THE EFFECT OF DIFFERENT MILKING TECHNIQUES ON THE PERFORMANCE OF THE ANATOLIAN WATER BUFFALOES

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ABSTRACT

This study was carried out to determine the effects of hand and machine milking on milk performance in buffaloes. Twenty-four adult Anatolian water buffaloes (AWB), the age of about (5 and 6 years) old at stage 35 to 37 days of lactation were randomly divided into two similar groups, 12 AWB in each group. As a result of the investigation, it was determined that the machine milking group (2) significantly improved silage dry matter (DM), alfalfa DM and the total DM consumption of the buffalo compared to the handle milking group (1) ($P<0.05$), ($P<0.05$) and ($P<0.01$) While, a significant increase ($P<0.01$) was observed in the values of milk yield in the buffalo group (2) conducted machine milking compared to that Control group (1) (7.12 to 8.23 kg day^{-1}). Another finding of the study was that the application of a pressure of 45 kPa increased the SCC compared to the handle milking group (1) (45.2-68.8x10 log mL^{-1}34.30%) ($P<0.05$). It was determined that regression equation between total DM and milk yield in machine milking was Y = -21.89+4.29 T**, regression coefficient was $R^2 = 0.868$ and correlation coefficient was r = 0.932 ($P<0.001$). As a result of the research, the use of machine milking in buffalo enterprises can be recommended both in terms of increasing milk yield and facilitating work.

Keywords: *Bubalus bubalis*, buffaloes, Anatolian water buffaloes, hand and machine milking, milk yield, dry matter consumtion

INTRODUCTION

The milk yield is strongly affected by the type of milking in buffaloes and by the massaging of their udders. Proximal to the teat canal, the teat does not pass into an open cistern, and the lumen is collapsed. Hence, buffaloes must be well pre-stimulated because the tissue above the teat canal is responsible for additional teat closure before milk ejection. Therefore, milk can only be obtained after pre-stimulation Ambord *et al*. (2010). In the nursing of buffalos, milking is the process associated with the greatest workload and requires the greatest sensitivity. Buffaloes are considered difficult

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animals to milk. There are many reported cases in which lactation and release milk cease because of calf mortality and a change in the milking operator (Mudgal, 1999; Thomas, 2004). On small farms, buffaloes are fed and generally milked by hand (Moioli and Borghese, 2015). Degirmencioglu (2016) reported that 88.9% of the buffalo breeders in the Karaoglan vilage of the Mustafakemalpasa district in Bursa city used the milking machine for their buffaloes, while the rest preferred to milk at hand. There is some misconception that buffaloes are milked with difficulty and, thus, that "they are not suitable for machine milking". The high frequency of problems during the transition from hand milking to machine milking leads to this idea. Compared to animals such as cows and goats, buffaloes are not easy to domesticate, are timid, and are genetically wild, making them very sensitive to milking. The difficulties associated with hand milking in buffaloes (such as insufficient pre-stimulation, non-continuity of atmospheric pressure and vacuum movements, missing the last massage term and a long milking time) prevent increases in milk yields, which are already very low (Soysal, 2006; Bava *et al*., 2007). It has been reported that milking machines with standard size, uniform udder head are preferred for milk cows and these machines are not suitable for buffaloes that do not have uniform udders (Dang *et al*., 2007). According to the literature, there have not been any reported studies on milking with machines, especially for AWB. However, studies are currently occurring. Vacuum pressure, number of pulses, and the pulse rate should be adjusted to the levels indicated levels for buffaloes. Despite similarities with cattle, the suitable vacuum pressure for AWB may be 40, 45 or 50 kPa. Additionally, the pulse rate can be 50, 60 or 70 pulses min^{-1}, and a pulse ratio (vacuum/rest ratio) of 50/50, 60/40 or 65/35 may be used (ISO, 5707; Caria *et al*., 2011; 2012; Unal, 2013). Kalyan *et al*. (2011) observed that somatic cell count (SCC) is strongly affected by buffalo milking of buffaloes. The purpose of the study was to determine the effect of hand and machine milking on feed consumption and SCC in AWB.

MATERIALS AND METHODS

The trial is planned in a semi-open barn system with a capacity of 24 milking buffalo cows. The buffaloes are taken to the birth chambers between January and February, and the calves (malaks) are kept in a two-month feeding program after birth. AWB (Anatolian water buffalo) (5 and 6 years old) at stage 35 to 37 days of lactation are randomly selected (Table 1).

