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Quarter Differences in Milk Yield, Composition, Milking Behavior in Khuzestan Buffaloes

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Abstract: Based on 202 observations, the mean and standard errors values per milking for hind left, hind right, fore right and fore left quarters of lactating Iranian buffaloes were recorded, respectively as 1200±19, 1167±18, 533±16 and 496±16 g for milk yield; 7.21±0.09, 7.21±0.09, 7.11±0.08 and 7.11±0.08% for fat, 9.91±0.06, 9.93±0.05, 9.89±0.04 and 9.90±0.4% SNF; 620±13, 611±12, 509±11 and 491±11 g min^{-1} for milk flow rate and 122±4, 119±4, 70±3 and 69±3 sec for total milking time under hand milking conditions. The overall let down time was 94±2 sec. The differences between individual quarters between fore pair and hind pair quarters and between right pair and left pair quarters were not significant only for fat and SNF contest, while between the right pair and left pair quarters differences were not significant for any of the parameters. Parity and stage of lactation influenced all the quarter (individual, fore pair vs. hind pair, right pair vs. left pair) parameters with trends similar to those of the same parameters for the whole udder, the time of milking (am or pm) influenced significantly milk yield, rate of flow and SNF content only, which were higher in the morning.

Key words: Quarters, milk flow rate, let down time, milk yield, composition of milk, Khuzestan buffaloes

INTRODUCTION

Buffaloes have no cisternal milk like cows and goats (Elliott and Graf, 1972) all the milk is expelled from the alveoli in to teat cisterns only during active milk ejection. Though the milk ejection is a conditional reflex; it mostly depends upon the functional status of the mammary gland, the state of animal's preparation for milking and animal's response to the milking. Disturbance of the routine conditions of milking, disturbs its normal behavior and intensity, prolongs the latent period and reduces the intra mammary pressure and milk ejection rate, thus decreasing the milk yield (Elliott and Graf, 1972; Thomas, 2004). There can be quarter a difference in this investigation was aimed at studying the milking behavior, milk yield and composition of milk of individual quarters of Khuzestan buffaloes.

MATERIALS AND METHODS

Observations on let down time, milking time, milk flow rate, milk yield and composition of milk of individual and paired quarters of buffaloes were recorded on all the 60 lactating Khuzestan buffaloes available in the herd of the station of livestock production in agricultural research Dezful, Iran, twice at a gap of one month and both am and pm milking is the months of November and December, 2007. The two observations of the same animal were considered as separate records as there were significant differences in parameters between the two recordings. Observations were recorded at the rate of six buffaloes daily by using a single milkier for all the 60 lactating Buffaloes so as to avoid variation due to the differences in the efficiency of the milkier. Observations on buffaloes with abnormalities were deleted. Finally, a total of 202 observations were used for statistical analysis. The date collected in this experiment was analyzed by using the least square analysis techniques (Harvey, 1986) as per the following model:

$$Y_{ijklm} = \mu + Q_i + P_j + S_k + T_l + E_{ijklm}$$

Where:

Y_{ijklm} = The mth observation belonging to Ith time, kth lactation stage, jth parity and ith Quarter
μ = The overall mean with equal sub-class numbers
Q_i = The effect due to ith quarter, i = 1, 2, 3, 4
P_j = The effect due to jth parity, j =1, 2, 3, 4 and above
S_k = The effect due to kth lactation stage k = 1, 2, 3
T_l = The effect due to lth time of milking, 1= 1.2
E_{ijklm} = The random error for corresponding Y_{ijklm}

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The parities considered were 1st, 2nd, 3rd and 4th and above, the stages of lactation were early (up to 100 days), middle (101-200 days), late (>201 days); the quarters were individual quarters (hind left, hind right, fore right and fore left); the pairs quarters of udder of buffaloes were the hind pair, fore pair, right pair and left pair and the times of milking were am and pm. A modified Duncan multiple range test was used for comparison between sub-class means.

