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Feeding Behavior of Etawa Crossbred Dairy Goats in Consuming *Cnidoscollus aconitifolius* as a Substitute Feed and Its Correlation with Palatability and Body Weight Gain

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Abstract. *This study evaluated the feeding behavior and palatability of Etawa Crossbred (PE) dairy goats fed diets with partial substitution of Cnidoscolus aconitifolius forage. An in vivo field experiment was conducted using a Completely Randomized Design with four dietary treatments and three replications. The treatments consisted of: (T0) Leucaena leucocephala (lamtoro) as the basal forage; (T1) lamtoro supplemented with concentrate; (T2) lamtoro plus concentrate with 10% substitution of lamtoro dry matter by C. aconitifolius; and (T3) lamtoro plus concentrate with 20% substitution of lamtoro dry matter by C. aconitifolius. Parameters observed included feed intake (dry matter, organic matter, crude protein, and crude fiber), body weight change, and feeding behavior related to forage preference. The goats consistently consumed forage prior to concentrate and exhibited a higher preference for diets containing C. aconitifolius. Inclusion of C. aconitifolius reduced lamtoro intake; however, no significant differences were observed among treatments for dry matter, organic matter, crude protein, or crude fiber intake (P>0.05). Body weight change showed a positive tendency in goats receiving 10% and 20% C. aconitifolius substitution, while goats fed the control diet experienced slight weight loss, although these differences were not statistically significant (P>0.05). In conclusion, C. aconitifolius demonstrated good palatability and potential as an alternative forage for PE goats when used as a partial substitute for lamtoro. Nevertheless, its inclusion at the tested levels did not significantly affect nutrient intake or body weight change. Further studies are recommended to optimize inclusion levels and feeding strategies to enhance its practical application in small ruminant production systems.*

Keywords: *Cnidoscolus aconitifolius, Etawa Crossbred dairy goats, Feeding behavior, Forage substitution, Palatability*

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INTRODUCTION

Feed availability and quality are critical determinants of productivity, health, and efficiency in ruminant livestock, including dairy goats. In smallholder production systems, feed resources largely rely on locally available forages, the supply and quality of which fluctuate seasonally. In tropical countries such as Indonesia, these challenges are exacerbated by increasing land-use conversion, climate variability, and rising costs of commercial concentrates, leading to chronic forage shortages and inconsistent nutrient intake among small ruminants.

Indonesia maintains a large and growing goat population, exceeding 20 million head, with the majority managed under smallholder systems (BPS 2023). goats are widely raised due to their adaptability and dual-purpose potential; however, their productivity is often constrained by limited access to high-quality forage. The declining availability of conventional forages such as grasses and commonly used legumes underscores the need to explore alternative, locally adaptable feed resources that can support sustainable goat production under resource-limited conditions.

Cnidoscolus aconitifolius (chaya) has emerged as a promising alternative forage for tropical livestock systems. The leaves are characterized by relatively high crude protein content, appreciable mineral concentrations, and moderate fiber levels, which indicate potential suitability for ruminant feeding (Hamid *et al*., 2022; Gobena *et al*., 2023). Moreover, chaya is tolerant to drought, adaptable to marginal soils, and easy to cultivate, making it a viable option for smallholder farmers facing forage scarcity under changing climatic conditions (Șonea *et al*., 2024). Despite these advantages, its utilization in goat feeding systems, particularly in Indonesia, remains limited.

A critical constraint to the adoption of novel forage resources is palatability, as animal acceptance directly influences voluntary feed intake and subsequent performance. Feeding behavior reflects the interaction between sensory attributes of the feed and post-ingestive responses, which together determine dietary preference and intake patterns (Desnoyers *et al*., 2011). To date, empirical information on the feeding behavior and palatability of *C. aconitifolius* in dairy goats is scarce, and studies evaluating its use as a partial substitute for commonly used forages in PE goats are particularly limited. This gap restricts evidence-based recommendations for its practical inclusion in smallholder feeding strategies.

