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Effect of feed supplementation on age at puberty in growing buffalo heifers

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Abstract

The study was undertaken to investigate the effect of different levels of concentrate supplement added with urea-molasses-straw based diet on feed intake and utilization, growth and age of sexual maturity of buffalo heifers. Sixteen buffalo heifers aged from 6-12 months were selected and divided into four homogenous (considering age and body weight) treatment groups (A, B, C and D). Buffaloes of all groups were provided urea-molasses-straws (UMS)as basal diet along with concentrate supplement @ 0.25, 0.5, 0.75, and 1.0% of live weight for group A, B, C and D, respectively. Concentrates were provided twice daily. The date of attaining puberty were recorded when the animals had shown first sign of heat or responded to teaser bull. DM requirement were regularly estimated and daily feed intake, body weight (fortnightly) were also recorded. The feeding trial was persisted for a period of 482days in a CRD design of experiment and accumulated data were analyzed with IBM SPSS 20.0 soft ware. The results indicate that total DM intake (DMI_t) differed significantly ($p<0.001$) among groups. The lowest DMI_t was obtained in group A. FCR of group A was obtained significantly better than C and D groups, although overall difference among groups were not significant ($p>0.05$). However, body weight gain (BWG) of animals among four groups were not significant ($p>0.05$). Quantity of concentrate feeds allocated by different proportions among four treatment groups had no significant ($p>0.05$) effect for either attaining age at puberty or body weight at puberty. Based on the results so far obtained from this study, it may be concluded that buffalo heifers could be allowed concentrates @0.25% on live body weight along with UMS *adlib* for obtaining optimum puberty, as more concentrates than this had not shown significantly better results. However, more researches including more animals need to be done to draw a concrete decision.

Keyword: Buffalo, Age at puberty, Feed supplement, Urea-molasses-straws

INTRODUCTION

Buffalo is one of the potential animal genetic resources of Bangladesh. Estimated buffalo population in Bangladesh is about 1.47 million (BER, 2016) and they are mostly local type. Buffalo shares about 2.0% and 0.94% of total domestic milk and meat, respectively (FAnGR, 2005,BBS, 2012). Contribution of buffalo on national red meat production is also very low (2.06%). This negligible share of buffalo to domestic milk and meat production is associated with their low production potential. Indigenous buffalo attained puberty at about 30 months of age when reared intensively, while 39 to 54.5 months when reared extensively (Annual Research Review Workshop, 2014),instead of optimal puberty age of 15 to 18 months in river buffalo and 21 to 24 months in swamp buffalo at on-station (Warriach, et al., 2015). These values deteriorate up to a significant extent under field condition.

The fertility of buffalo was significantly higher (83.5%) when kept on higher plain of nutrition as compared to 66.6% for those maintained on low plain of nutrition (Poy and Panda, 1971). Age at first calving may be reduced through providing balanced feeding, improved management and minimum disease prevalence (Heinrichs et al., 2005).

To get faster growth rate for early puberty, Bhatti et al. (2007) recommended that forge should be the main feed and concentrate feeds may be supplemented. Buffaloes are suitable for breeding at about 24 months of age. But, in the majority of dairy buffaloes calving occurs at 4-6 years of age due to an inadequate supply of feed and nutrients during the growing phase (Ingawale and Dhoble, 2004). Most buffalo cease ovarian cyclicity during hot summers probably due to the combined effects of nutrition, environment and management. Nutritional manipulations may influence the period of sexual maturation (Schoppee et al., 1996).

Low reproductive efficiency (late maturity, long calving interval and silent heat etc.) is a serious constraint to buffalo production (Mahadevan, 1978). This is due feeding buffaloes with very low quality and high fibrous roughage with very little or no concentrate. Rice straw is the main component of roughage supplied to cattle and buffalo in Bangladesh. But, it has very low digestibility with negligible nutrient contents that cannot fulfill nutrient requirements, even at least that required for daily maintenance. However, nutritive value as well as digestibility of straw can be improved to some extend by straw treated with urea and molasses. This will supplement nitrogen and energy to the animals. Barnah et al. (1992) reported that if molasses and urea are mixed with straw and supplied to animals, palatability, feed intake and digestibility of straw are increased. It was evident that buffalo can utilize high fibrous roughage more efficiently than cattle. If quality of roughage can be improved and supplied to buffalo with some concentrate supplementation body weight gain and early sexual maturity may be expected. Thus, the aim of this study was to investigate the effect of different levels of concentrate supplement added with urea-molasses-straw as basal diet on feed intake and efficiency, body weight and age of sexual maturity of buffalo heifers.

