LIVESTOCK RESEARCH INTERNATIONAL
Journal homepage: www.jakraya.com/journa/lri

ORIGINAL ARTICLE

Effect of bypass fat supplementation during prepartum and postpartum on reproductive performance in buffaloes

P.V. Ramteke, D.C. Patel, S. Parnerkar, S.S. Shankhpal, G.R. Patel and Arti Pandey

Animal Nutrition Research Department, College of Veterinary Science and Animal Husbandry, Anand Agricultural University, Anand-388 001 (Gujarat), India.

*Corresponding Author:

P.V. Ramteke

Email: drpritishramteke@gmail.com

Received: 26/07/2014

Revised: 08/08/2014

Accepted: 09/08/2014

Abstract

An experiment was conducted to study the effect of bypass fat on reproductive performance in buffaloes. Twenty four pregnant buffaloes in their 2-4 lactation were selected for on-farm trial of 150 days (30 days prepartum and 120 days postpartum) at an organized dairy farm of Gopalpura village of Anand district. The buffaloes were selected on the basis of their stage of pregnancy and were randomly allotted to two dietary treatments i.e. T_1 (control) and T_2 (bypass fat), following Completely Randomized Design. The buffaloes in control group (T_1) were fed as per farm feeding schedule followed by the farmer and those in bypass fat group (T_2) were reared on farm feeding schedule plus bypass fat at 100 g/d for 30 days and 15 g/kg milk yield per day for 120 days. Calf birth weight is significantly ($p<0.05$) increased in bypass fat supplemented group. However, days required for involution of uterus was reduced significantly ($p<0.05$) in bypass fat supplemented group. Reproductive disorders like calf mortality, retention of placenta, metritis, pyometra were also reduced to great extent. Similarly the days required for appearance of first postpartum heat were statistically ($p<0.05$) reduced in bypass fat supplemented group. Length of first and second estrous cycle was statistically similar in both the groups. The service period and number of artificial insemination per conception was statistically ($p<0.05$) reduced in bypass fat supplemented group.

Keywords: Buffaloes, pre-partum, post-partum, bypass fat, reproduction.

Introduction

Feeding of bypass fat, which is inert in rumen, to high producing lactating buffaloes can enhance energy density of ration and energy intake in early lactation without compromising rumen cellulolytic bacterial activity (Jenkins and Palmquist, 1984). Thus, the deleterious effect of acute negative energy balance on lactation can be avoided. A number of studies have reported a positive effect of dietary fat supplementation on reproductive performance in dairy cows (Ben Salem and Bouraoui, 2008; Hess *et al*., 2008; Lopes *et al*., 2009).

Initially, the role of protected fat was considered only as an energy supplement during the transition period leading to improvement in reproductive performance, but later on, it was demonstrated that the effect was also due to fatty acids which act as a precursor of progesterone via cholesterol and prostaglandins (Staples *et al*., 1998). Reported improvement from added fat includes higher conception rate (Ben-Salem and Bouraoui, 2008; Cerri *et al*., 2009; Moriel *et al*., 2009), increased pregnancy rate, and reduced service period (Lopes *et al*., 2007).

The influence of dietary fat supplementation on reproductive performance is not well understood as much of the published data emanates from studies having nutrition and lactation related objectives rather than those of reproduction. Considering the above points, a feeding trial was conducted to investigate the effect of bypass fat supplementation on milk production and reproductive performance of crossbred cows.

Materials and Methods

Location of the study

The study was conducted at organized dairy farm of Gopalpura village in Anand district.

Animals and treatments

The Rumen protected fat was purchased from GADVSU Ludhiana Punjab. Twenty four pregnant buffaloes in their 2-4 lactation were selected and divided in two groups (n=12) according to milk production, fat % and stage of pregnancy. The animals in T_1 (control) fed chaffed wheat straw chopped green jowar and homemade concentrate mixture as per the requirement calculated by ICAR (1998), while the animals in T_2 (Bypass fat group) were fed the same ration supplemented with bypass fat at 100 g/d for 30 days and 15 g/d/kg of milk yield for 120 days.

The concentrate mixture was offered twice a day in equal parts at the milking time, i.e., 05.00 A.M. and 04.00 P.M. Bypass fat was fed through concentrate mixture at one time, i.e., 05.00 A.M. Fresh green maize forage was fed at 10.00 A.M. and 07.00 P.M. in addition to wheat straw, which was fed along with green fodder at the same time. Left over, if any, was weighed next morning. DM content of forage and left over was determined to calculate the daily DMI. Fresh and clean water was provided free choice to each buffalo throughout a day. The buffaloes in T_2 group were supplemented bypass fat 30 days prepartum to 120 days postpartum.

