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Effect of nutritional supplementation on goat kid mortality in southern transition zone of Hassan district in Karnataka

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Abstract
The impact of maternal nutritional supplementation during late pregnancy on the growth performance of does and their kids was studied. Eighteen pregnant non-descript goats of similar age, parity, and body weight were selected and randomly assigned to three treatment groups: T_0 (grazing only), T_1 (grazing + 125 g/day ground maize), and T_2 (grazing + 250 g/day concentrate feed mixture). The supplementation was provided for four weeks prior to the estimated kidding date, with the entire study period spanning eight weeks (28 days pre-partum and 28 days post-partum). Weekly body weights of does and kids were recorded, and data were statistically analyzed using one-way ANOVA. Results revealed no significant differences in average weekly body weights of does among the groups during both pre- and post-partum phases, although cumulative weight gain during late gestation was significantly higher ($P < 0.01$) in T_1 and T_2. Kids born in T_2 had significantly higher birth weights ($P < 0.05$) and sustained superior growth over the first four weeks post-kidding ($P < 0.01$). Cumulative weight gain of kids followed the order $T_2 > T_1 > T_0$. The positive influence of maternal supplementation was attributed to enhanced nutrient availability supporting fetal development and increased milk production post-partum.

Keywords: Goats, Pregnancy, Supplementation, Kid growth, nutrition, Field study

Introduction
Goats are multifunctional livestock species that provide meat, milk, skin, fibre, and manure, playing a vital role in the livelihoods of landless, small, and marginal farmers. India possesses the largest goat population globally and ranks second in chevon (goat meat) production. Despite this, goat rearing is predominantly practiced under extensive or semi-intensive systems, often in open yards or unscientific mixed-type shelters. Enhancing goat productivity necessitates the adoption of improved management practices, which can be achieved through effective extension services, participatory approaches, and capacity-building programs [1]. One of the key constraints in goat production is high neonatal (pre-weaning) mortality, which significantly affects herd productivity and serves as a sensitive indicator of overall management effectiveness. A considerable proportion of kid mortality is attributed to non-genetic factors, including inadequate nutrition, poor housing, insufficient colostrum intake, and poor maternal care. In particular, kids born to nulliparous (first-time) does tend to exhibit higher mortality rates, primarily due to lower birth weights and reduced maternal experience. Disease and parasitic infestations are widespread across all agro-ecological zones of the country, leading to substantial economic losses and hampered productivity. Pre-weaning kid mortality can be significantly reduced by ensuring close bonding between the dam and kid during the first two weeks post-partum [2]. Additionally, providing supplementary nutrition to both the doe during late pregnancy and the kid postnatally enhances kid survivability and improves the postpartum body condition of the dam. These management interventions are crucial for improving the overall reproductive and productive performance of goat herds.

Material and Methods
The experiment was conducted at farmer's field of three flocks belonging to Arkalgudu taluk (Southern Transition Zone of Hassan district).

A total of 18 locally available pregnant does of non-descriptive goat breed having similarity in age, body weight and parity (2nd to 5th parity) were selected. Based on the breeding history obtained by the farmers the expected date of kidding was estimated for the selected pregnant does. The selected does were allotted to three treatment groups, each comprising 6 pregnant does and reared as per the below feeding regimens.

Treatment groups

- **T_0**: Regular browsing as practiced by the farmers in the region.
- **T_1**: Normal browsing plus daily supplementation @ 125 g Ground Maize grain.
- **T_2**: Normal browsing plus daily supplementation @ 250 g Concentrate feed mixture (Table 1)

Table 1: Composition of the concentrate feed supplement

Ingredient	% Composition
Maize	46.5
Groundnut cake	30.0
Wheat bran	20.0
Mineral mixture	2.0
Salt	1.0
Sodium bicarbonate	0.5

Crushed maize grain and a formulated concentrate mixture were supplemented to the does for four weeks prior to the estimated kidding date. The study spanned a total duration of eight weeks, comprising 28 days pre-partum and 28 days post-partum. A three-day adaptation period was provided before initiating concentrate supplementation. Concentrate was offered individually in separate feeding utensils according to the nutritional requirements of each doe. Body weight of each doe was recorded at the start of the experiment and subsequently at weekly intervals, consistently in the morning before feeding and watering. Average body weights were recorded during the fourth, third, second, and first week pre-partum. Post-partum weights of does and their kids were recorded on the day of kidding and at weekly intervals during the first, second, third, and fourth weeks post-partum.