The trial was carried out with 24 Anatolian water buffalo (AWB) assigned to two groups for 30 days. The ration that is used in the research, was prepared in a special mixture in Mustafakemalpaşa. In research. In Group 1 and Group 2, the buffaloes were milked twice a day by hand or with a milking machine, respectively. At the end of the study, the individual feed intake of buffalo cows was determined daily, taking into account the reports of Maynet and Gordon (1984). Alfalfs (*Medicago s*.) was provided at 6am and corn silage was given once a day at 7pm The ration was prepared according to the milk yield and milk composition of the buffalo NRC (2001). The feed and residual feed amounts for each buffalo were weighed and recorded daily. The nutrient content of the diet were determined according to the AOC method (1990) and that of the fiber fractions (NDF and ADF) according to Van Soest and Robertson (1991). The metabolizable energy value (ME) of

the diet was calculated by the National Research Council (NRC, 2001). The milk components were analysed by a Milcosan FT-120 device. SCC was determined with a Somacount 150 (Bentley Instruments, Chaska, USA). In this study, Mechanical pneumatic pulsators were used on the bucket milking device. There was a pneumatic (pulsator rate 60/40) pushing into each bucket. An electronic pulse and a pressure measurement in milking were made with the devices Exendis PT-V Pulsator Tester and PT 100 vacuummeter. Milking took place at the set a pressure of 45 kPa and pulse rate of 60 pulses min^{-1}. throughout the experiment

Data for DM and milk product in the AWB were tested with analysis of variance using the SPSS version 15.0 Statistical Package (2006) and means were compared using the t-test model described by Cochran and Cox (1957):

$$Yijkl- \mu+Ti+Pj+Eijk, \quad (1)$$

Where; Yijk - observation μ - population mean Ti - the milking technique (1: hand milking and 2: milking machine) Pj - animals (j = 1, 2, 3,……23 or 24). Eijk - residual error. Models were developed for the changes in total DM and milk yield in the milking tecnique and multivariate regression analysis was applied. The linear regression method, which is the SPSS (2006) automatic regression determination system was used.

RESULTS AND DISCUSSION

The silage, concentrate and total DM intake of AWB was significantly increased by machine milking (P<0.05 and P<0.01) (Table 3). Regression equation between total DM and milk yield in hand milking was Y = 3.63+1.27T, R2 = 0.605 and r = 0.778 and (P>0.001) and showed a low degree of interaction. Regression equation between total DM and milk yield in milking machine was Y = -21.89+4.29T** R2 = 0.868 and r = 0.932 (P<0.01).

There is an inverse and moderate relationship between them. The consumption increasing might be due to the increased nutrient demands and milk production associated with the machine-milking method. However, in some studies; there have been no detectable effects of hand and machine milking methods on DM intake (Aslam *et al*., 2014). Machine milking significantly improved milk yields compared to hand milking (7.12 and 8.23 kg day^{-1}), respectively (P<0.01). This result was similar to the findings of Filipovic and Kokaj (2009) and Sinapis (2007) who reported that machine milking in dairy cows and greek ewes significantly improved (P<0.05) the milk yield compared to hand milking. Filipovic and Kokaj reported that the milk yield was 27.07% in milk machine, which was higher than the milk yield of 13.48% found in our study. The milk yield (8.23 kg day^{-1}) found for a milking vacuum pressure of 45 kPa in this study were higher than that 3.95 kg day^{-1} found by Caria *et al.* (2012). During the experiment, the animals were not subjected to stress. On the contrary, Hemsworth (2003) reported that machine milking could be associated with stress and significant reductions of milk yield and composition However, Aslam *et al.* (2014) found that the milking method did not effective milk yield. In this study, the composition of the milk was not significantly affected by the milking method. These results are also supported by previous studies (Filipovic and Kokaj, 2009; Aslam *et al*., 2014).

The European Union Directives (92/46 CEE and 94/71 CEE) set a limit of 400 (x log10) cells ml^{-1} for SCC in raw buffalo milk Ceron-Munoz

Table 1. Preliminary information about the buffaloes used in the experiment.

Groups	Number of buffaloes	Body weight (kg)	Days in milk	Milk yield (kg d^{-1})
Groups 1 (A)	12	521.50±5.50	35.33±0.91	4.37±0.18
Groups 2 (B)	12	526.33±6.71	37.92±1.94	4.48±0.17
Significance level		NS	NS	NS

NS: non significant, Group's average of body condition score (BCS) is 2.5-3.

Table 2. The composition of feed mixtures used in the research.

