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RESEARCH ARTICLE

Effect of Oxytocin Administration before Milking on Milk Production, Somatic Cells Count and fat Contents in Milk of Nili-Ravi Buffaloes

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ABSTRACT

This study was escorted to know the effect of oxytocin administration before milking on milk production, somatic cells count and fat contents in milk of buffaloes. Twenty lactating Nili-Ravi buffaloes were randomly divided into two groups. Group A (n = 10) buffaloes were treated intramuscularly with 30 IU of oxytocin daily before the start of milking for the period of 7 days, whereas group B (n = 10) buffaloes were given no treatment and served as control. Milk samples were collected from all buffaloes 7 days before (Phase I), during (Phase II) and after (Phase III) the treatment. There were significantly higher ($P<0.05$) milk production (liters) during phase-II in group A (8.57±0.07 liters) buffaloes as compare to group B (8.40±0.04 liters) whereas non-significant differences were recorded in the mean milk production between group A and B during phase-I (8.46 vs 8.43 liters) and III (8.54 liters). Somatic cells count varied from 72.96 to 97.01 × 10^3 and 71.86 to 77.14 × 10^3 cells per ml in group A and B, respectively. Mean somatic cells count were significantly higher ($P<0.05$) in group A as compared to group B during phases II of study. During phase I, II and III, there were non-significant differences in fat percentage between two groups of buffaloes. It was concluded that milk production and somatic cells count in milk of Nili-Ravi buffalo were affected by oxytocin injection before milking whereas there was no effect of oxytocin on milk fat percentage.

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INTRODUCTION

The composition of milk varies widely due to inter-species differences. Nutritional and physiological requirements of each species are more or less distinctive and the breed, stage of lactation, nutritional status, health and milking intervals are some of the factors affecting composition of milk. Pattern of lactation curve is influenced by the number of secretary cells in the mammary glands and by the synthetic activity of each secretary cell. After parturition, the maintenance of the secretary epithelium is the key factor in determining lactation persistency and total milk yield. Maintenance of milk synthesis and secretion is controlled by a combination of both systemic and local regulatory factors (Akers, 2006).

Oxytocin plays an important role in milk ejection in buffaloes. The most important factor influencing milk removal and evacuation of the gland is the presence of the oxytocin-mediated milk ejection reflex (Belo and Bruckmaier, 2010). Oxytocin influences milk production by decreasing intra-alveolar pressure and the presence of feedback inhibitor of lactation from around the alveoli, and re-establishing normal mammary blood flow (Lollivier *et al.,* 2002). Furthermore, the presence of a proper milk ejection reflex during milking is a crucial factor for obtaining alveolar milk that is rich in total solids. In addition to the beneficial effect of oxytocin on milk production and milk quality due to better milk transfer within the mammary gland, oxytocin could also have a direct stimulatory effect on mammary metabolism (Lollivier *et al.*, 2002).

In Pakistan, exogenous oxytocin is being used by the farmers to upturn milk production. Oxytocin is usually injected intra-muscularly at a dose rate of 10-20 IU immediately before each milking. Indiscriminate use of oxytocin without veterinarian's advice is resulting in loss of

both productive and reproductive performance of animals (Mustafa *et al*., 2008).

Although there are several reports that exogenous oxytocin administration at the time of milking can raise milk production, but there are incongruity in the literature with respect to its effect on milk production and quality. According to Knight (1994), administration of large quantities of oxytocin (20 IU) over one week resulted in an increase in 15.5% milk production. Conversely, when oxytocin (20 IU) was administered to dairy cows over a couple of weeks, either before or after milking, milk production increased by 3%, regardless of the time of injection (Ballou *et al.*, 1993). Another study demonstrated that oxytocin injection (20 IU) prior to each milking for the entire lactation increased milk production by 11.6%; most of the increase in milk yield occurred during the descending phase of lactation (Nostrand *et al.*, 1991). Few reports, in cattle indicated either no or little effect of oxytocin on somatic cells count (SCC) (Millogo *et al.*, 2009). In buffaloes, effect of oxytocin on somatic cells count and other milk characteristics like fat percentage has not been studied so far. The present study was, therefore, designed with the objective to know the effect of exogenous oxytocin administration intramuscularly at the time of milking on somatic cells count, milk yield and fat percentage of milk of Nili-Ravi buffaloes.

