

EFFECT OF TWO MANAGEMENT SYSTEMS AND MINERAL FEEDING ON AGE AT PUBERTY IN NILI-RAVI BUFFALO HEIFERS

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ABSTRACT

The data of buffalo heifers reared in pasture (N=213) and stall feeding system (N=274) were collected to determine the age at puberty and seasonality in breeding behavior through a survey study. The results revealed that the age at puberty and seasonality in breeding behavior was lower in heifer reared in pasture compared to stall feeding system. To determine the effect of mineral supplementation on estrus response, thirty five buffalo heifers were divided into two groups; MIN and CTL. The MIN (N=20) group were fed with mineral mixture (100 grams/day/heifer) for four weeks. Whereas, CTL group (N=15) did not receive any mineral supplementation. Mineral supplementation enhanced estrus response in MIN compared to CTL heifers (65% versus 33%). In conclusion, the age at puberty and seasonality in breeding is less in heifers of pasture system. Furthermore, mineral feeding is helpful to induce estrus in heifers that had achieved average age of puberty.

Keywords: buffalo heifers, management systems, mineral feeding, puberty

INTRODUCTION

The water buffalo is important livestock specie of developing countries in tropical and sub-tropical environments. There are about 29.9 and 33 million heads of buffaloes and cattle present in Pakistan. Although, population of cattle is higher than buffalo, the buffalo milk contributes more than 61% to the total milk (27 million tons) production in the country (GOP 2013). The good feed conversion efficiency and relatively low maintenance requirements are the attributes which make buffaloes ideal in low-input, low-cost production systems. Accordingly, buffaloes have emerged as an increasingly important source of high quality animal protein, milk and meat (Singh *et al.*, 2009). Despite these merits buffalo is blamed for slow reproduction, long calving interval, delayed puberty, poor estrus expression and seasonality in breeding and calving (Naseer *et al.*, 2011).

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Moreover, different management systems may affect productive and reproductive performance of the animals such as age at puberty, conception rate, service period, and disease problems (Hansson and Öhlmér, 2008; Di Palo *et al.*, 2009).

Two types of management systems are in practice for buffaloes rearing in Pakistan. In traditional system, buffaloes are grazed on pastures along river banks and merely offered concentrate to milking animals. Breeding bulls are almost invariably present with large grazing herds so the farmers do not have to go for heat detection and artificial breeding. Animals have always access to water for drinking and wallowing that is considered a compulsory exercise in this system. Second type of system is dominant in areas where “cash-crop” production is priority of the farmers and grazing facility is not available. It is also dominant in peri-urban commercial dairying. In this system concentrate and green fodder is provided to buffaloes on the manger where they are kept tied. Usually the bulls are not present in herd, heat detection is relied on farmer’s observation and artificial insemination is practiced for breeding. Due to limited availability of wallowing ponds, animals merely do exercise (personal observation).

Heifer production is most expensive part of the dairy farm operation that requires more input with no visible returns. Attainment of early maturity of heifers results in early returns rather than the more efforts for longer time. Factors involving heat detection system, presence of bull, climate, environment of the area, wallowing facility and exercise during grazing, influence age of maturity in heifers (De Rosa *et al.*, 2009; Gokuldas *et al.*, 2010).

Dietary mineral elements are known to affect the physiological function in general and reproduction in particular (Ullah *et al.*, 2010).

Usually minerals play an intermediate role in the action of reproductive hormones and enzymes at cellular level which ultimately affect the reproductive performance of female (Bearden *et al.*, 2004). Deficiency of mineral elements like phosphorus, copper and zinc are associated with subnormal fertility and anestrus conditions in cows (Campbell *et al.*, 1999). Hence, the balanced feeding including mineral requirements is dire need for the optimal production performance of buffaloes and cows (Bhatti *et al.*, 2007). The present study was designed to determine the effect of pasture or stall feeding system on age of puberty by a survey of buffalo farms and to assess the influence of mineral feeding on estrus induction in Nili-Ravi buffalo heifers.

MATERIALS AND METHODS

Area of study

The study was conducted in Layyah district (30° 58’ 18” N and 70° 58’ 09” E) Punjab during July to November, 2011. Two types of management system are prevailing for buffaloes rearing in this area; pasture system and stall feeding. In pasture production system, buffaloes kept on grazing on the river bank whereas, in stall feeding system animals are kept tied and fed on the manger.

