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Research Article

Effect of Creep Feeding on Pre and Post-Weaning Performance of Black Bengal Goat Kids

¹Sadek Ahmed, ²Md Mahmudul Hasan Pasha, ³Md Habibur Rahman and ⁴Nusrat Jahan

¹Goat Production Research Division, Bangladesh Livestock Research Institute, Savar, Dhaka, Bangladesh

²Sheep Production Research Division, Bangladesh Livestock Research Institute, Savar, Dhaka, Bangladesh

³Animal Health Research Division, Bangladesh Livestock Research Institute, Savar, Dhaka, Bangladesh

⁴Department of Animal Nutrition, Genetics and Breeding, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh

Abstract

Background and Objective: Creep feeding is essential for kids to promote growth and weight gain during pre and post-weaning periods and reduce kid mortality. This study was conducted to assess the effect of pre-weaning creep feed supplementation on the Black Bengal goat (BBG) kids on pre and post-weaning performance. **Materials and Methods:** A total of 36 kids were assigned to three treatment Groups (A, B and C) having 12 kids in each Group. Kids in Groups A and B were fed with creep feed 1 (concentrate-based) and creep feed 2 (moringa-based), respectively along with Dam's milk while Group C (control Group) was only given water beside Dam's milk. After weaning, all 3 Groups were supplied same feed. Daily weight gain, growth rate, feed intake, disease incidence, kid mortality, FCR and economic benefit were studied during the experimental period and data was analyzed in SPSS 2020 version. **Results:** Group A showed the highest daily weight gain (66.4 g/day) and economic return (BDT 2093) until weaning, while Group C had the lowest (54.9 g/day and BDT 1734), though results were non-significant. Post-weaning, Group B had significantly higher daily weight gain (45.9 g/day, $p < 0.005$) and dry matter intake (20.4 kg, $p < 0.05$), with the lowest values in Group C (29.2 g/day, 17.9 kg). Group B also had the best FCR (5.01) and lowest cost per kg weight gain (BDT 230, $p < 0.05$). Moreover, lower diseases and mortality were observed in the Group B kids both in the pre and post-weaning period. **Conclusion:** The study showed that supplementation of creep feed particularly moringa-based creep feeding during the pre-weaning period significantly enhances the performances and economic traits of Black Bengal goats in post-weaning period.

Key words: Black Bengal goat, creep feed, growth performance, moringa, pre and post-weaning

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Corresponding Author: Sadek Ahmed, Goat Production Research Division, Bangladesh Livestock Research Institute, Savar, Dhaka, Bangladesh

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Bangladesh is home to a vast population of ruminant livestock with an astounding 27.12 million goats¹. The raising of goats under a subsistence farming system is a notable agricultural activity in the rural areas of the country. Goat farming is becoming increasingly popular locally to meet the country's growing demand for animal protein although, Bangladesh's hot and humid climate is favorable to numerous diseases^{2,3}. Medium and larger farmers are gradually adopting commercial goat farming in either semi-intensive or intense settings throughout the world. Goat production under stall-fed or semi-intensive conditions requires the standardization of diverse goat husbandry practices.

In Bangladesh, the Black Bengal breed accounts for 90% of all goats^{4,5}. The Black Bengal goat is distinguished by several unique attributes that make it stand out, such as its exceptional ability to reproduce, high rates of fertility, early sexual maturity, adaptability to hot and humid climates, high resistance to disease and exceptional quality of meat and skin^{6,7}. Besides, all those attributes lower growth performance, lower milk production for kids and kid mortality of BBG influences farmer's profitability. The variety of birth-single, twin or triplet-is one of the vital factors that affect the mortality rate of kids in BBG. If the kids are single born they will receive an adequate amount of milk from the dam but the problem occurs with twin or triplet-born kids, the mother cannot satisfy all the kids with milk since BBG is a low milk producer⁸. As a result, retard growth; higher kid mortality and profit loss occur. In practical experiences, farmers are often claimed for slower growth rate or total cease in growth, in some cases even weight loss after weaning of kids. Thus, the mortality of kids increases during the pre-weaning to post-weaning transition period and farmers are not able to get optimum profit from goat farming⁷. The efforts of livestock researchers aiming to formulate improved ruminant feeds have intensified not only the production of quality meat and milk but also reduced the cost of production to run the enterprise profitably.

