EFFECTS OF SUPPLEMENTATION OF MILK REPLACER ON HAEMOGLOBIN AND BLOOD BIOCHEMICAL PARAMETERS OF BLACK BENGAL KIDS

R. S. MANTRI*, G. M. KEDARE, S. LONKARE, A. MANDAL
M. KARUNAKARAN AND M. K. GHOSH

*ICAR-National Dairy Research Institute
Eastern Regional Station
Kalyani-741 235, West Bengal, India*

The present study was conducted to elucidate the effects of supplementations of two newly formulated milk replacers on haemoglobin and blood-biochemical parameters of Black Bengal kids. The study was conducted on 4 day old kids for a period 90 days growth trial. The control (T_0) group was fed with their dams' milk as per the routine practice while treatment groups were fed with milk and milk replacer both e.g. T_1 - Milk + Soyabean milk replacer (SBMR) and T_2 - Milk + Skimmed milk milk replacer (SMMR). Blood collection was done fortnightly. The results showed significant ($P<0.05$) increase in blood total protein, albumin and globulin values of T_2 group along with non-significantly higher Hb, glucose, BUN, SGPT and SGOT values compared to control. Thus, supplementation of SMMR or SBMR with milk has no negative effect on blood Hb, total protein, albumin, globulin, glucose, BUN, SGPT and SGOT levels.

Key words: Milk, Milk replacer, SBMR, SMMR

The old saying "The goat is the poor man's cow" still holds good for developing countries like India due to immense contribution of goat husbandry to the rural economy. Goat plays an important role in generating employment, income, capital storage and improving household nutrition (Husain, 1999). It is giving daily bread and butter to those millions of women's, landless laborers and marginal farmers who live in interior areas and don't have any other means of livelihood. Goats are

preferred as livestock for rearing especially in small holding farming system due to its unique ability to adapt and maintain themselves in harsh environmental condition. In long run, the overall productivity and profitability of farm is determined by health and growth rate of kids. In the rural areas high mortality of kids is regarded as one of most important constraints in goat production. Relatively low birth weight, slow growth rate and insufficient supply of dams' milk are major contributing factors

*Corresponding Author

associated with high mortality rates in kids (Miah, 2003). Particularly, in case of Black Bengal goats, due to twinning and triplets, the birth weights of kids is usually low (800-950g) followed by low availability of milk from dam which leads to high mortality in new born kids (30-35%) and poor growth of surviving kids (Chowdhury *et al.*, 2002). Sometimes conditions like dam abandoned kids, mastitis like health problems; death of dam makes the situation more complicated. Also, in modern husbandry, practices like commercial kid rearing and early weaning are commonly followed. These all things together have resulted in a heavy demand for the availability of an alternates to mother's milk like milk replacer from the goat farmers and entrepreneurs engaged in goat husbandry, so that the kids can be fed sufficiently to meet the nutritional requirement for the survival and growth during their early stage until they can go for grazing (Dutta *et al.*, 2006).

MATERIALS AND METHODS

Selection and distribution of experimental animals: Four day old kids of Black Bengal goat were selected for conducting the experiment. Total 18 animals were taken. All experimental animals were maintained at animal farm, I.V.R.I.-E.R.S., Kalyani. These animals were randomly divided into 3 groups T_0 , T_1 and T_2 (6 animals each). Equal number of males and females (5 males and 1 female) were allotted for each group. Mean birth weight for control (T_0) group was 1105.83 ± 37.74 g. The corresponding values in treatments groups T_1 and T_2 were 1123.33 ± 38.46 and 1113.33 ± 30.81 g, respectively and it does not differ significantly ($P > 0.05$) between the groups.

Formulation of milk replacers: Taking into consideration, the digestive limitations of kids less than 3 weeks of age, ingredients formulation is critical to allow for adequate digestion, proper growth and performance. The first 30 days after birth are the most critical and require special management in an intensive system (Husain, 1999). Therefore, it has been suggested that milk replacers should be formulated with ingredients processed for the underdeveloped digestive system of the young kids. Within the few weeks of age, the ability of the kids to digest various feedstuffs improves dramatically as its enzyme production increases and diversifies. The nutritional availability of protein and energy sources used for milk replacer is a key factor in determining the outcome of the feeding program based on the source of feed used (Bugti *et al.*, 2016). Keeping in mind these things, two milk replacers were formulated, one using soyabean as major ingredient and the other using skimmed milk powder and are abbreviated as SBMR and SMMR respectively. Soyabean milk replacer (SBMR) is a soya based formulation added with vegetable oil, maltodextrin, SMP, additives etc. Skimmed milk milk replacer (SMMR) is skimmed milk powder based formulation added with soya flour, maltodextrin, additives etc. Formulation of both the milk replacer is deliberately hidden for the purpose of patenting.

