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# Effect of Weaning Age on the Performance of Goat Kids in Mizoram

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## ABSTRACT

**Background:** The goat population in the North East Hill region is approximately 4.37 million, with Assam being the major contributor (6,169,193), while Mizoram accounts for 14,820 goats. Goats are a vital livelihood source for the region's people, with chevon being a preferred meat over pork and beef. Despite its potential, goat farming faces challenges such as inadequate feeding practices, limited grazing land and a significant gap between meat production and demand.

**Methods:** This study evaluated the effects of weaning age on the growth performance of 24 local nondescript goat kids (aged 0-3 months) reared under the agro-climatic conditions of Mizoram. Over a 90-day period at the Goat Unit, Instructional Livestock Farm Complex, Aizawl, the kids were divided into three treatment groups ($T_1$, $T_2$, $T_3$) with eight animals each. In $T_1$, kids were kept with their mothers for 90 days. In $T_2$, kids were weaned at 60 days and fed cow milk at 1/14$^{th}$ of their body weight, while $T_3$ kids were weaned at 45 days and fed cow milk at 1/12$^{th}$ of their body weight until day 60, then at 1/14$^{th}$ until day 90. All kids were given ad libitum access to creep feed and fodder starting on day 15. Total income from live weight gain was calculated considering total cost of feed and milk provided.

**Result:** The production economy of three treatment groups ($T_1$, $T_2$, $T_3$) was analyzed. Initial average body weights were 1.26 kg ($T_1$), 1.31 kg ($T_2$) and 1.27 kg ($T_3$), increased to 5.86 kg, 6.08 kg and 5.9 kg, respectively. Feed and fodder costs were Rs. 115.51 ($T_1$), Rs. 116.45 ($T_2$) and Rs. 114.45 ($T_3$), with total intake of 3.176 kg, 3.202 kg and 3.147 kg per head. Income from live weight gain was highest in $T_1$ (Rs. 1724) but lower in $T_2$ (Rs. 1280.79) and $T_3$ (Rs. 981.54) due to additional cow milk costs.

**Key words:** Goat kids, Growth performance, Morphometric parameters, Weaning age.

## INTRODUCTION

Goat farming is a vital component of the rural economy in India, providing livelihood to around 40 per cent of the rural population (Maske and Phule, 2011). As versatile livestock, goats offer a low-cost, sustainable and profitable farming model, particularly for small and marginal farmers. With India hosting the second-largest goat population in the world, contributing 17.93 per cent to the global count as per the 20$^{th}$ Livestock Census (2019), the significance of goat farming cannot be overstated. Chevon, a lean and deliciousmeat, is widely enjoyed across India due to the lack of religious prohibitions. Goats, which require less feed and land than larger ruminants, are becoming the preferred choice for farmers amid urbanization and industrialization.

In northeastern India, where goat farming serves as a primary livelihood source, the region's unique challenges-such as limited grazing land and traditional management practices-necessitate tailored approaches to maximize goat farming potential. Mizoram, with a goat population of 14,820, faces a demand-supply gap for meat production, highlighting the need for improved farming practices, including efficient weaning protocols (Talukdar *et al.,* 2022).

The weaning process is one of the key elements affecting goat farming's production and profitability. Weaning, the transition of young goats from milk to solid feed, is typically initiated between 60-90 days of age. Early weaning, particularly between 45-60 days, has been identified as an effective management strategy to improve milk availability, enhance rumen development and reduce kid mortality. Proper weaning practices help to optimize growth performance and ensure the health of goat kids, making it a keystone of successful goat farming.

Despite the importance of weaning, systematic studies evaluating its effects on growth performance, morphometric traits and health in goats of Mizoram are lacking. Considering these gaps, the present study focuses on assessing the impact of weaning age on the performance of goat kids in Mizoram. The findings aim to provide practical insights to enhance productivity and sustainability in goat farming practices.