Creep feeding is a method of feeding young animals usually kids with a high-energy, high-protein diet to promote growth and weight gain. It can be particularly effective in situations where natural feed/dam's milk supply is limited. This may help to support their rapid growth during the early stages of life⁹. Creep feed supplementation is needed to improve pre and post-weaning growth and reduce kid mortality, especially for twins and triplets, so they achieve early desired market weights and increase farmer net profit. Increased total weight, weaning weight and average daily weight were found when

the Group of kids was provided with creep feed containing alfalfa¹⁰. In addition, improved rumen morphology, higher rumen papillary surface area and thick keratinized layer were found where goat kids were nursed with creep feed supplementation¹¹. In Bangladesh, the creep feeding practice to the goat kid has hardly been observed. In addition, farmers are not aware of improving the feeding strategy to improve growth performances. However, there is a lack of extensive studies on the impact of creep feed supplements on the growth and development of BBG goat kids before and after weaning. So, this study aimed to see how creep feeding supplementation to BBG kids during the pre-weaning period affected their performance during and after weaning.

MATERIALS AND METHODS

Experimental site: This research was conducted at Goat Research Farm, Goat Production Research Division, Bangladesh Livestock Research Institute from July, 2021 to June, 2022. The farm is situated at 23.85°N 90.26°E at Savar, in the Dhaka District, the Central Region of Bangladesh.

Experimental animals and design: At 7 days old, 36 BBG kids and their dams were properly categorized into three treatment Groups (A, B and C). Every Group consisted of twelve kids with similar average weights ranging from 1.7 to 1.9 kg. Group A kids ate dam's milk+creep feed 1 (broken maize 68%, soybean meal 30%, vitamin-mineral premix 1% and salt 1%). Group B received dam's milk and creep feed 2 (broken maize 55%, soybean meal 18%, moringa leaves 25%, vitamin-mineral premix 1% and salt 1%). Group C kids, the control Group, received simply dam's milk and fresh water. Kids from all Groups were provided food at the feeder close to their mothers' enclosures. The treatment Groups (A and B) were fed with creep feed according to their assigned feeds, twice a day; (8 AM-12 PM and 2 PM-6 PM) whereas the control Group was only provided with water until weaning during that time frame (90 Days). After weaning, all 3 Groups were supplied the same feed (*ad libitum* green grass with concentrate feed of 1.5% of body weight containing 17% protein and 12 MJ of ME/kg of DM) up to 6 months of age.

Creep feed formulation: The CF was formulated to supplement energy and protein using locally available concentrate feed and dried moringa leaves. The chemical examination of crude fat, crude fiber, crude protein (CP), gross energy, moisture, ash and carbohydrate was conducted on samples of CF that were sent to the Animal Nutrition

Table 1: Chemical composition of formulated creep feed

Sample	Dry matter	Ash	Crude protein	Acid detergent fiber	Fat	Gross energy (J/kg DM)
Creep feed 1	88.3	6.44	20.2	5.87	1.93	15.9
Creep feed 2	90.3	9.83	18.9	8.77	2.03	16.3

Laboratory of the Bangladesh Livestock Research Institute. Table 1 shows the chemical analysis and feed ingredients of the prepared CF.

Feeding regiment: Individual pens (4 ft×5 ft) were used to house the dams and kids, were permitted to freely access their dams. Kids from all 3 Groups were segregated from the mothers and confined to the feeding stalls (12 ft×12 ft) that were situated close to the pens during feeding. The treatment Groups were given their designated feeds twice daily, from 8 AM to 12 PM and 2 PM to 6 PM, whereas the control Group was supplied with water. The dams were supplied twice daily, from 8 AM to 12 PM and 2 PM to 6 PM. Before kids came into contact with their dams, all remaining feed from the dams' feeding troughs was removed after their feeding period. Kids were fed 20 gm CF for 1st week and then increased to 5 gm per week. The feed was refilled daily. All of the Groups were provided with clean water during the investigation. The leftover feed in the feeding containers was used to determine the average overall feed consumption.

For an additional 90 days following weaning, all 3 Groups of growing goats were provided with *Ad libitum* German grass, concentrate feed at a rate of 1.5% of body weight and water.

The formulation of concentrated feed was 30% of wheat bran, 27% of broken maize, 23% of soybean meal, 16% of khesari bran, 1.5% of protein concentrate, 0.5% of vitamin-mineral premix, 1% of DCP and 1% of salt.