MATERIALS AND METHODS

Selection and management of buffaloes: Twenty lactating Nili-Ravi buffaloes in their early lactation were selected from the herd mentioned at Buffalo Research Institute (BRI), Pattoki, District Kasur during July to September 2011.

All buffaloes were in their 2nd to 6^{th} lactation having 6-9 liters of milk production and aged 6-11 years. These animals were managed in accordance with the feeding and management practices followed at BRI, Pattoki. The buffaloes were offered seasonal fodder *ad libitum*, and concentrate mixture (Cotton seed cake 10%, Maize 10%, Rape seed cake 5%, Wheat bran 34%, Maize gluten 24%, Molasses 15% and Mineral mixture 2%) approximately 3 kg per animal before the start of milking and have free access to clean water. Hand milking was done at 5:30 AM and 5:30 PM daily and the milk yields were recorded.

Experimental treatment and sampling of milk: Buffaloes were divided into two groups i.e. group A and B, comprising of ten animals in each group. Group A buffaloes were treated intramuscularly with 30 IU (3 ml) of oxytocin (Lawrance Pharma, Pvt. Ltd) daily before the start of milking for the period of 7 days, whereas group B buffaloes were given no treatment and served as control. Milk samples were collected from all buffaloes during 21 days experiment, divided into three phases of 7 days each. The three phases were Phase-I (7 days before treatment), Phase-II (7 days during the treatment) and Phase-III (7 days after the treatment). Milk samples were collected from all buffaloes during 21days experiment, divided into three phases of 7 days each. Milk samples were composited in proportion of milk yield and were used for analysis of somatic cells count and fat percentage. The surf field mastitis test was used to check mastitis in experimental buffaloes.

Analysis of milk samples: Milk (about 100 ml) was sampled from each buffalo of group A and B for the determination of somatic cell count and fat percentage. Precautions were taken to obtain a uniform composite milk sample that was free of contaminations. Before collecting the milk samples, teats were carefully washed by fresh water and first two streaks of milk were thrown away. The samples were cooled immediately after collection. Determination of somatic cell count and milk fat percentage was completed within 36 hours after collection. For each milk sample, direct microscopic somatic cell count was carried out by the procedure described by Schalm *et al.* (1971). Milk fat was determined by the method of Marshall, (1993). Briefly, 11 ml milk sample and 1 ml amyl alcohol were gently added to 10 ml of sulfuric acid previously poured in each Gerber's acido-butyrometer and were judiciously mixed after properly closing the butyrometer with rubber stoppers. Then samples were centrifuged at 1100 rpm for 4 to 5 minutes. Butyrometer was then transferred to a water bath at 65°C for 3 minutes and then percentage of fat was noted down.

The mean (±SE) values for milk production, somatic cell count and fat in milk of experimental buffaloes were calculated. The data was statistically analyzed by 2-way (ANOVA) analysis of variance (Steel *et al.*, 2006). The values were considered significant at ($P<0.05$).

RESULTS

The mean milk production in group A and B buffaloes during phase-I were 8.46 and 8.43 liters, whereas during phase-II, 8.57, 8.40 liters and during phase-III, the milk production in group A and B buffaloes were 8.54, 8.44 liters, respectively. There were non-significant ($P>0.05$) differences in mean milk production between group A and B during phase-I and III whereas significantly high ($P<0.05$) milk production was recorded during phase-II in group A buffaloes in comparison with group B (Table 1).

The mean somatic cell count in group A and B buffaloes were 72.86×10^3, 71.86×10^3 and 97.01×10^3, 77.14×10^3 and 87.43×10^3, 75.71×10^3 cells per ml during phase-I, II and III, respectively (Table 1). The mean somatic cell count was significantly higher ($P<0.05$) in group A as compared to group B during phase-II whereas, non-significant differences ($P>0.05$) were recorded in somatic cells count between group A and B during phase-I and phase-III (Table 1).