Therefore, the present study aimed to evaluate the feeding behavior of Peranakan Etawa dairy goats fed diets containing *Cnidoscolus aconitifolius* as a partial forage substitute, assess its palatability through intake-related responses, and examine its relationship with feed intake and body weight gain. The results of this study are expected to contribute to a better understanding of chaya as an alternative forage resource and provide scientific support for its potential application in sustainable goat production systems in Indonesia

LITERATURE REVIEW

Japanese papaya (*Cnidoscolus aconitifolius*), or Chaya, is recognized as a high-protein tropical foliage containing 23–29% crude protein on a dry matter basis, along with essential amino acids, minerals, and vitamins (Victor *et al*., 2016; Setiasih *et al*., 2024). Studies show that drying significantly reduces cyanide levels from 567 ppm to 97.2 ppm, ensuring its safety for ruminant feeding (Wongnhor *et al*., 2022). Supplementation of Chaya leaf pellets (CHYP) up to 8% of dietary dry matter enhances rumen fermentation by increasing ammonia-nitrogen, total VFA, propionate concentration, and microbial protein synthesis rising from 85.4 g N/d to 122.4 g N/d without negatively affecting blood metabolites or liver enzymes (Kholif et al., 2015; Totakul et al., 2021). These findings demonstrate that Chaya provides a nutrient-rich and cost-effective alternative to conventional protein sources such as soybean and maize, especially under fluctuating feed supply conditions

Compared to *Leucaena leucocephala*, which also contains high crude protein but carries notable antinutritional constraints such as mimosine and condensed tannins, Chaya offers a lower antinutrient burden and more favorable digestibility. Although Leucaena requires processing to reduce toxicity, Chaya maintains safe nutrient–antinutrient ratios following simple drying methods (Lennox *et al*., 2018; Simamora *et al*., 2023). In vivo and in vitro evaluations across various livestock species including dairy calves, goats, and broilers—show that partial replacement of concentrate with Chaya does not reduce feed intake, dry matter digestibility, or growth performance (Oni *et al*., 2017; Wongnhor *et al.*, 2022). In goats, substitution of concentrate with Chaya up to 75% does not negatively affect intake or nutrient digestibility, indicating strong palatability and effective rumen degradability.

Etawa Crossbred dairy goats respond favorably to forages containing high protein and moderate fiber, making them suitable for evaluating Chaya as a substitute feed. Etawa Crossbred Increased rumen propionate and microbial protein synthesis stimulated by Chaya supplementation provide metabolic advantages that support tissue accretion and body weight gain under in vivo feeding conditions (Totakul *et al*., 2021). Furthermore, palatability assessments show that goats readily consume Chaya-supplemented diets without reductions in dry matter intake or physiological stability. These findings indicate that incorporating Chaya into Etawa Crossbred goat diets can reduce dependence on conventional feed ingredients, improve fermentation efficiency, enhance nitrogen utilization, and support sustainable growth performance while maintaining animal health.

RESEARCH METHODS

Research Period and Location

The *Cnidoscolus aconitifolius* (Japanese papaya) forage used in this study was cultivated at the Agrotechnopark, Universitas Brawijaya. The *in vivo* feeding trial of Etawa crossbreed (PE) dairy goats was conducted from October to December 2024 at the Karya Mulya Farm, Sidomulyo Hamlet, Bangelan Village, Wonosari District, Malang Regency. Laboratory analyses of feed, feed refusals, feces, and urine samples were carried out in January 2025 at the Laboratory of Animal Nutrition and Feed Science, Faculty of Animal Science, Universitas Brawijaya.

Research Materials

The materials used in this study consisted of 12 Etawa crossbreed dairy goats in the second to fifth lactation stages were used, with an average body weight of 49.25 ± 11.8 kg. The feed ingredients included fresh *Leucaena leucocephala* (lamtoro) forage obtained from Karya Mulya Farm, commercial concentrate from KAN (Koperasi Agro Niaga) Jabung, and fresh *Cnidoscolus aconitifolius* leaves collected from the Agrotechnopark of Universitas Brawijaya. Lamtoro served as the primary forage source, the concentrate functioned as a nutritional supplement to balance energy and protein requirements, while *C. aconitifolius* was used as a partial substitute in the concentrate at two levels (10% and 20%).