Feed (g kg^{-1})	Diet	Roughages		
	Concentrate feed mixture	Medicago	Corn silage	Barley hay
Barley grain	310			
Wheat grain	320			
Sunflower meal	350			
Marble powder	10			
Salt	7.5			
Vitamin+minerals[1]	2.5			
Total	1000			
Nutrient composition (g kg^{-1})				
DM[2]	887	904.8	342.3	933.1
OM	855.7	815.5	288	869.1
CP	191.3	133.0	73.1	28.3
EE	19.5	15.5	25.6	10.5
CELL	90.2	334.6	209.7	405.5
CA	31.3	89.3	54.3	64.0
NFE	554.7	332.4	–	424.8
Starch	416.3	21.8	240.6	6.8
NDF	192.0	509.9	472.8	741.0
ADF	136.7	463.9	338.9	604.1
ADL	36.8	113.5	69.7	109.0

[1]Trace minerals and vitamins (per kg): 50,000 mg Niacin; 150 mg Co; 800 mg Iodine; 150 mg Se; 50,000 mg Mn; 50,000 mg Fe; 50,000 mg Zn; 10,000 mg Cu; 15,000,000 IU Vitamin A; 3,000,000 IU Vitamin D3; 20,000 mg Vitamin E.

[2]DM: Dry Matter; OM: Organic Matter; CP: Crude Protein; EE: Ether Extract; CELL: Cellulose; CA: Crude Ash; NFE: Nitrogen Free Extract; NDF: Neutral Detergent Fibre; ADF: Acid Detergent Fibre.

[3]ADL: Acid Detergent Lignin; ME: Metabolizable Energy.

Table 3. The effect of different milking techniques on the performance of buffaloes (mean ± SE).

Parameter	Milking techniques				Significance level
	N	Group (1) Handle milking	N	Group (2) Machine milking	
Corn Silage DM intake (kg d^{-1})	12	5.04±0.14	12	5.79±0.27	*
Medicago s. DM intake (kg d^{-1})	12	4.90±0.13	12	4.64±0.32	NS
Barley straw DM intake	12	0.03±0.01	12	0.05±0.02	NS
Concentrate DM intake	12	2.79±0.20	12	3.91±0.15	**
Total DM intake[1]	12	12.77±0.26	12	14.40±0.35	**
Milk yield (kg d^{-1})	12	7.12±0.16	12	8.23±0.19	**
4% FCM (kg d^{-1})[2]	12	9.46±0.38	12	10.32±0.24	*
Fat (%)	12	6.16±0.21	12	5.70±0.12	NS
SNF (%)	12	10.26±0.04	12	10.21±0.05	NS
Protein (%)	12	4.97±0.15	12	5.09±0.06	NS
SCC (x log10 mL^{-1})	12	45.2±5.92	12	68.8±6.78	*

[1]Total DM intake values for buffaloes were not added to pasture consumption.

[2]4% FCM = 4% fat-corrected milk; SNF: Solids-not-fat; SCC: Somatic Cell Count; SE: Standard Error; NS: Not Significant; *P<0.05, **P<0.01.

et al. (2002). The recorded SCC percentages were 45.2 and 68.8 (x log10 ml^{-1}) in the milking groups of hand and machine, respectively. The values of SCC in this study were within the normal range and near to the SCC values (63.6) (x log10 ml^{-1}) of (Ceron-Munoz *et al*., 2002) and more different than the levels in study (52.3 and 47.0 x log10 ml^{-1}) of Filipovic and Kokaj, 2009). The different values might be due to the differences in age, milk yield and lactation period of the animals Verma and Shiv (2021). SCC measurements in machine milking were more efficient than in the hand milking (34.30% (P<0.05); Table 3). These results are also supported by previous reports by Kosev *et al*. (1996); Pertinez (2003), who found that goats subjected to milking machines showed a high SCC. Similarly, Kalyan *et al*. (2011) reported that the SCC in Murrah buffaloes, was higher the machine milking group than the hand milking group. However, Zeng *et al*. (1996); Filipovic and Kokaj (2009) observed a similar effect of the two milking methods. Sinapis (2007) In a similar study conducted in Greek ewes, the SCC of milk were investigated by machine or hand milking. As a result of the research, it has been reported that macine milking decreases the percentage of SCC. This may be due to the varying shapes and sizes of buffalo teats Dang *et al*. (2007); Kalyan *et al*. (2011). The increased SCC may be due to the fact that the teat cups are not removed after milking and the use of automatic valved teat cups in milking machines (Manzur, 2007). Caria *et al*. (2012) reported a positive correlation between an increased operating vacuum and the SCC count in the milk of buffalos. The present study showed that a pressure of 45 kPa resulted in an increase in SCC

levels compared to hand milking.

CONCLUSIONS

The use of machine milking in local buffalo enterprises can be recommended both in terms of increasing milk yield and facilitating the work.

The vacuum settings of the machine milking should be checked regularly.

In machine milking, suitable milking heads for buffaloes should be used. Those with uniform nipples should be preferred as criteria in the selection of breeders.

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