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RESEARCH ARTICLE

Effect of Milk Replacer and Early Weaning Diets on Growth Performance of Buffalo Calves during Weaning Period

A. Azim, A.G. Khan, M. I. Anjum* and M. A. Nadeem

Animal Sciences Institute, National Agricultural Research Centre, Islamabad 45500, Pakistan
*Corresponding Author: mianjum_narc@yahoo.com

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ABSTRACT

This study was designed to examine the cost effective feeding system of buffalo male calves for quality meat production. Twelve buffalo male calves of 15-21 days of age and 41 ± 2 kg body weight (BW) were randomly divided into three equal groups. Group A was fed milk replacer (MR) @ 8% of BW for the entire period of 90 days, group B was fed MR @ 4% of BW + early weaning diet (EWD) on *ad libitum* and group C was fed MR @ 4% of BW + EWD for first 45 days and later on EWD only. Average weight gain was 0.42, 0.46 and 0.52 Kg/d and dry matter intake was 0.65, 0.72 and 1.00 kg/d in groups A, B and C, respectively and the difference was significant ($P<0.01$). Feed efficiency was superior ($P<0.01$) for group A (1.55) and B (1.62) compared to C (1.94). Feed cost per kg weight gain of group C was 52 and 25% less than calves in group A and B, respectively. In trial I (at 8th week), digestibility of both DM and CP was higher ($P<0.01$) in group A (96.28 and 94.32%) than B (87.53 and 85.92%) and C (88.32 and 84.46%). Similar trend of DM and CP digestibility was found in trial II (at 12th week). Dressing percentage of group C was the highest ($P<0.05$), however, carcass composition and weights of non-carcass components differed non significantly among groups. Feeding calves MR @ 4% of BW + EWD on *ad libitum* for first 45 days and later on EWD was the most cost effective feeding system.

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INTRODUCTION

Buffalo male calves are being reared conventionally on whole milk suckled directly from their dam's udder twice daily with some green fodder and concentrates. Because of high price of milk, calf rearing on whole milk is very costly; therefore, usually dairy farmers prefer to sell milk instead of feeding to the calves. Majority of male calves are slaughtered when these are 5-15 days old (Khan *et al*., 2002). Small number of calves is raised to 60-80 kg on extremely poor and unbalanced diets. If these calves are raised on balanced diet, they could double the quality beef production in the country. Dairy male calves are generally unwanted by dairy industry that can be used as alternative source for veal and beef production (Albright, 1983).

Calves rearing on whole milk or MR alone are uneconomical because this system has narrow margin of profit. Therefore, it is the need to explore the optimum growth of calves consumed EWD or their combination with MR in early age. Previous studies (Beauchemin *et al*., 1990; Pommier *et al*., 1995) reported that calves can efficiently utilize processed grain in complete diet and the performance was comparable to that obtained from calves fed whole milk. It is necessary to determine cost effective feeding system that will ensure the profit margin of the farming community. Better weight gain and feed efficiency was observed in cow calves (Khan *et al*., 2002) and buffalo calves (Khan and Azim, 2000) fed lysine and methionine supplemented cottonseed meal based EWD compared to non-supplemented cottonseed meal based diet. However, in Pakistan, MR as a substitute of whole milk for calves rearing is completely lacking. The present study, therefore, was planned to determine the cost effective feeding system of buffalo calves for quality meat production.

MATERIALS AND METHODS

Twelve Nili-Ravi buffalo male calves of 15-21 days of age and 41±2 Kg body weight were randomly divided into three groups. In group A calves were fed MR @ 8%

of body weight (BW) for the entire period of 90 days, in group B calves were fed MR @ 4% BW + EWD *ad libitum* and in group C the calves were fed MR @ 4% BW + EWD for 45 days and later on EWD only for the remaining days. Calves were housed in individual pens equipped with feeders and milk-water bucket.

Feeds and feeding

Milk replacer and EWD were formulated and prepared at Animal Nutrition Programme. Milk replacer and EWD were analyzed for their chemical composition (Table 1). Milk products (skimmed milk, whey and casein), vegetable protein sources, vegetable oil, glucose, vitamins and minerals were used for MR whereas, ground maize grains, soybean meal, vegetable oil, molasses, vitamin mineral premix were used for EWD preparation. Ingredient cost per Kg of liquid/constituted MR was Rs. 18.4, while that of early weaning diet was Rs. 20.8 per Kg.

Liquid milk replacer was prepared by diluting milk powder with water as 1:9 and served warm (39˚C) in sterilized stainless steel buckets with rubber nipple in half equal quantities in the morning and evening daily. Each morning the weighed quantities of EWD were offered to respective groups individually. Body weights were recorded in the beginning of the trial and then fortnightly. De-worming and vaccination against hemorrhagic septicemia and foot and mouth disease was done to all the animals at the beginning of trial.