RESULTS AND DISCUSSION

Let down time: The overall average and standard errors let down time recorded was 94±2 sec. The let down time was not influenced significantly by time of milking, i.e., am (90±3) or pm (96±3 sec) milking (Roshanfakr, 2001). However, in the late stage of lactation, a significantly ($p \leq 0.01$) higher let down time (10±5 sec) was recorded as compared to the early (85±2 sec) and middle (88±sec) stages of lactation (Naderfard and Qanemi, 1997). The average let down time was low (80±7 sec) in the case of buffaloes in the second and highest (101±2 sec) in buffaloes in the fourth and above lactations. These differences were significant ($p \leq 0.05$). Let down time in the first (95±7 sec) and third (97±4 sec) lactations did not differ significantly. This result is in agreement with the report of Roshanfekr (2001) in other herd of Khuzestan buffaloes.

Milking time: The average and S.E milking times per milking of individual quarters of udder, viz., hind left, hind right, fore right and fore left quarters were 122±4, 70±3, and 69±3 sec, respectively, while in paired quarters, viz., hind pair, fore pair, right pair and left pair of quarters, the average times were 119±2, 69±3, 94±4 and 91±3 sec, respectively (Table 1). The hind quarters of the udder were found to take significantly ($p \leq 0.01$) higher milking time than the fore quarters. This is due to higher milk yield from hind quarters, while milking time was similar in right and left pairs of quarters of udder as they yield nearly equal amounts of milk (Thomas, 2004). The overall mean and SE value of milking time per milking of whole udders recorded was 192±4 sec. However, the mean milking time per milking of whole udders was 209±6, 213±8 and 159±11 sec in the early, middle and late stages of lactation (Fig. 1).

There was no significant difference in milking time of the early and middle stage of lactation, while the late state had a significantly ($p \leq 0.01$) lower milking time as compared to the early and middle stages of lactation. This shorter time in the lat stage is because of low yield, as reported by Naderfard and Qanemi (1997) in Iranian buffaloes and De Rosa *et al*. (2009) in Murrah buffaloes. The mean milking time per milking in the second lactation (164±13 sec) was significantly ($p \leq 0.05$) lower than that in the first (211±9 sec), third (204±10 sec) and fourth and higher (195±5 sec). The milking time per milking did not differ significantly among the first third or fourth-and higher lactation (Nadefard and Qanemi, 1997).

Milk flow rate: The overall mean and SE rate of milk flow for the whole udder under hand milking was observed to be 1099±25 g min^{-1} (Table 1). This was higher as compared to the average flow rate (0.9 kg min^{-1}) observed by Naderfard and Qanemi (1997) in other herd of Iranian buffaloes.

The average milk flow rates for individual quarters, viz., hind left, hind right, fore right and fore left were 620±13, 611±12, 509±11 and 491±11 g min^{-1}, respectively (Table 1). The mean rates of milk flow in pairs of quarters of udder, viz., hind, fore, right and left pairs of quarters were 1201±24, 961±23, 1129±21 and 1141±22 g min^{-1}, respectively. This indicates that milk flow rate either of individual quarters or of pairs of quarters of udder is directly proportional to the milk yield of the respective quarter or pair of quarters of udder of Iranian buffaloes (Naderfard and Qanemi, 1997). It was found that time of milking had no effect on the milk flow rate; 1106±29 and 1096±29 g min^{-1}, respectively at am and pm milking of whole udders and also either individual or pairs of quarter's udder of Iranian buffaloes (Naderfard and Qanemi, 1997). The stage of lactation had a significant effect on milk flow rate in Khuzestan buffaloes. Mostly, the late stage of lactation had a significantly ($p \leq 0.01$) lower milk flow rate (978±47 g min^{-1}) as compared to the

Table 1: Least squares mean of milking time, milk flow rate, milk yield and milk composition of Khuzestan buffaloes (n = 202)

