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EFFECT OF DIFFERENT DIETARY ENERGY LEVELS ON MILK PRODUCTION IN LACTATING NILI-RAVI BUFFALOES

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ABSTRACT

Multiparous lactating Nili-Ravi buffaloes (n= 27) were selected and randomly divided into three groups with nine animals in each under a completely randomized design. Three diets were formulated, being iso-nitrogenous but having varying energy levels, viz; E-100 (Control), E-80 and E-120; E reflecting energy followed by percentage energy in relation to NRC recommended levels for lactating cows. Milk yield did not differ between diets E-100 and E-120 (10.63±0.165 and 10.87±0.124 kg/day, respectively) but was lower ($P<0.05$, 8.41±0.135 kg/day) on diet E-80. Dry matter intake (DMI), daily weight gain and milk composition did not differ ($P>0.05$) among the dietary treatments. However, feed efficiency in terms of fat corrected milk (FCM) per unit /DMI was lower ($P<0.05$) in animals fed diet E-80 (0.89 ± 0.019) than those on the other two treatments. Likewise, cost of feed per kg FCM was higher ($P<0.05$) in this group (17.85 ± 0.28 PK-Rs). It was concluded that feeding lactating Nili- Ravi buffaloes a diet containing more (i.e., 120 %) than the NRC level of ME recommended for large breed dairy cows conferred no advantage whilst feeding a diet containing less than the recommended level decreased both milk production and feed efficiency.

Key words: Dietary energy, lactation performance, Nili-Ravi. Buffalo.

INTRODUCTION

Buffalo is considered as the best dairy animal in Pakistan, accounting for more than 62 % to total milk (GOP, 2010). The country is bestowed with the best breeds of buffalo namely; Nili, Ravi, Nili-Ravi, Kundhi and Azi Kheli (Khan *et al*., 2007). The production level of these breeds is much lower as compared to the dairy cattle breeds of the developed world averaging 7500 kg per lactation (Khan, 2002). However, their yield is compared well with other buffalo breeds of the world. Nili-Ravi buffalo has more milk potential which can better exploited by appropriate feeding. Traditional system of raising animals either by grazing or by providing green fodder with or without any supplementation are not satisfactory as they are unable to meet the nutrient requirement of animals particularly energy, protein and minerals. Of nutritional needs, energy is one of most critical nutrients which may affect production performance. Earlier studies (Grummer and Carroll, 1988; Gong *et al*., 2002) reported that sufficient dietary energy is an important factor in lactating animals which may prevent negative energy balance and other metabolic disorders. Lactating animals fed low energy diet may able to produce equal quantity of milk than diets at or above NRC recommendations, but decline rapidly after twelve weeks of lactation (Hoogendoorn and Grieve, 1970). Literature is deficient with reference to the nutritional needs of buffalo animals in general and lactating buffaloes in particular. Keeping in view these facts, the present study was designed to evaluate optimum energy requirements of lactating Nili-Ravi buffaloes.

MATERIALS AND METHODS

Multiparous lactating Nili-Ravi buffaloes (n = 27) from the herd of Livestock Production Research Institute Bahadurnagar, Okara were selected and randomly assigned to three dietary treatments i.e., E-100 (Control), E-80 and E-120 under completely randomized design experiment in which each treatment had nine animals. Iso-nitrogenous diets (12.5, 12.4 and 12.7 crude protein, respectively) having varying energy, E-100 (Control), E-80 and E-120 percent of NRC level recommended for lactating cows were fed to the respective treatment groups for a period of 75 days. Throughout the study period the measured quantity of either diets E-100, E-80 or E-120 was offered daily in the morning and evening to individual animals and orts were measured the next morning to determine daily feed intake. These rations (Table 1) were fed *adlibiltum* to the experimental groups having energy at, below and above per National Research Council (NRC, 2001) recommendations for large dairy cattle breeds.

