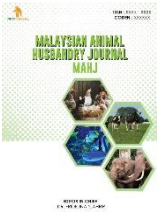
ZIBELINE INTERNATIONAL™ PUBLISHING

ISSN: 2805-5500 (Online)
CODEN: MAHJAQ

Malaysian Animal Husbandry Journal (MAHJ)

DOI: http://doi.org/10.26480/mahj.01.2025.15.19



RESEARCH ARTICLE

EFFECTS OF DIETARY ENERGY LEVELS DURING LATE PREGNANCY ON PERFORMANCE OF FEMALE BLACK BENGAL KIDS

Faria-Ter Jerin[a], Md. Mokarram Hossain[b*], Samsunnaher[c], Mohammad Moniruzzaman[a], Md Hasanur Alam[a]

[a] Department of Animal Science, Faculty of Animal Husbandry, Bangladesh Agricultural University, Mymensingh-2202
[b] Quarantine Pathologist, Central Packing House, Plant Quarantine Wing, Department of Agricultural Extension, Shampur, Dhaka-1204
[c] Physics, Govt. Keshab Chandra College, Jhenaidah-7300.
**Corresponding Author Email: hossainmokarram@dae.gov.bd*

This is an open access article distributed under the Creative Commons Attribution License CC BY 4.0, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ARTICLE DETAILS

Article History:

Received 12 October 2024
Revised 18 November 2024
Accepted 07 December 2024
Available online 09 January 2025

ABSTRACT

Appropriate amount of dietary energy during late pregnancy plays crucial roles for better performance of both dam and kids. Due to a prolonged energy shortage of dam in this phase, kids encounter higher mortality rate. However, knowledge on the energy required by the Black Bengal goats during their last stage of pregnancy as well as its' impact on performance of female kids remains unknown. The study aimed to analyze the effects of various dietary energy acquired in late gestation period on the weight during birth, rate of growth, weaning weight, physical measurements (heart girth, height at wither and body length), consumption of milk and age at puberty of female Black Bengal kids. Three isonitrogenous diets that contained three dissimilar levels of metabolizable energy i.e., low energy (8.67 MJ/Kg DM), medium energy (10.2 MJ/Kg DM) and high energy (11.73 MJ/Kg DM) were given to stall-fed female Black Bengal does (n=15) randomly. During the experiment, various data of kids including birth weight, weaning weight, rate of growth, length of body, heart girth, wither height of female kids underwent measurement and age of puberty were recorded. The difference among birth weights of the different treatment groups was insignificant. The live weight gain in high maternal energy group was significantly ($p<0.05$) higher than the low and medium groups. The heart girths, heights at wither and body lengths of high group were more than that of others. There was a positive relation between amount of milk consumed by kids and their growth performance. The kids belonging to the high maternal energy group were observed to consume significantly ($p<0.05$) more milk than others. The dams consuming high energy reached puberty comparatively earlier. To conclude, during late pregnancy, the level of dietary energy positively influenced the birth weight, growth rate, weaning weight, body measurements (heart girth, height at wither and body length), milk consumption and puberty of female kids.

KEYWORDS

Black Bengal goat, Female kids, Pregnancy, Dietary energy, Birth weight, Growth, Puberty

1. INTRODUCTION

The goat is economically, nutritionally and culturally an important resource to mankind for over 7000 years. It is considered amongst those countries having a great agricultural potential, goat raising is important for their livelihood (Daskiran et al., 2006). In rural areas, the contribution of small ruminants is beyond calculation. This implies high quality nutrients in the form of meat, milk, fiber, skins and regular sacrifices for social and religious occasions. Black Bengal is a potential, small, meat type breed of goat, common throughout Bangladesh and also found in northeastern India. As they are small in size, they do not need large management facilities. For the farmers who are poor and fail to rear large ruminants, the goat is justified as "poverty-stricken" and ensures a source of household income. It plays a pivotal role in the country's national economy.

