



Response of Buffaloes in Hay Versus Green Fodder and Loose Versus Barn House

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Comparative Response of Hay versus Green Fodder and Loose Versus Barn House on Feed, Nutrient and Water Intake in Murrah Buffalo Heifers

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ABSTRACT

The present study was undertaken to investigate the effect of hay versus green fodder and loose versus barn house on nutrient intake in buffalo heifers. Twenty heifers based on equal body weight and age were divided into four treatment groups; T1- conventional barn housing +hay and concentrate mixture (CM); T2- conventional barn housing + seasonal green fodder and CM; T3- loose housing +seasonal green fodder and CM; and T4 - loose housing +hay and CM during February 1st, 2004 to May 31st, 2004. The interactive relationship between two housing and feeding systems was also studied. No significant difference in daily dry matter intake (DMI), DMI per 100 kg body weight and $DMI/kg W^{0.75}$ in various treatments was reported and the interactive effect of two feeding and housing systems was also non-significant. The daily crude protein intake (CPI); CPI per 100 kg B. wt. and $CPI/kg W^{0.75}$ remained statistically similar among various treatments. The effect of interactions due to both housing and feeding systems was also non-significant. Similar trend was also observed with regard to daily TDN intake, TDN intake per 100 kg body weight and TDN intake per/kg $W^{0.75}$. Loose housing along with hay and concentrate feeding (T4) resulted in higher ($P<0.05$) daily voluntary water intake (VWI), $VWI/kg DM$ consumed and $VWI/kg W^{0.75}$. Housing systems had no significant effect on daily (VWI), $VWI/kg DM$ consumed and $VWI/kg W^{0.75}$. However, feeding systems had significant effect on daily VWI, $VWI / kg DM$ consumed and $VWI / kg W^{0.75}$. Daily TWI, TWI per kg DM consumed and $TWI/kg W^{0.75}$ was higher ($P<0.05$) due to green fodder feeding as compared to that of hay feeding system which was due to the higher moisture content in green fodder compared to that of hay. It was concluded that DM, CP and TDN intakes remained uninfluenced due to various treatments; and two feeding and housing systems. Voluntary water intake was significantly ($P<0.05$) higher in hay feeding than green fodder feeding; and total water intake was significantly ($P<0.05$) higher in green fodder feeding than hay feeding system and remained uninfluenced due to housing systems.

KEYWORDS: Barn housing, Green fodder, Hay, Loose housing, Murrah heifer, Nutrient

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INTRODUCTION

In India nearly 36% of the total milk production is contributed by indigenous buffaloes followed by 26% by crossbred cattle, 12% indigenous cattle, 9% and non-descript buffaloes contribute 13% milk production (Annual Report, 2016-17), thus making buffalo as the principal dairy animal of Indian dairy industry. Haryana is the home tract of world famous Murrah buffalo. Rearing and maintenance of buffalo heifers is the most

predominant and popularly adopted allied agricultural activity undertaken by the rural community in India and particularly in Haryana. Low productivity of the animals is chiefly due to inadequate supply of nutrients. There exists a huge gap in availability and supply of feed nutrients which is further aggravated during lean and scarcity period (Singh and Mojumdar 1992; Kumar et al., 2016). Inadequate supply of quality fodder is one of the reasons for poor livestock productivity (Anjum et al., 2012; Kumar et al., 2016).

A common problem in buffalo heifer management is underfeeding due to various reasons, like diversion of better feed and fodder in producing the herd at the cost of growing stock, heavy parasitic load, improper housing and management, faulty plane of nutrition and feeding that makes the calves remain away from feed, over-crowding and negative balance due to scarcity of good quality of green forages. With regard to housing, the loose and the tie stall housing systems are very common. Loose housing has the advantage of better udder health (Hultgren 2002; Regula et al. 2004), lower risk of ketosis and better fertility (Valde et al., 1997), generally being accepted by welfare scientists as having a superior potential for higher animal welfare (Rousing et al. 2000). However, loose housing systems have the disadvantage of a higher risk of lameness (Cook, 2003; Sogstad et al., 2005). There is some evidence that loose housing (Weary and Taszkun, 2000) and regular outdoor exercise (Gustafson, 1993; Regula et al. 2004) have positive effects on the health and welfare of animals. The objective of the present investigation was that heifers should be reared

scientifically to assess the nutrient intake for supplementing the income of the farmers through the sale of buffalo heifers.