Statistical Analysis

The data obtained on various parameters was compiled using Microsoft Excel and analyzed using statistical software SPSS and one way ANOVA was used to compare the data obtained in the trial.

Results and Discussion

A. Mean ± SE weekly body weight (kg) of Does under the trial

The weekly body weights of does across the treatment groups are presented in Table 2. The results indicated a progressive increase in body weight with advancement in pregnancy, continuing until parturition. Statistically, there were no significant differences ($P > 0.05$) in pre-partum body weights among the treatment groups, indicating a uniform response to the feeding regimen during gestation. A similar trend was observed during the post-partum period, where body weights remained statistically comparable across the groups ($P > 0.05$). The absence of significant differences between treatment groups during both pre- and post-partum phases may be attributed to inherent individual variability in body weight among does within each group. This intra-group variation could have masked any treatment effects, thereby influencing the overall statistical outcome.

B. Cumulative growth rate / weight gain (kg) in Does during the trial

Cumulative live weight gain of does during the experimental period is presented in Table 3. During the pre-partum phase, a significant difference ($P < 0.01$) in growth rate was observed among the groups. The does in treatment groups T_1 and T_2 exhibited significantly higher weight gains compared to the control group (T_0), with the highest gain recorded in T_2. This improvement in weight gain can be attributed to the enhanced nutritional intake through maize and concentrate supplementation, which likely supported both maternal tissue accretion and foetal development [3, 4, 5, 6]. The utilization of nutrients during late gestation generally follows a hierarchical pattern—first for maternal maintenance, followed by foetal growth and finally maternal tissue deposition. Hence, higher energy and nutrient availability in the supplemented groups likely translated into increased maternal weight gain.

In contrast, during the post-partum phase, no significant differences in cumulative weight gain were observed among the treatment groups ($P > 0.05$). This could be due to a shift in nutrient partitioning, where the nutritional intake was primarily directed towards maintenance and milk production rather than body weight gain. The metabolic demands of lactation typically take precedence over somatic growth, especially in early lactation. An improved body weight gain in goats receiving concentrate supplementation during late pregnancy was reported in the previous research studies also [7, 8, 9, 10, 11]. However, limited weight gain during lactation, despite supplementation, has been similarly attributed to nutrient prioritization for milk synthesis.

C. Average weekly body weight of Kids (kg) in the experimental groups

The weekly body weights of kids recorded during the study are presented in Table 4. The results revealed significant differences in average birth weights among the treatment groups ($P < 0.05$). Notably, kids born to does in the T_2 group had significantly higher birth weights (2.08 ± 0.077 kg) compared to those in the T0 group (1.72 ± 0.082 kg). This trend continued into the first week of age, with significant differences ($P < 0.05$) among the groups. Moreover, body weights during the second, third, and fourth weeks post-kidding were significantly different among the groups ($P < 0.01$), with the highest values consistently observed in T_2, followed by T_1 and T_0. This progressive trend indicates that prenatal nutritional supplementation—particularly with concentrate and crushed maize—positively influenced early growth performance in kids.

The significantly higher birth weights in the concentrate-fed groups (T_1 and T_2) suggest that enhanced maternal nutrition during late gestation contributed to improved foetal growth. Similarly, the superior body weight gains in kids from T_1 and T_2 groups during the first four weeks post-partum imply better milk yield and quality from does receiving nutritional supplementation. The improved performance in T_1 and T_2 groups can be attributed to the high palatability, better digestibility, and availability of fermentable nutrients in the concentrate feed and maize grain, leading to efficient utilization and enhanced growth rates in kids. Research

findings highlighting the positive impact of concentrate supplementation during late pregnancy on kid growth and development were recorded in support of these observation [7, 8, 12, 13].

D. Cumulative weekly weight gain in kids (kg) during the trial period

The cumulative weekly body weight gain of kids over the four-week postnatal period is summarized in Table 5. A statistically significant difference ($P < 0.01$) was observed in average weekly weight gain among the three treatment groups from the first to the fourth week. Kids in the T_2 group exhibited the highest cumulative weight gain (1.364 ± 0.053 kg), followed by those in T_1 (0.987 ± 0.057 kg) and T0 (0.586 ± 0.057 kg). The consistent increase in body weight gain observed in kids from the T_2 and T_1 groups reflects the positive influence of maternal nutritional supplementation during late gestation. The higher growth rates in these groups suggest that increased milk production in does—facilitated by concentrate and maize supplementation—contributed significantly to improved kid growth performance during the early lactation phase.