Determination of performances: For 6 months, the body weights of the animal under investigation were measured and documented every seven days before feeding at 8 o'clock in the morning through a digital weight balance. All the disease incidence and mortality records were recorded properly during the experimental period. Parameters such as body weight gain, growth rate, feed intake, disease incidence, kid mortality, feed conversion ratio (FCR) and economic benefit were studied during the experimental period.

Statistical analysis: The Generalized Linear Model (GLM) procedure was implemented in the Statistical Package for the Social Sciences (SPSS 2020) to analyze the data. The analysis was conducted using a Completely Randomized Design (CRD) and involved an Analysis of Variance (ANOVA). The Duncan's

Least Significant Difference (LSD) test was employed to determine differences between means and significant differences were declared when $p < 0.05$.

Ethical consideration: This research work was approved by the Animal Experimentation Ethics Committee of the Bangladesh Livestock Research Institute (BLRI) (Reference no.: AEEC/BLRI00102/2023). All animal care instructions were meticulously adhered to during the sample collection process.

RESULTS

Effect of the supplementation of creep feed to BBG kids during the pre-weaning period on the performances of the pre-weaning period:

The highest value for average weight gain from birth to weaning (5.97 kg) and daily gain from birth to weaning (66.4 gm/day) was found in Group A where kids nourished with dam's milk along with concentrate-based creep feed and the lowest value for those growth traits (4.95 kg and 54.9 gm/day) was seen in Group C where kids were only allowed to feed dam's milk along with water (Table 2) although, the results were not significant ($p < 0.05$) among the Groups. The highest return up to weaning (BDT 2093) was achieved in concentrate-based creep feeding Group A where the lowest return (BDT 1734) was found for control Group C, however, results were not significant ($p < 0.05$) among Groups (Table 2).

The common diseases or health problems observed during the pre-weaning period were diarrhea, contagious ecthyma and pneumonia. During the weaning period 25%, 16.67% and 33.33% of kids faced different diseases or health-related problems for Group A, B and C, respectively. The mortality rate was 8.33%, 0% and 25% for Group A, B and C, respectively (Table 3).

Effect of creep feeding during the pre-weaning period on the post-weaning performances of growing goat:

Highly significant ($p < 0.001$) variation was found among the treatment Groups for the total weight gain, daily weight gain and FCR (Table 4). In terms of total weight gain and daily weight gain, Group B which was raised with moringa-based creep feed along with dam's milk during the pre-weaning period showed the highest values (4.13 kg and 45.9 gm/day, respectively) whereas Group C which was raised solely on

Table 2: Performances of different Groups of kids supplemented with creep feed during the pre-weaning period

Parameter	Treatment Groups			SEM	Level of significance
	A	B	C		
Initial weight (kg)	1.17	1.15	1.14	0.026	NS
Average weight gain from birth to weaning (kg)	5.97	5.37	4.95	0.249	NS
Daily gain from birth to weaning (gm)	66.4	59.7	54.9	2.76	NS
Return up to weaning (BDT)	2093	1882	1734	87.2	NS

NS: Non-significant difference, BDT: Bangladeshi taka and SEM: Standard error of the mean

Table 3: Disease incidence and mortality during the pre-weaning period in different treatment Groups of kids

Diseases	Treatment Groups		
	A	B	C
Diarrhea (No.)	2	2	1
Contagious ecthyma (No.)	0	0	1
Pneumonia (No.)	1	0	2
Total (No. of kids)	3	2	4
Incidence of diseases (%)	25.00	16.67	33.33
Death (No.)	1	0	3
Mortality (%)	8.33	0	25.00

Table 4: Performances of different Groups of growing goats in the post-weaning period

Parameter	Treatment Groups			SEM	Level of significance
	A	B	C		
Total weight gain (kg)	3.08 ^a	4.13 ^b	2.63 ^a	0.150	**
Daily weight gain (g)	34.3 ^a	45.9 ^b	29.2 ^a	1.67	**
Dry matter intake (kg)	19.3 ^{ab}	20.4 ^b	17.9 ^a	0.367	*
FCR	6.29 ^a	5.01 ^b	7.08 ^a	0.288	**
Cost per kg weight gain (BDT)	331 ^{ab}	230 ^b	384 ^a	23.6	*

