Nepalese Journal of Agricultural Sciences, July, 2024, Volume 27
eISSN 2091-0428; pISSN 2091-042X; esjindex ID = 6279

PERFORMANCE EVALUATION OF KIDS FROM PREGNANT DOES SUPPLEMENTED WITH MOLASSES MINERAL SYRUP

Sagun Malla[1], D. P. Adhikari[1], Raju Kadel[2], S. H. Ghimire[1] and A. Adhikari[3]

[1]National Cattle Research Program, Rampur, Chitwan
[2]National Goat Research Program, Bandipur, Chitwan
[3]Nepal Polytechnic Institute, Bharatpur, Chitwan
Corresponding Author's email: sagun_malla44@yahoo.com

ABSTRACT

Goats are vital to Nepal's agricultural economy, with their population witnessing significant growth in recent years. Among indigenous breeds, Khari goats are particularly valued for their reproductive efficiency and adaptability. However, nutritional deficiencies, especially during pregnancy, hamper their productivity. This study investigates the efficacy of molasses mineral syrup supplementation in addressing nutritional deficiencies during late pregnancy. The research, conducted over five months at the Goat Research Station in Bandipur, Tanahun, focuses on Khari does in their second parity. Three treatment groups were established: a control group receiving standard feed, and two groups supplemented with different doses of molasses mineral syrup. Key parameters including kid birth weight, growth rate, and milk production were evaluated to assess the impact of supplementation. Results indicate a clear association between molasses mineral syrup supplementation and improved performance indicators. Kids born to supplemented does exhibited higher birth weights, with increasing dosage correlating with greater gains. Similarly, growth rates were significantly enhanced in supplemented groups, highlighting the potential for improved productivity. Furthermore, dams supplemented with molasses mineral syrup demonstrated increased milk production, benefiting both offspring growth and overall herd productivity. The study contributes valuable insights for enhancing the nutritional management of pregnant does in Nepal.

Keywords: Khari goats, Molasses mineral syrup, late pregnancy, productivity

INTRODUCTION

Goats play a crucial role in the agricultural economy of Nepal, and their commercial significance has been steadily increasing in recent years. According to Ministry of Agriculture and Livestock Development, Nepal (2022), there are approximately 142.42 million goats in Nepal, a substantial increase from the mere 10.99 million recorded a decade ago in 2068. Among the indigenous goat breeds, the "Khari" breed stands out due to its better twinning ability, shorter age at puberty, and reduced kidding interval compared to other local goat breeds (*Tiwari et al*., 2013; Pokharel & Neopane, 2006). However, despite their importance, goats in Nepal face challenges related to under nutrition, especially in the context of limited animal feed availability.

Ruminant livestock production in developing countries heavily relies on locally available feeds, which often consist of crop residues and fodder. Unfortunately, these feed resources are frequently of poor quality and deficient in essential nutrients such as protein, vitamins, and minerals (*Hart et al.,* 2016). As a result, the productivity of goats remains suboptimal, affecting both meat and milk production.

During late pregnancy, the energy requirements of pregnant does increase significantly. This period is critical for the development of healthy kids and successful lactation (Sutton & Alderman, 2000). Young does have even higher energy demands during this phase. Addressing these nutritional needs is essential to enhance overall productivity and ensure the well-being of both the does and their offspring. It has been shown that restricting nutrition in goats during pregnancy induces various physiological, endocrinological, and behavioral abnormalities in both does and kids (*Laporte-Broux et al*., 2011; *Terrazas et al.*, 2012).

Molasses, a byproduct of sugar production, has gained attention as a potential dietary supplement for ruminant livestock. It offers a cost-effective way to improve feed palatability while providing essential energy and protein. *Osman et al.* (2020) conducted a seminal study focusing on Nubian goat kids, wherein they demonstrated the efficacy of molasses supplementation in enhancing growth performance, bolstering protein metabolism, and optimizing rumen fermentation. The inclusion of molasses in the diets of goats could be a practical solution to mitigate the effects of under nutrition and enhance overall performance.

