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Effect of Faba Bean (*Vicia Faba*) as A Source of Dietary Protein on Reproductive Performance and Blood Biochemical Parameters in Buffalo

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ABSTRACT

The present study was carried out to study the effect of Faba Bean (*Vicia faba*) as protein source on performance of Murrah Buffaloes. For this, eighteen Murrah buffaloes in transition phase were utilized in a completely randomized design (CRD) and divided into three treatment groups i.e. T1, T2 & T3, having six buffaloes in each group on the basis of milk yield, body weight and parity. All the animals were kept in separate/individual shed and fed the required quantity of feeds and fodder to meet out the nutrients requirements as per ICAR (2013) feeding standards. The experimental buffaloes of control group (T1) were fed/offered dry& green roughages and concentrate mixture constituting of maize (29), barley (19.5), wheat (18), mustard cake(11), groundnut cake (10.5), soybean meal (9), mineral mixture (02) & common salt (01 part) having 18.5% crude protein. While in treatment T2 & T3 groups 15 and 30 percent crude protein of concentrate mixture of control was replaced with faba bean, respectively. The reproductive parameters post- partum estrus, service period, number of services per conception and conception rate were recorded for individual buffalo of all groups. The blood sample were analyzed for estimation of blood parameters i.e. WBC, RBC, Haemoglobin. The sera samples were analyzed for their content of biochemical parameters i.e. Phosphorous, Calcium, Magnesium, Glucose, Urea, Cholesterol, Albumin, Protein, Serum glutamic oxalo-acetic transaminase (SGOT) and Serum glutamic pyruvic transaminase (SGPT). It was reported that reproductive and haemato- biochemical parameters did not differ significantly among different treatment groups. So, it can be concluded that replacement of high cost protein source with faba bean *(Vicia faba)* up to 30% level does not have any deleterious effect on reproductive performance and haematological profile of the buffalo and also economical to the farmers as it reduced the feeding cost . These findings indicate that feeding of faba bean in buffalo diet supported reproductive & blood biochemical parameters similar to fed traditional oil seed cake based diet.

KEY WORDS: Faba Bean, Haemato-biochemical, Murrah, Protein, Reproduction

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INTRODUCTION

Protein feeds supplementation in the diet of dairy animals is a challenge for dairy nutritionist to establish minimal amount of protein required by high yielding animals (Huhtanen et al., 2011). High prices and consumers concern lead attention towards the use of more economical and ecological ways of producing home-grown protein feeds for animal feed market (Puhakka et al.,2016). In this regard, legume seeds may represent a good alternative due to their relatively high CP and starch contents (Petit et al.,1997; White et al.,2007 and Crepon et al., 2010). Faba bean is a valuable protein source with approximately 25 to 33% crude protein (Yu, 2005; Larsen et al., 2009 and Crepon et al., 2010) and can be a practical alternative to costly protein in the diet of high-yielding dairy animals. It also contains a considerable amount of starch ranging from 32 to 44% (Yu, 2005; Larsen et al., 2009 and Crepon et al., 2010), which makes faba bean an excellent source of energy. Therefore, reducing the use of costly cereal grains (e.g.corn) in dairy diets. There is no available literatures on the positive and negative consequences of replacing protein source by faba

bean as an alternative protein source on reproductive parameters and haemato- biochemical parameters of Murrah buffalo. Therefore, the present investigation was conducted to study the effect of replacing protein of concentrate mixture with Faba Bean (*Vicia faba*) on reproductive and haemato-biochemical parameter in Murrah buffalo diet.

MATERIALS & METHODS

Feeding Trial

The present research study was conducted at buffalo farm of Livestock Production Management, College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar for a period of 180 days on recommendation and approval by the Institutional Animal Ethics Committee (IAEC), 21/CPCSEA on dated 12-03-2021. For this eighteen Murrah buffaloes in transition phase (one month before calving) were selected and divided into 3 treatment groups i.e. T1, T2 & T3 , having six animals in each group on the basis of milk yield, body weight and parity following completely randomized design (CRD). The experimental Murrah buffaloes were kept in separate/ individual shed and fed roughage (berseem and wheat straw) and concentrate mixture to meet out the nutrients requirement as per ICAR (2013) feeding standards. The daily allowance of concentrate mixture was offered to each animal at the time of milking in the morning and evening as per the experimental diet while during transition phase concentrate were fed in the shed itself. The concentrate mixture fed to buffaloes of control group (T1) constituted Maize (29), Barley (19.5), Wheat (18), mustard cake(11), groundnut cake (10.5) , Soyabean meal (9), mineral mixture (02) & common salt (01 part) having 18.5% crude protein while in concentrate mixture of Treatment T2 and T3 group 15 and 30 % crude protein content of concentrate mixture of control group was replaced with protein of faba bean (*Vicia faba*), respectively.