The goat secures second position in case of meat, milk and skin production sharing about 32, 23 and 28 percent respectively of the total livestock in Bangladesh (DLS, 2021). Among the 563.28 lacs ruminant (cattle, buffalo, goat and sheep), goat occupies 266.94 lacs implying to 47.39% of total livestock population (DLS, 2021). The economic contribution of goat in the terms of animal proteins in the developing countries has been rigorously reviewed (Devendra et al., 2007). Above 90% of the goats are kept by rural people in Bangladesh (FAO, 2015). Black Bengal goats remain popular due to their remarkable adaptability in the adverse climatic conditions, poor management, low feed consumption, rapid maturity, high fertility, prolificacy, tasty meat and soft skin. Black Bengal goats are tolerant to tropical high temperature and humidity, they face reproductive failures associated with low plane of nutrition during late pregnancy (Husain et al., 1995).

Late gestation denotes the period demanding the greatest amount of nutrient for dam's sound health and having the potentiality of high milk production. Thus, the long-term malnutrition of dam is proposed to cause delayed estrous cycle of kids (Milton et al., 2015). This trend of goat production in Bangladesh as well as other tropical nations remain hindered because of high mortality ratio of kids and their low development rate (Amin et al., 2001). Low weights at birth, insufficient milk supply of the dam, predators, sickness, and more definitely inadequate nutrition at the time of pregnancy are supposed to be the main reasons of kid mortality (Devandera, 2001). Generally, Black Bengal goats have larger litter which is advantageous but also causes problems during the dam's insufficient milk supply to the kids.

Quick Response Code	Access this article online	
	Website: www.mahj.org.my	DOI: 10.26480/mahj.01.2025.15.19

Cite The Article: Faria-Ter Jerin, Md. Mokarram Hossain, Samsunnaher, Mohammad Moniruzzaman, Md Hasanur Alam (2025). Effects Of Dietary Energy Levels During Late Pregnancy On Performance Of Female Black Bengal Kids. *Malaysian Animal Husbandry Journal, 5(1): 15-19.*

2. Materials and Method

2.1 Place of experiment

Beginning from November 2020 and ending to March 2022, the experiment was carried out both at the Goat, Sheep and Horse farm and the Animal Science laboratory at Bangladesh Agricultural University, Mymensingh.

2.2 Experimental animals

The study was conducted on fifteen female Black Bengal does aging 7- 8 months. The goats were bought from the Goat Development Farm located at Savar, Dhaka. Initially, their overall body weight ranged from 9 to 10 kg. Before commencing the experiment, the does were reared to adjust with the experimental conditions as well as diets for 2 weeks. The kids born from the does were also included in the experiment.

2.3 Housing and management practices

15 separate pens were allocated for the goats housing an individual in each. Every pen was 5.7 feet long and 2.6 feet wide resulting an area of 14.82 square feet. The house was well ventilated. The gunny bag was hanged over the ventilator to protect rain and wind. Every day the floor, feeder and water trough were cleaned using phenyl as antiseptic. Separate feeder was used for roughage and concentrate feeding. The animals were identified with ear tags. Anthelmintic drug was administered to deworm the goats.

2.4 Layout of the experiment

Goats were divided into three groups while each group consisted of 5 goats. The experimental layout is shown in Table 1.

Table 1: Experimental layout

Parameter		Levels of Energy	
	Low (8.67 MJME/kg DM)	**Medium (10.2 MJME/kg DM)**	**High (11.37 MJME/kg DM)**
No. of does	5	5	5
Duration of trials (d) *	45	45	45
Average initial live weight (kg)	13.3 ± 0.4	13.16 ± 0.8	13.14 ± 0.7

* From 100 days of pregnancy to parturition.

2.5 Experimental diets

There were three diets formulated using common feed ingredients including German grass, wheat bran, maize, soybean meal, molasses, DCP (di-calcium phosphate) and common salt. The medium energy diet contained the recommended levels of metabolizable energy (ME) 10.20 MJ/kg DM, crude protein (CP) 14% following the NRC (1981) for goat. The other two levels of energy were high energy, HE = 11.73 MJME/kg DM and low energy, LE= 8.67 MJME/kg DM. All diets included 14% crude protein based on the dry matter. The ingredients as well as chemical composition of formulated diets are depicted in Table 2.