Previous studies have highlighted the benefits of molasses supplementation in ruminant diets. *Senthikumar et al.* (2016) reported that molasses is suitable for all

ruminant livestock and contributes positively to energy levels and protein intake. Additionally, it can serve as an effective feed additive to enhance palatability, encouraging better feed consumption.

Mineral deficiencies are a major limiting factor in the productivity of goats (*Tiwari et al.*, 2013). Addressing these deficiencies through appropriate supplementation could potentially improve reproductive outcomes and overall productivity. Thus, this research aims to evaluate the effects of molasses mineral syrup supplementation on key performance indicators such as kid birth weight, kid weaning weight, and milk production in late-pregnant Khari goats.

This study seeks to fill the knowledge gap regarding the nutritional management of pregnant goats in Nepal and provide evidence-based recommendations to enhance goat productivity. Through this research, we aim to contribute to the sustainable development of the goat farming industry in Nepal by improving the nutritional status and reproductive performance of Khari goats.

MATERIALS AND METHODS

Study site:
The study was conducted at the National Goat Research Program in Bandipur, Tanahun, Nepal.

Study duration:
The experimental period spanned five months, comprising two distinct phases: the pre-kidding phase, which lasted for two months, and the post-kidding phase, which extended for three months.

Species of animal involved:
The experimental animals were Khari does in their second parity.

Treatment groups and number of animals:
A total of 24 Khari does in late pregnancy were randomly assigned to one of three treatment groups, with eight does per group:

- **Control Group (T0):** This group received a concentrate feed at 1% of their body weight along with ad libitum access to seasonal fodder. This group served as the baseline for comparing the effects of the molasses mineral syrup.
- **Treatment 1 (T1):** In addition to the same concentrate feed and fodder provided to the control group, this group received an extra 25 ml of molasses mineral syrup daily.

- **Treatment 2 (T2):** This group was given the same concentrate feed and fodder as the control group, plus an additional 50 ml of molasses mineral syrup daily.

Molasses mineral syrup preparation:
The molasses mineral syrup was prepared by thoroughly mixing molasses, mineral mixture, and water in the proportions of 32%, 8%, and 60%, respectively. The ingredients were combined in a large mixing vessel and stirred continuously until a homogenous solution was achieved.

Recording of data:
Data collection focused on the following key parameters:

- **Kid Birth Weight:** Recorded immediately at birth.
- **Kid Growth**: Measured at 15-day intervals until the kids reached 90 days of age.
- **Milk Production:** Daily milk production of the does was monitored and recorded throughout the experimental period.

Data analysis:
The data collected were analyzed using the Analysis of Variance (ANOVA) technique with Microsoft Excel and Minitab 17. Treatment means were compared using the Least Significance Difference (LSD) test at a 5% significance level.

RESULTS AND DISCUSSION

The results from this study clearly indicate that supplementation with molasses mineral syrup significantly enhances both the birth weight and growth rate of kids, as well as the milk production of dams. Figure 1 describes the birth weight of kids born from dams

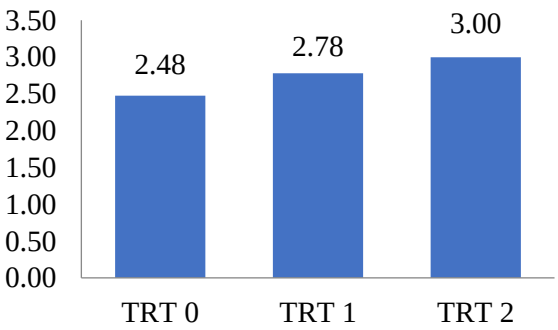

Figure 1: Birth Weight of kids born from the dams supplemented with Molasses Mineral Syrup