Parturition-related parameters

Calf weight at the time of birth was recorded. The per rectal examination for complete involution of uterus and pregnancy diagnosis was done by local veterinary officer on the field. However, for occurrence of reproductive disorders, help of experts in the field of veterinary medicine and veterinary surgery for disease diagnosis and treatment was taken.

Reproduction related parameters

The following variables were recorded for all cows during postpartum study: (a) conception rate, (b) first estrous observed after calving, (c) first and second estrous length, (d) service period, and (e) number of A.I./Conception. Cows were observed for 30-min by the same technician, three times daily (07.00 A.M., 02.00 P.M. and 04.00 P. M.) for signs of oestrus, and inseminated accordingly after 60-day postpartum. Approximately 90 days after AI, pregnancy diagnosis was carried out by rectal palpation of the uterus. Conception rate was defined as the number of cows pregnant per 100 inseminations and pregnancy rate as the number of cows pregnant per 100 cows in the group.

Blood sampling

During the entire experiment, the blood samples were collected at 0, 75 and 150 days of experiment from all animals early in the morning before offering feed and water by jugular vein puncture. The whole blood was collected into the clot activator tubes for serum collection. The collected serum samples were stored in deep fridge at -20° C for further analysis. The concentration of blood glucose and the serum concentrations of blood urea nitrogen, triglycerides and activities of alanine aminotransferases (ALT/SGPT), aspartate aminotransferases (AST/SGOT) and alkaline phosphatase (AKP), were estimated using Semi Automatic Analyzer for clinical chemistry test (Model 3000 EVOLUION) of Coral Clinical Systems. The commercial diagnostic kits for analysis were procured from CREST Bio-systems Ltd., Goa, India

Analytical technique

The degree of protection of rumen protected fat was judged by estimating the degree of saponification of the Ca Soaps (Garg and Mehta, 1998). The dried samples of concentrates, wheat straw and green jowar were ground to pass through 1 mm sieve, pooled, and samples were analyzed for proximate (AOAC, 2005).

Results and Discussion

The chemical composition of feed and fodder has been summarized in Table 1. Total fat content in the supplemented bypass fat was 87.96% and the ash percent was 12.04%.

Table 1: Chemical composition of feeds and fodders

Ingredients	CP %	EE %	CF %	NFE %	Ash %	Ca%	P%
CSC	23.54±0.20	9.15±0.24	23.27±0.30	38.47±0.39	5.57±0.32	0.30±0.72	0.50±0.39
Maize Cake	19.04±0.10	14.20±0.10	10.93±0.14	53.60±0.19	2.23±0.23	0.50±0.65	0.40±0.42
Maize Husk	6.94±0.06	3.00±0.09	4.16±0.15	85.56±0.57	0.27±0.21	0.26±0.16	0.90±0.45
Green Jowar	8.36±0.09	3.40±0.17	33.08±0.11	44.55±0.50	10.61±0.39	0.98±0.17	0.56±0.42
Wheat Straw	3.88±0.10	2.48±0.30	36.64±0.18	40.61±0.43	16.38±0.31	0.65±0.34	0.25±0.35
Bypass Fat*	-	87.96±0.22	-	-	12.04±0.33	9.30±0.04	-

Parturition related parameters

Calving performance of buffaloes is represented in Table 2. The average body weight of calves at the time of birth was 26.2 kg in T_1 and 28.12 kg in T_2 which was statistically (p<0.05) higher by (7.32%) in bypass fat supplemented group. Higher birth weight of the calves observed in T_2 may be due to the higher energy intake due to addition of bypass fat. Higher plasma progesterone concentration was reported on fat supplementation (Spicer *et al*., 1993; Son *et al*., 1996). The higher progesterone level may be responsible for better nourishment of fetus in the final stages of pregnancy. Similar results were also observed by Tyagi *et al*. (2010) and Shelke *et al*. (2011).