Table 2: Ingredients and chemical composition of the experimental diets

Ingredients	Energy Level		
	Low	**Medium**	**High**
German grass	80	50	30
Wheat bran	14	15	5
Maize crushed	1	20	50
Soybean meal	4	10	4
Molasses	-	4	10
Common salt	0.5	0.5	0.5
DCP	0.5	0.5	0.5
Chemical composition (DM basis)			
Estimated ME (MJ/kg DM)	8.67	10.2	11.73
Estimated CP (%)	14	14	14

ME and CP values of feed ingredients were taken from published values (Banerjee, 1978; Ranjan, 1980; Khan et al., 2008).

2.6 Feeding of goats

Goats were fed in stalls. After 7 days, the levels of dietary energy were calculated according to the changes of live weights in various treatments. Goats were fed routinely two times a day providing the concentrate mixture followed by green grass. The required amount of feed for individual goat was divided into two equal parts. The first portion was provided at 9 am while the rest amount was supplied at 4 pm and fresh water was provided *ad-libitum.*

2.7 Management practices of kids

Soon after birth, kids' nostrils were cleaned, placental membranes was removed, and they were gently rubbed with dry cloths. Within 30 minutes after taken birth, the infants were allowed to ingest colostrum. Only during the first month, the kids were permitted to suck colostrum. After that, they were allowed to eat roughage and have fresh water *ad libitum.*

2.8 Birth weight of kids

In order to compare differences among various treatment groups, after delivery, the birth weights of female kids were measured using weighing machine.

2.9 Live weight measurement

Every week, the kids were weighed separately using electric balance. The female kids were weighed at morning in empty stomach and data was recorded.

2.10 Body measurements of kids

Measuring tape was used to observe and record body parameters of female kids (length, heart girth, wither height) weekly.

2.11 Milk consumption record of kids

The amount of weekly milk consumption by female kids were measured. The kids were separated from their mother for 3 hours, i.e. from 9 am to 12 pm and kept unfed during the period. Later, they were allowed to have milk and weighed again. The difference between the first and second weights resembled the amount of milk consumed by the kids.

2.12 Puberty of kids

The time required for puberty of female kids was recorded manually.

2.13 Statistical analysis

All values were expressed as the mean ± SE (Standard Error). All data were subjected to one-way ANOVA, and the significance of difference among means was determined by the Duncan's Multiple Range Test (DMRT). A probability of less than 0.05 was considered statistically significant. All statistical analyses were conducted using IBM SPSS Statistics 20 software.

3. Results and Discussion

3.1 Birth weight of female kids

On an average, the kids of high maternal energy group showed higher birth

weight than the low and medium groups but the value did not differ significantly. The average birth weights of kids are shown in Figure 1.

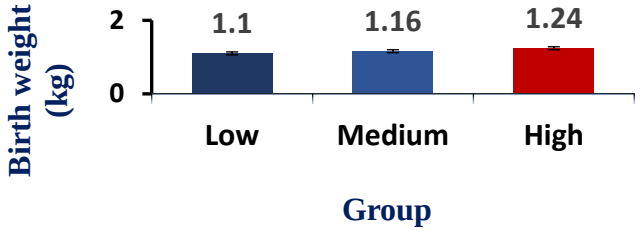


Figure 1: Effects of maternal energy on birth weight of female kids

A similar study was performed by a group researcher with 28 synchronized singleton pregnant Sistani goats under 4 different energy diets (Firoozi et al., 2017). They found that the birth weights of kids did not vary among the different energy groups. A group researcher reported that the similar outcome on maternal feed restriction (from 84 days to parturition) had less effect on birth weight of kids by carrying out an experiment on 60 nulliparous dairy goats and assigned them into two groups with different energy concentration (Corson et al., 2009).

3.2 Growth performance of female kids

The average live weight gain by female kids of different energy groups is shown in Table 2. On an average, final live weight of kids was shown to be higher in the high energy group than the others. Besides, average weekly live weight gain was also observed to be higher in the higher energy group than the others (Table 2).

