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Blood Metabolites of Murrah Buffalo Heifer on Supplementation of Different Sources of Rumen Bypass Proteins

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ABSTRACT

Eighteen Murrah buffalo heifers, at BRC, LUVAS, Hissar distributed into three treatments to evaluate the effect of supplementation of different sources of bypass proteins on blood biochemical profile. Heifers in all three group fed similar basal diets, in treatment T2 10% of crude protein requirement was replaced with commercially available soya bypass protein and in treatment T3 10% of crude protein requirement was replaced with natural bypass protein i.e fish meal. Blood samples were collected with or without anti-coagulant for biochemical and serum mineral analysis respectively, at the start of experiment and thereafter at monthly intervals for a period of 120 days. Feeding of bypass protein result in significant increase ($P<0.05$) in concentration of plasma glucose, total protein, globulin, and calcium but concentration of other biochemical parameters, serum mineral values and activity of enzymes showed no significant difference among the treatments.

Key words: Buffalo Heifer, Bypass Protein, Biochemical Parameters, Enzymes Activity, Feeding Trials

INTRODUCTION

India has the privilege of having best breeds of buffaloes, of which Murrah is most popular because of their superiority on commercial grounds. Fast and early growth of heifers for heard replacement requires feeding of quality protein ration. Among the available feeds soya bean meal is considered a promising protein source but have high degradability in rumen, result in excessive loss of nitrogen and in hepatic overload of ammonia (Alves *et al.,* 2004). To increase the efficiency of using dietary protein, protected or bypass nutrients are suggested (Garg, 1998). Fishmeal is a high protein and naturally less degradable in the rumen hence can be considered as natural bypass proteins or nutrients (Mercer *et al.,* 1980). Wide spectrums of protein and energy concentrate are being used to manipulate ruminant diets in order to enhance their production through efficient nutrient utilization without, compromising the economics. While recommending the feeds and fodder for livestock, it is essential to assess the biochemical profile after feeding.

Most of the studies on bypass nutrients have been done milk production and composition but, little work have been reported on heifers. Present experiment was carried out with the aim to evaluate the biochemical status of Murrah buffalo heifers, on feeding commercially available (bypass soya protein) and naturally available by-pass protein (fish meal).

MATERIALS AND METHODS

Eighteen Murrah heifers distributed into three treatment groups at Buffalo Research Center (BRC), LUVAS, Hisar. Heifers were offered a diet to meet their protein and energy requirement for growth as per ICAR standards (Ranjhan, 1998) in control group T1 for a period of 120 days. Animals in treatment T2 fed similar basal diet as control but 10% of crude protein requirement in concentrate mixture was replaced with commercially available soya bypass protein (CP % DMB-46 and RUP %- 70.0 min) and in treatment T3 fed similar basal diet but 10% of crude protein requirement in concentrate mixture was replaced with fish meal a naturally bypass protein.

The composition of the experimental diet of different treatment groups and proximate chemical composition is presented in table 1 and 2.

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Table 1. Chemical composition of feed ingredient (% on DM basis)

Ingredients	DM	CP	CF	EE	Ash	OM	NFE
Wheat straw	95.0	2.85	35.6	1.02	12.9	87.0	47.5
Green maize	23.0	7.71	28.3	3.11	9.11	90.8	51.7
Maize fodder	88.0	9.13	2.52	3.44	2.83	97.1	70.1
Ground nut cake (GNC)	93.4	40.2	9.43	9.05	8.90	91.1	25.8
Soybean meal	89.4	46.0	4.67	2.98	7.34	92.6	28.4
Fish meal	89.9	45.8	1.81	11.4	27.0	72.9	13.9
Wheat bran	88.6	14.0	7.99	4.30	93.6	6.36	59.7

Table 2. Ingredient and chemical of composition of different concentrate mixtures

Ingredient (kg/100kg)	T_1	T_2	T_3	Particulars	T_1	T_2	T_3
Maize	40	40	40	Dry matter	93.0	94.0	93.0
Ground nut cake	20	20	20	Crude protein	23.2	23.4	23.2
Soya bean meal	20	15	15	Ether extract	4.97	4.50	4.21
Bypass protein	-	5	-	Crude fiber	6.29	6.46	6.99
Fish meal	-	-	5	Organic matter	89.8	92.1	89.1
Wheat bran	17	17	17	Ash	10.1	7.81	10.8
Mineral mixture	2	2	2	Nitrogen free extract	55.2	57.7	54.6
Salt	1	1	1	Neutral detergent fiber	57.3	57.2	47.9
Total	100	100	100	Acid detergent fiber	13.8	13.4	12.7