Feed intake of each animal was recorded daily, whereas body weight of the buffaloes was determined early in the morning at each fortnight before offering fresh feed. Milk production was recorded daily and milk samples were collected weekly for milk composition analysis. Feed efficiency (FCM/DMI) was calculated by dividing DM intake (kg) with FCM (kg). Likewise, feed cost/kg FCM milk was calculated by dividing feed cost with total milk yield (kg). Proximate analyses of feed samples were conducted according to the procedures of AOAC (2000). Neutral Detergent Fiber (NDF) and Acid Detergent Fiber (ADF) were determined as described by Van Soest *et al*. (1991). Milk composition (milk fat, solids not fat, milk protein, lactose and total solids) analyses were carried out using the Lactoscan-S Milk Analyzer (50 W, Milkotronic Ltd., Bulgaria) at the Quality Operation Laboratory, University of Veterinary and Animal Sciences, Lahore. Metabolizable energy of ingredients was calculated from digestible energy as follows:

ME (Mcal/kg) = 1.011*D.E (Mcal/kg) -0.45 (NRC, 2001).

The data were analyzed through one way ANOVA techniques under Completely Randomized Design (Steel et al., 1997) using SAS 9.1.3 portable software. The differences among treatment means were tested through Duncan's Multiple Rang Test (Duncan, 1955).

RESULTS

The effect of varying dietary energy levels on different parameters in Nili-Ravi lactating buffaloes is given in Table 2. Milk yield did not differ (P>0.05) between animals fed diets E-100 and E-120 (10.63±0.165 and 10.87±0.124 kg/d, respectively), however it was significantly lower (P<0.05) fed on diet E-80 (8.41±0.135 kg/d). The same pattern was observed in the case of fat corrected milk (4% fat). Dietary energy level had no effect (P>0.05) on the percentage of milk constituents. The overall average percentage of milk fat, protein, lactose, solids not fat and total solids were 8.04, 4.42, 4.88, 9.62 and 17.34, respectively.

The overall average DM intake was 15.94 kg/d. with no difference in DM among the dietary treatments. Similarly, the average daily gain was not affected (P>0.05) by dietary treatments. The overall average live weight gain was 240 g/d. In case of feed efficiency, buffaloes fed E-100 and E-120 diets (1.09 ± 0.025 and 1.13 ± 0.020, respectively) showed similar efficiency, but was lower (P<0.05) on E-80 diet B (0.89 ± 0.019).

The cost of feed per kg milk produced in buffalo on diet E-80 was higher (P<0.05) than on diets E-100 and E-120.The cost between diets E-100 and E-120 did not differ (P>0.05).

DISCUSSION

Optimum performance of lactating buffaloes in terms of milk yield was observed in those animals fed on diet having dietary energy according to NRC recommendations for large dairy cattle breeds. This study confirms that the NRC recommendations for large dairy breed cows are suitable for Nili-Ravi buffaloes. Further, there was no advantage to feed lactating buffaloes above NRC recommended levels (E-120) for more milk yield while, it is detrimental to feed below these levels (E-80) as milk production decreased. Our results are partly in line with Patton *et al*. (2006) who reported that increasing dietary energy up to recommended level within 1st month of lactation enhanced milk yield. Conversely, Grummer *et al*. (1995) found increase in milk yield by providing extra dietary energy beyond NRC recommendation in lactating cows. The possible reason for this contradiction might be difference in species of animals and animals' physiological status.

The contents of milk fat, protein, lactose, solids not fat and total solids were not influenced (P>0.05) by varying dietary energy levels in lactating Nili-Ravi buffaloes. The results are in agreement with the findings of Aghaziarati *et al.* (2011) who concluded that **e**nriched dietary energy and protein with varying milking frequency did not affect milk fat and protein percent. Likewise, Komaragiri *et al*. (1998) also found that milk production and composition were not affected by feeding an energy-rich diet (added dietary fat) to Holstein cows. However, Vazquez-Anon *et al.* (1997) who studied the effect of high energy diet during mid to late lactation and concluded that increasing dietary energy density enhanced milk protein yield. The possible reason might be difference in lactation stage and the proportion of rumen undegradable protein in the diet.

Different dietary energy levels did not influence DM intake in lactating Nili-Ravi buffaloes. The results of present study are in agreement with those reported by Aghaziarati *et al.* (2011) who reported that different dietary energy density did not affect DM intake in Holstein cows. Similarly, Broderick (2003) also reported no effect of varying energy and protein levels on DM intake. However, contradictory to our findings, Vazquez-Anon *et al.* (1997) observed that increasing dietary energy density improved DM intake.