Table 3: Effects of dietary energy levels on live weight changes of female kids

Parameters	Energy Level		
	Low	Medium	High
Average birth weight (kg)	1.1 ± 0.14	1.16 ± 0.05	1.24 ± 0.09
Average weight at 24 weeks of age (kg)	9.35^{b} ± 0.15	9.82^{ab} ± 0.34	11.06^{a} ± 0.41
Average live weight gain (kg)	8.25^{b} ± 0.11	8.66^{ab} ± 0.26	9.82^{a} ± 0.38
Average live weight gain (gm/week)	576^{c}± 0.57	611^{b} ± 0.68	676^{a} ± 0.76

Means with uncommon superscripts in the same row differ significantly.

Significant at 5% level ($p<0.05$)

Initially, the average live weight was similar but in the case of the kids at 24 weeks, the final live weight was significantly ($p< 0.05$) different within the treatment groups. Average daily live weight gain of the female kids was shown to be significantly ($p< 0.05$) higher in high maternal energy group than the medium and low maternal energy ones (Figure 2).

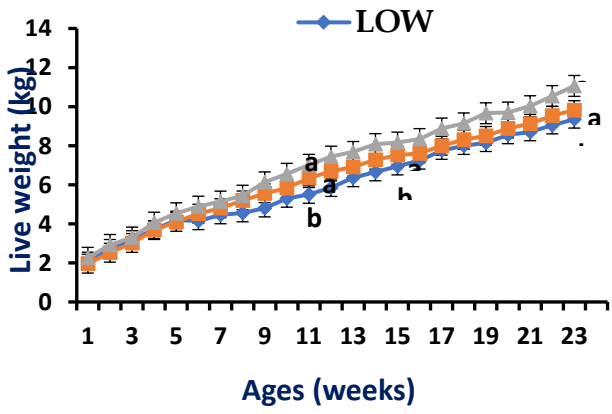


Figure 2: Effects of maternal energy levels on live weight changes of female kids

A similar investigation was carried out by (Waldeland et al., 1996). They treated 4 different energy levels on sixty ewes from 80 days to 140 days of pregnancy and observed that kid from high dietary energy group achieved up to 132g/d than the others. A group researcher denoted a significant influence of nutrient intake during pregnancy on the growth of fetal and placenta as well as vascular development (Redmer et al., 2004). This statement strongly supported the above (3.2) result.

3.3 Body measurements of female kids

3.3.1 Body length

In the experiment, the final body length of female kids belonging to the high maternal energy group was higher than the following two groups. The results are shown in (Figure 3). Similar statement was found (Hasanat et al., 2003). They reported the average body length of Black Bengal female kids to be 42.99 at 6 months of age and illustrated a correlation between body weight with length in Black Bengal kids.

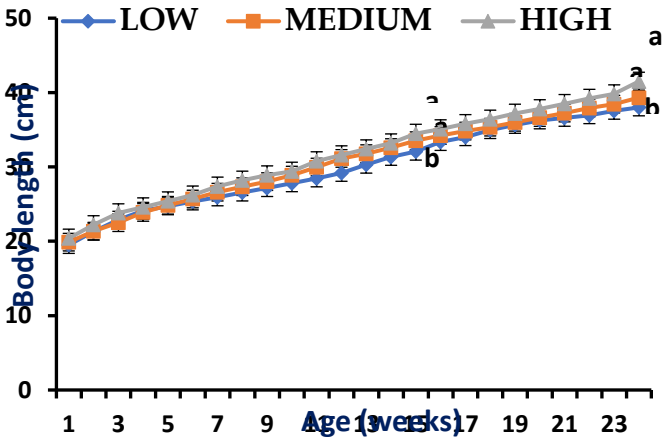


Figure 3: Effects of maternal energy levels on body length of female kids

3.3.2 Heart girth

In the study, the heart girth of female kids was significantly ($p<0.05$) higher in high maternal energy group than the others (Figure 3). Similarly, Rahman (2007) found a positive correlation between body weight and heart girth of kids.