Feeding trial: All groups were fed with their dams' milk for first 4 weeks of life, then all groups kids were weaned and kept housed in the experimental animal cages. Treatment group (T_1 , T_2) kids were supplemented with dams' milk along with milk replacer formula developed for their group both (T_1 - Milk + SBMR and T_2 - Milk + SMMR). Control group

was continued feeding measured quantity dams' milk with feeding bottles as per schedule. By 31st day onward introduction of kid starter and soft green grass was done for all groups by gradual replacement of milk and milk replacer in the respective group. From 61st day up to completion of trial only kid starter + soft green grass was fed to all groups. During whole trial all kids were given clean potable drinking water *ad lib*. Milk replacer was prepared in the form of a powder and fed as liquid by adding hot water, then mixed uniformly, cooled to body temperature and fed using feeding bottles. Table 1 presents the details of feeding schedule followed during whole trial period.

Collection of blood and analysis of blood parameters: Blood samples were collected at 7.00 am before any feed offered to the experimental animals at fortnight interval by means of jugular vein puncture. 5 mL blood was collected in every collection. The blood

samples were collected into heparinized tubes (20 IU heparin/mL of blood), put in an ice bucket and carried to the laboratory immediately. 1 mL blood sample kept for haematological parameter estimation and remaining blood samples were centrifuged at 3000 rpm for 30 min at 4°C and plasma was separated and kept in the labelled storage vials of 5 mL capacity and stored at -20°C till analysis for blood metabolites viz. Hb, glucose, total protein, albumin, blood urea nitrogen and enzymes viz SGPT and SGOT.

Hb estimation was done by Sahlis Haemoglobinometer and globulin by total protein and albumin difference method, while other blood parameters such as total protein (modified biuret, end point assay method), albumin (bromocresol green, end point assay method), blood glucose (GOD-POD method), blood urea (DAM method). Activity of enzymes SGPT/ALT and SGOT/AST were

Table 1. Detailed feeding schedule followed during trial period

Group		T ₀	T ₁	T ₂	All groups	
Feeding rate		@ % of Body weight			g/day	
Month	Week	Milk	Milk+ SBMR	Milk + SMMR	Conc.	Green
1	1 - 4	<i>Ad lib.</i>	<i>Ad lib.</i> + 5%	<i>Ad lib.</i> + 5%	-	-
	5	15%	15% + 5%	15% + 5%	20	
	6	10%	10% + 4%	10% + 4%	30	
2	7	5%	5% + 3%	5% + 3%	40	<i>Ad lib.</i>
	8	2.5%	2.5% + 2%	2.5% + 2%	50	
	9	2.5%	2.5% + 2%	2.5% + 2%	60	
3	10	-	-	-	70	
	11	-	-	-	80	<i>Ad lib.</i>
	12	-	-	-	90	
	13	-	-	-	100	

estimated by 2, 4-DNPH (Reitman and Frankel Method), using commercially available kit (Span Diagnostics Ltd., India).

Statistical analysis: Suitable statistical procedures were followed to analyse the data recorded under various experiments in the study. Different statistical designs were considered for analysis of data as per Harvey (1990) and analysis was done through LSMLMW mixed model least square and maximum likelihood computer programme.

RESULTS

The effects of supplementations of two newly formulated milk replacers on various haematological parameters and serum enzymes of Black Bengal kids have been depicted in Table 2. Mean Hb level in T_1 group were comparable to control group (T_0) but, in T_2 group it is higher than control.

Mean total protein was non-significantly higher in T_2 and T_1 groups compared to control (T_0). Mean albumin level in T_2 group was significantly ($P<0.05$) higher than all other groups, whereas, it was non-significant for globulin content.

The present study revealed that glucose and BUN levels in blood were similar in all groups.