Survey to assess age of puberty

A survey was carried out to assess and compare the age of puberty in Nili-Ravi heifers in pasture and stall feeding system. The study was based on retrospective cross-sectional data from dairy farmers in the study area. A total of 83 farmers (53 farmers practiced stall feeding and 30 farmers practiced pasture system) were included who reared their own replacement heifers. Data

collection procedure was based on direct question, answer and conversation with farmers. For this purpose a questionnaire was developed to survey the farmers. Very simple question (what was the age of heifer and season at first estrus or at first breeding?) was asked to farmers. The age at first breeding was considered as age of puberty in each individual heifer. Only the data of heifers of age 20 to 50 months were included in this study. Additionally, the questions about feeding (total ration offered/heifer or grazing time allowed/day) and breeding (natural/AI) practices were also asked. It was noticed whether farmers have or have not their own breeding bulls. After collection, the data were organized into different age groups (20 to 26, 27 to 32, 33 to 38 and 39 to 50 months) in both pasture and stall feeding systems separately. Age at puberty and seasonality in breeding behavior were compared between pasture and stall feeding systems.

Effect of feeding mineral mixture on estrus response in heifers

This study was conducted during peak breeding season (October to December). A group of thirty five buffalo heifers (42.05 ± 1.18 months of age) from stall feeding system were used that had passed the average age of puberty as assessed by survey. The ovarian status was confirmed twice (11 day apart) for the presence of any functional structure (follicle/corpus luteum) through rectal palpation before the start of trial. All heifers had small inactive ovaries, were divided into two groups randomly: MIN (N=20) and CTL (N=15). MIN heifers were fed with UVAS MM^R mineral mixture (Dicalcium Phosphate; 70.81%, Sodium Chloride; 18.91%, Magnesium Sulphate; 8.64%, Ferrous Sulfate; 0.89%, Manganese Sulfate; 0.49%, Zinc Sulfate; 0.22%, Copper Sulfate; 0.03%, Potassium

Iodide; 8.77% and Cobalt Chloride; 0.89%) 100 gram/day/heifer for a period of four consecutive weeks in addition to their normal daily ration. CTL heifers were not fed with any additional mineral supplement and served as control. Both the groups were observed visually for estrus expression daily for a period of three months from the start of the trial. Estrus was confirmed by presence of tone in uterus, vaginal mucus, vulvular swelling and a large follicle observed through rectal palpation.

Statistical analysis

The mean age at puberty of heifers in pasture and stall feeding system was compared using independent-samples *t*-test. Whereas, the percentage of buffalo heifers attained puberty in different age groups, seasonality in breeding behavior, farmers having their own breeding bull in pasture or stall feeding system and effect of mineral mixture feeding on estrus response in MIN and CTL were compared using Chi-square test. A probability level of ($P < 0.05$) was considered significant. All data were analyzed using Statistical Package for the Social Sciences (SPSS version 17; SPSS Inc., Chicago, IL).

RESULTS

Survey to assess age of puberty

The number of heifers raised by farmers in two management systems and their age at puberty is shown in Table 1. The age at puberty in heifers raised in pasture system was lower compared to stall feeding system. Percentage of heifers attained puberty at different ages has been depicted in Figure 1. It is evident that more than 62% heifers in pasture group had attained puberty at the age of 32 months, whereas, in stall feeding system only

30.7% heifers reached to puberty at this age. It has been observed that the number of farmers keeping their own breeding bulls was higher in pasture system compared to stall feeding system (Table 1). The seasonality in breeding behavior was lower in heifers in pasture system compared to stall fed system (Table 1).

Effect of feeding mineral mixture on estrus response in heifers

The effect of mineral feeding on estrus response has been shown in Table 2. The percentage of heifers which showed estrus signs during the study period remained higher in MIN group (65% versus 33%) compared to that in CTL group.

DISCUSSION

The present study reports that age at puberty in heifers raised in pasture system is lower as compared to the heifers reared in stall feeding system. Furthermore, supplementation of mineral has been found helpful to induce estrus in heifers that had achieved or passed average age of puberty. Our findings are in agreement with previous reports about the improved management system for water buffaloes in commercial dairy farming (De Rosa *et al.*, 2009; Neglia *et al.*, 2009). The practice of providing plenty exercise through roaming in ample space, bull presence for breeding and heat detection, grazing on natural grasses and wallowing to combat with heat stress are the advantages of pasture system which minimize the seasonality and pubertal age in buffalo heifers. Oliveira *et al.* (2009) studied effects of biostimulation (presence of bull in the herd) in Nelore cow heifers kept under extensive management systems in tropical environment. They noted that the exposure of

heifers to a male during the pre-pubertal period decreased age at the first breeding season, resulting in a significant reduction in age of first pregnancy. Bolanos *et al.* (1997) and Gokuldas *et al.* (2010) reported similar findings that bull biostimulation effectively enhanced resumption of ovarian activity in cows and buffaloes under intensive system. Bhatti *et al.* (2007) commented that buffalo heifers attaining their proper weight just before the breeding season were more likely to get bred than those attaining proper weight after this season. However, in case of absence of seasonality of breeding, this possible delay in age at puberty will be ruled out.