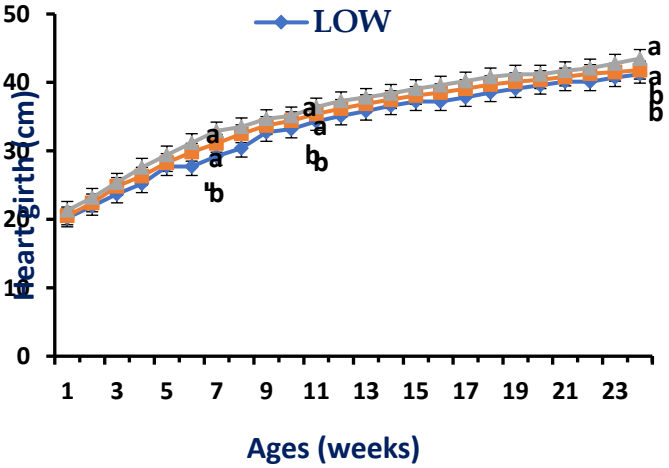


Figure 4: Effects of maternal energy levels on heart girth of female kids

3.3.3 Wither height

The study revealed that final wither height of female kids was higher in maternal energy group than others (Figure 4). This results strongly implies the statements of who reported that increase in height at wither reflected significantly ($p<0.001$) on the increase of body weight of the kids (Rahman, 2007; Noran and Mukherjee, 1997; Singh et al., 1991).

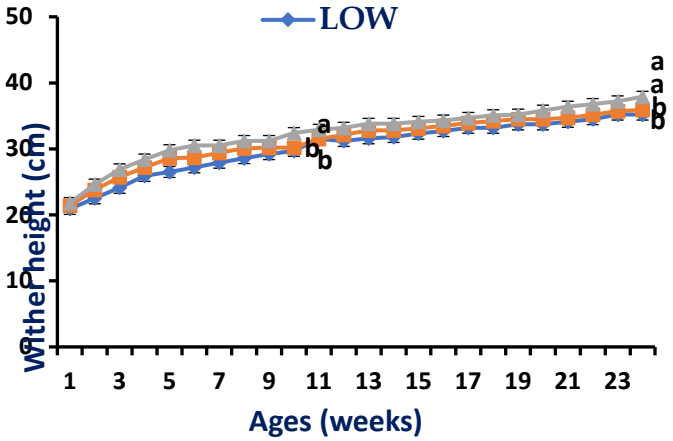


Figure 5: Effects of maternal energy levels on wither height of female kids

3.4 Milk consumption of female kids

In this experiment, average milk consumption rate of female kids up to 12 weeks of age denoted that the average milk consumption was high in high maternal energy group (357.5 ml/week) than the low and medium maternal energy groups (approximately 316.45 ml/week and 346.56 ml/week respectively). The results are shown in Figure 6. Higher milk consumption was recorded in kids of high energy group than the others. Similarly, a group researcher stated that higher energy feed at late gestation enhances milk production of dam and milk consumption of their kids (Sadjadian et al., 2013). Similarly, a group researcher observed that the restriction of energy or protein intake during the last third of gestation reduced the milk consumption in Liuyang goats (He et al., 2013). This statement strongly supported the result of Figure 6.