Table 1: Chemical composition (% DM) of milk replacer and early weaning diet

Parameters	Milk Replacer	Early Weaning Diet
Dry matter	90.96	88.9
Crude protein	27.05	23.16
Ether extract	18.47	5.00
Crude fibre	0	3.77
Total ash	4.93	5.29
Nitrogen free extract*	49.55	62.78
Total digestible nutrient*	108.09	84.13

*= Calculated values

Digestibility, slaughter traits and non-carcass components

Two digestibility trials I and II were conducted at 8th and 12th week of experiment respectively. In digestibility trial, 12 calves were used and daily feed intake was recorded. Feed and orts samples were also collected. Total feces voided were collected, weighed, mixed manually and sub-sampled. Feces samples were frozen daily and subsequently composited for each calf. Samples were oven dried at 70˚C and subsequently analyzed for DM and CP content according to AOAC (1990).

At the end of the experiment, three calves per treatment were randomly selected, weighed and slaughtered by Halal method to collect data on carcass characteristics as described by (Mirza *et al*., 2002). Meat was analyzed for DM, CP and EE according to AOAC (1990).

Statistical analysis

Data collected were subjected to analysis of variance by using Completely Randomized Design as described by Steel *et al*. (1997). Significance of difference among treatment means was determined by applying the Duncan's Multiple Range Test.

RESULTS

Data on average daily weight gain (ADG), daily dry matter intake (DMI), feed efficiency and economic efficiency are presented in Table 2. The ADG was 0.42, 0.46 and 0.52 Kg and DMI was 0.65, 0.72 and 1.00 Kg in calves of group A, B and C, respectively. There were significant (P<0.01) differences in ADG and DMI among all groups. Calves in group B and C consumed 9 and 54% more DMI and achieved 9 and 23% higher ADG, respectively than group A. Feed efficiency (kg feed required for per Kg gain) was 1.55, 1.62 and 1.94 in calves of group A, B and C, respectively and the differences were significant (P<0.01) among the groups.

Table 2: Growth performance of buffalo calves reared on different feeding systems

Parameters	*Groups			PSE
	A	B	C	
Average initial weight (kg)	40	42	41	0.5
Average final weight (kg)	77.8^{c}	83.4^{b}	87.8^{a}	0.02
Average daily weight gain (kg)	0.42^{c}	0.46^{b}	0.52^{a}	0.01
Total DM intake (kg)	58.5^{c}	64.8^{b}	90.0^{a}	0.03
Average daily DM intake, (kg)	0.65^{c}	0.72^{b}	1.00^{a}	0.04
Feed efficiency	1.55^{a}	1.62^{b}	1.94^{c}	0.04
Feed cost/Kg weight gain (Rs.)**	211.2	134.4	100.8	--

Different superscripts in the same row differ significantly (P<0.01). PSE = Pooled Standard Error. *Group A fed MR @ 8 % of BW; group B fed milk MR @ 4 % BW + EWD at ad-libitum basis and group C fed MR @ 4 % BW + EWD for first 45 days and later on EWD only. **Ingredient cost per Kg MR was Rs. 18.2, while that of per Kg EWD was Rs. 20.8.

After one month of feeding trial, ADG and DMI was increased significantly (P <0.01) in C group compared to A and B. Feed cost per kg weight gain of calves fed diets A, B and C was calculated (Ogundola, 1981) to be Rs. 211.2, 134.4 and 100.8, respectively. Feed cost per kg weight gain was noted 52 and 25% higher in calves of group A and B than group C, respectively.

Dry matter and CP digestibility during 8th and 12th week of experiment are given in Table 3. In digestibility trial I, DM digestibility was 96.28, 87.53 and 88.32% and CP digestibility was 94.32, 85.92 and 84.46% in group A, B and C, respectively. Digestibility of both DM and CP was higher (P<0.01) in group A than B and C; however, no difference was found between later two groups. Similar trend of DM and CP digestibility was found in trial II.

Table 3: Apparent digestibility in buffalo calves reared on different feeding systems

Digestibility (%)	Groups			PSE
	A	B	C	
Trial I				
Dry Matter	96.28^{a}	87.53^{b}	88.32^{b}	2.80
Crude Protein	94.32^{a}	85.92^{b}	84.46^{b}	2.96
Trial II				
Dry Matter	95.39^{a}	84.73^{b}	80.35^{b}	4.47
Crude Protein	94.00^{a}	82.93^{b}	78.54^{b}	4.60

Different superscripts in the same row differ significantly (P<0.05). PSE = Pooled Standard Error.

