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Research Article**NUTRITIONAL PARAMETERS IN RELATION TO REPRODUCTIVE PERFORMANCE IN ANESTRUS CHAURI (YAK HYBRID) CATTLE AROUND JIRI, DOLAKHA****B. P. Gautam², B. Devkota^{1*}, R. C. Sapkota², G. Gautam¹, and S. K. Sah¹**¹Agriculture and Forestry University, Rampur, Chitwan²Department of Livestock Services, Ministry of Livestock Development, Kathmandu**ABSTRACT**

Anestrus Chauri (Yak hybrid) cattle raised in Jiri area of Dolakha district, Nepal were selected to investigate the status of blood nutritional parameters in relation to their reproductive performance during active breeding months. Blood samples were collected from 20 (13 pregnant and 7 non-pregnant) anestrus Chauries to estimate nutritional parameters in serum, and body condition score (BCS) of each animal was recorded. The non-pregnant anestrus Chauries were supplemented with vitamin-mineral mixture for two months followed by second blood sampling and BCS recording. The response of supplementation was evaluated in terms of estrus, fertile mating and pregnancy. Four out of 7 (57%) non-pregnant anestrus Chauries responded to the vitamin-mineral supplementation to produce pregnancy. Statistical analysis revealed that level of blood glucose, total cholesterol, calcium and phosphorus were not significantly different between pregnant and non-pregnant anestrus Chauries while the level of serum total protein was significantly higher in pregnant than in non-pregnant Chauries. BCS of pregnant and non-pregnant Chauries differed significantly ($p < 0.05$). Successful conception was observed in Chauries with BCS greater than 3.0. When compared with the levels of blood nutritional parameters before supplementation, higher level ($p < 0.05$) of total protein, total cholesterol and calcium were observed after vitamin-mineral supplementation. In conclusion, blood nutritional parameters and BCS indicate the reproductive performance in Chauries, and vitamin-mineral supplementation in non-pregnant Chauries helps in achieving pregnancy.

Key words: BCS, chauri, pregnancy, vitamin-mineral supplementation**INTRODUCTION**

Chauries or Yak hybrids are the crosses of Yak (*Bos grunniens*) and local hill cow (*Bos indicus*) or Tibetan yellow cattle (*Bos taurus*), and are confined in high hills and mountain regions of Nepal, mostly above 2000 meter from the sea level (Joshi, 1982). These possess superior genetic and productive traits than the either parents (Joshi et al., 1994) and are raised under transhumance system (Joshi, 1982; Miller, Craig, & Rana, 1997). Nepal is endowed with 70588 Yak and Chauri and the count is 4,083 in Dolakha District (MoAD, 2014). The method of feeding and nutrition is common relying on absolute grazing with no supplementation except handful of salt once daily. Yak hybrids show seasonality in breeding, breeding season being in July to September. This is attributable to poor nutrition due to harsh climatic condition and high altitude. The economic loss in Chauri farming is due to undiagnosed reproductive disorders and infertility problem. Among the various causes of infertility, nutrition is one of the important factors for infertility in domestic animals. Nutritional status of the animal can be ascertained by body condition score (BCS) and is an important factor influencing the reproductive performance in farm animals (Baruselli, Barnabe, Barnabe, Visintin, Molero-Filho, & Porto, 2001). The nutritional status of animals affects the follicular growth, maturation and ovulation (Diskin, Mackey, Roche, & Sreenan, 2003) and poor nutrition is the major cause of anestrus in dairy animals. Deficiency in any of the nutrients like energy, protein, mineral or vitamin may provoke infertility in animals. Infertility may be associated with decrease in level of glucose, total protein, cholesterol, mineral level and increase in the level of BHBA, NEFA, blood urea nitrogen in the circulation (Parkinson, 2001).

Infertility in Chauries has been reported in various regions of Nepal and this issue has resulted huge economic loss in Chauri herders. There are no more researches carried out regarding study on management of infertility issues in Chauries in Nepal. The main objective of this study was to compare the nutritional status based on the blood metabolic profile and the BCS between the pregnant and non-pregnant anestrus Chauries, and find the association of BCS with pregnancy. In addition, the response of vitamin-mineral supplementation by anestrus Chauries in terms of estrus and fertile mating was also studied.