supplemented with molasses mineral syrup. The control group (T0), which received only a concentrate at 1% of body weight plus ad libitum seasonal fodder, had an average kid birth weight of 2.48 kg. The group supplemented with 25 ml of molasses mineral syrup (T1) had a higher average birth weight of 2.78 kg. The group receiving 50 ml of molasses mineral syrup (T2) showed the highest average birth weight at 3.00 kg. These results indicate that supplementation with molasses mineral syrup during late pregnancy positively influences the birth weight of kids, with higher supplementation levels leading to greater increases in birth weight. This finding is consistent with *Ghimire et al.* (2019), who reported that higher amounts of mineral supplementation during late gestation increase the birth weight of kids, leading to better growth outcomes. As shown in Figure 2, the body weight progression of kids over 90 days displayed significant differences among the treatment groups. Kids from does supplement with 50 ml of molasses mineral syrup (T2) consistently showed the highest body weights at each measured interval, followed by those supplemented with 25 ml (T1), and the control group (T0). By 90 days, the average body weights were approximately 10 kg for T0, 11.5 kg for T1, and 13.5 kg for T2. These findings highlight that higher levels of molasses mineral syrup supplementation positively impact the growth rates of kids, with the 50 ml dosage resulting in the greatest weight gain. This aligns with *Osman et al.* (2020), who demonstrated the efficacy of molasses supplementation in enhancing growth performance, bolstering protein metabolism, and optimizing rumen fermentation in Nubian goat kids. Similarly, *Malau-Aduli et al.* (2004) found that supplementation during the third trimester of pregnancy resulted in higher birth weights and three-month weights of kids.

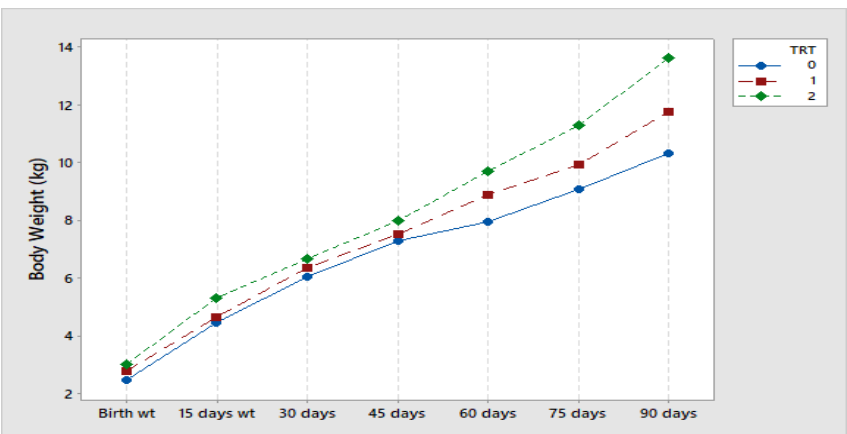

Figure 2. Body Weight of kids born from the dams supplemented with Molasses mineral syrup

Table 1 presents the body weight gain (kg) of kids born from the dams supplemented with molasses mineral syrup. The control group (T0) exhibited a total weight gain of 7.84 ± 0.55 kg. Kids supplemented with 25 ml of molasses mineral syrup (T1) had a total weight gain of 9.00 ± 0.55 kg, while those supplemented with 50 ml (T2) showed the highest total weight gain of 10.60 ± 0.27 kg. Noticeable differences in weight gain were observed particularly during the 45 to 60 days interval ($p < 0.005$), 75 to 90 days interval ($p < 0.005$), and overall, from birth to 90 days ($p < 0.001$). These findings underscore the significant positive impact of molasses mineral syrup supplementation on the growth of kids, with higher supplementation levels yielding greater weight gains.

Table 1. Body Weight gain (kg) of kids born from the dams supplemented with Molasses Mineral Syrup

Treatment	Kid Body Weight Gain (kg) from						
	Birth to 15 days	15 to 30 days	30 to 45 days	45 to 60 days	60 to 75 days	75 to 90 days	Birth to 90 days
T_0	1.99±0.25	1.58±0.16	1.24±0.28	0.69±0.27^{b}	1.11±0.26	1.22±0.26^{b}	7.84±0.55^{b}
T_1	1.85±0.27	1.73±0.19	1.18±0.19	1.34±0.20^{ab}	1.07±0.27	1.84±0.19^{ab}	9.00±0.55^{ab}
T_2	2.29±0.19	1.33±0.16	1.34±0.23	1.71±0.17^{a}	1.59±0.17	2.32±0.19^{a}	10.60±0.27^{a}
p value	0.428	0.289	0.879	0.009	0.227	0.005	0.001

