Research Article

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EFFECT OF MANAGEMENT SYSTEMS ON GROWTH PERFORMANCE OF BUFFALO CALVES IN HOT-HUMID WEATHER

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ABSTRACT

A study was conducted on 24 murrah buffalo calves of either sex at the animal farm, LUVAS, Hisar during summer season from July 15, 2015 to October 15, 2015 (90 days). Experimental calves were divided into four treatments having six animals in each treatment, viz. Loose housing system + 100% feeding level (T_1), Loose housing system + 120% feeding level (T_2), Conventional barn housing system + 100% feeding level (T_3), Conventional barn housing system + 120% feeding (T_4). There was significantly higher ($p<0.05$) temperature and temperature humidity index in conventional house than loose house. Body weight gain was higher in loose house as compared to conventional house. Nutrients digestibility was higher in animals in loose house and 120% feeding level as compared to conventional house and 100% feeding level. Water intake was significantly higher in those animals which were housed in conventional house and 120% feeding level as compared to loose house and 100% feeding level. Feed conversion ratio (FCR) was lowest in loose house and 100% feeding level as compared to conventional house and 120% feeding level. Cost of rearing an animal per kg body weight gain was lowest in T_1 and highest in T_4 which indicated that rearing buffalo calves in loose house with 100% feeding level as per ICAR recommendation was more economical as compared to conventional barn and in 120% feeding level in hot-humid weather.

Key words: Cost, digestibility, feed conversion ratio, growth, Murrah buffalo calves.

In tropical and subtropical areas, high ambient temperature is the major constraint on animal productivity and the effect of heat stress is aggravated with high humidity (Marai *et al*., 2008). Calf mortality was associated with the type of housing, feeding, management practices, and weather conditions. 20% calf mortality resulted in reduction of 38% profit of a livestock farm. (FAO, 1979). Under hot conditions, the performance of loose housing buffalo calves was found to be superior to those tied from their neck (Habeeb *et al*., 2012). Now a day, the prices of concentrates is going up leading to higher prices of the animal products (meat, cheese, etc). To produce low price meat, feed intake should be programmed in order to lower the concentrate ratio in the diet. Keeping in view, this experiment was designed to study the effect of housing systems and levels of feeding on growth performance, nutrient digestibility and cost of rearing of buffalo calves under different treatments.

MATERIALS AND METHODS

Experiment was conducted at the buffalo farm of Livestock Production Management (LPM) Department, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar. Hisar city is situated in semi-arid region and climatic conditions are sub-tropical in nature. Geographically, Hisar is situated at 29º 10' N latitude, 75º 40' E longitude and 215.2 (m) altitude.

Animals and Experimental Design

Twenty-four murrah buffalo calves of either sex between 6 to 9 months of age were selected from the old buffalo farm, LPM Department, LUVAS, Hisar. These calves were divided into four groups of 6 calves each and allotted to 1 of the 4 treatments, viz. Loose housing system + 100% feeding level (T_1), Loose housing system + 120% feeding level (T_2), Conventional barn housing system + 100% feeding level (T_3), Conventional barn housing system + 120% feeding level (T_4). Feeding levels were according to the ICAR recommendation.

Feeding and Watering

All the experimental calves were fed sorghum during the experimental period. Wheat straw *ad libitum* and a concentrate mixture containing barley, ground nut cake (GNC), deoiled rice polish (DORP), mineral mixture (MM) and common salt was prepared. The allowance of concentrate mixture was fixed in such a way that calves of T_2 and T_4 got 20 per cent higher and calves of T_1 and T_3 were fed at normal 100% ICAR recommended level of concentrate per head per day. A weighted amount of sorghum was fed to all calves daily according to dry matter requirement of calves other than the dry matter present in the concentrate mixture. Animals were given *ad-lib* fresh water throughout the experimental period. Before formulation of rations, the feed ingredients were analyzed (AOAC, 2005) for proximate composition. Ingredients of concentrate mixture (kg), green fodder, dry fodder and its chemical composition (on DM basis) are presented in Table 1.

Observations

Microclimate of houses (temperature and relative humidity) was taken with the help of automatic hygrometers which were placed in individual houses during the whole period of experiment. The buffalo calves weights and body measurements were individually taken initially and there after at fortnightly interval till the end of the experiment.