Recording of observations and sample analysis

The reproductive parameter days to attain post-partum estrous, number of services per conception, service period and conception rate (number of animals conceived out of service/ AI done) were recorded for individual buffalo of all groups. Blood sample were collected at the beginning of the experiments i.e. day 0, at time of calving and thereafter at end of experiment period. The blood sample were analyzed for estimation of blood parameters i.e. WBC, RBC, Haemoglobin. The sera samples were analyzed for estimation of biochemical parameters i.e. Phosphorous, Calcium, Magnesium, Glucose, Urea, Cholesterol, Albumin, Protein, Serum glutamic oxaloacetic transaminase (SGOT) and Serum glutamic pyruvic transaminase (SGPT).

Statistical analysis

The data of present research findings were statistically analyzed by adopting the statistical methods Snedecor and Cochran (1994). Difference of significance in variables between three groups were compared with the help of one-way analysis of variance (ANOVA) which were carried out with the help of SPSS computer software version 21. The mean differences among different treatments were separated by Duncan's multiple range tests. Consequently, a level of ($P<0.05$) was used as the criterion for statistical significance (Duncan, 1955).

RESULT AND DISCUSSION

The acceptance of a male by the female is the most prominent and reliable symptom of estrous in buffaloes and was used to observe post-partum estrous in experimental animals. Means and treatment effects on reproductive performance are shown in Table 1.

Table 1. Average reproductive traits of experimental Murrah buffaloes during the experimental period under different dietary treatments

Attributes	Treatments		
	T1	T2	T3
Days to attain first postpartum estrous	71.6±10.0	74.2±17.3	85.1±14.8
Service period	151.16±17.4	120.00±21.0	129.16±15.6
No. of service/conception	2.33±0.33	2.16±0.30	1.83±0.30
Conception Rate 1st service (%)	16.6	16.6	33.3
Conception Rate 2nd service (%)	40.0	60.0	75.0
Conception Rate 3rd service (%)	100	100	100

The number of days to first observed estrus after calving were 71.66, 74.17 and 85.16 days in treatment groups T1,T2 & T3, respectively . The results revealed that period taken for exhibition first postpartum oestrus did not differ significantly due to replacement 30 % protein content of cake-based concentrate mixture with faba bean protein. Service period results revealed that numerically the period between date of calving to date of successful conception was more/longer in buffalo of control group T1, (151.16) than T2 (120.00) and T3 (129.16) but statistically did not differ significantly between different groups. Similarly, the average number of service per conception in experimental buffaloes of dietary treatment groups T1, T2 and T3 were 2.33, 2.16 and 1.83, which also did not differ significantly. However, it was observed that first service conception rates were was higher in buffaloes of treatment group T3 fed 30 percent protein from faba bean as compared to treatment group T2 and T1 (control). The reproductive performance of all the experimental buffaloes was normal and essentially unaffected by including the faba bean as protein source in their dietary regimen. However, the literature on the effect of feeding faba bean (as alternative of protein source) on reproductive parameters in buffalo or cattle is not available.

Various blood and serum parameters also did not differ significantly among the different treatment group as shown in table 2, 3 and 4.

Table 2. Average blood parameters of experimental Murrah buffaloes during start of experiment, at time of calving and towards end of experiment under different dietary treatments

Parameters		T1	T2	T3
WBC	At start of the experiment (*10^3/µL)	6.94±0.46	6.54±0.20	8.05±0.99
	At time of calving (*10^3/µL)	7.72±0.46	7.15±0.77	8.81±0.70
	At end of experiment (*10^3/µL)	8.14±0.42	7.57±0.58	8.66±0.30
RBC	At start of the experiment (*10^{12}/L)	7.76± 0.95	7.74±0.89	8.57±0.92
	At time of calving (*10^{12}/L)	7.02±1.05	6.85±0.19	5.80±0.14
	At end of experiment (*10^{12}/L)	9.86±0.85	10.1±0.54	10.34±1.40
Haemoglobin	At start of the experiment (gm%)	11.4±0.68	11.3±1.42	12.0±2.08
	At time of calving (gm%)	11.1±2.36	11.0±1.03	11.7±0.79
	At end of experiment (gm %)	13.5±1.67	13.89±1.19	14.21±2.71

Table 3. Average Serum Phosphorous, Calcium, Magnesium, Glucose and Blood Urea Nitrogen of experimental Murrah buffaloes during start of experiment, at time of calving and towards end of experiment under different dietary treatments

Parameters		T1	T2	T3
Phosphorous	At start of experiment (mg/dl)	5.64±0.92	5.46±0.30	5.77±1.08
	At time of calving (mg/dl)	4.69±0.32	4.90±0.12	4.59±0.15
	At end of experiment (mg/dl)	3.26±0.18	2.96±0.19	3.40±0.43
Calcium	At start of experiment (mg/dl)	9.46±1.00	9.11±1.06	8.06±0.25
	At time of calving (mg/dl)	8.78±0.80	9.08±1.07	8.60±0.80
	At end of experiment (mg/dl)	7.68±0.38	5.66±0.58	5.90±1.03
Magnesium	At start of experiment (mg/dl)	2.52±0.28	3.10±0.060	2.77±0.39
	At time of calving (mg/dl)	2.81±0.16	2.76±0.28	2.50±0.17
	At end of experiment (mg/dl)	1.31±0.09	1.30±0.06	1.24±0.07
Glucose	At start of experiment (mg/dl)	51.1±6.94	69.7±0.63	65.0±13.1
	At time of calving (mg/dl)	62.5±3.67	65.3±6.23	57.2±1.37
	At end of experiment (mg/dl)	70.9±6.21	64.8±4.07	76.9±7.20
Blood Urea	At start of experiment (mg/dl)	35.5±5.15	40.6±0.91	36.31±7.04
Nitrogen	At time of calving (mg/dl	35.9±0.86	39.7±1.66	37.4±1.13
	At end of experiment (mg/dl)	33.8±1.79	24.9±2.41	29.5±4.86

Table 4. Average Serum Cholesterol, Albumin, Globulin, Protein, SGOT and SGPT of experimental Murrah buffaloes during start of experiment, at time of calving and towards end of experiment under different dietary treatments.