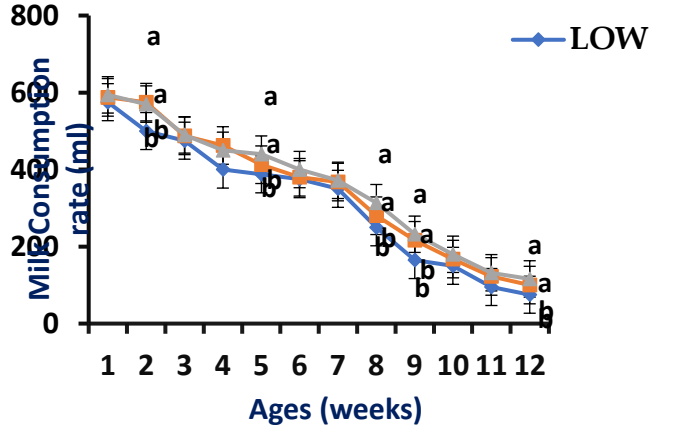


Figure 6: Milk consumption of female kids

3.5 Age at puberty of female kids

In this study, kids of high maternal energy group reached puberty earlier (184.4 days) than the medium (189.6 days) and low (191 days) energy consumed dam group. The results are presented in Figure 7. Similarly, a group researcher stated that kids of more energy concentrate group dams reached puberty earlier than others (Mellado et al., 2020).

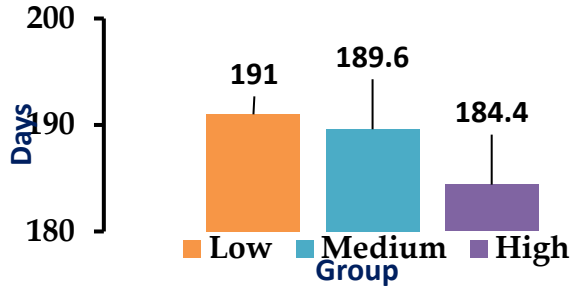


Figure 7: Age at puberty of female kids

4. Conclusion

The experiment was conducted at the Goat, Sheep and Horse farm where 7-8 months old prepubertal female Black Bengal goats were used and the diet was supplied to does starting from one hundred days of pregnancy to parturition with a view to investigating the impacts of various levels of dietary energy on the birth weight, growth rate, milk consumption, body measurements as well as age at first heat of their female kids (n=15). The does were divided into three equal treatment groups. The groups were assigned randomly into 3 feeding regimes i.e., low, medium and high energy (8.67, 10.2 and 11.73 MJME/kg DM). All does were provided with similar management conditions. The female kids belonging to the high maternal energy goats showed higher average birth weight than the other treatment groups. The weekly gain of kids in high maternal energy group was significantly higher than the other two groups. The weaning weight, final body length, heart girth and wither height of kids were higher in kids of high maternal group than low and medium groups. The kids of higher energy group consumed more milk than the others. It is observed that the kids of high energy group reached puberty earlier than the other two groups. Therefore, it can be reiterated that, this study implies the positive impacts of high energy during late pregnancy on the birth weight, growth performance, body measurements (body length, heart girth and wither height), milk consumption and age at puberty of female Black Bengal kids.

Acknowledgement

This research work was financed by The Ministry of Science and Technology, Govt. of the People's Republic of Bangladesh. FARIA-TER JERIN (Student id: 20230205, Reg. No: 43421) was awarded with National Science and Technology Fellowship/2021 from The Ministry of Science and Technology, Govt. of the People's Republic of Bangladesh, for the research.

References

Amin, M.R., Hussain. S.S., Islam. A.B.M.M., 2001. Reproductive peculiarities and litter weight in different genetic groups of Black Bengal does. Asia-Australian Journal of Animal Science, 14 (3), Pp. 297-301.

Banerjee, G.C., 1978. Feeds and Principles of Animal Nutrition. Oxford and IBH Publishing Company, New Delhi, Calcutta.

Corson, A.M., laws, J., litten, J.C., Lean, I.J., Clarke, I., 2009. Intergenerational effects of birth weight on glucose tolerance and reproductive performance. Animals, 3, Pp. 579–591.

Daskiran, I., Kor, A., Bingol, M., 2006. Slaughter and carcass characteristics of Norduz male kids raised in either intensive or pasture condition. Pakistan Journal of Nutrition, 5 (3), Pp. 274-277.

Devandera, 2001. Small ruminant imperatives for productivity Enhancement improved Livelihoods and Rural growth. Asian-Australian Journal of Animal Science, 14 (10), Pp. 1483-1496.

Devendra, C., Mcleory, G.B., 2007. Qualitative and quantitative aspects of meat production from goats. In: Small Ruminants in the Near East, Animal Production, 2, Pp. 55.