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Amount of feed and water intake measured in three consecutive days in a fortnight. Growth performance in terms of feed conversion ratio (FCR) was calculated during the feeding trial. A digestion trial of five days was conducted at the end of the experiment to know the effect of treatments on digestibility of feed and fodder. Feed samples from each dietary treatment were collected and analyzed for proximate chemical compositions. The faecal samples were pooled within pen and dried in an air drying oven at 60°C for 72 h, and ground in a Wiley mill and used for chemical analysis. Experimental diets and excreta samples were analyzed according to the AOAC (2005) methods. The feed cost was calculated based on the price of ingredients used and then employed to calculate the feed cost per kg body weight gain and total feed cost in different treatments.

Statistical Analysis

The data regarding growth, feeding was compared by one way ANOVA using SPSS software version 16.0.

RESULTS AND DISCUSSION

Microclimate

Average fortnightly temperature (ºC) and temperature humidity index (THI) of loose house and conventional barn house during experiment period is presented in Table 2 and Table 3, respectively. The maximum temperature was found to be significantly ($p<0.05$) higher in conventional barn type housing system compared to loose housing system. The minimum temperature was found to be significantly higher in loose house compared to conventional barn type housing system. The maximum temperature humidity index (THI) was found to be significantly ($p<0.05$) higher in the conventional house as compared to the loose house. Similar results were reported by Jat *et al.* (2010), Shekhwat *et al*. (2012) and Singh *et al.* (2012).

Body weight and Body measurements

Average total body weight gain and average daily body weight gain by the calves in loose house was found to be significantly ($p<0.05$) higher as compared to conventional barn housing system (Table 4). Average total body weight gain and average daily body weight gain in calves were found to be statistically similar between the feeding levels. Similar results were reported by Razzaque *et al*. (2009) and Habeeb *et al*. (2012), Contrary to this, Jat *et a*l. (2010) and Singh *et al*. (2014) found no significant effect of housing systems on body weight gain. There was no significance difference in increase in body measurements due to housing system and feeding levels. Similar results were reported by Sahu (2004), Jat *et al*. (2010), Iqbal *et al*. (2014) and Singh *et al*. (2014).

Water intake

There was significant ($p<0.05$) difference in daily total water intake between two housing systems as well as two feeding levels (Table 5). It was higher in conventional house and ICAR 120% feeding level. There was higher intake of water per kg DM consume in conventional house than the loose house. Water intake per kg metabolic body weight ($W^{0.75}$) was also significant between the housing systems and it was higher in conventional house than the loose house. Water intake was higher in ICAR 120% feeding level which may be due to more dry matter intake. Water intake was higher in conventional house because of higher heat stress. Similar results were reported by Ashour *et al.* (2007) and Shekhwat *et al*. (2012).

Feed conversion ratio (FCR)

There was a significant ($p<0.05$) difference in dry matter intake per kg body weight gain between loose house and conventional barn housing system. It was found to be higher in conventional barn housing system (6.77±0.16) than in loose house (6.01±0.28). There was no significant effect of feeding levels on the efficiency of animals in any house. Similar results were reported by Tauqir *et al*. (2010). Contrary to this, results were reported by Jat *et al.* (2010), Helal *et al.* (2011) and Tomar *et al.* (2014) in winter season. Lower FCR in loose house may be due to comfortable environment to the animals with comparatively low temperature and low temperature humidity index than conventional barn housing system.

Digestibility

Digestibility of nutrients was significantly ($p<0.05$) affected by both housing systems as well as levels of feeding (Table 6). Digestibility was found to be higher in the loose house as compared to conventional barn type housing system. The digestibility coefficients were found to be significantly higher ($p<0.05$) in ICAR 120% level of feeding. It may be because the calves on high plane of nutrition received more nutrient required for higher growth. Similar results were reported by Sahu (2004) and Kumagai *et al.* (2012). Contrary to these, results were reported by Helal *et al.* (2011) and Tomar *et al.* (2014).

Cost of raising buffalo calves

Cost of raising of a calf under different treatments for experimental period and effect of housing systems and levels of feeding on cost of raising of a calf under different treatments for experimental period is presented in Table 7 and Table 8, respectively. The cost per kg body weight gain was higher in treatment T_4 which may be due to higher amount of feeding cost and poor growth of animals due to higher temperature and temperature humidity index (THI) of house which may had caused heat stress in this treatment group. Another reason for higher cost per kg body weight gain may be due to poor digestibility of