Results of carcass characteristics are shown in Table 4. Dressing percentage on slaughter weight was 51.59, 52.40 and 56.67 and on empty body weight was 59.59, 59.96 and 63.71 for group A, B and C, respectively. Significantly (P<0.01) higher dressing percentage was found in calves of group C both on slaughter weight and empty body weight basis; however, no difference was found between A and B groups. Weight of trotters, rumen, intestine and hide was comparatively higher in group C than other groups but the difference was non-significant. Similarly, there was no significant difference in weights of heart, liver, lungs, spleen and kidney among the groups. Chemical composition of veal is presented in Table 5. Results showed that dry matter content of veal was 28.67, 29.51 and 30.17 in group A, B and C, respectively. The range of protein was from 77.80 to 79.23%. The highest value was found in group A as compared to B and C, while ether extract was higher in group C but the difference was non-significant among the groups.

Table 4: Slaughter traits and non-carcass components of buffalo calves reared on different feeding systems

Parameters	Groups			PSE
	A	B	C	
Dressing Percentage				
Slaughter weight	51.59^{b}	52.40^{b}	56.67^{a}	1.58
Empty body weight	59.59^{b}	59.96^{b}	63.71^{a}	1.32
Non-carcass components (Kg)				
Liver	1.80	1.50	1.85	0.11
Heart	0.80	0.20	0.77	0.19
Lungs	1.15	1.37	1.70	0.26
Spleen	0.35	0.40	0.41	0..02
Kidney	0.55	0.57	0.60	0.01
Head	5.62	6.50	6.50	0.29
Trotters	4.80	4.62	5.00	0.11
Rumen and intestine	9.00	9.30	11.00	0.62
Hide	12.00	12.50	13.00	0.29

Different superscripts in the same row differ significantly (P<0.05). PSE = Pooled Standard Error.

Table 5: Carcass composition of buffalo calves reared on different feeding systems

Carcass composition (%)	Groups			PSE
	A	B	C	
Dry matter	28.67	29.51	30.17	0.43
Crude protein	79.21	78.77	77.80	0.41
Ether extract	13.49	15.41	17.22	1.08

Different superscripts in the same row differ significantly (P<0.05). PSE = Pooled Standard Error.

DISCUSSION

Average daily gain and DMI was significantly higher in calves of group C compared to group A and B after 45 to 90 days of experiment. These results substantially supported by Ogundola (1983) who reported that calves weaned at 7 weeks of age consumed more diet than those calves weaned at 3 and 4 weeks. Our results also supported by Alam *et al*. (1995), who suggested that buffalo calves can be weaned without impairing the growth and health conditions. Feed efficiency appeared to improve significantly in calves fed liquid diet (group A) than calves fed solid diets (group B and C) might be due to higher biological value of liquid diet as reported by Khan and Azim (2000).

It has been observed that those calves (group B and C) started consumption of DM at early age weaned successfully with improved (P<0.01) ADG and DMI than the calves fed liquid diet (group A) however, calves of group C performed better when completely shifted on EWD after 45 days than the calves fed MR+EWD and MR only throughout the experiment. This might be due to the earlier reticuloruminal development of calves fed solid diet. Similar findings have been reported by Harrison *et al*. (1960), who reported that solid feed stimulates gastrointestinal tract development in young calves. Sinhal *et al*. (1978) reported that micro-flora need longer time to establish in rumen of the calves fed whole milk compared with the calves fed starter ration.

Cost of feed per Kg gain was 52 and 25% higher in calves fed MR (group A) and MR + EWD (group B) than the calves of group C, respectively. Similar findings have been reported by Wina *et al.* (1996), who reported that cheaper milk substitute resulted increase per head profit than a commercial milk replacer.

Presumably, group A had higher DM and CP digestibility because of high biological values of liquid diet than other two groups consumed solid diet. The result is in accordance with the findings reported by Khan *et al.* (2002), who suggested that digestibility of DM and CP was (P<0.05) higher in cow calves fed milk replacer than EWD. No changes in DM and CP digestibilities between calves groups B and C fed solid plus liquid diets are in line with Obitsu *et al*. (1995), who reported that apparent digestibility of organic matter and nitrogen did not differ between age of 10 to 15 weeks when calves weaned at the age of 6th weeks. Leibholz (1975) reported that the ruminal digestibility of dry matter in calves weaned at 5th week of age reached the adult level by 8th week of age when calves were fed high concentrate diet.

The highest (P<0.01) dressing percentage in calves of group C both on slaughter weight and empty body weight basis might be due to higher fat content in carcass that resulted may be due to high starch in EWD. Özlütürk *et al.* (2008) observed hot carcass dressing percentage 59.6 and 62.9 in Eastern Anatolian Red bulls finished between 168 and 210 days period, respectively.

In conclusion, fed on MR @ 4% of BW plus EWD *ad libitum* for 6 week and later on EWD is proved to be most cost effective feeding system for buffalo calves rearing.

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