Table 1. Chemical Composition of Feed Ingredients Used in the Experimental Diet (% DM basis)

Feed Ingredient	DM (%)	OM (% DM)	Ash (% DM)	CP (% DM)	CF (% DM)	EE (% DM)	NFE (% DM)
Leucaena leucocephala (Lamtoro)	24.85	96.13	3.86	15.29	47.54	2.13	31.17
Concentrate	86.50	92.43	7.57	16.88	10.82	2.89	61.83
Japanese Papaya (*Cnidoscolus aconitifolius*)	14.00	91.26	8.74	12.36	21.72	2.47	54.71

Research Procedures

Experimental Feeding Procedures

The research procedure began with the preparation of feed ingredients consisting of *Leucaena leucocephala* forage, Japanese papaya forage, and concentrate. Both forages were harvested in the afternoon and wilted overnight to reduce moisture and minimize bloat risk, then weighed the next morning according to ration requirements before being mixed with concentrate to prevent feed selection. The in vivo trial was conducted through four stages. The 7-day adaptation phase allowed goats to adjust to metabolic cages and gradually adapt to the experimental diets after initial body weight measurement. This was followed by a 7-day preliminary period in which goats were grouped by milk production and fed 4% BW with ad libitum water, while feed intake, refusals, and milk yield were recorded to ensure stable consumption. The 46-day data collection period measured daily feed offered, refusals, milk production, feces, and urine from each animal. Finally, laboratory analyses were performed to determine nutrient composition and digestibility using AOAC (2005) methods, along with nitrogen retention, milk quality, and IOFC evaluation. The nutrient composition of feed treatments is presented in Table. 2.

Table 2. Nutrient Composition of Experimental Diets for Etawa Crossbreed Dairy Goats (% DM basis)

Treatment/ Feed Components	Nutrient (%)						
	DM	OM	CP	CF	EE	Ash	NFE
P0							
100% *Leucaena leucocephala*	24,5	96,13	15,9	47,54	15,62	3,6	17,68
Total	24,5	96,13	15,9	47,54	15,62	3,6	17,68
P1							
50% *Leucaena leucocephala*	12,25	48,06	7,64	23,77	7,81	1,93	8,84
50% Concentrate	43,25	46,21	8,44	5,41	8,42	3,78	23,94
Total	55,5	94,27	16,08	29,18	16,22	5,71	32,78
P2							
50% *Leucaena leucocephala*	12,25	48,06	7,64	23,77	7,81	1,93	8,84
40% Concentrate	34,60	36,97	6,75	4,32	6,73	3,02	19,15
10%*C. aconitifolius*	1,40	9,125	1,23	2,17	1,70	0,87	4,01
Total	48,25	94,16	15,63	30,26	16,24	5,83	32,01
P3							
50% *Leucaena leucocephala*	12,25	48,06	7,64	23,77	7,81	1,93	8,84
30% Concentrate	25,95	27,72	5,06	3,24	5,05	2,27	14,36
20% *C. aconitifolius*	2,8	18,25	2,47	4,34	3,40	1,74	8,03
Total	41	94,04	15,18	31,35	16,26	5,95	31,24

Feed analysis

Samples of the offered feed and feed refusals were collected daily, oven-dried, and analyzed following standard proximate methods. The parameters included dry matter (DM), organic matter (OM), crude protein (CP), crude fiber (CF), ether extract (EE), and ash content. These analyses were used to calculate total feed intake and nutrient consumption

Observation Feeding Behavior

Feeding behavior was observed visually through direct monitoring during both morning and afternoon feeding sessions. The evaluation focused on several key behavioral parameters, including the time required for the animals to initiate eating, the duration of chewing activity, the frequency of feed refusal, and the preference shown toward specific components of the offered ration. Trained observers continuously recorded these behavioral indicators, ensuring that all responses related to feed interaction were documented in real time. The qualitative data obtained were analyzed descriptively, and the resulting behavioral patterns were compared with findings reported in reference literature to accurately interpret palatability levels and overall feeding tendencies exhibited by the animals.