A significantly ($P<0.05$) higher SGPT level in T_1 group compared to control but from the values are consistent with T_2 . Mean SGOT level was non-significant compared to control (T_0).

DISCUSSION

Present study revealed that feeding SMMR and SBMR as supplementation with milk in Black Bengal kids gives positive effect on total protein, albumin, globulin and SGPT level in blood and its supplementation with milk in Black Bengal kids does not affect blood Hb, glucose, BUN and SGOT levels. Thus, feeding of SMMR and SBMR solely or its supplementation with milk showed positive impact on mortality and growth performance of Black Bengal kids. Diaz-Gomez *et al.* (2008) supported the current result as in his study of feeding milk replacer to Nubian kids, he observed kids fed with milk replacer + 0.0 % concentrate of soy protein had higher ($P>0.05$) concentration of Hb (11.5 ± 0.1 g/dL) than those fed 20% and 40% concentrate of soy protein. However, different results were reported by

Table 2. Means of haemoglobin and biochemical parameters of all experimental groups

Parameters	T_0	T_1	T_2
Hb level (mg/dL)	10.77 $\pm$ 0.17	10.76 $\pm$ 0.12	11.19 $\pm$ 0.27
Total protein (g/L)	64.76 ^{bc} $\pm$ 4.73	67.94 ^b $\pm$ 2.54	74.51 ^a $\pm$ 1.12
Albumin(g/L)	28.76 ^b $\pm$ 2.78	29.37 ^b $\pm$ 1.14	32.42 ^a $\pm$ 0.93
Globulin(g/L)	35.99 ^b $\pm$ 3.55	38.56 ^b $\pm$ 1.56	42.08 ^a $\pm$ 0.49
Glucose level (mg/dL)	63.96 $\pm$ 2.59	65.06 $\pm$ 3.59	70.65 $\pm$ 2.04
Blood urea nitrogen (mg/dL)	43.2 $\pm$ 5.14	50.84 $\pm$ 5.98	47.13 $\pm$ 5.43
SGPT (IU/L)	21.58 ^b $\pm$ 1.33	29.48 ^a $\pm$ 1.99	24.25 ^{ab} $\pm$ 1.43
SGOT (IU/L)	71.77 $\pm$ 6.26	69.47 $\pm$ 9.36	73.09 $\pm$ 1.59

Values bearing different superscripts (a,b etc.) within a row differ significantly ($P<0.05$) from each other

Lee *et al.* (2008) in his study that total protein and albumin concentrations in calves were not affected by feeding of high protein and low energy milk replacer in Holstein calves during the pre-weaning period. Shukla (2012) while studying effect of feeding milk replacer on Holstein-Kankrej crossbred calves reported that no significant ($P>0.05$) difference was observed for total protein, serum albumin and serum creatinine among the calves of different treatments. Morand-Fehr *et al.* (1982) stated blood glucose level as nutritional status in goats. Lee *et al.*, 2008 reported similar results in his study of feeding high protein and low energy milk replacer in Holstein calves during the pre-weaning period. He observed that glucose concentrations in calves were not affected significantly ($P>0.05$) by feeding of milk replacer. Quigley *et al.* (2006) also supported this result as he found that feeding of milk replacer in calf elevates concentrations of plasma glucose but not significantly ($P>0.05$).

Knegsel *et al.* (2007) reported that feeding animals with diets having higher quantity of fermentable carbohydrates is associated with higher levels of blood glucose concentration, in present study as the treatment groups T_1 and T_2 were supplemented with milk replacer containing fermentable sugars like maltose, dextrose etc. along with milk it might have raised their blood glucose levels. Lee *et al.* (2008) reported that BUN concentrations in calves were increased by feeding of high protein and low energy milk replacer in Holstein calves during the pre-weaning period. Quigley (2006) supported this result as he found that feeding of milk replacer in calf increases concentrations of plasma urea N and insulin- like growth factor-I.