Blood samples (10ml) were collected at into a set of sterile plastic tubes with and without anti-coagulant for biochemical and mineral analysis respectively at beginning and thereafter at monthly interval upto four month of experiment period. Biochemical parameters like plasma glucose (mg/dl), total protein (g/dl), albumin (g/dl), globulin (g/dl), A/G ratio, blood urea nitrogen (mg/dl), cholesterol (mg/dl), triglyceride (mg/dl),glutamic pyruvic transaminase (GPT) (IU/l), glutamic-oxaloacetic transaminase (GOT) (IU/l), alkaline phosphatase (ALP) (U/L) creatine kinase (CK) (U/L), plasma calcium (g/dl) and phosphorus (g/dl) were carried outby kits, procured from M/S Transasia Biomedical Limited using fully automated Random Access Clinical Chemistry Analyzer (EM 200TMErba Mannheim -Germany). Digested serum used for estimation of minerals (copper, zinc, and manganese) by atomic absorption spectrometer (Model Pinaacle 900T, S/N PTAS13050201 of PerkinElmer Company). Data obtained were subjected to statistical analysis as per Snedecor and Cochran (1994) using Completely Randomized Design (CRD). All the data were subjected to ANOVA using IBM SPSS (2007) version 16.

RESULTS AND DISCUSSION

Plasma glucose concentration was significantly (P<0.05) higher in treatment groups as compared to control T1 from 60 onwards. Similarly Chen *et al.,* (2002) reported that feeding heat treated soya bean meal diet increased glucose concentration significantly (P<0.05) in Holstein cows. This improved plasma glucose concentration on feeding of rumen protected protein could be due to reduced energy loss which is generally caused by excessive microbial protein turnover rate. Plasma cholesterol and triglyceride concentration showed no significant difference among the treatments and control groups (Table 3) throughout experiment, but slightly higher values were obtained in the treated groups T2 and T3. Similarly Dosky *et al.* (2012) and Chen et al. (2002) reported that feeding heat treated soya bean meal showed no any significant difference in the serum cholesterol and triglyceride concentration.

Table 3. Effect of supplementation of rumen protected protein on blood biochemical parameters

Particular	Treatments	Days of experiment				
		0	30	60	90	120
Glucose (mg/dl)	T_1	60.7±2.20	60.8±1.30	61.4^a±1.76	66.1^a±0.69	69.6^a±3.98
	T_2	63.1±0.95	66.8±2.66	68.4^b±1.89	75.1^b±3.08	81.9^b±0.62
	T_3	61.9±3.50	67.2±2.40	68.7^b±1.11	74.3^b±2.79	83.6^b±1.49
Cholesterol (mg/dl)	T_1	38.1±2.65	50.1±3.95	68.1 ±4.54	73.6 ±2.38	80.5 ±4.02
	T_2	37.5±3.72	52.5±4.99	74.6 ±4.06	75.0 ±3.11	84.3 ±4.36
	T_3	39.3±2.65	55.0±4.31	72.3 ±4.62	77.6 ±4.17	89.3 ±4.46
Triglyceride (mg/dl)	T_1	7.16 ± 0.47	8.00 ± 0.44	14.3 ±0.76	14.7± 0.90	15.5±1.09
	T_2	7.33 ± 0.84	9.33 ± 0.21	16.1 ±1.19	17.5 ±0.72	18.1±1.08
	T_3	7.33 ± 0.42	8.33 ± 0.76	16.5 ±0.43	15.6± 1.05	18.3 ±0.56
Total protein (g/dl)	T_1	4.54 ± 0.21	5.14^a ±0.18	6.13^a ± 0.14	6.95^a ± 0.34	7.33^a ± 0.19
	T_2	4.52 ± 0.26	6.14^b ±0.25	6.67^b ± 0.13	8.05^b ± 0.22	8.29^b ± 0.16
	T_3	4.41 ± 0.08	5.56^{ab}±0.28	6.33^{ab}±0.07	7.37^{ab}±0.19	7.81^{ab}±0.16
Albumin (g/dl)	T_1	1.89 ± 0.16	2.08 ± 0.14	2.26 ± 0.15	3.25 ± 0.10	3.39 ± 0.04
	T_2	1.98 ± 0.24	2.40 ± 0.18	2.07 ± 0.16	3.38 ± 0.11	3.51 ± 0.09
	T_3	1.99 ± 0.17	2.40 ± 0.10	2.19 ± 0.17	3.48 ± 0.10	3.57 ± 0.13
Globulin (g/dl)	T_1	2.65 ± 0.16	3.06 ± 0.15	3.87^a±0.08	3.69^a±0.34	3.95^a±0.17
	T_2	2.54 ± 0.10	3.7 ± 0.20	4.61^b ±0.11	4.67^b ±0.24	4.78^b ±0.16
	T_3	2.42 ± 0.20	3.16 ± 0.33	4.14^{ab}±0.23	3.89^{ab}±0.24	4.23^{ab}±0.27
Albumin: Globulin	T_1	0.73 ± 0.08	0.69 ± 0.06	0.59 ± 0.05	0.92 ± 0.09	0.86 ± 0.03
	T_2	0.79 ± 0.09	0.66 ± 0.07	0.45 ± 0.04	0.74 ± 0.06	0.74±0.039
	T_3	0.89 ± 0.16	0.81 ± 0.12	0.55 ±0.069	0.92 ± 0.08	0.87 ± 0.08
Urea (mg/dl)	T_1	12.1±1.24	29.6±2.16	29.9±1.59	36.2±2.17	44.1±1.60
	T_2	11.6±0.98	22.3±2.78	25.7±1.01	35.9±2.88	40.2±1.74
	T_3	12.0±1.74	26.0±2.65	27.4 ±1.57	34.1 ±1.29	39.1 ±1.63