Experimental Design

The study employed a Completely Randomized Design (CRD) consisting of four treatments and three replications, grouped based on initial milk yield to minimize variability. The four experimental diets were as follows:

T0: 100% *Leucaena leucocephala* (control)

T1: 50% *Leucaena leucocephala* + 50% concentrate

T2: 50% *Leucaena leucocephala* + 40% concentrate + 10% *C. aconitifolius*

T3: 50% *Leucaena leucocephala* + 30% concentrate + 20% *C. aconitifolius*

All rations were formulated to meet the nutrient requirements of lactating goats according to NRC (2007) standards. Feed was offered twice daily, and refusals were collected and weighed for intake calculation

Research Variable

The variables measured in this study consisted of feeding behavior, feed intake, and body weight gain. Feeding behavior was assessed qualitatively to observe the animals' preference and selection patterns toward the offered feed components, providing insight into palatability and acceptance of the diet. Feed intake was quantified through measurements of dry matter, organic matter, crude protein, and crude fiber consumption to determine the level of nutrient utilization from the experimental rations. Body Weight Gain (BWG) was evaluated by calculating the difference between initial and final body weights, allowing for assessment of the animals' growth response to the dietary treatments

Data Analysis

Qualitative behavioral data were analyzed descriptively, supported by literature interpretation. Quantitative data (DM, OM, CP, CF intake, and BWG) were statistically analyzed using R Studio software. One-way ANOVA was performed to test treatment effects, and differences were considered significant at $T < 0.05$

RESULTS AND DISCUSSION

Feeding Behavior of PE Dairy Goats Fed Diets Containing Cnidoscolus aconitifolius Substitution

The feeding behavior of PE dairy goats receiving diets with partial substitution of *Cnidoscolus aconitifolius* was observed to evaluate their preference, acceptance, and selection patterns toward the offered feed. The forages were wilted prior to feeding to reduce moisture content and minimize the risk of toxicity, consistent with the findings of Yusuf et al. (2022), who reported that wilting can increase crude fiber content while reducing or eliminating sap and toxic compounds in fresh forages. Behavioral observations focused on whether goats consumed the feed immediately or displayed hesitation, such as sniffing before eating.

Goats in the P0 treatment immediately consumed *Leucaena leucocephala* forage, likely because it was part of their regular daily diet, making it familiar and highly acceptable. In the P1 treatment, goats showed greater preference for *Leucaena* leaves than for the concentrate portion and exhibited noticeable sniffing behavior prior to consumption. This response was expected since the animals had previously been accustomed to receiving *Leucaena* as their primary forage, requiring a brief adjustment period with the introduction of a complete ration containing concentrate.

In treatments T2 and T3, goats consumed Japanese papaya (*Cnidoscolus aconitifolius*) forage readily without displaying significant sniffing behavior, indicating ease of adaptation and minimal feed selection. Across all treatments, goats tended to consume forage components both *Leucaena* and *Cnidoscolus aconitifolius* before other components of the ration. In treatments where Japanese papaya was included, goats showed a clear preference for Japanese papaya, which is likely associated with its softer texture and favorable nutrient characteristics. This finding aligns with reports by Kalang

(2014) and Hendarto & Soediarto (2018), who noted that goats prefer leaves and young plant parts because they are easier to chew and contain higher nutrient concentrations.

Specific feed part preference was also observed. Goats in T0 and T1 preferred *Leucaena* leaves, twigs, and bark. In P2, goats consumed *Leucaena* leaves, twigs, and bark, as well as nearly all parts of Japanese papaya except for the older stems. In T3, goats presented similar feeding patterns toward *Leucaena* as in the other treatments but exhibited selective feeding behavior toward Japanese papaya, consuming only the leaves and avoiding even the young stems. These selective patterns highlight the role of physical structure, texture, and nutrient availability in shaping forage preferences among PE dairy goats. To provide a clearer understanding of which feed ingredient showed the highest level of consumption among the three materials used, a comparison of their intake is presented in Table 3.