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## MATERIALS AND METHODS

The study is conducted at the Goat Research Farm, Department of Livestock Production and Management, College of Veterinary Science and Animal Husbandry, Selesih, Aizawl, Mizoram. The experiment was conducted over a period of three months, utilizing 24 non-descript kids aged between zero and three months. The animals were housed on high wooden platforms over concrete floors in a facility with a closed roof and walls. Each animal was provided with separate drinkers, feeders and identification tags to ensure proper management and monitoring. All standard health protocols were strictly followed throughout the experiment. The goats were divided into three treatment groups based on the weaning age: Treatment 1 ($T_1$), the control group, consisted of 8 kids that were kept with their mothers until 90 days of age, provided with ad libitum creep feed from 15 days and offered water at fixed intervals; Treatment 2 ($T_2$) included 8 kids weaned at 60 days of age, confined to stalls, receiving ad libitum creep feed from 15 days and milk after weaning at 1/14th of their body weight, split into morning and evening feeds; Treatment 3 ($T_3$) consisted of 8 kids weaned at 45 days of age, confined to stalls, with ad libitum creep feed from 15 days and milk provided after weaning at 1/12$^{th}$ of their body weight, also split into morning and evening feeds.

**Parameters recorded**

**Growth performance**

**Average live weight**

Recorded at the start and atfortnightly intervalduring the 90-day experiment.

**Average daily gain (ADG):** Calculated as follows:

Average daily gain (g) =

$$\frac{\text{Final body weight - Initial body weight}}{\text{Number of days}}$$

**Body measurements**

Measurements were taken at the start of the experiment and atfortnightlyinterval by using a measuring tape. All measurements were recorded in centimetre (cm) like Height at withers (HW), chest girth (CG), body length (BL) was taken in centimetre. Regression of body weight on body measurements was also calculated by using linear and multiple regression method.

**Production economy**

Cost of feeds and cow milk, medicines incurred was taken into account for calculating the input cost and the total income from live weight gain was calculated and compared between the three treatment groups.

**Statistical analysis**

The data was documented, compiled and tabulated in standard format. Significant differences of means between treatments were analysed by using SPSS Version 16 software. Regression of body weight on body measurements was also calculated by using linear and multiple regression method. Model used for linear regression in the present study.

$$Y = b_0 + b_1X_1$$

Where,

Y = Dependent variable.

$X_1$ = Independent variable.

$b_0$ = Intercept (value of Y when X1= 0).

$b_1$ = Slope of the regression line (rate of change in Y per unit change in X).

Model used for multiple regression.

$$Y = b_0 + b_1X_1 + b_2X_2$$

Where,

Y = Dependent variable.

$X_1, X_2, \ldots, X_n$ = Independent variables.

$b_0$ = Intercept.

$b_1, b_2, \ldots, b_n$ = Coefficients (effect of each independent variable on Y).

## RESULTS AND DISCUSSION

The fortnightly mean body weights (kg) of kids from birth to 90 days were recorded for three groups (Table 1). The findings of this study revealed that there were no statistically significant differences in thebody weights of goat kids across the treatment groups ($T_1$, $T_2$ and $T_3$) at various stages frombirth to 90 days. In $T_1$ (kept with dam), weights increased from 1.26±0.07 at birth to 5.86±0.13 at 90 days. In $T_2$ (weaned at 60 days), weights ranged from 1.31±0.10 to 6.08±0.12, while in $T_3$ (weaned at 45 days), weights progressed from 1.27±0.07 to 5.90±0.10 over the same period. The absence of a significant difference is consistent with previous research by Ali *et al.* (2015), Aksakal *et al.* (2009) and Ugur *et al.* (2004), which indicated that variations in weaning age, within a reasonable range, do not substantially impact body weight. These results suggest that the nutritional strategies employed post-weaning can effectively supportgrowth, regardless of the weaning age (Talukdar *et al.,* 2016). The similarity in body weights observed in this study could be attributed to the early rumendevelopment and gradual adaptation to solid feed

**Table 1:** Fortnightly bodyweight (kg) of kids under different treatment groups (Mean ± SE).

| Days | Fortnightly body weights (kg) | | | p - value |
|---|---|---|---|---|
| | $T_1$ (Control) | $T_2$ | $T_3$ | |
| 0 | 1.26±0.07 | 1.31±0.10 | 1.27±0.07 | 0.907 |
| 15 | 1.92±0.12 | 2.01±0.08 | 1.86±0.09 | 0.568 |
| 30 | 2.70±0.12 | 2.68±0.11 | 2.57±0.11 | 0.705 |
| 45 | 3.61±0.18 | 3.76± 0.07 | 3.62±0.11 | 0.680 |
| 60 | 4.37±0.14 | 4.28±0.08 | 4.22±0.14 | 0.700 |
| 75 | 5.16 ±0.08 | 5.27±0.15 | 5.01 ±0.09 | 0.212 |
| 90 | 5.86±0.13 | 6.08±0.12 | 5.90 ±0.10 | 0.370 |

