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LACTATION RESPONSE TO THE SUPPLEMENTATION OF FATS AND NIACIN IN NILI-RAVI BUFFALOES

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ABSTRACT

The objective of the study was to compare the effect of supplying vegetable oil and rumen by pass fats with or without supplying niacin in rations for buffaloes. Project was planned in Completely Randomized Design. Twenty lactating buffaloes were allocated with 5 different dietary treatments: A) Ctrl: Basal diet containing 18% CP; B) Ctrl + Oil; C) Ctrl + Oil + Niacin; D) Ctrl + bypass fat; E) Ctrl+ bypass fat + Niacin in a continuous scheme. The cumulative forage intake was not affected by the treatments; whereas concentrate intake varied across the treatments. Milk yield remained unaffected by the treatments. Supplementation of oil and by pass fat increased milk fat and lactose concentration with or without using niacin compared to control (Ctrl). Milk protein remained unaffected with the treatments effects. Plasma urea and glucose contents also varied with the treatments. It can be concluded that using by-pass fat or oil increase milk fats and can be used as a substitute of each other.

Key words: Nili Ravi Buffaloes, Fats, Niacin, Performance

INTRODUCTION

Pakistan's milk supply depends majorly on buffaloes (up to 65%) which contains bulk of nutrients in terms of more milk protein, fats, and lactose contents compared to cow's milk. Interestingly, in Pakistan the traditional dairy farmers use vegetable oil as component of buffalo feeding to improve health status, milk yield and fat contents. The price structure of milk market rely on total solids components where milk fats play a pivotal role in this regard. Use of fats in different form is already a routine practice in high yielding buffaloes. Studies in dairy animals showed an increase in milk fat (Fahey *et al*., 2002; Schroeder *et al*., 2003; Zheng *et al*., 2005; Palmquist and Griinari, 2006) after utilization of fats as an energy source. The positive relationship between supplementation of fats with milk fats is related with a higher demand of energy in different phases especially in early lactation when animal in under production stress. The use of oils (or rumen available fats) could be hazardous to the rumen environment as it may affect the rumen fermentation process as the unsaturated fatty acids bind more to the bacteria especially fibrolytic micro flora. On the other hand, several by-pass fat soaps bound with calcium offer safer supply of energy to the animals. In Pakistan, temperature and humidity are the two major factors that adversely affect the productivity of livestock. As an anti-stress vitamin, B_3 (Niacin) has been shown to improve the performance of dairy animal (Knapp and Grummer, 1991, Al-Haidary *et al*., 2003) by increasing the peripheral blood circulation of the body to improve sweat gland activity. Keeping in view the importance of using fats and niacin, the objective of the current study was to evaluate the response of supplying vegetable oil and rumen by pass fats with or without addition of niacin in ration of dairy animals.

MATERIALS AND METHODS

Animal, Experimental Design and Treatments: The trial was conducted at the Buffalo Research Institute (BRI) Pattoki, Pakistan using Completely Randomized Design. For this purpose, twenty lactating buffaloes were randomly allocated with 5 different treatments: A) Ctrl: Basal diet containing 18% CP (level adjusted according to production level of animals) B) Ctrl + Oil; C) Ctrl + Oil + Niacin; D) Ctrl + bypass fat; E) Ctrl+ bypass fat + Niacin in a continuous scheme. Complete dietary protocol is depicted in Table 1.The duration of experiment was 70 days in which first 15 days were used as adaptation period.

Diets and Management: Buffaloes were offered 45 kg green forage (Berseem), 5kg wheat straw, whereas concentrate was fed based on their production status (1kg of concentrate/3kg of milk yield) twice a day at 8:00 and 17:00 (Table 1).All experimental rations were all iso-nitrogenous, whereas the net energy for lactation (NRC, 2001) was variable due to addition of oil or by-pass fat. Niacin was supplemented on top at the rate of 15g / day in group C and E. Buffaloes were milked at 6:00 and 16:00 every day. All experimental animals had free access to fresh water during the trial.