Based on the percentage of feed consumption shown in the table, each diet formulation exerted a distinct effect on the palatability of the individual feed ingredients. The concentrate exhibited the highest and most consistent consumption across all parameters (DM, OM, CP, and CF), with values consistently above 74% and exceeding 97% in several treatments, indicating that it was highly preferred by the goats. *Cnidoscolus aconitifolius* also demonstrated high palatability, particularly for crude protein intake, which approached 100% in treatments T2 and T3, although a slight decrease was observed in T3. In contrast, *Leucaena leucocephala* (lamtoro) showed comparatively lower consumption than the other two feed components, with a declining trend in T2 and PT, especially for DM and CF values, which decreased to approximately >57%. These findings differ from those reported by Abour et al. (2015), who found that goats exhibited the highest palatability for lamtoro forage, with intake exceeding 60%. This discrepancy suggests that changes in feed proportion or physical characteristics in the current treatments may have influenced acceptance and intake behavior. Overall, treatment P1 tended to yield the best palatability profile, likely due to a more balanced proportion of feed ingredients that met the animals' preferences for taste, texture, and aroma.

These results support the principle that palatability is shaped by both the physical and chemical properties of feed. Ingredients with a distinctive aroma, natural sweetness, and a texture that is easy to chew are generally preferred and consumed in greater quantities. Abour *et al.* (2015) also emphasized that numerous factors influence palatability, including environmental conditions such as season and plant growth stage, which affect feed chemical composition and physical structure, including the concentration of secondary metabolites such as tannins that can reduce preference. Additionally, flavor, aroma, and post-ingestive feedback play a critical role, as feeds that meet the animal's nutritional needs produce positive feedback and enhance palatability, whereas the presence of toxins or undesirable metabolites can decrease it.

Table 3. Nutrient Intake of Individual Feed Components in PE Dairy Goats Fed Diets Containing Cnidoscolus aconitifolius (g/day)

Feed Component	Nutrient Intake (g)															
	DM				OM				CP				CF			
	T0	T1	T2	T3	T0	T1	T2	T3	T0	T1	T2	T3	T0	T1	T2	T3
Leucaena leucocephala	1242,53	1017,15	678,04	628,42	1197,66	979,00	646,27	605,00	234,63	198,06	145,57	127,00	542,50	443,78	280,44	266,68
Konsentrat		770,23	865,40	707,84		715,00	799,97	654,00		123,64	144,96	119,00		109,42	93,54	76,48
Cnidoscolus aconitifolius			91,30	154,09			83,31	140,00			11,43	20,00			19,70	374,37
Total	1242,53	1787,38	1634,7	1490,36	1197,66	1694,00	1529,55	1400,00	234,63	196,92	301,96	266,00	542,50	553,20	393,69	

Feed Component	Nutrient Intake ((g/kg $BB^{0,75}$/day)															
	DM				OM				CP				CF			
	T0	T1	T2	T3	T0	T1	T2	T3	T0	T1	T2	T3	T0	T1	T2	T3
Leucaena leucocephala	65,58	55,96	43,32	33,40	63,31	53,86	41,12	33,40	12,29	10,85	9,14	7,05	28,87	24,44	18,12	14,65
Konsentrat		41,63	53,97	38,78		38,62	49,89	35,85		6,68	9,05	6,50		5,95	5,83	4,19
Cnidoscolus aconitifolius			5,70	32,20			5,20	8,40			0,71	7,65			1,23	1,11
Total	64,21	96,43	101,93	104,86	60,63	91,03	95,20	76,85	12,07	17,35	18,74	21,08	28,18	29,84	24,64	19,55
Feed Component	Nutrient Intake (%)															
	DM				OM				CP				CF			
	T0	T1	T2	T3	T0	T1	T2	T3	T0	T1	T2	T3	T0	T1	T2	T3
Leucaena leucocephala	61,51	67,91	57,50	58,29	61,66	67,98	57,02	58,35	76,70	86,37	80,41	77,94	56,24	62,17	50,43	51,79
Konsentrat		74,88	95,03	97,70		75,18	95,04	97,73		70,75	94,33	97,04		81,99	94,91	97,55
Cnidoscolus aconitifolius			98,30	92,54			98,30	92,44			99,56	99,01			97,72	88,71

Feed Intake

Feed Intake data for dry matter (DM), organic matter (OM), crude protein (CP), and crude fiber (CF) are presented in Table 4**.**