MATERIALS AND METHODS

Animals and treatments

Twenty Murrah buffalo heifers of 12 to 15 months of age were selected from the Buffalo Research Centre, Department of Livestock Production and Management, College of Animal Sciences, CCS Haryana Agricultural University, Hisar and equally divided into four treatment groups (T1 to T4) based on their nearness to body weight and age as below: T1- conventional barn housing +hay and concentrate mixture CM), T2 - conventional barn housing +seasonal green fodder and CM, T3- loose housing +seasonal green fodder and CM, T4 - loose housing +hay and CM. The heifers were dewormed and sprayed against external parasites and subjected to an adjustment period of 15 days and experimental period of 120 days (i.e. during February st^h- May 31st, 2004). The detailed particulars of the animals in T1 to T4 are presented in Table 1.

Table 1. Particulars of Experimental Animals

Treatments	Animal Number	Date of birth	Age (Days)	Initial Body Weight (Kg)
T1	069	22.08.2002	524	181
T1	076	11.09.2002	504	158
T1	077	13.09.2002	502	159
T1	083	04.10.2002	482	125
T1	085	05.10.2002	481	179
Mean			498.6	160.4
T2	065	05.08.2002	540	183
T2	071	28.08.2002	518	131
T2	087	09.10.2002	477	171
T2	098	11.11.2002	444	178
T2	102	19.11.2002	428	153
Mean			481.4	163.2
T3	080	22.09.2002	493	140
T3	092	24.10.2002	462	187
T3	097	11.11.2002	444	176
T3	104	22.11.2002	425	173
T3	109	06.12.2002	420	151
Mean			448.8	165.4
T4	066	13.08.2002	533	190
T4	089	20.10.2002	466	175
T4	100	16.11.2002	439	174
T4	111	11.12.2002	415	144
T4	117	12.01.2003	384	143
Mean			447.4	165.2

Feeds and feeding

CM (Wheat 40; Groundnut cake 30; Deoiled rice polish 30 parts; containing mineral mixture 2 and common salt 1kg/100 kg) was prepared. An equal and weighed amount of hay and green fodder was fed to all the heifers daily and its protein content was taken into consideration while fixing the allowance of concentrate for each group. The heifers in each group were fed extra amount of wheat bhusa to meet the requirement of TDN

as per NRC (2001). The feed intake was determined on the basis of weighing of feed and fodder offered and left over individually for two consecutive days in a fortnight. Samples of wheat bhusa, green forage, hay and concentrate mixture were taken daily for two consecutive days per fortnight before feeding the animals and analyzed for proximate principles as per AOAC (1995) - (Table 2); and the DM, CP and TDN intakes were determined.

Table 2. Proximate composition (%) of feeds and fodders on dry matter basis

Feedstuffs	DM	CP	EE	CF	ASH	NFE
Concentrate mixture	90.7	19.1	2.21	7.77	8.55	62.3
Berseem green	13.3	22.2	1.96	17.8	9.82	48.1
Oat green	27.6	9.9	2.22	26.6	10.9	50.4
Berseem hay	79.2	17.5	2.17	17.3	15.6	47.4
Wheat bhusa	91.1	3.67	2.28	19.4	9.27	65.4

A measured quantity of fresh clean water offered ad libitum individually to each heifer by placing a graduated bucket full of water twice in a day (at 11.00 AM and 2.30 PM). Refusals were measured for two consecutive days to know the voluntary water intake (VWI). Simultaneously, the water intake from the feed and fodder consumed by the heifers on that particular day was also calculated. The total water intake (TWI) was thus obtained by adding the VWI and water consumed through feed and fodder and the values of WI per kg dry matter consumed and per kg $W^{0.75}$ were calculated. The data thus obtained were analyzed by using 2x2 factorial design as described by Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

The data pertaining to various nutrient intakes (DM, CP, TDN and water) was statistically analyzed and presented in Tables 3-7.