Samples Collection, Preparation and Analysis: Dietary intake was determined for each buffalo by weighing green fodder offered and fodder refused. Feed samples were analyzed in laboratory of Animal Nutrition Division, Buffalo Research Institute, Pattoki, District Kasur and laboratory of Dept. of Animal Nutrition, UVAS, Lahore for dry matter, crude protein, crude fibre, ether extract and ash concentration (A.O.A.C., 1990). Milk yield was recorded twice a day whereas milk samples were collected on weekly basis to determine milk fat, lactose, protein contents, pH and specific gravity.

Plasma Metabolites: The blood samples from each buffalo were collected on monthly basis. After collection in EDTA, these samples were immediately centrifuged for 15 minutes at 5000 rpm at 4°C. The extracted plasma was used to analyze total protein, urea, cholesterol, and blood glucose. The total protein was analyzed by commercial kits (Randox Laboratory) using Biuret Method at a wavelength of 546 nm. Cholesterol was determined at 500 nm. For glucose, GOD/PAP liquid method was used to measure the absorbance 500 nm. Modified Urease-Berthelot method was used for detection of urea in the plasma.

Statistical Analysis: The data thus obtained were statistically analyzed through analysis of variance technique under Complete Randomized Design (Steel *et al*., 1997).

RESULTS

Feed Intake, Milk Yield, and Milk Composition: The cumulative forage intake was not affected by the treatments (Table 2; P = 0.16); however, it increased in treatments D and E where by-pass fat was used with or without niacin respectively, compared to control(45.5Kg/d). On the other hand, the concentrate intake varied among the treatments (P = 0.01) and was similar in oil or by-pass fat based diets, except that the response in treatment E (bypass fat + Niacin) was similar as in treatment A (3.83kg). Milk yield remained unaffected by treatments (P = 0.55) except that it was highest in treatment B (7.70kg/d) compared to other treatments. Fat contents increased in all treatments compared to Ctrl up to 5.27% (P = 0.01) and were highest in the treatment E (by-pass fat+ niacin).Fat contents in group E were 2.41%more than Ctrl. Solid-not-fat contents were highest in treatment D (by pass fat) compared to Ctrl and varied across all treatments (P < 0.01). Protein contents remained unaffected with the treatments (P = 0.79). Lactose contents increased in all treatments (P = 0.01) and the highest contents were observed in treatment E (by-pass fat+ niacin).

Plasma Metabolites: Plasma urea concentration increased across the treatments (Table 3; P = 0.04) where the highest concentration was observed in treatment B (oil) compared to A (Ctrl). Similarly plasma glucose levels varied across the whole range of treatments (P = 0.02) and the highest concentration was observed in treatment A (Ctrl) and C (Oil + Niacin) compared to others.

Table 1. Ingredient composition and nutritive values of concentrate used in different treatments.

Ingredients, %	Ctrl	Oil based	By-pass fat based
Corn gluten meal, 30%	4.1	9.2	9.2
Canola Meal	13.3	15.4	15.4
Sunflower meal	10.3	12.3	12.3
Cotton seed cake	15.6	8.3	8.3
Wheat Bran	20.1	15.1	15.1
Rice Polish	10.4	10.4	10.4
Maize	12.0	10.0	10.0
Molasses	11.9	13.6	13.6
DCP Mineral Mix	2.3	2.3	2.3
Oil		3.3	
Bypass Fat			3.3
Total	100	100	100
Nutritive values			
DM, %	87	87	87
CP, % of CP	18	18	18
RUP[1], % CP	28	27	27
MP[2], g/kg DM	89	89	89
NE_L[3], Mcal/kg DM	1.56	1.66	1.69
EE, % of DM	4.2	4.0	4.0

[1]RUP = Predicted Rumen un-degradable protein in % of crude protein, [2]MP = Predicted Metabolizable protein
[3]NE_L = Predicted Net energy for lactation