Parameters		T1	T2	T3
Cholesterol	At start of experiment (mg/dl)	99.3±4.01	100.95±5.71	100.84±5.75
	At time of calving (mg/dl)	98.0±3.37	97.8±4.52	95.8±8.38
	At end of experiment (mg/dl)	167.5±7.44	123.6±26.20	133.3±17.26
Albumin	At start of experiment (gm/dl)	2.20±0.33	2.51±0.10	2.47±0.42
	At time of calving (gm/dl)	2.06±0.08	2.14±0.14	2.04±0.10
	At end of experiment (gm/dl)	1.98±0.10	2.01±0.16	1.96±0.26
Globulin	At start of experiment (gm/dl)	3.18±0.23	4.02±0.25	2.94±0.28
	At time of calving (gm/dl)	4.60±0.06	4.27±0.08	4.53±0.10
	At end of experiment (gm/dl)	6.66±0.20	6.23±0.26	6.11±0.16
Protein	At start of experiment (gm/dl)	5.38±1.02	6.53±0.31	5.41±0.99
	At time of calving (gm/dl)	6.66±0.15	6.41±0.26	6.57±0.25
	At end of experiment (gm/dl)	8.64±0.36	8.24±0.34	8.07±0.57
SGOT	At start of experiment (U/L)	121.5±6.31	116.9±1.27	121.1±4.75
	At time of calving (U/L)	119.8±5.25	115.2±1.82	118±3.26
	At end of experiment (U/L)	120.6±5.89	117.6±1.95	117.7±1.95
SGPT	At start of experiment (U/L)	57.6±3.09	48.5±7.04	60.7±6.46
	At time of calving (U/L)	62.5±0.36	63.1±0.31	62.3±0.32
	At end of experiment (U/L)	64.7±0.40	63.3±1.25	64.4±0.40

The mean values of WBCs counts in experimental buffaloes at the end of experiment were 6.94, 6.54 and 8.05 (*10^3/μL) in treatment groups T1, T2 & T3 respectively. The results of the study revealed that WBC counts in different treatment groups did not differ significantly. Similarly the RBCs count (1012/L blood) and hemoglobin-Hb concentration (gm%/) of buffaloes in different groups did not differ significantly ($p>0.05$). The WBCs (5.12 - 15.18 × 103/iL blood) and RBC (5.33 - 10.72 × 1012/L blood) count of buffaloes were within the normal physiological range (Abd Ellah et al., 2013) indicated the feeding of 30 % protein from faba bean in concentrate mixture of buffaloes has no detrimental effect on the health.

The statistical analysis of the data of present study revealed that there was no significant effect of replacement of 15% and 30% Crude protein of control group with faba bean on Serum Phosphorous, on Serum Magnesium, Serum Calcium, Blood urea nitrogen, Albumin, Globulin, Total protein and Cholesterol . The mean values of SGOT at end of experiment was 120.66, 117.63 and 117.7 and SGPT was 64.69, 63.32 and 64.4 in T1, T2 & T3 respectively. The value of liver function tests like serum aspartate amino transferase (SGOT; U/L), and serum amino transferase (SGPT; U/L) differed non-significantly among the different groups indicating feeding of faba bean protein is safe to feed to buffaloes. The findings of present study was in agreement with Puhaka et al. (2016) who evaluated the physiological response on Finnish Ayrshire to the substitution of faba bean for rapeseed meal at two protein supplementation levels in grass silage–based diets. Plasma concentration of glucose increased when dietary CP level was increased, and it tended to increase linearly.

However, the findings of present study was in disagreement with Volpelli et al. (2016) as they observed test flaked faba beans as a partial substitute for soybean meal in the diet of Reggiana breed dairy cows. They found that blood urea was observed in cows fed on the Faba concentrate. The decreased degradability of faba beans protein due to steam-flaking could express its effect in the reduction of ammonia in the rumen and of urea in blood.

CONCLUSION

It was observed that by replacement of 15% and 30% crude protein of control group with faba bean, there was no significant change in reproductive and haemato- biochemical parameters of experimental murrah buffaloes. So, it can be concluded that replacement of high cost protein source with faba bean (cheap protein source) upto 30% level does not have any deleterious effect on reproductive parameters of the animal and can be used in the ration of dairy animals. But the above study was conducted under loose housing system and from period July to Feb. So, further studies are till required under different agroclimatic conditions and with larger herd size.

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