Research Journal of Animal Sciences 2 (1): 1-4, 2008
ISSN: 1993-5269

Effects of Compensatory Growth on Carcass Traits of Male Buffalo Calves in West Azerbaijan Province of Iran

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Abstract: In order to study compensatory growth in male buffalo calves, in a completely randomized design (3 treatments and 8 replicates), 24 male buffalo calves nutritionally restricted for groups 0 (control), 3 (group2) and 5 month (group3) periods. In restriction period, the calves received only forage (80% wheat straw and 20% alfalfa hay) ad libitum. Later in re-alimentation periods they were offered not only forage as such restriction period but also, 35 g, concentrate (beet pulp 46%, wheat bran 28%, barley grain14% and cotton seed meal 12%) per kg metabolic Body Weight ($BW^{0.75}$) of the calves. Data obtained from the experiment in restriction period show that carcass yield and lean meat was the highest in control group and the lowest for group 3. Carcass bone and fat was the lowest in control group and the highest in groups 3 and 2, respectively. In realimentation period show that carcass yield was the highest in group 2 and the lowest for group 3. Carcass lean meat and fat was the highest in control group and the lowest for group 3. The lowest and the highest carcass yield were for group 3 and 2, respectively. Carcass bone was the lowest in control group and other groups were the same.

Key words: Male buffalo calves, compensatory growth, carcass yield, restriction, realimentation

INTRODUCTION

Livestock production systems in Iran mainly depend on natural vegetation of the range and farmlands. Seasonal variations in feed quantity and quality cause periods of live weight loss and gain in growing animals. The productivity of the animals is low compared to performance of the same species in more favorable environments, but their ability to survive in bad periods is remarkable. Determining the physiological changes during feed quality restriction and subsequent periods of compensatory growth may be used to overcome these problems (Kamalzadeh *et al*., 1997).

The ability of animals to compensate for prior under nutrition is affected by: The severity and duration of the period of under nutrition (Zubair, 1994). The stage of development (relative to maturity) of the animal (McMurtry *et al*., 1988; Zubair and Leeson, 1994). Diet nutrient content during re-alimentation. Level of feed intake during re-alimentation (Ryan *et al*., 1993a). Period of re-feeding (Ryan *et al*. 1993a). Genotype and sex. Differences in compensatory responses between genotypes within a species appear to be more pronounced than differences between sexes. As well, it is not only the growth rates that are known to differ, but the final body composition can also be influenced (Carstens *et al*., 1991; Hogberg and Zimmerman, 1978; Plavnik and Hurwitz, 1985, 1991).

Buffalo is traditionally considered a slow-growing animal. This trait has a direct bearing on early maturity and age at first calving in this species. Whether located at the farmer's household or in an organized livestock farm, the buffalo is normally a neglected individual in terms of the quality and quantity of feeding as well as other supporting manages mental cares. This compounds the biological constraints on growth and maturation.

Body composition is dynamic and changes continuously in response to environmental factors. Knowledge of sources of variation of body composition can help in developing strategies to alleviate undesirable effects of poor nutrition on growth and to optimize the use of feedstuffs by animals. Body composition changes in animals undergoing compensatory growth (Wilson and Osborn, 1960; Butler-Hogg, 1984; Carstens *et al*., 1991). Various reports have indicated increases in fat content and others have reported increases in in protein and water of refed animals (Turgeon *et al*., 1986; Carstens *et al*., 1991). In other reports body composition was not affected by period of feed restriction followed by realimentation (Thornton *et al*., 1979; Drouillard *et al*., 1991).

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There is no published data available on the effects of compensatory growth on weight of body organs and carcass composition of West Azerbaijan buffaloes. This study was conducted to determine the effects of restricted feeding on the carcass traits.