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MATERIALS AND METHODS

A longitudinal study was conducted adopting purposive sampling method in Jiri Municipality of Dolakha District from July, 2016 to December, 2016. The climate of the study site comprised of temperate and subalpine climate with pasture including the mixed forest, temperate tree fodder species and alpine pastures for feeding the Chauri cattle. The feeding of Chauri mostly relies on grazing on pasture and fodder grasses and trees available in the community forest areas. Twenty animals (13 pregnant and 7 non-pregnant anestrus) were selected from Chauri herds. The pregnant Chauri (control group) were in lactating state, possessed varied months of gestation, aged ranging from 6-9 years and of 2-4 parity while the non-pregnant anestrus Chauri (experimental group) cattle aged from 6-8 years and were also of 2-4 parity. Blood samples were collected and BCS recording was done initially for all 20 animals. Blood samples were collected from jugular vein with 18 gz needle in non EDTA serum vials. Serum was separated by centrifugation at 4000 rpm for 5 minutes and was preserved at -20°C. Body condition score (BCS) was noted with score ranging from 1 to 5 similar to that of dairy cattle as described by Ferguson, Galligan, & Thomsen (1994). The non-pregnant experimental group of Chauries were provided with Chelated Agriminforte™, a vitamin-mineral (Vit-M) mixture supplement, for 2 months at the dose rate of 35gm/animal/day orally. Blood samples and BCS were taken for the second time only from the experimental group Chauries after 2 months of vitamin-mineral supplementation. Blood parameters namely glucose, total protein, total cholesterol, calcium and phosphorus were assessed to compare between pregnant and non-pregnant animals and to determine the effect of vitamin-mineral supplement in experimental group of Chauries colorimetrically by Automated Bio-Slide Technology; Johnson and Johnson, USA in Civil Hospital, Kathmandu. The effect of supplementation was assessed in terms of change in blood nutritional parameters, change in BCS, expression of estrus behavior and mating behavior and conception status. Statistical analysis of the data were done using MS-Excel and Software SPSS version 20. The mean value of serum nutritional parameters namely glucose, total protein, total cholesterol, calcium and phosphorus of pregnant and non-pregnant Chauries were compared with independent sample T-test and the association of the BCS with pregnancy was done using chi-square test using SPSS software version 20 at 95 % confidence interval and 5 % level of significance. The response of the Vit-M mixture supplement on change in blood nutritional parameters namely glucose, total protein, total cholesterol, calcium and phosphorus of non-pregnant anestrus Chauri cattle before and after Vit-M supplement was determined by Paired t-test using SPSS version 20 and the association of BCS with pregnancy/conception was determined by Chi-square test using SPSS software version 20.

RESULTS AND DISCUSSION

Comparison of mean of serum nutritional parameters of pregnant and non-pregnant anestrus Chauri

Comparison of mean value of serum nutritional parameters of pregnant and non pregnant anestrus Chauri is shown in Table 1. The results showed no significant difference in levels of serum glucose, serum total cholesterol, serum calcium and serum phosphorus of pregnant and non pregnant anestrus Chauri cattle at 5% level of significance. However, the serum total protein level was significantly higher in pregnant Chauri cattle than non pregnant anestrus Chauri at 5 % level of significance.

Table 1. Comparison of mean of serum nutritional parameters of pregnant and non-pregnant anestrus Chauri

Nutritional Parameters	Mean value in pregnant Chauri (Mean±SE)	Mean value in non-pregnant Chauri (Mean±SE)	p-value
Glucose	73.46±3.91	64.57±4.08	0.175
Total protein	7.69±0.12	6.35±0.32	0.001
Total cholesterol	116.84±5.31	116.42±11.29	0.970
Calcium	7.85±0.36	8.01±0.55	0.812
Phosphorus	4.24±0.41	4.54±0.41	0.668

Significant lower level of serum total protein reflects low availability of protein in diet resulting to decline of concentration of it in serum (Maurya & Singh, 2015). Low plasma protein levels may result in the deficiency of certain amino acids required for the biosynthesis of gonadotropins and gonadal hormones which might cause hormonal imbalances in domestic animals leading to inactive ovaries.

Relationship of body condition score (BCS) and pregnancy

In the present study, the result showed that the BCS distribution was different for the pregnant and non-pregnant Chauri and the BCS was significantly associated with pregnancy or conception in the investigated Chauri cattle ($p < 0.05$) using Chi-square test at 5 % level of significance. The results are shown in Table 2.

Table 2. BCS and pregnancy status in Chauri

BCS Score	Total number of Chauri	Number of Chauri conceived	p-value
< 2.5	2	0	0.005
2.5-3.0	9	4 (44.44 %)	
> 3.0	9	9 (100 %)	
Total	20	13	

Out of 20 Chauries investigated, no Chauries were found to be pregnant with BCS less than 2.5. Out of 9 Chauries with BCS 2.5-3.0, 4 (44 %) Chauries were pregnant and all of 9 Chauries with BCS greater than 3.00 were found to have conceived. There was association of BCS with pregnancy status ($p < 0.05$) with significantly higher number of pregnant animals with BCS greater than 3.0 than the pregnant animals with BCS 2.5-3.0.