In the present study a higher number of heifers were observed in estrus in mineral fed group compared to control. This evidenced that other than the proteins and energy, minerals and vitamins are also vital nutrients which influence the growth of calves to become heifers (Bhatti *et al.*, 2007). Therefore, the balanced feeding to the young stock is essential for the future reproduction. It has been reported that dairy animals reared in the area of having low level of mineral in the forages and soil lead to low production; therefore, the supplementation of required minerals is essential for optimum production (Kumaresan *et al.*, 2010; Khan *et al.*, 2008). Naidu *et al.* (2009) conducted a similar study in Murrah buffalo heifers and concluded that mineral supplementation could be cheap and convenient source than hormonal therapy to enhance the fertility in delayed pubertal heifers.

CONCLUSIONS

Buffalo heifers reared under pasture system attained puberty earlier than those reared

Table 1. Age at puberty (months) in buffalo heifers in two management systems in the study area.

	Management system				P-Value
	Pasture (N=213)		Stall fed (N=274)		
	Mean	SEM	Mean	SEM	
Heifers raised/farmer	7.10	0.45	5.17	0.27	0.000
Age at puberty of heifers	32.90	0.43	38.07	0.40	0.000
Seasonality in breeding behavior	36.67%	-	92.45%	-	0.000
Farmers having own breeding bull	100.00%	-	24.53%	-	0.000

Table 2. Estrus response of buffalo heifers in mineral feeding (MIN) and control (CTL) groups.

Group	Number of heifers	Estrus response (%)
MIN	20	65% ^b
CTL	15	33% ^a

The values with different superscript within the same column are different ($P < 0.05$).

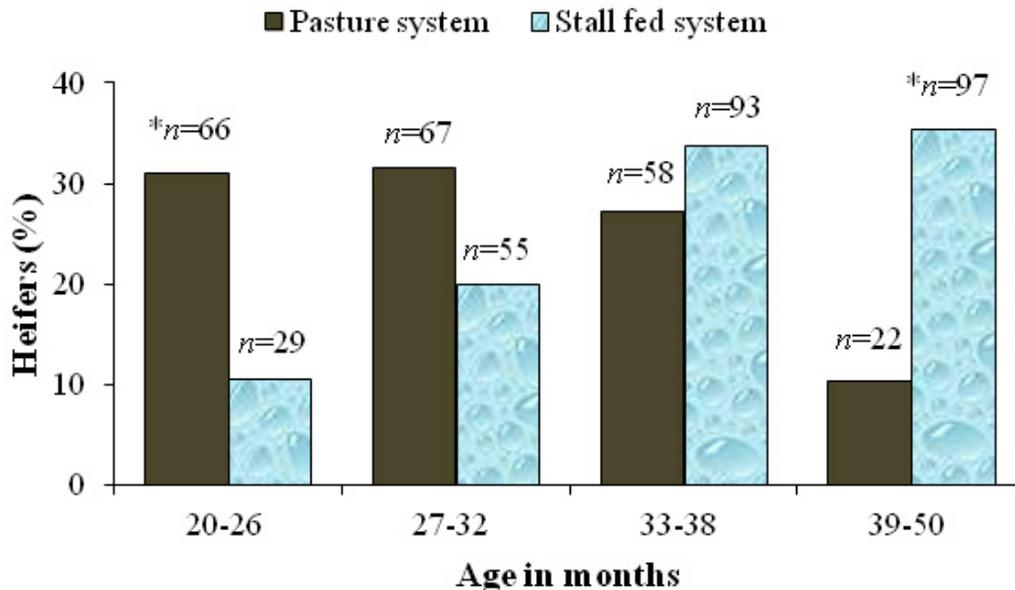


Figure 1. Buffalo heifers (%) attained puberty in different age groups reared in pasture or stall feeding system. * $P < 0.05$ in given age group.

under stall feeding system.

Seasonality of breeding in buffaloes was lower in pasture system due to out-door grazing, ample space per animal, biostimulation and wallowing in river banks.

In addition, the mineral supplementation might be a strategy to induce estrus in heifers that passed average age of puberty onset.

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