MATERIALS AND METHODS

Animals and treatments: A total of 24 male Azeri buffalo calves, initial age and weight of 8 mo and 140 kg, were divided into three groups of similar live weight. In each group, eight calves were randomly penned in individual stalls allowing for experimental feeding. Each group was randomly assigned to one of the three treatments. The first group (control, CG) was given from the beginning to a fattening diet allowing for rapid growth for 12 mo. The fattening diet was based on ad-libitum forage (20% alfalfa and 80% wheat straw) complemented with a concentrate (48% sugar beet pulp, 28% wheat bran, 14% barley grain and 12% cotton seed meal) fed 35 g per kg metabolic Body Weight (BW0.75) of calves (Table 1). The other groups (G2 and G3) subjected to restricted feeding 3 and 5 mo, respectively, following the re-alimentation for the end of the experiment (Fig. 1).

In restriction period, the calves in G2 and G3 received only forage (80% wheat straw and 20% alfalfa hay) ad libitum. Later in re-alimentation periods they were offered not only forage as such restriction period but also, 35 g, concentrate (beet polpe 46%, wheat bran 28% and barley grain 14% and cotton seed meal 12%) per kg metabolic Body Weight ($BW^{0.75}$) of calves.

Measurements: Four calves were slaughtered at the beginning, after the end of restriction and realimentation periods from each group, respectively. Feed was withdrawn 16h before slaughter. After slaughtering, carcass were weighed hot and spilt longitudinally. Then the alimentary tract was weighed full and empty. Visceral organs such as internal fat, abdominal fat, heart, liver and kidney were weighed separately. The left carcass half was stored at -20 for 24 h. Then it was weighed and separated to lean meat, fat and bones.

Statistical analysis and mathematical modeling: A total of 24 calves were divided into three groups of similar live weight. In each group, eight calves were randomly penned in individual stalls allowing for experimental feeding (Fig. 1). Data relative to , carcass composition and organs were analyzed using GLM procedure based on completely random design and the means of the treatments were subjected to Duncan's multiple range test using Spss software Ver 11.

Table 1: Dry matter composition of experimental diets*

Ingredients	Roughage	Concentrate
Alfalfa	0.2	0
Wheat straw	0.8	0
Wheat bran	0	0.28
Cotton seed meal	0	0.12
Sugar beet pulp	0	0.46
Barley grain	0	0.14
Total	1	1
ME (Mcal day^{-1})	1.58	2.83
CP (%)	5.97	13.9
Ca (%)	0.47	0.41
P (%)	0.23	0.61

*Ca, P, K, NaCl, trace elements and vitamins A, D and E were supplemented at concentrations to meet or exceed NRC recommendations

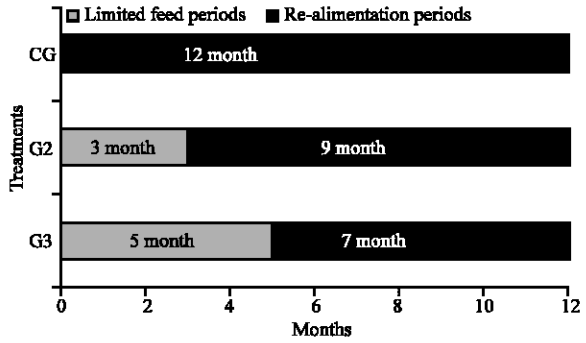

Fig. 1: Experimental design. Bars relative to fattening of Control Group (CG) or limited feed periods for 3, or 5 mo. (G2 and G3) before a re-alimentation period in buffalo male calves.

RESULTS AND DISCUSSION

Carcass characteristics and body organs of different groups at the beginning, after the end of restriction and realimentation periods are shown in Table 2 and 3. Data obtained in initial period for all groups was the same, because of the same slaughtering weight at the beginning for all groups. Hot and cold carcass weights in all periods were not statistically different ($p>0.05$). Nevertheless, in restricted period, G2 and G3 had lower values than CG. It may be related to feed restriction and lower growth rate in these groups than CG. In realimentation period, following increased growth rate in G2 and G3, the values were improved. The values of G3 were lower than G2. It is the reflection of the compensatory growth. These findings are in agreement with Kabbali *et al.* (1992) but in contrary with Coleman *et al.* (1993). This confliction may arise from the factors affecting the compensatory period such as animal's age, stage of maturity, weight, sex and breed (Pearson and Datson, 1993; Sainz *et al.*, 1995). There is no published data regarding to the compensatory growth in Iranian buffalo calves.