In a study on the peri-urban buffalo farms near Peshawar, the overall mean value of ME intake was 174.5± 1.1 MJ/day and was lower in the normal than the low breeding season calvers (P<0.01, Qureshi, et al, 2002). Increasing energy intake increased BCS (r=0.16) and duration of expulsion of placenta (r=0.19) and discharge of lochia (r=0.24) but decreased postpartum ovulation interval (r=-0.27, p<0.01).Prepartum ME intake was higher in animals observed in oestrous than those remaining anoestrous (177.2 vs 155.9 MJ/day, P<0.05). As per prevailing practice the animals were fed on same scale irrespective of production, so the increasing intake of ME exhibited a favorable affect on productivity and fertility.

The average daily gain was not affected by varying dietary energy levels in buffalo during the early lactation stage. Similar results have been previously reported by Lalman *et al.* (2000) who found that weight change at early lactation stage was not affected by increasing dietary energy density and Grummer *et al.* (1995) who reported that body weight changes were not affected by dietary fat supplementation postpartum. In contrast, Broderick (2003) reported that increasing dietary energy density improved weight gain in lactating cows. The possible reason for this contradiction might be difference in species and stage of lactation in experimental animals. Further, feeding above NRC level for large dairy breed cows to buffaloes did not prove advantageous in either milk yield or daily gain and excreted unutilized which caused economic losses.

Feed efficiency (FCM/ DMI) was affected by varying energy levels of diets. Optimum performance recorded in diets E-100 and E-120 These findings are partly in accordance with the earlier studies (Broderick, 2003; Tarazon-Herrera *et al.,* 2000) who reported that increasing dietary energy in diet up to recommended level increased feed efficiency (milk yield/DMI) in lactating cows.

Table 1: Ingredient and nutrient composition of experimental diets

Ingredients	Experimental diet		
	E-100	**E-80**	**E-120**
Cotton seed cake	23	30	-
Maize oil cake	10	8	25
Maize gluten 30	-	-	15
Barley	10	0	20
Wheat bran	20	25	-
Wheat straw	10	22	-
Rice polishing	10	-	20
Molasses	15	13	18
Salt	01	01	01
Mineral mixture *	01	01	01
Total	100	100	100
CP (%)	12.5	12.4	12.7
ME (M Cal/kg)	2.4	1.92	2.88
NDF (%)	31	42	09
ADF (%)	19	27	05

*100 kg mineral mixture included 70.81 kg DCP, 18.91 kg NaCl, 8.64 kg $MgSO_4$, 0.89 kg $FeSO_4$, 0.49 kg $MnSO_4$, 0.22 kg $ZnSO_4$, 0.03 kg $CuSO_4$, 8.77 g KI, 0.89 g $CoCl_2$ and 1.5 g $NaSiO_3$.

Table 2: Effect of varying dietary energy levels on feed intake and milk production in Nili- Ravi Buffaloes

Description	Energy levels (%)		
	100	**80**	**120**
Milk Production (Kg/d)			
Milk yield	10.63 ± 0.165 [a]	8.41 ± 0.135 [b]	10.87 ±0.124 [a]
FCM	17.65 ± 0.27 [a]	13.69 ± 0.22[b]	18.05 ± 0.2 [a]
Milk composition (%)			
Fat	8.12 ±0.098 [a]	8.0 ±0.151 [a]	7.97 ±0.0702 [a]
Protein	4.40 ±0.04 [a]	4.41 ±0.0309 [a]	4.44 ±0.044 [a]
Lactose	4.87 ±0.040 [a]	4.86 ±0.033 [a]	4.91 ±0.026 [a]
Solids not fat	9.62 ±0.113 [a]	9.54 ±0.132 [a]	9.70 ±0.102 [a]
Total solids	17.40 ±0.138 [a]	17.32 ±0.149 [a]	17.33 ±0.072 [a]
DM intake (kg/d)	16.16 ± 0.20 [a]	15.66 ±0.28 [a]	16.0 ± 0.25 [a]
Avg. daily gain (g/d)	228.0 ± 25.0 [a]	228 ±25.0 [a]	263 ± 17.0 [a]
FCM/DMI	1.09 ± 0.025 [a]	0.89 ±0.019[b]	1.13 ± 0.02[a]
Cost of feed/kg FCM (PKR)	15.38 ± 0.23 [a]	17.85 ±0.28[b]	15.23 ± 0.17 [a]

Values having different superscripts within same row are significantly different ($P<0.05$).

Conclusion: It is concluded that provision of dietary energy as recommended by NRC, 2001 for large breed dairy cattle is also suitable for optimum performance in lactating Nili-Ravi buffaloes under environmental conditions of Pakistan.

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