The values in a row with different superscripts differ significantly ($P<0.05$)

Total protein and globulin concentration improved significantly in group T2 supplemented with commercially protected protein compared to control T1, although both the parameters were comparable T3 fed with natural protected protein (Table 3). Albumin concentration and albumin, globulin ratio of treatment groups was similar to control group during trial period (Table 3). The concentration of total protein, albumin, globulin, albumin globulin ratio and urea was within the normal range as has been reported by Abd Ellah *et al.* (2014) in buffalo heifer. Present findings are in accordance with Kumar and Walli (1994) who observed higher plasma protein level in crossbred calves fed with formaldehyde treated ground nut cake. In contrast to this, Bhagwat and Srivastava (1993) reported that feeding bypass protein to ruminants did not show any significant effects on total protein, albumin and globulin concentration. It was observed that group supplemented with protected protein had lower plasma urea concentration during experimental periods as compared to control, though it was not statistically significant. Present results are in accordance White et al. (1992) where they reported that replacing SBM with fish meal (FM) in steer and lamb diets, did not change the plasma urea concentration. Serum urea nitrogen, which is an indicator of protein status in animals, varies with the protein quality and quantity. Lower level of blood urea nitrogen was observed in growing buffalo heifers fed with protected protein as compared to the control indicating better utilization of protein that may be due to the reduced protein degradation in rumen. However, Bhagwat and Srivastava (1993) found significant variation in the urea concentration due to feeding treated soybean cake compared to untreated in crossed bred calves.

Activity of enzymes like GPT, GOT, ALP and CK found to be similar in all the experimental groups of heifers throughout the experimental periods (Table 4). The plasma activity of all enzymes recorded in the present experiment was within the normal range as has been reported by Abd Ellah *et al.* (2014) in buffalo heifers. The level of SGPT and SGOT was found to be statistically non-significant among the various groups of experimental animals and indicated that the animals remained healthy condition without any cellular dysfunction; otherwise it would affect the cellular synthesis of protein and growth performance (Lehninger *et al.,* 1993). Present finding are in agreement with the results of Bhagwat and Srivastava (1993) who observed non significant variation on serum GOT/ GPT enzymes due to feeding formaldehyde and tannic-acid treated soybean cake compared untreated cake in crossed bred calves.

Table 4. Effect of supplementation of rumen protected protein on plasma enzyme activity

Particular	**Treatments**	**Days of experiment**				
		0	**30**	**60**	**90**	**120**
SGPT (IU/l)	T_1	22.6±1.42	29.4±2.74	32.1±2.50	22.1±2.09	25.5±2.16
	T_2	23.7±2.68	26.2±1.90	27.2±0.80	22.6±1.43	28.9±2.22
	T_3	23.6±1.36	23.9±1.36	25.4±2.59	22.6 ±1.39	24.5±0.78
SGOT (IU/l)	T_1	69.0±4.54	62.2±2.96	60.8 ±3.36	66.6 ±4.77	59.9 ±4.38
	T_2	69.0±4.97	64.6±5.13	60.8±4.64	64.6±2.80	65.2±2.91
	T_3	71.4±3.85	67.6±4.66	69.0±5.71	63.8±6.53	68.4±5.90
AP (U/L)	T_1	115.0±5.62	132.0±18.86	102.8±6.82	125.3 ± 9.27	127.5±8.58
	T_2	120.6±17.80	126.1 ± 8.51	105.1±6.80	119.5 ± 7.97	125.0±7.56
	T_3	113.8±9.04	110.8±6.02	104.6±3.24	138.8±20.17	119.1±8.95
CK(U/l)	T_1	226.6±25.65	194.4±21.20	220.7±13.16	219.0±20.58	184.7±23.81
	T_2	198.1±24.35	187.6±12.67	228.6±10.21	224.9±21.61	226.1±21.41
	T_3	222.1±16.36	206.5±15.72	231.8 ± 4.98	211.3±19.51	205.7±16.03