Dry matter intake (DMI)

The average daily DMI, DMI per 100 kg body weight and DMI/kg $W^{0.75}$ in various treatments; and two housing and feeding systems is presented in Tables 3. No significant difference in daily DMI, DMI per 100 kg body weight and DMI/kg $W^{0.75}$ in various dietary treatments was reported. The effect of two feeding and housing systems on daily DMI, DMI per 100 kg body weight and DMI/kg $W^{0.75}$ was also non significant. The interaction due to housing and feeding systems was non significant.

Table 3. Average daily dry matter intake (Kg) of buffalo heifers under different treatments

Treatments	Daily DMI	DMI/100kg B. Wt.	DMI/kg $W^{0.75}$
T1	5.19±0.24	2.49±0.01	0.09±0.0007
T2	5.21±0.23	2.48±0.01	0.09±0.0007
T3	5.26±0.24	2.49±0.01	0.09±0.0007
T4	5.29±0.24	2.48±0.01	0.09±0.0008

However, it was reported that heifers in loose house consumed numerically more DM (5.279 kg) as compared to their counterparts in conventional barn (5.205 kg). Also, Sarma (1991) found 5-8 %

more nutrient intake in loose housed heifers than those housed in conventional barn. Similar, findings were also reported by Kumar et al. (2019); Gere et al. (1987); Chauhan et al. (1999); Poudel (2001); Gupta

et al. (1983); Singh et al. (1984); Antil (1988); Singh et al. (1988); Thiagarajan and Thomas (1991); and Lal (1999). However, Labande et al. (1980) and Chakrabarti (1991) reported higher DMI in conventional barn than that of loose house. On the other hand, Bhatta et al. (2004); Singh et al. (2014); Dahiya (1997); Haley et al. (2000) and Singh (2000) reported no significant effect on DMI due to various housing systems. Murdoch (1964) reported that the total DMI increased with lower quality hay and concentrate feeding. Rao et al. (1983) observed increase in overall DMI with the decrease in green fodder feeding. On the contrary, Jackson and Gupta (1971) and Ghadge et al. (1996) observed significant increase in DMI due to feeding of green fodder. Maity et al. (1997) indicated that 50 percent of CM could be replaced by green berseem without adversely affecting nutrient utilization in cows. Similarly, significant differences for DMI were observed by Kumar et al. (1981), Chaudhary (1998), Kumar et al. (2004) and Chauhan et al. (2004). The results reported in the present study are contradictory to the findings of the above workers.

Crude protein intake (CPI)

Daily CPI, CPI per 100 kg body weight and CPI per kg metabolic body size under different treatments; and two housing and feeding systems have been presented in Tables 4. The daily CPI, CPI per 100 kg body weight and CPI per kg metabolic body size remained statistically similar among various dietary treatments and remained uninfluenced due to housing and feeding systems. The effect of interactions due to housing and feeding systems was also non significant. In the present study, the CPI remained uninfluenced due to feeding and housing systems. Similar results of no significant effect on CPI due to various rearing systems were also reported by Kumar et al. (2019); Singh et al. (2014); Sarma (1991); Shenu (2000); Rao et al. (1983); Antil (1988); Chakrabarti et al. (1996); Lal (1999) and Chauhan et al. (2004).

However, Kumar et al. (1981); Singh et al. (1988) and Chaudhary (1998) reported that different systems of feeding in buffalo calves and heifers had significant effect on daily CPI, CPI per 100 kg body weight and CPI/kg $W^{0.75}$. Also, Jat et al. (2003) observed significant effect of different housing systems on protein intake in buffalo calves.