Factor	Milking time (sec)	Milk flow rate (g min^{-1})	Milk yield (g)	Fat (%)	S.N.F (%)	T.S. (%)
Hind left	122±4^{a}	620±13^{a}	1200±19^{a}	7.21±0.9^{a}	9.91±0.06^{a}	17.09±0.10^{a}
Hind right	11894^{a}	611±12^{a}	1167±18^{a}	7.21±0.09^{a}	9.93±0.05^{a}	17.10±0.11^{a}
Force right	70±3^{a}	509±11^{b}	533±16^{b}	7.11±0.08^{a}	9.89±0.04^{a}	17.07±0.12^{a}
Force left	69±3^{b}	491±11^{b}	496±16^{b}	7.11±0.08^{a}	9.90±0.04^{a}	16.96±0.11^{a}
Hind pair	119±2^{b}	1201±24^{a}	2369±41^{a}	7.15±0.07^{a}	9.88±0.05^{a}	17.04±0.13^{a}
Fore pair	69±3^{b}	961±23^{b}	1031±39^{b}	7.06±0.11^{a}	9.94±0.03^{a}	17.01±0.10^{a}
Right pair	94±4^{a}	1129±21^{a}	1699±29^{a}	7.11±0.06^{a}	9.89±0.01^{a}	17.00±0.09^{a}
Left pair	91±3^{a}	1141±22^{a}	1703±25^{a}	7.11±0.04^{a}	9.93±0.02^{a}	17.04±0.08^{a}
Whole udder	194±4	1099±25	3398±44	7.11±0.01	9.91±0.04	17.02±0.11

The mean of a particular trait with different superscripts within the subclass differ significantly

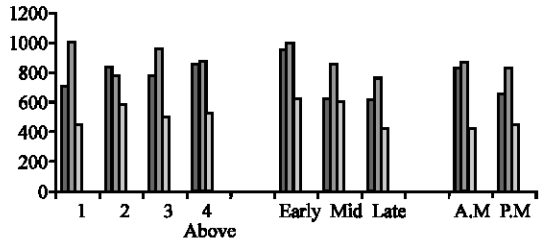

Fig. 1: Effect of parity, stage and time of milking of milk yield, milking time and milk flow rate of individual quarters of udder of Khuzestan buffaloes

early stage (1202±25 g min^{-1}) and the middle stage (1122±36 g min^{-1}) during milking of the whole udder of buffaloes (Fig. 1). A similar trend in the effect of stage of lactation on milk flow rate was found for milking of individual and pairs of quarters of udders of Iranian buffaloes (Roshanfekr, 2005). These researchers explain that the milk rate depends on milk yield and milking period as the milk yield decreases due to advancing stages of lactation, the average flow rate decreases gradually as the lactation progresses. A significantly higher ($p \leq 0.01$) mean rate of milk flow was recorded (1313±63 g min^{-1}) in the second lactation as compared to 881±39 g min^{-1} in the first, 1079±43 g min^{-1} in the third and 1130±25 g min^{-1} in the fourth and higher lactations. A similar trend of effect of parity of milk flow rate was found during milking of individual and pairs of quarter of udder in Iranian buffalos. The flow rate is controlled by teat anatomy and change in teat sphincter, which becomes both lengthened and dilated with increase in parity (Elliott and Graf, 1972) facilitating easier flow of milk.

Daily milk yield: The mean and SE milking yields of individual quarters (Table 1), viz. hind right, fore right and fore left was 1200±19, 1167±18, 533±16 g, respectively. The average percentages of total milk from the individual quarters were 35.42, 34.33, 15.67 and 14.58, respectively (Thomas, 2004). The differences of milk yield between hind quarters and individual fore quarters of udder were highly significant ($p \leq 0.01$). However, the difference of milk yield among individual hind quarter and among individual, fore quarters was not significant as they have more or less the same yield. Whereas the overall averages of pairs of quarters, viz. hind pair vs. 1703±25g, respectively. The average percentages of total milk yield from these pairs of quarters were 69.75 and 31.25 and 50, respectively (Naderfard and Qanemi, 1997). It was found that more than two-third of total milk was obtained from the hind pair of quarters of udders of Iranian buffaloes. This is because of more extensive backward than forward development of udder resulting in greater width and length of the rear half of the udder (Roshanfekr, 2001) with consequent increase in capacity, which fact is responsible for the higher quantity of milk from hind quarters. Thus the quarter features and quarter milk yield in Iranian buffaloed are different from those of recognized European dairy breeds (Thomas, 2004), a fact to bee kept in mind in evolving any suitable machines for milking buffaloes. Time of milking had a significant ($p \leq 0.01$) influence on the milk yield of Iranian buffaloes. The average milk yields recorded during a.m. and p.m. milking of whole udders of buffaloes were 3617±73 and 3186±73 g, respectively. A similar trend of influence of time of milking on milk yield was recorded during milking individual and pairs of quarters of udder of buffaloes.