The present study revealed significant differences in BCS between pregnant and non-pregnant Chauri and therefore BCS was associated with pregnancy ($p < 0.05$). Only 44.44 % pregnancy rate was observed in Chauries with BCS 2.5 to 3.0 and 100 % conception was found in Chauries with BCS above than 3. The result revealed that the Chauri with BCS between 2.5 to 3 were less pregnant than the Chauries with BCS above than 3.0. Low conception rate in Chauries with BCS 2.5-3.0 could be due to insufficient energy and protein reserves in the animal body and greater conception with BCS above 3.0 might be due to improved nutrition and good energy reserves. The findings are similar to the findings of Bohora and Devkota (2009) stating significantly higher BCS in cyclic buffaloes as compared to non-cyclic anestrus buffaloes.

Effect of vitamin-mineral supplementation in non-pregnant anestrus Chauri

Out of 7 non-pregnant Chauri, 4 (57.1 %) were found to be pregnant (closed) and 3 (42.9 %) remained non-pregnant (open). There was no significant association of BCS ranging from 2.5-3.0 with conception in Chauries statistically ($p > 0.05$). The BCS and the status of pregnancy outcome after mineral supplementation are shown in Table No. 3.

Table 3. BCS and pregnancy rate after mineral supplementation

BCS	Total number of Chauri	Number (percentage) of Chauri conceived	p-value
2.5	2	1 (50 %)	0.646
2.75	4	2 (50 %)	
3.0	1	1 (100%)	
Total	7	4 (57.1%)	

Out of 7 non-pregnant anestrus Chauries provided with Vit-M supplement, 57 % (4/7) of the anestrus Chauries responded to Vitamin-mineral supplementation with expression of estrus and were successfully mated and all the mated animals conceived while the remaining 43% (3/7) did not show any estrus signs and were not mated and were remained open. 100 % (4/4) conception rate was found in the Chauries that had

responded to the Vit-M supplement. The response effect of Vit-M supplement in anestrus Chauries is shown in Table 4.

Table 4. Response effect of vitamin-mineral supplementation

No. of experimental animals provided with Vit-M supplement	Proportion (%) of animals showing estrus signs	Proportion (%) of Chauries mated	Overall proportion (%) of Chauries conceived
7	4/7 (57.14%)	4/7 (57.14%)	4/7 (57.14%)

High percentage of conception rate was observed after vitamin-mineral supplementation probably due to beneficial effect of minerals and vitamin in diet. Conception was observed with BCS greater than 2.5. The results are in accordance with the findings of Devkota et al. (2013) stating higher percentage of conception achieved with BCS greater than 2.5 in water buffaloes after vitamin-mineral supplementation.

Comparison of blood nutritional parameters in experimental group of non-pregnant Chauries before and after mineral supplementation

The result showed that there were significantly higher level of total protein, total cholesterol and calcium in experimental Chauries ($p < 0.05$) after Vit-M mixture supplement than before while there was no significant change in level of glucose and phosphorus after treatment with Vit-M mixture supplement. The results are shown in Table 5. The significant increase in total protein in experimental anestrus non-pregnant Chauri cattle after Vit-M supplement may be due to inclusion of DL-methionine in the supplement. DL-methionine is the amino acid which is important in synthesis of protein in the body. Similarly, the significant increase in total cholesterol after supplementation may be due to the role of mineral Manganese which acts as co-factor of enzymes needed for cholesterol synthesis. The significant increase in serum calcium level in non-pregnant anestrus Chauri cattle after Vit-M supplement may be attributed to the presence of this element in higher proportion in the supplement.

Table 5. Comparison of blood nutritional parameters in experimental group Chauries (n=7) before and after mineral supplementation

Blood nutritional parameters (Mean±SE)	Before Vit-M supplement	After Vit-M supplement	p-value
Glucose(mg/dl)	64.57± 4.18	63.71±1.92	0.881
Total protein(gm/dl)	6.35±0.33	7.34±0.30	0.007
Total cholesterol(mg/dl)	116.42±11.41	177.85±20.61	0.050
Calcium(mg/dl)	8.01±0.56	9.71±0.17	0.023
Phosphorus(mg/dl)	4.54±0.42	4.84±0.36	0.591

The findings are similar to of studies of Sah, Sah, Yadav, & Kaphle (2010) in repeat breeding buffaloes and Joshi & Shrestha (2011) in infertile bovine in hills of Nepal.

CONCLUSION

Serum glucose, total cholesterol, calcium and phosphorus were not statistically significant between the pregnant and non-pregnant anestrus Chauries while the level of serum total protein was significantly higher in pregnant Chauri as compared to non-pregnant anestrus Chauries. Moreover, there was a significant difference in BCS between pregnant and non-pregnant anestrus animals. Higher pregnancy rate was observed with BCS greater than 3.00 and positive response of supplementation of mineral mixture in non-pregnant anestrus Chauri for successful conception. Therefore, blood nutritional parameters and BCS indicated the reproductive performance in Chauries and vitamin-mineral supplementation in non-pregnant Chauries helped in achieving pregnancy.

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