Treatments group T_2 recorded higher SGPT values than control (T_0) group, these values differ significantly ($P<0.05$) which may be indicative of different type of proteins i.e. proteins of different amino acid make as compared to milk protein may be supplied through milk replacer. As these values are in normal physiological range so they are suggestive of apparently healthy kids. While the SGPT values for T_2 group was though higher than control (T_0) group but these values do not differ significantly ($P>0.05$). The SGPT values highlighted the fact that during supplementation of milk replacer kind of protein supplied by materials used in formulating milk replacer should be given attention. The above results are corroborated with the findings of Heo *et al.* (1999), who reported that in growing lambs the value of SGPT and SGOT were significantly ($P<0.05$) less in the Ca and P mineral deficient lambs which may be due to low supply of these minerals through milk which is deficient in them. While the higher value of SGPT and SGOT may be due to increase in transamination reaction due to higher availability of these minerals as they were added in milk replacer during its formulation. Lee *et al.* (2008) reported that SGPT and SGOT concentrations were significantly higher ($P<0.05$) in calves fed with high protein and low energy milk replacer. Thus from above study it can be revealed that on feeding milk replacer in addition to milk (T_1 and T_2 groups) the liver enzymes SGPT and SGOT levels remains in normal physiological range which is an indication normal healthy status of liver, thus it can be concluded from this investigation that, by feeding of milk replacer there is no adverse effect on their liver apparently.

Conflict of interest: Authors declare there is no conflict of interest regarding the present research work.

ACKNOWLEDGEMENT

The authors acknowledge the National Dairy

Research Institute for providing the institutional fellowship to Author R. S. Mantri and all necessary facility required for present work. Sincere thanks to IVRI - Eastern Regional Station, Kalyani for providing assistance required to carry out animal trial during present work.

REFERENCES

- Bugti AG, Kaleri HA, Shah MA, Zaman S, Iqbal MA *et al.*, 2016. Effect of milk replacer on the growth of goat kids. *J Agri Biotec*, 01(01): 22-25
- Chowdhury SA and Faruque S, 2002. Feeding Black Bengal goat under intensive management: Milk feeding in pre-weaned kids. *Asian-Australasian J Anim Sci*, 17: 39-45
- Dutta TK, Rao SB, Sahoo PK and Nawab S, 2006. Formulation and evaluation of probiotics supplemented milk replacers in preweaning Barbari kids. *Indian J Anim Sci*, 76(12): 1050-1054
- Diaz-Gomez MO, Ochoa-Cordero MA, Torres-Hernández G, Mandeville PB, Urrutia-Morales J *et al.*, 2008. Hematological parameters of Nubian kids artificially raised with a milk replacer. Conference Paper, <https://www.researchgate.net/publication/234097022>
- Harvey WR, 1990. Users guide for LSMLMW mixed model least square and maximum likelihood computer programme (PC-@) version. Ohio State University Press, Columbus, 91
- Heo KN, Odle W, Oliver JH, Kim IK and Han E, 1999. Effects of milk replacer and ambient temperature on growth performance of 14-day-old early-weaned pigs. *Asian-Australasian J Anim Sci*, 12(6): 908-913
- Husain SS, 1999. A Study on the productive performance and genetic potentials of Black Bengal goats. Ph.D. thesis, Bangladesh Agricultural University, Mymensingh, Bangladesh, pp45-55
- Knegsel A, Van den Brand H, Graat E, Dijkstra J, Jorritsma R *et al.*, 2007. Dietary energy source in dairy cows in early lactation: metabolites and metabolic hormones. *J Dairy Sci*, 90: 1477-1485
- Lee HJ, Khan MA, Lee WS, Kim HS, Ki KS *et al.*, 2008. Growth, blood metabolites and health of Holstein calves fed milk replacer containing different amounts of energy and protein. *Asian-Australasian J Anim Sci*, 21(2): 198-203
- Miah G, Uddin MJ, Akhter S and Kabir F, 2003. Effect of birth weight and milk yield of dam on kid mortality in Black Bengal goat. *Pakistan J Biol Sci*, 6: 112-114
- Morand-Fehr P, Hervieu J, Bas P and Sauvant D, 1982. Feeding of young goats. Proceedings of the third International Conference on Goat Production and Disease, January 10 to 15, 1982; Tucson, Arizona U.S.A., pp90-104
- Quigley D, Wolfe TA and Elsasser TH, 2006. Effects of additional milk replacer feeding on calf health, growth, and selected blood metabolites in calves. *J Dairy Sci*, 89: 207-216
- Shukla R, 2012. Effect of Feeding Milk Replacer on Holstein-Kankrej Crossbred Calves. M.V.Sc Thesis submitted to the Anand Agricultural University, Gujarat (India)