This significant difference in milk yield between am and pm milking was due to unequal milking intervals (13 vs. 11 h).

This is similar to the findings of Roshanfekr (2001) in other herd of Iranian buffaloes. It was observed that milk yield decreased significantly ($p = 0.01$) with advancement in Iranian buffaloes were 393466, 3721±89 and 2510±115 g, respectively in the early, middle and late stages of lactation (Naderfard and Qanemi, 1997 in Iranian buffaloes). Similar trends of influence of lactation on per milking yield of individual and pairs of quarters of udder were recorded in Iranian buffaloes. Thomas (2004) observed that milk yield decreased significantly as stage of lactation advanced in buffaloes, because with the advance in stage of lactation, there is a gradual involution of mammary gland tissue, which results in decreasing the number of secretary alveoli in mammary gland tissue. The per-milking yield for the whole udder of buffaloes of first lactation (2844±99 g) differed significantly ($p \leq 0.01$) from that of second lactation (3531±149 g), third lactation (3670±105 g) and fourth and higher lactations (3641±59 g) (Naderfard and Qanemi, 1997).

Milk composition: The average and SE percent fact, SNF and TS content of milk individual quarters, viz. hind left, hind right, fore fight and fore left were respectively, 7.21±0.09, 7.21±0.09, 7.11±0.08 and 7.11±0.08, 9.91±0.06, 9.93±0.05, 9.89±0.04 and 9.90±0.04 and 17.09±0.10, 17.10±0.11, 17.07±0.12 and 19.96±0.11 (Table1). These do not differ significantly (Roshanfekr, 2001). The average values of percent of fact, SNF and TS from milk of am and pm milking were 7.16 and 7.06, 10.14 and 9.68 and 11.30 and 16.64, respectively (Fig. 2). The fact percentage was found not differ significantly between a.m. and p.m. milking (Roshanfekr, 2001). SNF and TS percent of milk were significantly ($p \leq 0.01$) different between a.m. and p.m. milking (Roshanfekr, 2005). Such differences were said to be because of unequal milking intervals

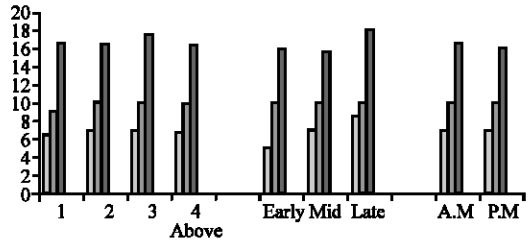

Fig. 2: Effect of parity, stage and time of milking on percent of fat, SNF and TS in milk of individual quarters of Khuzestan buffaloes

(13 vs. 11 h) between am and pm milking. The average values of percentages for fat and for TS recorded (Fig. 2) were 5.90, 6.93 and 8.49 and 15.92, 16.78 and 18.36 in early, middle and late stages of lactations, respectively. These differences were significant ($p \leq 0.01$). SNF percentages recorded in this study were 10.02, 9.85 and 9.87, respectively in the early, middle and late stage of location, these differences begging not significant. Similar finding was reported by Naderfard and Qanemi (1997). The fat and TS percentages differed significantly ($p \leq 0.01$) among the parities. The highest fat, Ts and SNF percentages were recorded in the first lactation, while the second and fourth and higher lactations did not differ significantly in this respect (Roshanfekr, 2005).

CONCLUSION

The milking behavior traits were related to milk yield which in its turn was most influenced by stage, parity and time of milking. There were no quarter differences in milking behavior and milk composition but milk yield was higher in hind quarters by 38%. At least calf suckling from the left side may be avoided.

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