Figure 3 presents a comparative analysis of the treatment's impact over the experimental period. The bar graph illustrates the weight gain of kids from birth to 90 days, divided into three intervals: 0-45 days, 45-90 days, and 0-90 days. The graph indicates that higher levels of molasses mineral syrup supplementation resulted in greater weight gains in kids. Kids in the TRT 2 group (50 ml supplementation) consistently showed the highest weight gain across all intervals, followed by TRT 1 (25 ml supplementation), and TRT 0 (control group). This trend is especially clear in the 45-90 days interval, where the weight gain difference between the groups is more pronounced. Overall, the data shows the positive impact of molasses mineral syrup on the growth of kids, with the highest supplementation level yielding the greatest weight gains.

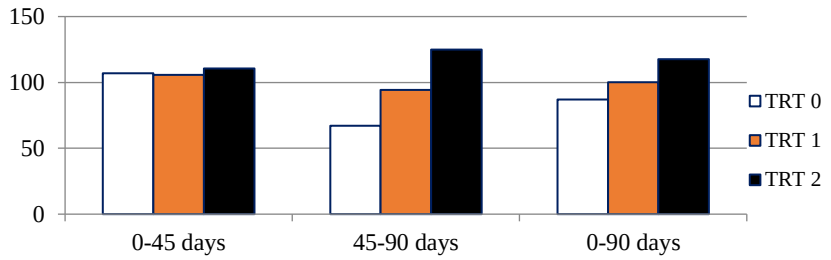

Figure 3. Average Daily Body Weight Gain (ADG, g/day) of kids born from the dams supplemented with Molasses Mineral Syrup

The table 2 presents the average daily milk production (in liters) of dams from birth to 90 days across three treatment groups (T0, T1, and T2). The data indicates a significant increase in milk production in the T2 group compared to T0 and T1 across all periods. The control group (T0) had a relatively stable production ranging from 1.06±0.05 liters in the first 15 days to 0.72±0.03 liters from 75 to 90 days. The T1 group, which received intermediate supplementation, showed an increase in milk production, starting at 1.20±0.06 liters and ending at 0.81±0.04 liters in the same period. The T2 group, receiving the highest supplementation, exhibited the most significant increase, with milk production starting at 1.46±0.09 liters and remaining at 1.04±0.08 liters by the end of the 90-day period. These trends were statistically significant, as indicated by the p-values provided ($p < 0.05$), suggesting a positive impact of molasses mineral syrup on milk production. These trends were statistically significant, as indicated by the p-values provided ($p < 0.05$), suggesting a positive impact of molasses mineral syrup on milk production. This finding is supported by *Mishra et al.* (2016) and *Tekeba et al.* (2013), who reported increased milk yield in cows supplemented with UMMB licks and blocks, as well as Mengistu & Waseyehon (2017), who found that UMMB supplementation increases production while maintaining animal performance and feed efficiency.

Table 2. Average daily milk production of the does supplemented with mineral molasses syrup

Treatment	Kid Body Weight Gain (kg) from						
	Birth to 15 days	15 to 30 days	30 to 45 days	45 to 60 days	60 to 75 days	75 to 90 days	Birth to 90 days
T_0	1.99±0.25	1.58±0.16	1.24±0.28	0.69±0.27^{b}	1.11±0.26	1.22±0.26^{b}	7.84±0.55^{b}
T_1	1.85±0.27	1.73±0.19	1.18±0.19	1.34±0.20^{ab}	1.07±0.27	1.84±0.19^{ab}	9.00±0.55^{ab}
T_2	2.29±0.19	1.33±0.16	1.34±0.23	1.71±0.17^{a}	1.59±0.17	2.32±0.19^{a}	10.60±0.27^{a}
p value	0.428	0.289	0.879	0.009	0.227	0.005	0.001

