

Effects of Milking Methods on Milk Yield, Milk Flow Rate, and Milk Composition in Cow

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Abstract: Cow milking is considered as laborious and time-consuming job at livestock farms. This experiment was conducted with an objective to know the effects of milking methods on milk yield, milk flow rate, and milk composition at National Cattle Research Program, Chitwan, Nepal. Four cows were selected randomly. All cows were maintained under uniform feeding and management conditions. The selected cows were milked with milking machines on the first day and the same cows were milked with hand on the second day. The results showed that there were no significant differences between hand and machine milking for milk yield ($p > 0.05$). However, significant differences were found in milking time and milk flow rate between hand and machine milking methods. We did not find any significant differences in milk composition between hand and machine milking methods. The machine milking saves time compared to hand milking. Therefore, we concluded that machine milking can be used in commercial farms of Nepal.

Keywords: Milking methods, Milk yield, Milk flow rate, Milk composition

1. Introduction

Nepal is located in South Asia and has economic dependency is on agriculture [1]. About eighty percent of its population works in the agriculture sector which contributes about 40% of Gross Domestic Product (GDP) [1]. Livestock is an integral part of Nepalese agriculture. The dairy sector contributes about 63% to the total Livestock Gross Domestic Products (LGDP) which is more than 5% of total National GDP (MOAD, 2009) [2]. Farmers are attracted to dairy farming recently. The productivity of the cattle is 519.56 Kg per lactation (MoAD, 2014) [3]. Milk demand in the country is increasing day by day which necessitates the need to increase the milk yield of the country. Almost three-fourths of the households in Nepal keep cattle and one-half keep buffalo for milk production [4]. Commercialization of livestock, especially dairy farming is crucial for the economic development of the country. Almost 1.5 million of the population is involved directly or indirectly in livestock production [5]

Cow milking is considered as laborious and time-consuming job at livestock farms [6]. Machine milking is gaining its popularity as it improves labor efficiency and reduces the costs [7]. Aslam *et al.*, (2014) [6] reported that machine milking has the potential to increase milk production by up to 12%, reduce labor by up to 18%, and improve dairy cow welfare. Hillerton and Winter (1992) [8] and Pappe and Capuco (1997) [9] reported that milk yield can be increased by machine milking, and it is also beneficial for udder health. There is limited literature regarding the effects of machine milking on milk yield, milk flow rate, and milk composition of Nepalese cattle. Therefore, this study was conducted to know the effects of milking methods on milk yield, milking flow rate, and milk composition.

2. Material and Methods

2.1. Experimental site

The study was conducted at the National Cattle Research Program, Chitwan in July, 2019. It is situated in the central region of Nepal ($27^{\circ} 65' N$ latitude; $84^{\circ} 35' E$ longitude and 187 mean sea levels) at Rampur, Chitwan.

2.2. Selection of experimental animals

Four lactating cows with almost similar average bodyweight, conditions, and production performance were selected. Cow milking was carried out by the hand and machine milking methods on alternate days. Animals were kept in separate pens under identical conditions.

2.3. Feeding and data recording during experiment

Animals were given standard diet according to their body weight. Before milking, the udder of each cow was thoroughly washed with moderately warm water and dried properly. The milking machine was thoroughly washed in lukewarm water every day after milking operation was completed. Milking data were recorded for two methods of milking in the morning time. Milk yields of all cows were recorded using an electric balance. The milking time in seconds was recorded with stop watch. The milk flow rate was calculated as the ratio of milk yield per unit time. The following parameters such as milk yield (kg), milking time (sec), milk protein (%), milk fat (%), milk lactose (%), milk total solids (%), and milk density were studied to determine the responses of milking methods.

Milk composition analysis was carried out using a milk analyzer for the following milk constituents: milk fat, non-fat solids, milk protein, lactose, and total solids.

2.4. Information about milking machine

The machine was made in India. It is operated by electric current with one horse power motor. It can milk two cows in single operation and hence it saves time of milking.

2.5. Statistical analysis

The experiment was conducted in a completely randomized design with three replications. The data were analyzed using one-way ANOVA followed by Tukey's HSD test ($p < 0.05$). All analyses were done with STATISTIX 8 (Analytical Software, Tallahassee, FL, US).

3. Results and Discussion

3.1. Effects of milking methods on milk yield of cow

The effects of milking methods on average milk yields are presented in Fig. 1. Milk yield between the machine and hand milking treatment groups were not significantly different ($p > 0.05$). The average milk yield by machine and hand milking were 6.05 and 5.85 kg, respectively. Aslam *et al.* (2014) [6] also reported that there was no significant difference in milk yield of cow between machine and hand milking.