intake across all groups. Similar findings werereported by Abbas *et al.* (2010), who noted that early weaning promotes rumen development, allowing for efficient utilization of solid feeds, compensating for the lack of milk. Additionallybreed-specific differences and management practices may account for variations seen in otherstudies, as highlighted by Nagpal *et al.* (1995). While this study observed no significant differences in live weights among the groups, but significant patterns emerged over the fortnightly intervals. Kids in the $T_2$ group (weaned at 60 days) exhibitedslightly higher weights in the later stages, likely due to their increased intake of creep feed andmore advanced rumen functionality. These results are consistent with Atasaglu *et al.* (2008), who reported no significant differences in body weight across different weaning ages but notedimproved feed efficiency in kids exposed to early solid feed consumption.Contrary to present findings, Amjad *et al.* (2021) and Ward *et al.* (2008) reported that earlier weaning can lead to higher final body weights due to increased relianceon creep feed and enhanced solid feed intake, stimulating growth. However, the incongruitycould be due to differences in breed, nutritional quality and management practices. The average daily weight gain (ADG) data showed significant differences within specific timeframes (Table 2). While no significant differences were observed from birth to 45 days, a notable decreasein ADG (34.99±3.72 kg) was recorded at 60 days for the $T_2$ group compared ADG (50.83±5.33 kg) of $T_1$ group, likely due to the cessationof milk production by the Doe. However, by 75 days, kids in the $T_2$ group exhibitedsignificantly higher ADG (65.83±2.93 kg) than those in $T_1$ (52.49±4.07 kg) and $T_3$ (52.50±2.65 kg), suggesting effective adaptation to solidfeeds. This is consistent with findings by Ugur *et al.* (2007), who observed similar variations in growth rates post-weaning. The variation in ADG among treatment groups at specific intervals highlights the importanceof providing high-quality creep feed during the transitional period. The $T_2$ group has shownsuperior ADG at 75 days, which may reflect better rumen reticulum development and nutrient assimilation. This is in line with studies by Schichowski *et al.* (2008) and Górka *et al.* (2011), which reportedenhanced growth rates in early-weaned lambs due to improved rumen development and dietaryadjustments. The present findings was similar with the value obtained by Abbas *et al.* (2010) and Ramakrishnappa *et al.* (2013), who noted that early weaning at around two months, may supports growth and reduce lactationalstress to dams, without negatively impacting post-weaning performance. However, earlyweaning's success depends on the provision of high-protein and energy-rich feeds tocompensate for the reduced milk intake, as reported by Muktiani *et al.* (2020). The average body length of kids (cm), the average chest girth (cm) and average height at wither of kids (cm) recorded every fortnightly from birth up to 90 days. The mean body length of kids was recorded fortnightly from birth to 90 days of age. In the $T_1$ group, body length ranged from 26.35 cm at birth to 53.85 cm at 90 days. The $T_2$ group showed a range from 26.03 cm to 53.18 cm, while in the $T_3$ group, it ranged from 25.71 cm to 52.74 cm. All groups exhibited a steady increase in body length over the growth period, but no significant difference among the three groups. The average chest girth (cm) of kids was recorded fortnightly up to 90 days. In the $T_1$ group, values ranged from 22.06±0.86 at birth to 43.12±0.23 at 90 days. The $T_2$ group showed similar growth, from 22.79±0.57 to 43.11±0.39, while the $T_3$ group had ranging from 24.95±1.32 at birth to 42.97±0.40 at 90 days and there was no significant difference found among the three groups at fortnightly intervals. The average height at withers of kids was recorded fortnightly from birth to 90 days of age. In the $T_1$ group, the height ranged from 20.22 cm at birth to 39.33 cm at 90 days. In the $T_2$ group, it ranged from 21.24 cm to 39.11 cm over the same period. The $T_3$ group showed a

**Table 2:** Fortnightly daily weight gain (gm) of kids under different treatment groups (Mean ± SE).

| Days | Groups | | | p - value |
|---|---|---|---|---|
| | $T_1$ (Control) | $T_2$ | $T_3$ | |
| 15 | 44.16±7.12 | 46.66±6.9 | 39.16±2.33 | 0.661 |
| 30 | 51.66±3.72 | 44.9±3.02 | 47.50±3.87 | 0.423 |
| 45 | 60.83±5.55 | 71.60±4.49 | 70.00±3.08 | 0.210 |
| 60 | 50.83±5.33[a] | 34.99±3.72[b] | 40.00±2.81[ab] | 0.036* |
| 75 | 52.49±4.07[b] | 65.83±2.93[a] | 52.5±2.65b | 0.012* |
| 90 | 46.66±3.77 | 53.33±4.71 | 59.16±5.55 | 0.199 |
| Overall | 51.11±2.10 | 52.91±2.52 | 51.38±2.09 | 0.830 |