The graph in Figure 4 illustrates the cumulative milk production (in liters) of dams over a period of 90 days across three treatment groups (T0, T1, and T2). The x-axis represents the days post-birth, while the y-axis represents the cumulative milk production. The blue line shows the cumulative milk production for the control group. The line has a consistent upward slope, indicating a steady increase in milk production over time. However, it remains the lowest among the three groups throughout the entire period. Similarly, the red line represents the cumulative milk production for the intermediate treatment group. This group shows a higher cumulative milk production compared to T0, with a steeper slope indicating more rapid milk production. It consistently produces more milk than T0 from the start and continues to diverge slightly more as time progresses. Similarly, the green line depicts the cumulative milk production for the enhanced treatment group. This group shows the highest cumulative milk production among all groups, with the steepest slope. The production in T2 increases more rapidly and significantly outpaces both T0 and T1 as time progresses. Overall, Figure 4 clearly indicates that the dams in the T2 group, which received the enhanced treatment, produced the highest amount of milk over the 90-day period, followed by T1, and then T0. This suggests that the treatments had a positive effect on milk production. *Panadi et al.* (2018) also reported lower feed conversion ratios in goats supplemented with UMMB and MUMB, indicating efficient feed conversion to milk, consistent with the findings of this study. *Kawas et al.* (2010) and *Singh et al.* (1999) highlighted the benefits of multi-nutrient blocks based on molasses and urea, which stimulate rumen fermentation and supply necessary nutrients, complementing deficiencies in low-quality forages. This suggests that molasses mineral syrup may enhance rumen function and nutrient absorption, contributing to improved growth and milk production.

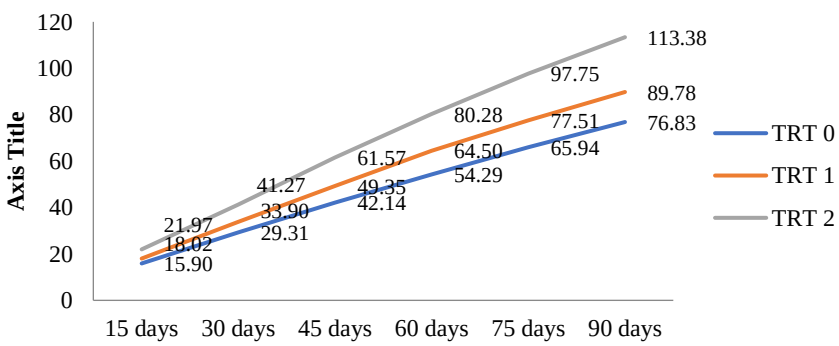

Figure 4. Cumulative milk production of does supplemented with mineral molasses syrup

The significant differences in weight gain observed in specific intervals (Table 1) suggest critical windows during which supplementation has the most pronounced effects. The 45 to 60 days and 75 to 90 days intervals showed noticeable differences, indicating these periods may be particularly sensitive to nutritional interventions. These findings suggest that targeted supplementation during these critical growth phases can optimize weight gain and overall development in kids.

CONCLUSION

This study demonstrated that molasses mineral syrup supplementation during late gestation period significantly improved the birth weight and growth rate of kids, as well as the milk production of dams. These results provided valuable insights for optimizing nutritional strategies in goat farming to enhance productivity and overall herd health.

The data suggested that higher levels of supplementation yield greater benefits, making a strong case for incorporating molasses mineral syrup into the feeding regimes of pregnant and lactating does.

Future research should explore the specific mechanisms through which molasses mineral syrup exerts these benefits, assess its long-term impacts on reproductive performance and overall animal health, and determine the optimal supplementation levels for different breeds and production systems.

REFERENCES

Ghimire, S., Adhikari, D., Malla, S., Kadel, R., & Ghimire, R. (2019) Supplementation of concentrate mixture on the production performance of kids during gestation period of doe. *Bangladesh Journal of Animal Science*, *48*(1), 10.3329/bjas.v48i1.44554

Hart, E. H., Onime, L. A., Davies, T. E., Morphew, R. M., & Kingston-Smith, A. H. (2016) The effects of PPO activity on the proteome of ingested red clover and implications for improving the nutrition of grazing cattle. *Journal of Proteomics*, *141*, 67–76. https://doi.org/10.1016/j.jprot.2016.04.023