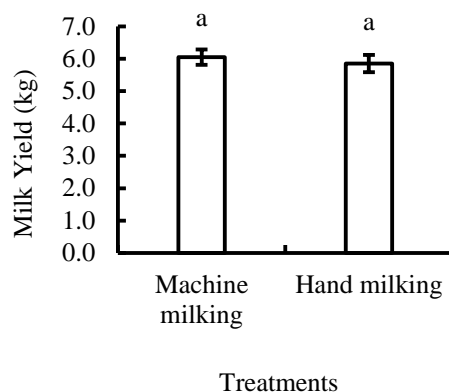


Fig. 1: Effects of milking method on milk yield in cow. Error bars indicate the standard deviations of means (S.D.) (n=3).

3.2. Effects of milking methods on milking time of cow

The effect of milking method on milking time is presented in Fig. 2. The machine milking significantly lower ($p < 0.05$) the milking time compared to that of hand milking. On an average the milking time by machine milking was decreased by 52.17% compared to that of hand milking.

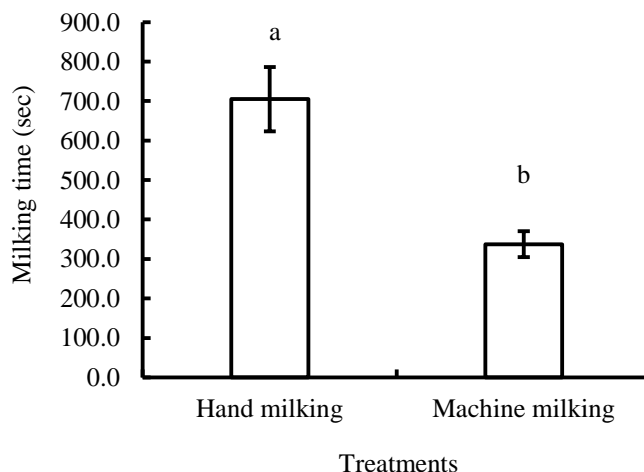


Fig. 2: Effects of milking method on milking time in cow. Error bars indicate the standard deviations of means (S.D.) (n=3).

3.3. Effects of milking methods on milk flow rate of cow

The effect of milking methods on milk flow rate is presented in Fig 3. Milk flow rate was higher ($p < 0.05$) in cows milked with machine compared to those milked with hand. The milk flow rate by machine milking was increased by 50.57% compared to that of hand milking.

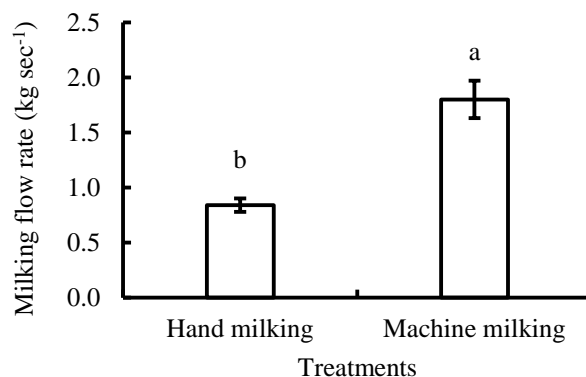


Fig. 3: Effects of milk flow rate on milk flow rate in cow. Error bars indicate the standard deviations of means (S.D.) (n=3).

3.4. Effects of milking methods on milk composition of cow

The effects of milking methods on milk composition are shown in Table 1. Milking method did not influence fat percentage in milk. Similarly, the percentage of total solids was also not significantly different among the treatment groups. The percentages of protein and lactose in milk were not significantly different ($p > 0.05$) among cows in the different treatment groups. The fat, protein, lactose, and SNF in hand milking were 3.98%, 2.97%, 4.48%, and 8.25%, respectively. However, the fat, protein, lactose, and SNF in machine milking were 3.69%, 3.03%, 4.56%, and 8.29%, respectively. Aslam *et al.* (2014) [6] also reported that there was no significant difference in milk composition of cow between machine and hand milking.

Table 1: Effects of milking method on fat (%), protein (%), lactose (%), SNF (%), and density in cow

Treatments	Fat (%)	Protein (%)	Lactose (%)	SNF (%)	Density
Hand Milking	3.98 ± 0.4 ^a	2.97 ± 0.05 ^a	4.48 ± 0.07 ^a	8.25 ± 0.09 ^a	27.41 ± 0.74 ^a
Machine Milking	3.69 ± 0.37 ^a	3.03 ± 0.02 ^a	4.56 ± 0.03 ^a	8.29 ± 0.06 ^a	28.36 ± 0.61 ^a

Same letters are not significantly different at ($p < 0.05$) by Tukey's HSD test.

4. Conclusions

This study was conducted to clarify the effects of milking methods on milk yield, milking flow rate, and milk composition. From the results of our study, we concluded that the machine milking is profitable for milking of cows as it saves time and also there were no significant differences in milk composition compared to hand milking.

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