Table 4. Nutrient Intake of PE Dairy Goats Fed Diets Containing *Cnidoscolus aconitifolius* (g/kg $BW^{0.75}$/day)

Treatment	DM (g/kg $BW^{0.75}$/day)	OM (g/kg $BW^{0.75}$/day)	CP (g/kg $BW^{0.75}$/day)	CF (g/kg $BW^{0.75}$/day)
T0	65.68 ± 29.68	63.31 ± 28.66	12.29 ± 4.89	28.87 ± 14.32
T1	97.59 ± 22.00	92.48 ± 20.66	17.53 ± 4.31	30.43 ± 4.56
T2	102.93 ± 34.28	96.21 ± 30.82	18.90 ± 6.03	25.18 ± 8.21
T3	81.88 ± 8.91	76.90 ± 8.46	14.67 ± 1.13	20.58 ± 4.37

The results showed that dry matter (DM) intake of Etawa Crossbred dairy goats receiving diets with partial substitution of *Cnidoscolus aconitifolius* did not differ significantly among treatments (T>0.05). DM intake ranged from 65.68 to 102.93 g/kg BW^0.75/day, with the highest intake observed in T2, indicating a numerical improvement despite the lack of statistical significance. This finding aligns with Totakul et al. (2021), who reported that the supplementation of chaya leaf pellets in a complete feed based on rice straw did not significantly increase total DM intake, which remained within 4.7–5.0 kg/day at inclusion levels of 0–8%. Likewise, Kumar et al. (2010) observed that substituting Japanese papaya leaf meal up to 75% in sheep diets did not alter DM intake, which remained between 56.7–68.7 g/kg BW^0.75/day. In contrast, Arisani et al. (2022) reported substantially higher DM intake (283 g/kg BW^0.75/day) in PE goats fed a complete ration containing elephant grass and concentrate, while Amr et al. (2023) found an average DM intake of 99.97 g/kg BW^0.75/day in dairy goats supplemented with natural and nano-zeolite. Differences between these studies may stem from feed type, nutrient density, fiber characteristics, and feed processing. The present stable intake supports the premise that Japanese papaya has a nutrient profile comparable to conventional concentrate, as previously characterized by Victor et al. (2016) and Kumar et al. (2010), enabling goats to maintain normal consumption patterns even when concentrate is partially replaced.

Organic matter (OM) intake exhibited a similar trend, showing no significant differences (T>0.05) among treatments, with values ranging between 63.31 and 96.31

g/kg BW^0.75/day—equivalent to approximately 94% of DM intake. This proportional relationship is consistent with findings by Kumar et al. (2010), who reported OM intake at 92% of DM intake in sheep fed diets containing papaya leaf meal, and with Totakul et al. (2021), who observed OM intake representing 88% of DM intake in cattle supplemented with chaya leaf powder. The similarity across studies indicates that OM intake is highly dependent on DM intake, as noted by Boymau et al. (2015) and Murni et al. (2012). Furthermore, the absence of OM intake reduction in the present study suggests that the organic fraction and digestibility characteristics of *C. aconitifolius* are sufficiently comparable to the basal diet, reducing any tendency for feed selectivity or avoidance (Hamid et al., 2022).

Crude protein (CP) intake tended to increase with higher levels of *C. aconitifolius* substitution, with the highest intake observed in P2 (18.90 g/kg BW^0.75/day). Although the differences were not statistically significant (T>0.05), the trend is strongly supported by the high CP content of Japanese papaya—24.97% reported by Victor et al. (2016) and 20.52% by Kumar et al. (2010). The readily degradable nature of its protein fraction, demonstrated by Fuady et al. (2024), suggests that papaya leaves provide adequate nitrogen for rumen microbes, facilitating microbial protein synthesis. This mechanism aligns with NRC (2007), which states that female PE goats require only 4.15 g/kg BW^0.75/day for maintenance, meaning that all treatments in the present study exceeded baseline requirements. Higher CP intake in T2 also reflects the balanced nutrient contribution of lamtoro combined with substituted concentrate, thereby improving rumen microbial activity and pH stability, as proposed by Chuzaemi (2012). The elevated CP intake compared with the control further demonstrates that the protein-rich properties of Japanese papaya can enhance diet quality without suppressing overall feed intake.