Table 2: Carcass characteristics and body organs of different groups

		Groups				
Traits (%)	Periods	CG	G2	G3	SEM	p
	Initial	43.2	43.2	43.2	0.00	ns
Hot carcass yield	R	45.040	43.190	42.820	1.08	ns
	RA	50.51	51.22	47.65	1.24	ns
	Initial	42.09	42.09	42.09	0.00	ns
Cold carcass yield	R	44.030	42.230	42.210	1.02	ns
	RA	49.82	50.59	46.83	1.17	ns
	Initial	7.83	7.83	7.83	0.00	ns
Empty stomach	R	7.76	7.32	6.7	0.363	ns
and small intestine	RA	6.65	6.85	7.9	0.369	ns
	Initial	0.41	0.41	0.41	0.00	ns
Heart	R	0.430	0.40	0.390	0.023	ns
	RA	0.38	0.41	0.42	0.019	ns
	Initial	1.55	1.55	1.55	0.00	ns
Liver	R	1.300	1.190	1.020	0.052	*
	RA	1.05	1.09	1.12	0.032	ns
	Initial	0.793	0.793	0.793	0.00	ns
Visceral fat	R	2.165	1.391	1.391	.099	ns
calves	RA	2.165	2.195	2.326	.097	ns

Table 3: Carcass components of different groups

		Groups				
Traits (%)	Periods	CG	G2	G3	SEM	p
% of carcass weight						
	Initial	66.7	66.7	66.7	0.00	ns
Lean meat	R	64.900	64.510	64.370	1.1	ns
	RA	69.27	68.46	67.71	1.16	ns
	Initial	26.45	26.45	26.45	0.00	ns
Bone	R	24.5	27.44	27.76	0.858	ns
	RA	22.31	23.71	23.71	0.697	ns
	Initial	6.85	6.85	6.85	0.00	ns
Fat	R	8.150	7.620	7.60	0.312	ns
	RA	8.41	7.79	7.80	0.325	ns

Table 4: Average daily Live Weight Gain (LWG) of groups (g d^{-1}) and (g/day/kgBW$^{0.75}$)

		Groups			
Traits (%)	Periods	CG	G2	G3	SEM
LWG (g d^{-1})	R	504a	157b	89c	222.583
	RA	445	465	448	10.786
	T	459a	405ab	323b	68.479
LWG (g kg^{-1} BW$^{0.75}$)	R	12.25a	3.83b	2.14c	5.415
	RA	8.68	10.11	9.61	0.726
	T	11.22a	9.78ab	7.73b	1.754

Empty stomach and small intestines, liver, heart and visceral fat of any group were not significantly different ($p>0.05$). However, it seems that the values trends have diminishing in restricted and rising in realimentation periods. Although the differences among the treatments were not significantly different, however the trend shows the effects of restricted and re alimentation, respectively. These organs are shown to be the sensitive to nutritional stress, which decline in restriction and growing up in re feeding periods. These observations are in agreement with Kabbali *et al.* (1992) but in contrary with Coleman *et al.* (1993). This confliction may arise from the factors mentioned above.

Lean meat, bone and fat percent of carcass among the experimental groups were not significantly different ($p>0.05$). However lean meat and fat values in G2 and G3 were lower and bone values were higher than CG in restricted period. Reverse trend has been observed for the traits in realimentation period. Increasing the bone parallel to the decrease in carcass lean in restricted period is reasonable. Pirmohammadi and Amini (2006) reported a complete compensatory growth in group 2 and partial one in group 3. It is clear that higher growth rates may lead to the higher lean and fat and less carcass bone.

Generally it may be concluded from this study that G2 performed more beneficially than other groups, because of consuming poor quality feed but the same carcass performance as CG. More investigation should be done to determine the effects of different periods of restriction, age, feed composition and duration in re alimentation period for carcass characteristics of buffalo calves.

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