FCR: Feed conversion ratio, BDT: Bangladeshi taka, SEM: Standard error of the mean, Different superscripts in the same row differ significantly and * $p < 0.05$ and ** $p < 0.01$

Table 5: Disease incidence and mortality during the post-weaning period in different treatment Groups of growing goats

Diseases	Treatment Groups		
	A	B	C
Diarrhea (No.)	1	1	2
Contagious ecthyma (No.)	0	0	1
Pneumonia (No.)	1	0	1
Total (No. of kids)	2	1	4
Incidence of diseases (%)	18.18	8.33	44.44
Death (No.)	0	0	1
Mortality (%)	0	0	11.11

dam's milk and water during the pre-weaning period showed the lowest values (2.63 kg, 29.2 gm/day) among 3 Groups. The lowest FCR ($p < 0.005$) value 5.01 was found in Group B and C showed the highest value (7.08). Results showed that there were significant ($p < 0.05$) differences existed among the Groups for total dry matter intake and cost per kg weight gain. Total dry matter intake in the total study period after weaning was highest (20.4 kg) in Group B and lowest (17.9 kg) in Group C. The highest value (BDT 384) was found for cost per kg weight gain in Group C compared to Group B (BDT 230) and A (BDT 331).

Common diseases observed during the post-weaning period (Table 5) were diarrhea, contagious ecthyma and pneumonia. During the post-weaning period 18.18%,

8.33% and 44.44% of growing goats faced different diseases or health-related problems for Group A, B and C, respectively. The mortality rate was 0.0%, 0.0% and 11.11% for Group A, B and C, respectively.

DISCUSSION

In the present study, results showed that providing creep feed during the pre-weaning period improves the performance and profit-related traits and reduces disease incidences and kid mortality of Black Bengal goats in both pre and post-weaning periods. Many researchers also found that creep feed supplementation is beneficial for increasing the pre and post-weaning growth performances of kids as well as for

decreasing kid mortality, especially where twin or triplet kids are born^{9,10,12}. In the pre-weaning period, growth traits like total weight gain and average daily weight gain of goat kids depend on many factors such as breed, birth weight, the season of birth, types of birth, dam's age, dam's weight and dam's milk production ability¹³⁻¹⁵. In this experiment, it is observed that creep feeding has a positive effect on the economic traits of BBG kids. Improved total weight gain, average daily weight gain, lower disease incidences and mortality in kids fed with creep feed during the pre-weaning stage. These results were consistent with the findings of Hayes *et al.*⁹ where authors stated that kids supplemented with creep feed gained higher pre-weaning average daily weight and weaning weights than kids who were not supplemented with creep feed.

In this study, the concentrate-based creep-fed Group showed a higher value for total weight gain and average daily weight gain of goat kids than the Group where creep feed was formulated with moringa during the pre-weaning stage. This might be due to less intake of moringa leaf-containing creep feed by the kids during the early pre-weaning stage. Moreover, concentrate-based creep feed might provide more bypass nutrients compared to moringa leaf-based creep feed to the kids showed better growth performances¹⁶. Generally, during 1st few weeks of life, the kids do not take a significant amount of starter feed other than dam's milk due to less rumen activity as it takes 4 to 5 weeks to become fully functional¹⁷. These findings did not agree with Htoo *et al.*¹⁰. They found that kids fed creep feed containing alfalfa leaf performed better than kids fed concentrated-based creep feed and feeding without creep feed in terms of total weight gain (11.2 ± 0.36 kg vs. 7.9 ± 0.49 kg vs. 5.5 ± 0.43 kg, respectively) and average daily gain (145.2 ± 4.64 gm/day vs. 102.9 ± 6.43 gm/day vs. 71.1 ± 5.56 gm/day, respectively). Since the growth rate and birth weight of boar kids are significantly higher due to the larger size and higher milk production ability of the boar dam, the process of rumen development may be a bit faster in boar kids than in BBG kids and this might be a possible reason for better utilization of roughage-based creep feed by boar kids. In this case, the goat breed also may have a significant effect.