Table 2. Intake, milk yield, and its composition

Item	Treatments[1]					SEM	P-value
	A	B	C	D	E		
Forage intake, kg/d	45.5[a]	46.9[ab]	46.5[bc]	46.6[c]	46.7[c]	24.7	0.16
Concentrate intake, kg/d	03.83[a]	03.96[bd]	03.93[c]	03.96[d]	03.84[a]	03.13	0.01
Milk yield, kg/d	07.13[a]	07.70[b]	07.31[ac]	07.31[ad]	07.46[a]	08.81	0.55
Fat contents, %	05.29[a]	06.23[b]	06.31[b]	06.67[c]	07.41[d]	00.16	0.01
Solid-not-fats,%	09.31[a]	09.27[ad]	09.20[b]	09.50[c]	09.24[bd]	00.04	<0.01
Protein contents,%	03.24[a]	03.27[a]	03.32[a]	03.27[a]	03.32[a]	00.10	0.79
Lactose contents,%	04.20[a]	04.30[b]	04.39[c]	04.32[b]	04.46[d]	00.02	0.01

[1]Treatments = A) Ctrl: Basal diet containing 18% CP; B) Ctrl + Oil; C) Ctrl + Oil + Niacin; D) Ctrl + bypass fat; E) Ctrl+ bypass fat + Niacin.

Table 3. Plasma metabolites concentration in different treatments.

Item, mg/dl	Treatments[1]					SEM	P-value
	A	B	C	D	E		
Urea	15.4[a]	22.0[b]	18.7[c]	19.6[dc]	16.6[a]	4.6	0.04
Glucose	44.9[a]	35.1[b]	43.5[a]	37.6[b]	35.7[b]	12.7	0.02

[1]Treatments = A) Ctrl: Basal diet containing 18% CP; B) Ctrl + Oil; C) Ctrl + Oil + Niacin; D) Ctrl + bypass fat; sE) Ctrl+ bypass fat + Niacin.

DISCUSSION

Feed Intake: Our objective in this study was to compare the lactation responses of Nili-Ravi buffalo after supplementation of oil or by-pass fat with or without niacin. Feed intake responses observed in this study are in agreement with the finding of Abu Ghazaleh *et al*. (2003) who observed that addition of fish oil in the diet of animals differing in fatty acid profile imposed no effect on feed intake of the animals. Similarly Schroeder *et al*. (2003) reported that supplementation of fat in the ration of dairy animals did not affect the dry matter intake of grazing animals. Contrarily, Nawaz *et al*. (2006) reported that the feed intake decreased with increase supplementation of tallow in the diets of the animals. In fact, the dry matter intake has been shown to vary more with the changes in metabolizable protein (MP, NRC, 2001) supply compared to the changes in energy supplies (Faverdin *et al*., 2003). In the current study the MP supply were not modified (Table 1).

Milk Yield: In terms of milk yield, the findings of the present study are in accordance with the findings of Abu Ghazaleh *et al*. (2007) where they observed no effect on milk yield by using oil in diets. Although we observed a higher milk yield in oil based diets compared to other treatments as it was observed previously by Mosley *et al*. (2007) where they observed a trend toward increase in milk yield. On the other hand, Niacin supplementation did not modify milk yield similar to the observation by Martinez *et al*. (1991).

Milk Composition: In the current study, milk fats and lactose contents increased with the supplementation of oil as well as with rumen by-pass fats. The results are consistent with the findings of previous studies where the observed the increase in milk fat yield by supplementing oil (Schroeder *et al*., 2003; Zheng *et al*., 2005; Palmquist and Griinari, 2006) or rumen-by-pass fat (Fahey *et al*., 2002). On the other hand the results Piperova *et al*. (2004) reported rather a decrease in milk fats contents with the supplementation of rumen-bypass fats. Milk lactose increase with oil and by-pass fat was consistent with the study by Fahey *et al*. (2002) whereas Belibasakis and Tsirgogianni, (1996) and Nawaz *et al*. (2006) showed that milk lactose contents were not affected by niacin and tallow supplementation, respectively. Similarly, Piperova *et al*. (2004) concluded that treatments had no effect on lactose contents of milk by adding rumen protected fat in the diet of the dairy animals. Milk protein contents remained unaffected by the treatments as it was observed previously by (Piperova *et al*., 2004; Palmquist and Griinari, 2006).

Conclusion and Perspective: The results of the current study showed an increase in milk fats and lactose with the supplementation of fats both in oil and by-pass fat forms. However as the diets were iso-nitrogenous the interaction between protein and energy could not be identified that may be focused in future research. Niacin responses on performance of cows were not clearly identified and require further investigation.

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