Crude fiber (CF) intake varied among treatments, with T1 showing the highest value (28.87 g/kg BW^0.75/day) despite having the lowest fiber content in the ration. This pattern indicates that CF intake is influenced primarily by total DM intake rather than fiber concentration. Similar observations were reported by Ørskov & McDonald (1979), who emphasized the importance of synchronized nitrogen and energy supply in optimizing fiber degradation. The relatively stable CF intake across treatments agrees with Fuady et al. (2024), who found that the neutral detergent fiber (NDF) and acid detergent fiber (ADF) fractions of Japanese papaya are moderately degradable, preventing excessive rumen fill and allowing animals to maintain normal intake levels. Meanwhile, P3 exhibited the lowest CF intake despite its higher dietary fiber content, suggesting that excessive substitution might increase fiber degradability and reduce the need for high-volume intake to meet energy and protein requirements. This is consistent with the concept of physical satiety and rumen fill effects reported in ruminant feeding studies. The higher CF intake in T1 may also be influenced by the structural fiber contribution of lamtoro, which enhances chewing and rumination, an important factor for rumen health highlighted by Grant (2023).

Overall, the comparisons with previous studies reinforce that *C. aconitifolius* can be used as an effective partial substitute for concentrate without negatively affecting nutrient intake. The stable intake patterns observed across all nutrient fractions DM, OM, CP, and CF demonstrate that Japanese papaya is palatable, nutritionally balanced, and well accepted by PE goats, supporting its potential as an alternative feed resource.

Body Weight Gain

Table 5. Body Weight Gain of PE Dairy Goats Fed Diets Containing Cnidoscolus aconitifolius (g/head/day)

Treatments	Body weight gain (BWG) (g/ek/day)
T0	1,46 ± 34,99
T1	106,95± 35,32
T2	87,02 ± 89,97
T3	54,83 ± 14,95

Statistical analysis showed no significant effect (P>0.05) of *C. aconitifolius* substitution on body weight gain (BWG), although goats in T1, T2, and T3 exhibited a positive trend in weight gain, whereas the control group (T0) experienced weight loss. This pattern indicates that the substituted diets were able to meet maintenance requirements and support modest growth, even though the differences were not statistically significant. These findings differ slightly from Kuswoyo et al. (2024), who reported an average gain of 83.67 g/day in male Jawarandu goats fed fermented diets based on corn cobs and *Azolla microphylla*, representing a 94.5% improvement over the control. Likewise, Hassen et al. (2020) documented an average BWG of 107.78 g/day in Afar goats receiving improved forages as partial concentrate replacements. The differences between studies may be attributed to variations in dietary energy–protein synchronization, feed digestibility, and rumen fermentation efficiency. Overall, the positive BWG observed in substitution treatments suggests that inclusion of *C. aconitifolius* up to 20% of the ration does not impair goat performance and may contribute to more sustainable feeding systems by reducing reliance on commercial concentrates.

CONCLUSION

The results of this study indicate that Cnidoscolus aconitifolius can be utilized as a potential alternative forage in the diet of Etawa Crossbred (PE) dairy goats. Goats readily accepted diets containing C. aconitifolius, demonstrating good palatability and adaptation to the substituted forage. Behavioral observations showed that goats tended to prioritize forage consumption and exhibited a clear preference for C. aconitifolius, which may be associated with its softer texture and favorable nutritional characteristics. The inclusion of C. aconitifolius at substitution levels of 10% and 20% did not significantly affect dry matter, organic matter, crude protein, or crude fiber intake ($P>0.05$). Likewise, body weight gain was not significantly influenced by the dietary treatments, although goats receiving the substituted diets showed a positive trend in growth compared with the control group. Overall, these findings suggest that Cnidoscolus aconitifolius has good potential as an alternative forage resource for PE dairy goats and can be incorporated into feeding systems without negatively affecting feed intake or animal performance. Further studies are recommended to determine optimal inclusion levels and evaluate its long-term effects on productivity and feed efficiency.

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