Table 1
Chemical composition of feed given to the experimental animals

Ingredients	DM%	OM%	CP%	CF%	EE%	ASH%	NDF%	ADF%	NFE%
Barley	92.06	89.71	10.50	7.02	3.50	2.30	24.23	8.71	76.70
Groundnut cake	92.72	85.74	39.16	8.12	8.31	7.10	23.07	10.12	37.54
Deoiled rice polish	90.07	83.61	14.50	13.09	2.10	6.41	49.23	16.13	64.1
Sorghum	25.00	14.32	7.45	27.01	3.40	10.73	64.87	37.84	51.45
Wheat straw	90.00	78.00	2.81	35.00	1.05	12.16	74.83	51.9	49.14

Whole concentrate mixture (barley, GNC, DORP) alsocontain 2 kg Mineral mixture (MM) and 1kg common Salt.

Table 2
Average fortnightly temperature (ºC) of different housing during experimental period

	Temperature (°C)			
Fortnights	Loose house		Conventional barn	
	Max.	Min.	Max	Min.
1	$36.21^{c} \pm 0.54$	$33.25^{d} \pm 0.43$	$39.78^{a} \pm 0.72$	$29.32^{b} \pm 0.96$
2	$35.14^{c} \pm 0.68$	$32.79^{d} \pm 0.27$	$36.99^{a} \pm 0.96$	$27.07^{b} \pm 0.47$
3	$36.52^{c} \pm 0.62$	$32.77^{d} \pm 0.20$	$38.74^{a} \pm 0.72$	$29.82^{b} \pm 0.72$
4	$38.30^{c} \pm 0.16$	$28.82^{d} \pm 0.32$	$40.66^{a} \pm 0.69$	$26.30^{b} \pm 0.63$
5	$35.04^{c} \pm 0.89$	$27.84^{d} \pm 0.36$	$38.05^{a} \pm 0.89$	$25.41^{b} \pm 0.65$
6	$36.42^{c} \pm 0.32$	$25.38^{d} \pm 0.40$	$39.36^{a} \pm 0.35$	$21.32^{b} \pm 1.57$

Means in Rows with different superscripts differ significantly (p<0.05)

Table 3
Average fortnightly temperature humidity index (THI) of loose house and conventional barn during experiment period

Fortnights	Temperature humidity index (THI)			
	Loose house		Conventional barn	
	Max.	Min.	Max	Min.
1	$87.28^{c} \pm 1.75$	$78.25^{a} \pm 1.25$	$93.40^{b} \pm 0.97$	$75.16^{a} \pm 0.50$
2	$88.71^{c} \pm 1.62$	$76.48^{a} \pm 0.86$	$93.06^{b} \pm 1.04$	$75.54^{a} \pm 0.30$
3	$84.69^{c} \pm 1.20$	$79.36^{d} \pm 0.89$	$93.13^{a} \pm 0.88$	$74.28^{b} \pm 0.30$
4	$87.77^{c} \pm 0.74$	$73.39^{d} \pm 0.94$	$93.03^{a} \pm 0.46$	$71.21^{b} \pm 0.59$
5	$84.95^{c} \pm 0.87$	$72.52^{a} \pm 0.87$	$90.83^{b} \pm 1.03$	$71.85^{a} \pm 0.67$
6	$86.02^{c} \pm 0.51$	$67.03^{a} \pm 1.81$	$90.71^{b} \pm 0.49$	$67.09^{a} \pm 0.55$

Means in Rows with different superscripts differ significantly (p<0.05)

R_` jc 4
Effect of housing systems and levels of feeding on average body weight gain (kg)

T_pg_`jcq	Fms qgl e qwqrck		Dccbgl e jct cj	
	Jmmqc fms qc	Aml t cl rgml _j ` _pl	/ . . # GA? P	/ 0. # GA? P
Gl grg_j ` mbw u cge f r	/ / 0,/ 5 ∫ 6,14	/ / . ,. 6 ∫ 4,42	/ / / ,20 ∫ 4,/ 0	/ / . ,61 ∫ 5,. 5
Dgl _j ` mbw u cge f r	/ 64,36 ∫ 7,44	/ 53,70 ∫ 4,6.	/ 56,45 ∫ 4,4.	/ 61,61 ∫ 4,/ 4
Rmr_j ` mbw weight Gain	52,20a ± 3.70	43,61b ± 1.71	45,03ab ± 2.22	51,. . ab ± 1.75
B_gjw ` mbw u cge f r e_gl	. ,61a ± 0.04	. ,51b ± 0.01	. ,53ab ± 0.02	. ,6/ ab ± 0.01