Values are means ±standard errors

Plasma calcium level was significantly higher (P=0.05) (Table 5) in group supplemented with fish meal compared to control T1 from day 90 onwards, though value of T3 and T2 was comparable. Present experiment suggested that animals of groups T2 and T3 supplemented with protected protein fulfills the required dietary calcium for depositing in bone tissue and maintaining normal blood calcium level. Concentration of phosphorous was higher in treated groups compared to control T1, though statistically non-significant (Table 5). Paengkoum *et al.,* (2004) also observed that phosphorous intake, absorption and retention tended to be increased as a consequence of rumen undegradable protein supplementation in Saanen goats fed oil palm fronds. The concentration of other mineral like copper, zinc and manganese were similar among the groups throughout the experiment (Table 5). Mondal and Chopra (2008) also did not find any change in the blood mineral (Mg, P, K, Cu and Zn) concentration due to feeding different levels of rumen degradable and undegradable protein ratio to crossbred cows.

Table 5. Effect of supplementation of rumen protected protein on mineral concentrations

Particular	Treatments	Days of experiment				
		0	30	60	90	120
Calcium (g/dl)	T_1	5.18 ± 0.24	6.84 ± 0.39	8.50 ± 0.64	8.40^{a} ± 0.28	9.35^{a}± 0.20
	T_2	5.22 ± 0.53	7.35 ± 0.35	8.78 ± 0.82	8.63^{ab}±0.09	10.1^{ab}±0.37
	T_3	4.88 ± 0.37	7.40 ± 0.31	9.25 ± 0.91	9.42^{b} ± 0.47	10.5^{b}±0.27
Phosphorus (g/dl)	T_1	3.35 ± 0.17	4.25 ± 0.24	4.18 ± 0.24	5.78 ± 0.24	6.62 ± 0.13
	T_2	3.23 ± 0.30	4.74 ± 0.16	4.69 ± 0.33	6.12 ± 0.41	6.92 ± 0.26
	T_3	3.19 ± 0.21	4.67 ± 0.21	4.57 ± 0.28	6.22 ± 0.40	7.01 ± 0.24
Copper (mg/l)	T_1	0.50 ± 0.01	0.54± 0.02	0.64 ± 0.02	0.70 ± 0.02	0.88 ± 0.03
	T_2	0.52 ± 0.02	0.60 ± 0.01	0.64 ± 0.02	0.66 ± 0.01	0.90 ± 0.02
	T_3	0.54 ± 0.01	0.64 ± 0.02	0.66 ± 0.01	0.80 ± 0.01	0.84 ± 0.02
Zinc (mg/l)	T_1	0.55 ± 0.06	0.65 ± 0.07	0.70 ± 0.06	0.80 ± 0.05	0.95 ± 0.08
	T_2	0.53 ± 0.08	0.70 ± 0.05	0.78 ± 0.05	0.90 ± 0.04	0.98 ± 0.09
	T_3	0.55 ± 0.09	0.62 ± 0.08	0.74 ± 0.08	0.85 ± 0.06	0.90 ± 0.05
Manganese (mg/l)	T_1	0.02 ± 0.02	0.03 ± 0.01	0.03 ± 0.02	0.05 ± 0.02	0.06 ± 0.03
	T_2	0.03 ± 0.03	0.04 ± 0.03	0.04 ± 0.00	0.05 ± 0.02	0.06 ± 0.01
	T_3	0.02 ± 0.03	0.04 ± 0.02	0.05 ± 0.01	0.06 ± 0.02	0.07 ± 0.01

The values in a row with different superscripts differ significantly (P=0.05)

CONCLUSION

From the present investigation we can conclude that supplementation of commercial and natural bypass protein in concentrate mixture result in increased concentration of plasma glucose, total protein, globulin, and calcium concentration in serum. Feeding bypass protein through either source did not result any adverse effect on the system

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