Table 4. Average daily crude protein intake (CPI) (Kg) by buffalo heifers under different treatments

Treatments	Daily CPI	CPI/100kg B. Wt.	CPI/kg $W^{0.75}$
T1	0.71±0.01	0.34±0.01	0.013±0.0003
T2	0.71±0.01	0.34±0.01	0.013±0.0002
T3	0.71±0.01	0.34±0.01	0.013±0.0002
T4	0.71±0.01	0.34±0.01	0.013±0.0003

Total digestible nutrient (TDN) intake

Daily TDN intake, TDN intake per 100 kg body weight and TDN intake/kg $W^{0.75}$ in various treatments; and two housing and feeding systems is given in Tables 5. The results indicated that the daily TDN intake, TDN intake per 100 kg body weight and TDN intake/kg $W^{0.75}$ was statistically similar in various treatment groups. The results further showed that the housing and feeding systems had no significant effect on TDN intakes. The interactive effects between housing and feeding systems was also non significant. Similarly, Antil (1988); Pradhan and Sastry (1988) and Singh et al. (1988) did not

find any significant difference in TDN intake due to different feeding systems. Jat et al. (2003) reported significant differences in the TDN intake due to different housing systems. On the other hand, Singh et al. (2014); Dahiya (1997) and Singh (2000) reported no significant effect on TDN intake due to various housing systems. However, Thomas (1969) reported higher TDN intake in open housing compared to sheltered counterpart. Also, Rao et al. (1983); Kumar et al. (2004) and Chauhan et al. (2004) reported that there was significant ($P < 0.05$) difference in TDN intake due to different feeding systems in buffalo calves and heifers.

Table 5. Average daily TDN intake (kg) by buffalo heifers under different treatments

Treatments	Daily TDN intake	TDN intake/100kg B. Wt.	TDN intake/kg W ^{0.75}
T1	3.34±0.13	1.61±0.01	0.06±0.0001
T2	3.35±0.13	1.60±0.02	0.06±0.0002
T3	3.38±0.01	1.60±0.02	0.06±0.0002
T4	3.39±0.13	1.60±0.02	0.06±0.0001

Voluntary water intake (VWI)

The average daily VWI, VWI per kg DM consumed and VWI/kg W^{0.75} of heifers in various treatments; and two housing and feeding systems was presented in Tables 6. The results revealed that the daily VWI was higher ($P<0.05$) in group T4 as compared to that of T2. The daily VWI among groups T1, T2 and T3 did not differ significantly ($P<0.05$). The VWI/kg DM consumed and VWI/kg W^{0.75} was higher ($P<0.05$) in group T1 compared to that of T2. The VWI/kg DM consumed and VWI/kg W^{0.75} did not differ significantly ($P<0.05$) between groups T1 and T3; and T2 and T3. The VWI/kg DM consumed and VWI/kg W^{0.75} in group T4 was higher ($P<0.05$) than those of T2 and T3.

The results revealed that the loose housing along with hay and concentrate feeding (T4) resulted in higher ($P<0.05$) daily VWI, VWI/kg DM consumed and VWI/kg W^{0.75}. The results revealed that the housing systems had no significant effect on daily VWI, VWI/kg DM consumed and VWI/kg W^{0.75}.

However, feeding systems had significant effect on voluntary water intake, VWI/kg DM consumed and VWI/kg W^{0.75}. It was observed that the heifers housed in loose house consumed 9 percent more

water as compared to those heifers housed in conventional barn, however, the difference in VWI due to housing systems was not significant. This result was in agreement with those of earlier reports of Sastry and Georgie (1988); Chakrabarti (1991); Sarma (1991) and Shenu (2000). However, Yadav (1982); Yadav (1984) and Jat (2002) reported significant difference in VWI of buffalo heifers due to different housing systems. In the present study, the interactive effect of feeding and housing systems on VWI was not significant.