MATERIALS AND METHODS

To conduct this study, sixteen buffalo heifers aged from 6-12 months were selected and divided into four homogenous (considering age and body weight) treatment groups (Group A, B, C and D) in a completely randomized design (CRD) layout. Buffaloes of all groups were fed urea molasses straw *adlib*. The experimental buffaloes were receiving concentrates at the rates of 0.25% on body weight for group A, 0.5% for group B, 0.75% for group C and 1.0% for group D, respectively. Required amount of concentrates were provided twice in a day (50% in the morning and 50% in the evening). After taking feed they were allowed to move freely in the barn. Fresh water was supplied *adlib* to separate mangers for each group. The date of attaining first estrous was recorded when the animals had shown first sign of heat or responded to teaser bull. Any sign of reproductive disorders were also monitored during the whole experimental period. Live body weight of each animal was regularly (fortnightly) taken to adjust DM requirements and to observe growth pattern. Quantity of UMS supplied to animals and feed refusals were recorded to obtain daily actual feed intake. Regular de-worming and vaccination against common diseases were ensured during experimental periods for all groups. The trial was conducted for a period of 482 days and data generated of those periods were analyzed statistically with IBM SPSS 20.0 software.

RESULTS AND DISCUSSION

The results of feed intake and efficiency and body weight gain of buffalo heifers from whole experimental period are illustrated in Table 1 and discussed hereby as follows:

Feed intake and efficiency

As shown in Table 1 that total DM intake (DMI_t) differed significantly ($p<0.001$) among treatment groups. Highest DMI_t was shown in animals of group D and lowest in group A. FCR in A group was significantly better than C and D groups, although overall difference among groups were not significant ($p=0.06$). It was evident that feed intake and utilization by the animals depend on size of animal, quality and palatability of diet supplied to the animals. However, other factors like climate, feeding and management system, body condition, soundness of health, duration of feeding may play roles for feed intake and utilization. These factors did not create any significant influence for DMI_t and FCR. This finding is in accordance with Singh et al.(2015) who studied three dietary groups (based on protein level) to evaluate the intake and efficiency of feed for Bhadawari buffalo heifer and found similar feed dry matter (DM) intake (% body weight) and FCR in all three diets. In contrast, Rahman et al. (2009) investigated the effects of supplementation of Urea-Molasses-Straw (UMS) based diet with different levels of concentrate for fattening emaciated bulls, where they obtained significant ($p<0.01$) variations of total DM intake and FCR among animals of different dietary groups. They obtained highest DM intake and best FCR with diet containing concentrate 30% of DM requirement to replace same amount UMS and green grass. This variation could be due to differences of species and composition of diet. Recently, Iqbal *et al*. (2017) studied varying levels of concentrate on growth performance and feed economics in Nili-Ravi buffalo heifer calves with three different levels of concentrates (0.5, 1.0 and 1.5% of body weight) added with green fodder as basal diet. In their experiment, they investigated significant ($p<0.01$) difference of total DM intake by the animals among three dietary groups. They obtained increased DM intake when increased the level of concentrates. Their results differ with this study. However, in concurrence with this study, they did not find any signification variation of total body

weight gain for 8-month period in their experiment. Further, they estimated FCR values from 10.01 (low level of concentrates) to 12.85 (high level of concentrates) with highly significant ($p<0.01$) variations among dietary groups.

Body weight gain

As to maintain homogeneity in experimental groups, prior to divide animals into four groups, all animals were weighed and then divide accordingly. As a result, initial body weight (BW_i) did not differ significantly ($p=0.939$) as shown in Table 1. However, final body weight (BWf), total body weight gain (BWG_t) and daily average body weight gain (BWG_d) of animals did not differ statistically ($p=0.924$, 0.680 and 0.680, respectively) among four treatment groups. Singh et al. (2015) studied three dietary groups (based on protein level) to evaluate body weight changes and found no significant effect on Bhadawari buffalo heifer's weight, which agreed well by this study. As discussed above, Iqbal et al. (2017) showed similar findings on total body weight gain of Nili-Ravi buffalo heifer calves. Rafiq et al. (2008) conducted an experiment to know the effect of supplementation of concentrate mixture (2.0, 4.0 and 0.0 kg in three groups) along with green fodder on growth rate and age of maturity in growing buffalo heifers, where they obtained significant difference of daily body weight gain between concentrate supplement and zero concentrate groups. But, they obtained no significant difference between two levels (2.0 kg vs 4.0 kg) of concentrate supplement groups. Their finding agrees well with this study. Earlier, Rahman et al. (2009) investigated the effects of supplementation of Urea-Molasses-Straw (UMS) based diet with different levels of concentrate for fattening emaciated bulls, where they obtained significant ($p<0.01$) difference of live weight gain between UMS based diet and without UMS based diet. Interestingly, they did not find any significant variations of live weight gain among UMS based treatment groups containing different levels of concentrates. Their observation corresponds with this study.

