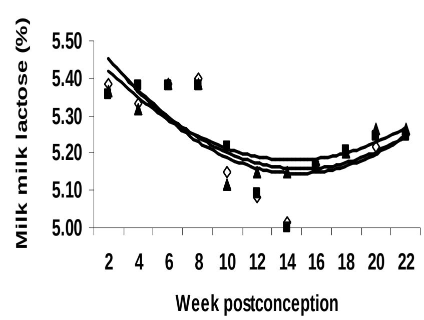

Fig. 3. Changes in milk lactose (%) with the advancing pregnancy in high (□), medium (■) and low (▲) yielding dairy buffaloes. Polynomial trend-lines show the regression with R^2 of 0.58, 0.55 and 0.56 for the three respective groups.

Milk yield losses as reported in present study might be due to the nutritive requirements of the gravid uterus. Energy requirements for pregnancy not only include the energy deposited in the conceptus, but also the energy used for the conceptus metabolism and the energy used by maternal tissues to support the conceptus (Bell *et al*.,1995). The idea was supported with the rise in yield of pregnant supplemented animals in this study. Present investigation reported a significant difference in milk yield decline among the production groups. Coulon *et al*. (1995) also reported that the decrease in milk yield was greater in high-producing than medium or low producing multifarious cows and by week 29 of pregnancy the daily milk yield was 3.6 and 2.4 kg lower for high- and medium/low-producing cows respectively. Lee *et al*. (1997) showed a significant relationship between days open (i.e., pregnancy status) and 305-d milk yield, and their report showed that even a slight change in days open (<10 day) had significant effects on milk production. However, they also pointed out that days open alone is probably not an accurate means of assessing the effect of pregnancy, as there is a high probability that it is the higher-yielding cows that have greater days open, thereby biasing the result by 70 %. Having removed the effect of early lactation milk yield (first 100 d), Lee *et al*. (1997) still found that pregnant cows produced 265 kg less milk than non pregnant cows over 305 days. Rodriquez *et al*. (1985) reported that stage of lactation and pregnancy affects accounts for about 50 percent of the variability of yield and 3 to 23 percent of percentages. Present study investigated that in buffaloes the decline in milk yield with pregnancy could be managed largely through feed supplementation.

Pregnancy and milk composition

Present results reported significantly lower milk fat contents in the milk from pregnant buffaloes as compared to their non pregnant counter part. Mather *et al*. (1969) and Wilcox *et al*. (1959) detected pregnancy effects on fat, protein, and SNF percentages after 4 month of pregnancy for mature cows and slightly later for first and second calf heifers. Logamthan and Thompson (1967) reported significant effects of stage of pregnancy on fat yield and SNF percentages, but pregnancy accounted for less than 0.5% of the total variance in each. Lee *et al*. (1997) found that pregnant cows produced 9.8 kg less fat, and 9.2 kg less protein than non pregnant cows. Present study reported a significant decline in milk fats on week 6th of pregnancy. In agreement with the present findings Olori *et al*. (1995) reported that there was little change in protein and lactose content but fat content increased significantly from the 6th month of gestation. A significant interaction between gestation stage and lactation stage was observed, indicating that the adverse effect of pregnancy was higher in mid-lactation than in late-lactation. Lactation milk fat, protein and lactose yield was estimated to decrease by 21, 1.5, 0.9 and 1.4 kg, respectively, for cows that were pregnant for 3 months during lactation. If pregnant for 8 months, corresponding losses were 207, 8.1, 8.7 and 10.7 kg, respectively due to the effect of pregnancy. Borman *et al*. (2002) reported a decline in the yield of milk, milk fat, and milk protein, from approximately 90 day in pregnant cows, compared with non pregnant cows. The difference in production was particularly noticeable during the third trimester of gestation.

Leakiness of tight junctions (TJ) during advanced pregnancy may account for milk composition differences between pregnant non pregnant animals. Elevated levels of progesterone induce TJ leakiness, and the injection of a progesterone antagonist in mice in late pregnancy resulted in a rapid closure of TJ (Nguyen *et al*., 2001). The highest level of circulating progesterone was reported to be between wk 8 (when placenta is functional) and wk 17 of pregnancy in goats (Kornalijnslijper *et al*., 1997), and was proportional to the number of fetuses. Thus, elevated progesterone concentrations during advance pregnancy may favor TJ leakiness. However this study investigated that the decrease in milk contents could be managed with balanced feeding. This may be associated with the reduced adverse effect of progesterone hormones in buffaloes fed with supplemented ration (Khan *et al*., 2008a).

CONCLUSIONS

It may be concluded that milk yield decreases with advancement in pregnancy and this decline becomes significant on week 8.th Milk contents, especially milk fats were decreased with advancement in weeks post conception as compared to their non pregnant counter part.

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