The present study reported that feeding systems had significant ($P<0.05$) effect on daily VWI, VWI per kg dry matter consumed and VWI per kg metabolic body size. Similar results were also reported by Gupta and Tripathi (1983); Antil (1988); Chaudhary (1998) and Kumar et al. (2004). However, Seth et al. (1988) and Chauhan et al. (2004) did not find any significant differences in VWI due to different feeding systems. Higher VWI due to hay feeding system may be due to more weight gain per day compared to that of green fodder feeding counterpart group. This result was in agreement with that of Pandey et al. (1989) who reported positive relationship between body weight gain and water intake.

Table 6. Average daily voluntary water intake (VWI) in litre by buffalo heifers under different treatments

Treatments	Daily VWI	VWI/kg DM consumed	VWI/kg W ^{0.75}
T1	21.8 ^{ab} ±1.50	4.09 ^{ab} ±0.19	0.39 ^{ab} ±0.01
T2	18.0 ^b ±1.85	3.30 ^c ±0.22	0.31 ^c ±0.02
T3	20.3 ^{ab} ±1.73	3.72 ^{bc} ±0.17	0.35 ^{bc} ±0.01
T4	23.4 ^a ±0.72	4.35 ^a ±0.12	0.41 ^a ±0.01

Means having different superscripts differ significantly ($P<0.05$)

Total water intake (TWI)

The daily TWI, TWI per kg DM consumed and TWI/kg $W^{0.75}$ in different treatment groups; and two housing and feeding systems is presented in Table 7. The daily TWI, TWI/kg DM consumed and TWI/kg $W^{0.75}$ between T1 and T4; and between T2 and T3 was statistically similar. The daily TWI, TWI/kg DM consumed and TWI/kg $W^{0.75}$ in T1 and T4 was lower ($P<0.05$) than those of T2 and T3. The results revealed that daily TWI, TWI per kg DM consumed and TWI/kg $W^{0.75}$ was higher ($P<0.05$) due to green fodder feeding as compared to that of hay feeding system which is due to the higher moisture content in green fodder compared to that of hay. However, daily TWI, TWI per kg DM consumed and TWI/kg $W^{0.75}$ remained uninfluenced by the housing systems. The interactive effect of housing and feeding systems on TWI was non-significant.

Higher TWI due to green fodder feeding was because of less dry matter consumed and higher moisture content compared to that of hay which resulted into lesser body weight gain in green fodder feeding than hay feeding system. In the present study, different housing systems had no effect ($P<0.05$) on TWI of animals. This result was in agreement with earlier reports of Chakrabarti (1991); Sarma (1991) and Shenu (2000). However, Yadav et al. (1986) and Jat (2002) reported significant difference in the TWI of buffalo calves due to different housing systems. The present study further reported higher ($P<0.05$) TWI due to green fodder compared to hay feeding. Similar results were also reported by Antil (1988); and Kumar et al. (2004). However, Chauhan et al. (2004) reported no significant effect due to different feeding systems on TWI.

Table 7. Daily total water intake (TWI) in litre by buffalo heifers in different treatments

Treatments	Daily TWI	TWI/kg DM consumed	TWI/kg $W^{0.75}$
T1	22.9 ^b ±1.53	4.29 ^b ±0.19	0.40 ^b ±0.01
T2	30.3 ^a ±2.16	5.68 ^a ±0.35	0.54 ^a ±0.03
T3	33.8 ^a ±1.34	6.30 ^a ±0.21	0.59 ^a ±0.01
T4	24.7 ^b ±0.77	4.56 ^b ±0.13	0.43 ^b ±0.01

Means having different superscripts differ significantly ($P<0.05$)

CONCLUSION

It was concluded that DM, CP and TDN intakes remained uninfluenced due to various treatments and two feeding and housing systems. Voluntary water intake was higher ($P<0.05$) in hay feeding than green fodder feeding and total water intake was significantly ($P<0.05$) higher in green fodder feeding than hay feeding system and remained uninfluenced due to housing systems.

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