DLS (Department of Livestock Services). 2021. An annual report on Livestock and poultry development activities. Government of Bangladesh, Dhaka.

FAO. 2015. Asian Livestock. Monthly Technical Magazine of the FAO Animal Production and Health Commission for Asia and the Pacific (APHCA), 168, Pp. 85-87.

Firoozi, R., Teimouri, Y.A., Dirandeh, E., 2017. Effects of energy and protein levels of maternal diets at late gestation on growth, health and performance of goat kids. Iranian Journal of Applied Animal Science, 7 (4), Pp. 611-620.

Hasanat, M.T., Husain, S.S., Amin, M.R., Miah, G., 2003. Characterization of Black Bengal goats for some qualitative traits. Bangladesh Journal of Animal Science, 32, Pp. 109-120.

He, Z.X., Wu, D.Q., Sun, Z.H., Tan, Z.L., Qiao, J.Y., Ran, T., Tang, S.X., Zhou, C.S., Han, X.F., Wang, M., 2013. Protein or energy restriction during late gestation alters fetal growth and visceral organ mass: An evidence of intrauterine programming in goats. Animal Reproduction Science, 137, Pp. 177–182.

Husain, S.S., 1993. A study on the productive performance and genetic potentials of Black Bengal goats. Ph.D. Thesis, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Husain, S.S., Islam, A.B.M.M., and Horst, P., 1995. Effects of different factors on pre-weaning survivability of Black Bengal kids. Small Ruminant Research, 18, Pp. 1-5.

Huston, J.E., Engdhal, B.S., Bales, K.W., 1988: Intake and digestibility in

sheep and goats fed three forages with different levels of supplemental protein Small Ruminant Research, 1, Pp. 81-92.

Khan, J., Wangehuk, K., Sampath, K.T., Poadyal, S.M., Habib, G., Samarasinghe, K., 2008. Best practices in animal feed production and management in SAARC countries. SAARC Agriculture Centre, Dhaka, Bangladesh.

Mellado, M., Rodríguez, I.J., Alvarado, E.A., Véliz, F.G., Mellado, J., García, J.E., 2020. Short communication: Reproductive response to concentrate supplementation of mixed-breed goats on rangeland. Tropical Animal Health and Production, 52, Pp. 2737–2741.

Milton, J.T.B., Lindsay, D.R., Martin, G.B., and Quintans, G., 2015. Colostrum production in ewes: a review of regulation mechanisms and of energy supply, 9 Pp. 831–837.

Noran, A.M., Mukherjee, T.K., 1997. Physical traits versus the buck's reproductive abilities. Asian-Australian Journal of Animal Science, 10, Pp. 245-250.

Rahman, A.H., 2007. Morphometric characterization of Black Bengal Buck. M.S. Thesis. Department of Animal Breeding and Genetics. Bangladesh Agricultural University, Mymensingh

Ranjan, S.K., 1980. Animal Nutrition in the tropics. Vikas Publishing House Pvt. Ltd. Vikas House, Ghajiabod VP, India. Pp. 350.

Redmer, D.A., Wallace, J.M., Reynolds, L.P., 2004. Effect of nutrient intake during pregnancy on fetal and placental growth and vascular development. Domestic Animal Endocrinology, 27, Pp. 199–217.

Sadjadian, R., Seifi, H.A., Mohri, M., Naserian, A.A., Farzaneh, N., 2013. Variations of energy biochemical metabolites in periparturient dairy Saanen goats. Comparative Clinical Pathology, 22 (3), Pp. 449–456.

Singh, C.S.P., Mukherjee, D.K., Prasad, B., Mishra, H.R., 1981. Note on body measurements and weights of Black and Brown Bengal goats. Indian Journal of Animal Science, 51, Pp. 234-236.

Waldeland, H., Havrevoll, Ø., Eik, L.O., Andresen, Ø., Engeland, I.V., 1996. Effect of type of roughage and energy level on reproductive performance of pregnant goats. Small Ruminant, 21 (2), Pp. 97–103.