Table 2: Calving performances of buffaloes fed with or without bypass fat

Attributes	T1	T2
Calf weight (kg)	$26.23^a \pm 0.32$	$28.12^b \pm 0.22$
Involution of uterus (days)	$42.83^b \pm 0.76$	$37.25^a \pm 0.52$
Calf mortality and reproductive disorders		
Dystocia	2	-
Metritis	-	-
Pyometra	-	-
Prolapsed of uterus	1	-
Retention of placenta	2	1
Calf mortality	2	-

*Means with different superscripts in a row for a parameter differ significantly, * (p < 0.05).*

Similarly no of days required for involution of uterus in T_1 and T_2 42.83 and 37.25 days respectively which was statistically (p<0.05) lower by (5.58 days) in bypass fat supplemented group than control. According to Shelke *et al.* (2012) the reproductive performance is strongly associated with energy status. Dietary fats can provide fatty acids precursors for cholesterol and prostaglandin production, which have an effect on ovarian function, uterine function, and conception rates. There were two cases of dystocia, prolapsed of uterus and calf mortality. No such cases were observed in T_2.

Reproductive performance

The data on reproductive performance of experimental buffaloes is given in Table 3. The no of days required for appearance of first postpartum heat in T_1 and T_2 is 57.42±1.37 and 48.26±1.21 which was statistically (p< 0.05) reduced by (9.12 days) in bypass fat supplemented group. The commencement of cyclicity is related with the process of involution of uterus, as the duration for uterine involution was reduced on bypass fat supplementation, it may responsible for relatively early commencement of cyclicity. The present results are in the agreement with Tyagi *et al*. (2010) and Shelke *et al*. (2011).

The first and second estrous lengths were 15.58±0.54 and 16.00±0.30 days; 21.33±0.51 and 20.75±0.18 days in T_1 than T_2, respectively. There was no significant difference in the length of first and second estrus cycle length recorded between the groups. The first estrous after calving is generally irregular and of shorter duration from the normal estrous, the same was observed in present study. The second estrous was of normal duration and considered as suitable for the conception. Similar results were also reported by Tyagi *et al*. (2010) and Shelke *et al*. (2011).

Table 3: Reproductive parameters in buffaloes fed rations with or without Ca salts of fatty acids

Attributes	T1	T2
Postpartum heat (days)	$57.42^b \pm 1.37$	$48.26^a \pm 1.21$
1st estrous length (days)	15.58±0.54	16.00±0.30
2nd estrous length (days)	21.33±0.51	20.75±0.18
Service period (days)	$106.42^b \pm 2.92$	$73.92^a \pm 2.14$
No. of AI per conception	$3.58^b \pm 0.34$	$2.00^a \pm 0.24$

*Means with different superscripts in a row for a parameter differ significantly, * (P < 0.05).*

The service period in T_1 than T_2 was 106.42±2.92 and 73.92±2.14 which was statistically reduced by 32.56 days in T_2 than that of T_1. Similarly, no of AI per conception in T_1 and T_2 was 3.58 and 2.00 which was statistically lower in bypass fat supplemented group. The service period was shorter in T_2 than that of T_1, indicating that lesser time was required for the animals in T_2 for conception. Similar observation of reduction in service period through feeding of bypass fat was also recorded by Ben Salem and Bouraoui (2008) and Lopes *et al.* (2009), Tyagi *et al*. (2010) and Shelke *et al*. (2011). Buffaloes of T_2 required 1.58 less AI per conception than those of T_1 indicating better efficiency of AI in T_2. Bypass fat typically increases concentrations of circulating cholesterol, the precursor of progesterone (Grummer and Carroll, 1991). Ruminants fed supplemental fat often have a slight increase in blood progesterone concentration (Staples *et al*., 1998). Progesterone, secreted by the corpus luteum prepares the uterus for implantation of the embryo and helps to maintain pregnancy by providing nourishment for the conceptus via induction of heterotrophic proteins from the endometrium.

Blood biochemical profile of experimental buffaloes fed with or without bypass fat

The data on blood biochemical parameters is represented in Table 4.

Table 4: Blood biochemical profile of experimental buffaloes

Attributes	T1	T2
Blood glucose (mg/dl)	55.86±0.89	56.58±0.94
Serum triglyceroids (mg/dl)	77.83±0.99	75.00±0.80
Blood urea nitrogen (mg/dl)	33.50^{b}±0.59	29.10^{a}±0.50
SGPT	81.78±1.89	81.00±1.76
SGOT	188.50±4.32	187.19±4.12
Alkaline phosphatase	306.86±20.46	307.42±9.29

*Means with different superscripts in a row for a parameter differ significantly, * ($p < 0.05$).*

The blood glucose level (mg/dl) serum triglyceroids level (mg/dl) and activities of serum enzymes like SGPT, SGOT and alkaline phosphatase was within normal range in all the buffaloes except blood urea nitrogen (mg/dl) level in T_1 and T_2 was 33.50±0.59 and 29.10±0.50, respectively, which was statistically reduced in bypass fat supplemented group than control.