Table 1: Feed intake and efficiency(up to 482 days) of buffalo heifers for different groups

Parameter	Treatment group (Mean±SE)				Level of significance
	A	B	C	D	
DMI_t (Kg)	2501.75^{a}±160.4	2926.50^{b}±28.05	3189.50^{b}±93.09	3593.50^{c}±70.28	$P=0.000^{***}$
BW_i (Kg)	195.5±19.62	220.38±41.23	194.75±28.51	203.5±37.19	$P=0.939^{NS}$
BW_f (kg)	302.5±19.50	319.25±40.77	297.25±22.46	292.25±31.69	$P=0.924^{NS}$
BWG_t (kg)	221.75±16.61	191.25±25.82	192.75±11.42	205.50±22.04	$P=0.680^{NS}$
BWG_d (g)	460.06±0.03	396.78±0.05	399.89±0.02	426.35±0.04	$P=0.680^{NS}$
FCR	11.31^{a}±0.23	16.21^{ab}±2.27	16.68^{b}±0.82	18.21^{b}±2.25	$P=0.060^{NS}$

A=UMS (*adlib*)+0.25% concentrate; B=UMS (*adlib*)+0.5% concentrate; C=UMS (*adlib*)+0.75% concentrate; D= UMS (*adlib*)+1.0% concentrate; NS-not significant ($p>0.05$); DMI_t- total dry matter intake; BW_i- initial body weight; BW_f- final body weight; BWG_t - total body weight gain;BWG_d- daily body weight gain; ***-significant at 0.1% level ($p<0.001$); mean with uncommon superscripts within the same row differed significantly ($p<0.05$).

After conducting a period of up to 482 days of feeding, 10 buffalo heifers out of 16, taken for this experiment were came into first estrous. Age and body weight at puberty of 10 buffalo heifers were analyzed and results are depicted in Table 2. Results are discussed below:

Age at puberty

Age at puberty of buffalo heifers among four treatment groups are presented in Table 2, which shows that quantity of concentrate feeds allocated by different proportions among four treatment groups had no significant ($p=0.678$) effect for age at puberty of buffalo heifers. In general agreement, Singh et al. (2015) studied three dietary groups (based on protein level) to evaluate sexual maturity of Bhadawari buffalo heifer and obtained no significant effect on diet for age at puberty. In the same experiment as stated above, Rafiq *et al*. (2008) proved age of maturity in growing buffalo heifers to be varied significantly ($p<0.05$) between concentrate supplement and zero concentrate feeding groups. However, they claimed no significant variation of age of maturity between two levels of concentrate supplement groups (24.26 months at 2.0 kg concentrate supplement vs 25.80 months at 4.0 kg concentrate supplement). Their findings concurred with this study. It was evident that age at puberty delayed for under nourished feeding system. Nanda et al. (2003) concluded that better nutrition reduces the age of maturity in buffalo heifers. However, this study reveals that UMS as basal diet supplied

to buffalo heifers *adlib* with minimum concentrate @ 0.25% of live body weight is sufficient to attain sexual maturity at desired ages.

Body weight at puberty

Body weight at puberty of buffalo heifers among four treatment groups are given in Table 2, which indicate that quantity of concentrate feeds allocated by different proportions among four treatment groups had no significant (p=0.351) effect for body weight at puberty of buffalo heifers. Earlier, Rafiq et al. (2008) reported body weight at age of maturity of buffalo heifers to be 411.10 kg when given 2.0 kg concentrate supplement and 431.17 kg when given 4.0 kg concentrate supplement, while statistical difference between groups was not significant. Their finding coincides with the result obtained in this study. However, difference of body weight at puberty between experiments may be due to difference of buffalo breed, feeding regime, management or environmental condition where the studies were taken place.

Table 2: Age and body weight at puberty for different groups of buffalo heifers

Trait	*Treatment group (Mean±SE)				Level of significance
	A	B	C	D	
Age at puberty (month)	22.94±1.07 (03)	23.40±0.80 (02)	23.90±0.40 (03)	24.30±0.60 (02)	P=0.678^{NS}
Body weight at puberty (kg)	346.67±16.91 (03)	372.30±2.50 (02)	355.0±1.73 (03)	372.50±10.61 (02)	P=0.351^{NS}

A=UMS (adlib)+0.25% concentrate; B=UMS (adlib)+0.5% concentrate; C=UMS (adlib)+0.75% concentrate; D= UMS (adlib)+1.0% concentrate; NS-significant at 5% leve (p<0.05)

CONCLUSION

Based on the results so far obtained from this study, it may be concluded that buffalo heifers could be allowed concentrates @0.25% on body weight along with UMS *adlib* for obtaining optimum puberty, as more concentrates than this had not shown significantly better results. However, more researches including more animals need to be done to draw a concrete decision.

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