The total profit per kid was BDT 358.82 and BDT 147.43 for treatment Groups A and B, respectively obtained by creep feeding compared to control although Hayes *et al.*⁹ found financial returns were not higher for creep-fed kids compared with kids feeding without creep feed. The profit has been calculated by deducting feed cost, treatment cost and labor cost from the weight value of kids up to 90 days. However, Hayes *et al.*⁹ showed that both total profits and net income

figures did not differ between creep and non-creep kids ($p > 0.05$). The analysis did not account for the extra expenses related to creep feeding tools and labor, that will further decrease the possible economic advantage of creep feeding for a goat farmer. Even though creep feeding improved the weaning weights of animals, the additional expenses of creep feeding (worker, feed and apparatus, etc.) led to a decrease in profit marketed for creep-fed animals in comparison to non-creep-fed animals, as reported by Broadhead *et al.*¹⁸. Although, the total return is not significant in this current investigation but might affect the farm profitability.

Post-weaning performances of growing goats may depend on various factors like bucks, litter size, birth season, weaning season, rearing season, availability of feeds and management practices during the pre-weaning and post-weaning periods¹⁹⁻²¹. Pre-weaning management practices may play a crucial role in determining post-weaning performances. Moreover, weaning weight determines the time needed to attain market weight for ruminants. In this experiment, Group B performed significantly better than the other 2 Groups in terms of total weight gain, daily weight gain, FCR and cost per kg weight gain in the post-weaning period. During the pre-weaning period after 3 to 4 weeks of age, a goat kid's rumen starts to develop and function gradually²². During the pre-weaning period if the kid is supplemented fiber fiber-based creep feed along with dam's milk, then the rumen of this kid becomes functional morphologically faster than those that are not supplemented by creep feed¹¹. Consumption of dry feed has been identified as the principal factor influencing rumen development, specifically regarding papillae length, width and total surface area in square centimeters²³. Rumen morphological features comprising total papillae surface area, total inner papillary area, total surface area, rumen papillae length, rumen papillae width, rumen mucosa depth, rumen muscular thickness and rumen wall thickness were found to be highest in kids at 12 weeks of age which were supplemented roughage-based creep feed during the pre-weaning period¹¹. In this study, kids of Group B were supplemented moringa based creep feed during the pre-weaning period which triggered their rumen to be developed and functional more rapidly than other kids of Groups A and C. Consequently, growing goats of Group B might utilize fiber-type feeds and fodder more efficiently than goats of other Groups during post-weaning period. Maybe for this, comparatively better rumen efficiency, total weight gain, daily weight gain, FCR and cost per kg weight gain were the highest in goats of Group B.

In this experiment, kids supplemented with creep feed encountered fewer disease incidences and a lower rate of mortality compared to the control Group. The increased total phenolic compounds in moringa-based feeds may enhance the health of goats. Studies indicate that the leaves of *Moringa oleifera* possess the capability to neutralize free radicals due to their significant antioxidant properties²⁴. However, literature is very limited on the correlation between creep feeding and occurring of diseases and mortality. This may happen because the creep feed-supplemented Group received some bypass nutrients through creep feeding that helped them to generate antibodies against various diseases. Moreover, when goats having good body condition scores have lower susceptibility to various diseases²⁵.

The study was conducted on a relatively small sample size and in a controlled environment at a research farm of a national research institute. Future research should be conducted with a larger population of Black Bengal goat kids across multiple farms to validate the findings and ensure broader applicability. Since environmental and management conditions differ, region-specific studies are also recommended to adapt creep-feeding strategies to various agro-climatic zones. Additionally, practical training and extension programs should be developed to educate farmers on the benefits, feeding practices and economic aspects of creep feeding to improve adoption rates.

CONCLUSION

This study showed that creep feed supplementation in BBG kids during the pre-weaning period had a significant effect on the post-weaning period. Kids supplement with creep feed performed significantly better in terms of total weight gain, daily weight gain, FCR and cost per kg weight gain, reduced disease incidence and low kid mortality during the post-weaning period. Moreover, kids nourished with moringa leaf-based creep feed showed the best results in this current investigation. Therefore, it is very important to provide creep feed along with dam's milk for rapid weight gain of kids, boost immunity and financial benefit of the goat farmers.

SIGNIFICANCE STATEMENT

The mortality and retarded growth of kids are the major problems of goat farming throughout the world. The current study provided insights into the effect of creep feed supplementation on kids, which ultimately helps increase goat production and farm profitability nationally and globally. It is found that kids supplemented with creep feed

performed significantly better during the pre and post-weaning period. In addition, kids nourished with moringa leaf-based creep feed showed the best results. So, it is essential to provide creep feed along with dam's milk for kids to gain weight rapidly, boost immunity and benefit the goat farmers financially.

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