Conclusion

Due to feeding of rumen protected fat during prepartum and early lactation was significantly improved the birth weight of the calf. However, time required for the involution of uterus, onset of first postpartum heat, service period and number of AI per conception was significantly reduced due to feeding of rumen protected fat. Other postpartum complications like pyometra, dystocia, retention of placenta, metritis, mastitis and calf mortality was reduced to great extent. Blood serum and enzyme profile was similar in both the group except blood urea nitrogen which was statistically lower in bypass fat supplemented group.

Acknowledgement

I acknowledge all my professors like Dr. Gupta, Dr. Pandya, Dr. Sheikh, and Dr. Devaliya for their kind support and constructive suggestions. I also acknowledge the ANRS for providing all the facilities for the completion of this project as well as the GADVASU for providing sufficient samples for this research.

References

AOAC (2005). Association of Official Analytical Chemists. *Official Methods of Analysis. Washington, DC.*

Ben-Salem M and Bouraoui R (2008). Effects of calcium salts of palm fatty acids and protected methionine supplementation on milk production and composition and reproductive performances of early lactation dairy cows. *International Journal of Dairy Science,* 3: 187-193.

Cerri RLA, Juchem SO, Chebel RC, Rutigliano HM, Bruno RGS, Alvão KNG, Thatcher WW and Santos JEP (2009). Effect of fat source differing in fatty acid profile on metabolic parameters, fertilization, and embryo quality in high-producing dairy cows. *Journal of Dairy Science*, 92: 1520-1531.

Garg MR and Mehta AK (1998). Effect of feeding bypass fat on feed intake, milk production and body condition of Holstein Friesian cows. *Indian Journal Animal Nutrition*, 15: 242-245.

Grummer RR and Carroll DJ (1991). Effects of dietary fat on metabolic disorders and reproductive performance of dairy cattle. *Journal of Animal Science,* 69: 3838-3852.

Hess BW, Moss GE and Rule DC (2008). A decade of developments in the area of fat supplementation research with beef cattle and sheep. *Journal of Animal Science*, 86: E188-E204.

ICAR (1998). Nutrient requirements of livestock and poultry. 2nd revised edition. *Indian Council of agricultural Research, New Delhi.*

Jenkins TC and Palmquist DL (1984). Effect of fatty acids of calcium soaps on rumen and total nutrient digestibility of dairy rations. *Journal of Dairy Science,* 67: 978-986.

Lopes CN, Scarpa AB, Cappellozza BI, Cooke RF and Vasconcelos JLM (2009). Effects of rumen-protected polyun-saturated fatty acid supplementation on reproductive performance of Bosindicus beef cows. *Journal of Animal Science*, 87: 3935-3943.

Lopes CN, Vasconcelos JLM, Araujo TPB and Oliveira LOF (2007). Effect of supplementation with Megalac-E on pregnancy rate in primiparous Nellore cows. *Journal of Animal Science*, 85 (Suppl. 2), (Abstract).

Moriel P, Goncalves EP, Nayigihugu V, Aines G, Block E and Hess BW (2009). Conception rates of beef cows fed a supplement with rumen-protected fat. *Midwest ADSA-ASAS Abstr.#281.*

Shelke SK, Thakur SS and Amrutkar SA (2011). Effect of prepartum supplementation of rumen protected fat and protein on performance of murrah a buffaloes. *Indian Journal of Animal Science,* 81: 946-950.

Shelke SK, Thakur SS and Amrutkar SA (2012). Effect of feeding protected fat and proteins on milk production, composition and nutrient utilization in murrah buffaloes (Bubalusbubalus). *Animal Feed Science and Technology,* 171: 98-107.

Son J, Grant RJ and Larson LL (1996). Effects of tallow and escape protein on Lactational and reproductive performance of dairy cows. *Journal of Dairy Science,* 79: 822-830.

Spicer LJ, Vernon RK, Tucker WE, Waterman RP, Hogue JF and Adams GD (1993). Effects of inert fat on energy balance plasma concentrations of hormones, and reproduction in dairy cows. *Journal of Dairy Science,* 76: 2664-2673.

Staples CR, Burke JM and Thatcher WW (1998). Influence of supplemental fats on reproductive tissues and performance of lactating cows. *Journal of Dairy Science,* 81: 856-871.

Tyagi N, Thakur SS and Shelke SK (2010). Effect of bypass fat supplementation on productive and reproductive performance in crossbred cows. *Tropical Animal Health and Production,* 42: 1749-1755.