These findings highlight a direct relationship between maternal nutrition, milk availability, and early growth in kids. The superior performance in the supplemented groups (T_1 and T_2) can be attributed to the higher energy and nutrient intake of does, which likely supported enhanced lactation and, in turn, greater nutrient availability to the offspring during the critical early growth period.

Table 2: Showing mean ± SE of weekly body weight (kg) of does during the trial

	Pre-partum				Post-partum				
	4th week	**3rd week**	**2nd week**	**1st week**	**0 day**	**1st week**	**2nd week**	**3rd week**	**4th week**
T_0	26.30 ± 0.79	26.49 ± 0.80	26.81 ± 0.80	27.04 ± 0.82	24.98 ± 0.67	25.03 ± 0.67	25.11 ± 0.68	25.18 ± 0.67	25.24 ± 0.67
T_1	25.83 ± 0.66	26.18 ± 0.67	26.73 ± 0.70	27.13 ± 0.74	24.71 ± 0.47	24.78 ± 0.46	24.87 ± 0.46	24.95 ± 0.46	24.99 ± 0.46
T_2	26.00 ± 0.70	26.53 ± 0.70	27.18 ± 0.69	27.71 ± 0.70	24.95 ± 0.63	25.03 ± 0.63	25.11 ± 0.63	25.20 ± 0.64	25.27 ± 0.63
P value	0.899	0.931	0.898	0.796	0.94	0.944	0.946	0.947	0.935

Table 2: Cumulative growth rate / weight gain (kgs) in does during the trial

	Pre-partum			Post-partum			
	3rd week	**2nd week**	**1st week**	**1st week**	**2nd week**	**3rd week**	**4th week**
T_0	0.198 ± 0.32^a	0.515 ± 0.28^a	0.747 ± 0.28^a	0.051 ± 0.28	0.13 ± 0.29	0.208 ± 0.19	0.268 ± 0.19
T_1	0.343 ± 0.00^b	0.902 ± 0.33^b	1.293 ± 0.33^b	0.075 ± 0.33	0.158 ± 0.00	0.24 ± 0.26	0.282 ± 0.26
T_2	0.528 ± 0.27^c	1.183 ± 0.27^c	1.71 ± 0.29^c	0.085 ± 0.30	0.165 ± 0.27	0.248 ± 0.27	0.317 ± 0.28
P value	0.001	0.001	0.001	0.088	0.637	0.557	0.088

Table 4: Average weekly body weight of Kids (kg) in the experimental groups

	0 day	**1st week**	**2nd week**	**3rd week**	**4th week**
T_0	1.72 ± 0.082^a	1.86 ± 0.093^a	2.01 ± 0.106^a	2.15 ± 0.119^a	2.31 ± 0.133^a
T_1	1.93 ± 0.082^{ab}	2.14 ± 0.093^b	2.38 ± 0.106^b	2.64 ± 0.119^b	2.92 ± 0.133^b
T_2	2.08 ± 0.077^b	2.38 ± 0.087^b	2.71 ± 0.099^c	3.07 ± 0.111^c	3.45 ± 0.124^c
P value	0.017	0.030	0.001	0.001	0.001

Note: Means between the groups, bearing different superscripts are statistically significant at $P < 0.05$

Table 5: Cumulative growth rate / weight gain in Kids (kgs) during the trial

	1st week	**2nd week**	**3rd week**	**4th week**
T_0	0.137 ± 0.012^a	0.279 ± 0.027^a	0.429 ± 0.042^a	0.586 ± 0.057^a
T_1	0.211 ± 0.012^b	0.447 ± 0.027^b	0.710 ± 0.042^b	0.987 ± 0.057^b
T_2	0.294 ± 0.011^c	0.629 ± 0.025^c	0.985 ± 0.039^c	1.364 ± 0.053^c
P value	0.001	0.001	0.001	0.001

Note: Means between the groups, bearing different superscripts are statistically significant at $P < 0.01$

Conclusion

Additional nutritional supplementation during the late gestation period significantly enhanced kid birth weight, reflecting improved maternal nutrition and subsequent milk production. Does supplemented with concentrate feed produced kids with the highest birth weights and showed a consistent increase in kid growth rates during the first four weeks post-partum, followed by those supplemented with maize and those maintained on grazing alone. The observed growth trends indicate a direct relationship between maternal supplementation, milk yield, and early kid growth performance. Therefore, targeted supplementation with small quantities of energy-dense feed, particularly during the last month of pregnancy and early lactation, is a practical and effective strategy to improve doe and kid performance, ensure better weight gain in offspring, and enhance kid survivability under field conditions.

Conflict of Interest: Authors would like to express no conflict of interest in the present research work.

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