The mean fat percentage was 5.36, 5.37 (phase-I), 5.36, 5.39 (phase-II) and 5.39, 5.34 (phase-III) in group A and B buffaloes, respectively. During phase I, II and III, there were non-significant differences ($P>0.05$) in fat percentage between two groups of buffaloes.

DISCUSSION

In the present study the milk production, somatic cell count and fat percentage were determined in control and treatment group buffaloes, 7 days before, during and 7 days after oxytocin injection.

Table 1: Mean (±SE) values for milk production, somatic cell count and fat in oxytocin treated and control group buffaloes during different phases

Phases	Milk Production (liters)		Somatic Cell Count (SCC)×10^3/ml		Fat (%)	
	Group A	Group B	Group A	Group B	Group A	Group B
Phase-I	8.46±0.056	8.43±0.059	72.86±1.10	71.86±2.22	5.36±0.03	5.37±0.06
Phase-II	8.57±0.077[a]	8.40±0.049[a]	97.01±1.58[b]	77.14±1.89[b]	5.36±0.02	5.39±0.06
Phase-III	8.54±0.051	8.44±0.052	87.43±1.93	75.71±1.34	5.39±0.02	5.34±0.03

Values sharing similar superscripts in a row for different parameters differed significantly (P<0.05).

Sensitive receptors for stimulating milk let-down are located in the teat skin. After stimulation of sensitive receptors located in teat skin, pituitary gland releases a hormone, oxytocin, into the blood. Oxytocin travels to the udder and causes contraction of the muscle fibers (or myoepithelial cells) that surround the alveoli. Contraction forces milk into the large ducts and udder cistern where the milking then can remove the milk (Jones, 2000).

In the present study, the milk production increased during phase-II, when 30 IU of oxytocin were administered in group A buffaloes. These results are divergence with the results of Ballou *et al.* (1993) and Knight (1994) who reported increase in milk production with exogenous oxytocin administration at milking in dairy cows. Oxytocin influences milk production by reducing intra-alveolar pressure, reducing the presence of the feedback inhibitor of lactation from around the alveoli, and re-establishing normal mammary blood flow. Moreover, the presence of a proper milk ejection reflex during milking is a crucial factor for obtaining alveolar milk that is rich in total solids. Oxytocin affects milk production due to better milk transfer within the mammary gland and direct stimulatory effect on mammary metabolism (Lollivier *et al.,* 2002).

The somatic cell count was significantly higher in oxytocin treated group as compared to control group during phase-II, whereas, non-significant differences were recorded in somatic cells count between oxytocin treated and control group during phase-I and phase-III. These findings corroborated many other studies (Prasad and Singh, 2001). Bidarimath and Aggarwal (2007) reported an increase in 5.36 to 6.22% somatic cell count in milk of lactating Murrah buffaloes treated with injections of oxytocin at 0, 15, 30 and 45 days post-partum. In developed countries, milk somatic cell counts (SCC) is used as a marker to determine the mammary health and quality of milk (Dang and Anand, 2007).

The fat in milk occurs as fat globule (0.1-2 µm in diameter) surrounded by the milk fat globule membrane which acts as an emulsifier. The lipid fraction of milk mainly comprises of 98% triglycerides (Larsen *et al*., 2011). In the present study, the fat percentage varied non-significantly during phase I, II and III, between oxytocin and control group buffaloes. Prasad and Singh (2001) also reported that exogenous oxytocin had no effect on milk composition i.e. milk fat percentage in Murrah buffalo whereas, Nostrand *et al.* (1991) reported similar findings in Holstein cows.

It is evident, that milk production increased after administration of oxytocin injection, yet it could not be used in routine practice to get more milk production because the long-term practiced exogenous oxytocin administration reduces the release of endogenous oxytocin and sensitivity to oxytocin in the udder, possibly due to oxytocin receptor down-regulation resulting in reduced spontaneous milk ejection after withdrawal of oxytocin (Bruckmaier, 2003).

It is therefore concluded that oxytocin have significant effect on milk production and somatic cell count but use of oxytocin injections for milk let down should be exactingly proscribed and cognizance should be created among farmers about the detrimental effects of oxytocin.

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