**Table 3:** Regression of body weight on body measurements.

| Prediction equation | Intercept (Y) | Regression co-efficient | | | $R^2$ |
|---|---|---|---|---|---|
| | | $T_1$ | $T_2$ | $T_3$ | |
| $Y = a + b_1X_1$ | -2.939 | 0.161 | - | - | 0.966** |
| $Y = a + b_2X_2$ | -3.153 | - | 0.202 | - | 0.907** |
| $Y = a + b_3X_3$ | -3.472 | - | - | 0.231 | 0.880** |
| $Y = a + b_1X_1 + b_2X_2$ | -3.105 | 0.128 | 0.045 | - | 0.971** |
| $Y = a + b_1X_1 + b_3X_3$ | -3.150 | 0.136 | - | 0.039 | 0.969** |
| $Y = a + b_2X2 + b_3X_3$ | -3.370 | - | 0.141 | 0.074 | 0.914** |
| $Y = a + b_1X_1 + b_2X_2 + b_3X_3$ | -3.149 | 0.126 | 0.035 | 0.015 | 0.971** |

Probability in parentheses: $R^2$-Coefficient of determination; $X_1$-Body length; $X_2$-Heart girth; $X_3$-Height at withers; Y-Body weight.

height range from 23.36 cm to 36.26 cm. All groups exhibited a gradual increase in height with age but no significant difference was found among the three groups, recorded fortnightly. In multiple regression analysis (Table 3), identifying the most important independent variables influencing the dependent variable is key. Adding more variables typically increases the $R^2$ value, indicating a better fit. For nondescript goat kids, the lowest $R^2$ (0.914) was observed using chest girth and height at withers as predictors of body weight, but including body length raised the $R^2$ value to 0.971. A higher $R^2$ reflects a stronger model fit, aligning with findings from Chitra *et al.* (2012), Topal *et al.* (2004) and Alade *et al.* (2008). Thus, body weight is best estimated using body length alone or alongside other measurements. The production economy of three treatment groups ($T_1$, $T_2$, $T_3$) was calculated. The initial body weights were 1.26 kg ($T_1$), 1.31 kg ($T_2$) and 1.27 kg ($T_3$), while final weights reached 5.86 kg, 6.08 kg and 5.9 kg, respectively. The additional concentrate feed and fodder provided from day 15 resulted in slightly varying costs among the three treatment groups. The cost was Rs. 115.51 in $T_1$, Rs. 116.45 in $T_2$ and Rs. 114.45 in $T_3$. Compared to $T_1$, the feed cost in $T_2$ was 0.82% higher, while in $T_3$ it was 0.92% lower. However, when analyzing the income from live weight gain at the rate of Rs. 400 per kg, $T_1$ yielded the highest return of Rs. 1724. This income was 25.7% more than that of $T_2$ (Rs. 1280.79) and 43.05% more than that of $T_3$ (Rs. 981.54). The reduced income in $T_2$ and $T_3$ could be attributed to the additional cost of cow milk feeding after weaning in these groups, which may have influenced overall growth performance and net returns. Nagpal *et al.* (1995) have also observed higher income with early weaning, whereas Ahmed *et al.* (2024) reported better production economy with late weaning due to greater weight gain.

## CONCLUSION

The results of this study confirm that weaning at either 45 or 60 dayswith appropriate post-weaning nutritional management do not adversely impact body weight or growth rates of goat kids. The observed patterns in ADG further emphasize the importanceof tailored feeding strategies to optimize growth during critical developmental periods. However, further studies may be conducted taking into consideration the body weight of kids upto 150 days of age and the economy of feeding the kids, when weaned at 45 or 60 days of age to arrive at a conclusion.

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### Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided, but do not accept any liability for any direct or indirect losses resulting from the use of this content.

### Informed consent

All animal procedures for experiments were approved by the Institution Animal Ethics Committee of College of Veterinary Sciences and Animal Husbandry, Central Agricultural University, Selesih, Aizawl, Mizoram, India.

### Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this article. No funding or sponsorship influenced the design of the study, data collection, analysis, decision to publish or preparation of the manuscript.

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