K c_l q gl Pmu q u grf bgddcpcl r qsncpqapgnrq bgddcp qgel gdga_l rjw &n: . ,. 3'

Table 5
Effect of housing systems and levels of feeding on average water intake (litre) by buffalo calves

Variables	Loose house	Conventional barn	ICAR 100%	ICAR 120%
Daily water intake	$20.97^{a} \pm 0.14$	$23.33^{b} \pm 0.07$	$21.3^{a} \pm 0.17$	$23^{b} \pm 0.11$
Water intake/kg DM consumed	$4.05^{a} \pm 0.03$	$4.49^{b} \pm 0.01$	$4.27^{c} \pm 0.04$	$4.28^{c} \pm 0.02$
Water intake/kg metabolic body weight ($W^{0.75}$)	$0.50^{a} \pm 0.02$	$0.57^{b} \pm 0.02$	$0.52^{ab} \pm 0.02$	$0.55^{ab} \pm 0.02$

Means in Rows with different superscripts differ significantly (p<0.05)

Table 6

Effect of housing systems and levels of feeding on average digestibility coefficient (%) of different nutrients

Variables	Housing systems		Feeding levels	
	Loose house	Conventional barn	ICAR 100%	ICAR 120%
DM	$67.97^{a} \pm 0.14$	$65.46^{b} \pm 0.13$	$65.74^{b} \pm 0.21$	$67.69^{a} \pm 0.29$
CP	$69.88^{a} \pm 0.29$	$68.39^{b} \pm 0.46$	$68.46^{b} \pm 0.39$	$69.81^{a} \pm 0.29$
CF	$53.73^{a} \pm 0.23$	$52.37^{b} \pm 0.37$	$52.07^{b} \pm 0.36$	$54.04^{a} \pm 0.41$
EE	$73.17^{a} \pm 0.16$	$70.83^{b} \pm 0.28$	$71.24^{b} \pm 0.39$	$72.76^{a} \pm 0.20$
NDF	$54.35^{a} \pm 0.53$	$52.46^{b} \pm 0.44$	$52.49^{b} \pm 0.44$	$54.31^{a} \pm 0.32$
ADF	$51.84^{a} \pm 0.29$	$50.50^{b} \pm 0.26$	$50.66^{b} \pm 0.23$	$51.68^{a} \pm 0.29$
NFE	$74.82^{a} \pm 0.37$	$72.77^{b} \pm 0.15$	$73.02^{b} \pm 0.34$	$74.56^{a} \pm 0.21$

Means in Rows with different superscripts differ significantly ($p<0.05$)

Table 7

Cost of raising of a calf under different treatments for experimental period

Variables	Housing systems		Feeding levels	
	Loose house	Conventional barn	ICAR 100 %	ICAR 120 %
Concentrate cost	2786.35	2789.84	2468.66	3107.53
Green cost	819.39	820.01	819.24	820.16
Straw cost	316.66	320.98	316.31	321.33
Total cost	3922.41	3930.84	3604.22	4249.03
Total body weight gain	74.41	65.83	67.25	73.00
Cost/kg body weight	53.49	59.93	54.49	58.93

Table 8

Effect of housing systems and levels of feeding on cost of raising of a calf under different treatments for experimental period

Variables	T_1	T_2	T_3	T_4
Concentrate cost	2468.33	3104.37	2468.99	3110.69
Green cost	818.85	819.94	819.64	820.39
Straw cost	313.93	319.39	318.69	323.28
Total cost	3601.11	4243.70	3607.32	4254.37
Total body weight gain	72.83	76.00	61.66	70.00
Cost/kg body weight	50.25	56.73	58.73	61.13

nutrients. Least cost per kg body weight gain was recorded in loose house and 100% ICAR feeding level because the calves in this group grew faster than the calves raised in conventional barn type housing system and less concentrate level decreased the cost of feeding. Kamboj *et al.* (2007) found that economically rearing of animal could be attained by decreasing concentrate level in feed or by decreasing the quality of concentrate by substituting any ingredient in concentrate mixture.

Results of present study clearly indicates that buffalo calves housed in loose house with standard feeding as per ICAR recommendation during hot-humid weather had better growth and feed conversion efficiency as compared to the calves kept in conventional house under same feeding condition. The cost of raising per kg gain in body weight of calf was also less in loose house as compared to conventional house. Within the limit of present experiment, it can be concluded that loose house with standard 100% feeding as per ICAR recommendation was better for young growing calves in hot-humid weather.

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