Kawas, J., Andrade-Montemayor, H., & Lu, C. (2010). Strategic nutrient supplementation of free-ranging goats. *Small Ruminant Research*, *89*(2-3), 234-243. https://doi.org/10.1016/j.smallrumres.2009.12.050

Laporte-Broux, B., Duvaux-Ponter, C., Roussel, S., Promp, J., Chavatte-Palmer, P., & Ponter, A. (2011). Restricted feeding of goats during the last third of gestation modifies both metabolic parameters and behavior. *Livestock Science*, *138*, 74–88. https://doi.org/10.1016/j.livsci.2010.12.008

Malau-Aduli, B. S., Eduvie, L., Lakpini, C., & Malau Aduli, A. E. O. (2004) Crop-residue supplementation of pregnant does influences birth weight and weight gain of

kids, daily milk yield but not the progesterone profile of Red Sokoto goats. *Reproduction Nutrition Development. 44*.

Mengistu, G., & Waseyehon, A. W. (2017) Review on: Supplementary feeding of urea molasses multi-nutrient blocks to ruminant animals for improving productivity. *International Journal of Animal Husbandry and Veterinary Science*, *2*(6). ISSN (Online): 2455-8567

.Ministry of Agriculture and Livestock Development, Nepal. (2022). *Statistical Information on Nepalese Agriculture 2078/79 (2021/22)*.

Mishra, S., Kumari, K., & Dubey, A. (2016) Body condition scoring of dairy cattle: A review. *Journal of Veterinary Science*, *2*(1), 58-65.

Osman, O. A., Elkhair, N. M., & Abdoun, K. A. (2020). Effects of dietary supplementation with different concentration of molasses on growth performance, blood metabolites and rumen fermentation indices of Nubian goats. *BMC Veterinary Research*, *16*, Article number: 411.

Panadi, M., Zahari, W., Rusli, N. D., Mat, K., & Rusli, M. (2018). Effects of non-medicated and medicated urea molasses multi-nutrient blocks on dry matter intake, growth performance, body condition score and feed conversion ratio of Saanen lactating does fed conventional diets. *Pertanika Journal of Tropical Agricultural Science*, *41*.

Pokharel, P. K., & Neopane, S. P. (2006) Study on productivity improvement of hill goat through selective breeding programme. *Nepal Journal of Science and Technology*, *7*, 1-5.

Senthilkumar, S., Suganya, T., Deepa, K., Muralidharan, J., & Sasikala, K. (2016). Supplementation of molasses in livestock feed. *International Journal of Science, Environment and Technology*, *5*(3), 1243-1250.

Singh, P., Verma, A. K., Dass, R. S., & Mehra, U. R. (1999). Performance of pashmina kid goats fed oak (*Quercus semecarpifolia*) leaves supplemented with a urea molasses mineral block. *Small Ruminant Research*, *31*(3), 239-244. https://doi.org/10.1016/S0921-4488(98)00142-4

Sutton, J. D., & Alderman, G. (2000). The energy and protein requirements of pregnant and lactating dairy goats: The Agriculture and Food Research Council report. *Livestock Production Science*, *64*, 3-8. https://doi.org/10.1016/S0301-6226(00)00170-6

Tekeba, E., Wurzinger, M., Baldinger, L., & Zollitsch, W. J. (2013). Effects of dietary supplementation with urea molasses multi-nutrient block on performance of mid-lactating local Ethiopian and crossbred dairy cows. *Livestock Research for Rural Development*, *25*(6). Retrieved April 23, 2017

Terrazas, A., Hernández, H., Delgadillo, J. A., Flores, J. A., Ramírez-Vera, S., & Fierros, A. (2012). Undernutrition during pregnancy in goats and sheep, their repercussion on mother-young relationship and behavioral development of the young. *Tropical and Subtropical Agroecosystems*, *15*(Supl 1), S161–S174.

Tiwari, M., Shrestha, B. K., Mandal, P., & Panday, L. N. (2013). Growth performance of Khari goats on supplementation of urea molasses mineral block (UMMB) in fodder-based diets. *Nepal Journal of Science and Technology*, *13*(2). https://doi.org/10.3126/njst.v13i2.7710.