Effect of Addition of Different Level of Ginger Powder to Concentrate Diet on Growth Performance and Growth Hormone in Karadi Male Lambs

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Abstract

This experiment investigated the impact of supplementing different levels of ginger (Zingiber officinale) powder on growth traits and circulating growth hormone (GH) in Karadi male lambs. A total of twenty lambs were equally distributed into four experimental groups (five animals each) receiving diets containing 0%, 0.5%, 1.0%, and 1.5% ginger over a 90-day period.

The results indicated that lambs fed 1.0% ginger achieved significantly greater ($P < 0.05$) final body weight, daily weight gain, GH concentration, and more efficient feed utilization compared to the control. Feed intake remained statistically unchanged among all treatments ($P > 0.05$).

These findings highlight that a 1.0% inclusion level of ginger may positively influence hormonal activity and growth efficiency, suggesting its usefulness as a natural alternative to synthetic growth promoters.

Keywords: Ginger, Growth Hormone, Growth Performance, Karadi Lambs.

Introduction

Research into natural phytogenic feed additives as safer alternatives to antibiotic growth promoters has been pushed by the restriction on their use in livestock nutrition [1] . According to Platel and Srinivasan [2 , 3], ginger, scientifically known as Zingiber officinale, has a number of useful properties, including a strong antioxidant, antibacterial, anti-inflammatory, and metabolic regulator. According to [4], growth hormone (GH) is essential for controlling ruminant tissue development, protein synthesis, and nutrition partitioning. Nutritional status and bioactive food components can affect its secretion and physiological activity [5]. Ginger's growth-promoting qualities have been extensively researched, but little is known about how it could affect lambs' GH production. Growth hormone (GH) is a key regulator of animal development, influencing protein synthesis, energy metabolism, and tissue growth. Its secretion can be affected by nutritional and physiological factors, including bioactive dietary components. Therefore, modifying diet composition may serve as a practical approach to enhancing endocrine responses and improving animal performance.Growth hormone (GH) plays a central role in regulating growth, metabolism, protein synthesis, and nutrient partitioning in ruminants [8,9]. The secretion and biological activity of GH are influenced by nutritional status, endocrine interactions, and bioactive compounds present in the diet [10,11]. Nutritional strategies that modulate GH secretion can therefore significantly impact animal growth and productivity.

Materials and Methods

1. Location and Experimental Period

This trial was carried out in Gulan village (Dolle) from the 1st of April 2025 to1st of July 2025. All animal handling and experimental procedures were conducted in accordance with approved ethical standards.

2. Experimental Animals and Design

Twenty clinically healthy Karadi male lambs, aged between 3 and 4 months with an average initial weight of 19.3 ± 2.1 kg, were used. Animals were randomly assigned into four dietary groups (five lambs per treatment) under a completely randomized design. Ginger powder was added at level of 0,0.5, 1 and 1.5 to concentrate diet of the first ,second, third and fourth groups of karadi male lambs respectively. The experiment continued for 90 consecutive days.

Four groups were prepared:

- Control (0% ginger)
- 0.5% ginger
- 1.0% ginger
- 1.5% ginger

3. Feeding Strategy and Animal Care

All lambs received a standard diet formulated to meet recommended nutrient requirements. Ginger powder was incorporated into the concentrate portion of the ration according to treatment levels. Clean drinking water was freely accessible throughout the study.

ISSN 2072-3857

4. Growth Performance

Body weights were recorded at the start and at the end of the feeding period. Daily feed intake was monitored, and performance indicators including average daily gain (ADG) and feed conversion ratio (FCR) were subsequently calculated. Body weights were recorded at Day 0 and Day 90.

5. Blood Sampling and Hormone Analysis:

At the end of the 12-week experiment period, 10 millilitres of blood were drawn from the jugular vein. In order to prepare the serum, the samples were transferred to simple tubes. The serum was centrifuged to separate it and then kept at -20°C until it was time for analysis. Following the directions provided by the manufacturer, growth hormone concentrations were measured using ELISA kits that are commercially available.

6. Statistical Procedures

Collected data were subjected to one-way analysis of variance (ANOVA) using SPSS software (version 25). Treatment means were compared using Duncan's multiple range test, with significance declared at $P < 0.05$.

Results

1. Growth Performance:

1.1 Initial Body Weight (BW)

No significant difference (P = 0.92). All groups started at similar weights.

1.2 Final Body Weight

Significant differences (P = 0.008).
Ranking: **T2 (1.0%) > T3 (1.5%) ≈ T1 (0.5%) > Control** ,T2 achieved the highest final weight.
Superscripts (a, b, c) confirm statistical differences.

1.3 Total Weight Gain

Significant (P = 0.006). ,Same pattern as final BW: **T2 highest (15.5 kg)** ,T3 and T1 intermediate , Control lowest

1.4 Average Daily Gain (ADG)

Significant (P = 0.005). ,**T2 again best (173 g/day)**. Indicates optimal growth at 1.0% inclusion.

1.5 Feed Intake

Not significant (P = 0.19). Animals ate similar amounts across treatments.
So differences in growth are due to efficiency, not intake.

1.6 Feed Conversion Ratio (FCR)

Highly significant (P = 0.003). , Lower FCR = better efficiency: **T2 (6.65) best**
T3 and T1 intermediate , Control worst (9.50)

ISSN 2072-3857

Table 1. Effects of Ginger Levels on Growth Performance

Parameter	C (0%)	T1 (0.5%)	T2 (1.0%)	T3 (1.5%)	SEM	P-value
Initial BW (kg)	19.3	19.1	19.4	19.0	0.22	0.92
Final BW (kg)	29.6^{c}	31.7^{b}	34.9^{a}	32.8^{b}	0.78	0.008
Total Gain (kg)	10.3^{c}	12.6^{b}	15.5^{a}	13.8^{b}	0.64	0.006
ADG (g/d)	114^{c}	140^{b}	173^{a}	154^{b}	6.45	0.005
Feed Intake (kg/d)	1.09	1.12	1.15	1.18	0.04	0.19
FCR	9.50^{a}	8.00^{b}	6.65^{c}	7.65^{b}	0.46	0.003

In the row with various superscripts (a,b,c) , there is a significant different between the means at a level of $p< 0.05$

2. Serum Growth Hormone Response

Dietary inclusion of ginger significantly affected circulating GH concentrations ($P = 0.002$). Lambs supplemented with 1.0% ginger exhibited the highest hormone levels, clearly surpassing both the control and other treatment groups. Although moderate increases were observed in the 0.5% and 1.5% groups, the response was not as pronounced as in the 1.0% treatment. These findings indicate that the optimal inclusion level lies around 1.0%, beyond which no additional hormonal benefit is achieved.

Table 2. Effects of Ginger Levels on Serum Growth Performance

Parameter	C (0%)	T1 (0.5%)	T2 (1.0%)	T3 (1.5%)	SEM	P-value
Serum GH (ng/mL)	3.1^{c}	4.3^{b}	5.9^{a}	4.9^{b}	0.31	0.002

In the row with various superscripts (a,b,c) , there is a significant different between the means at a level of $p< 0.05$

Graphical Representation of Results

Figure 1. Growth Hormone Concentration (ng/mL)

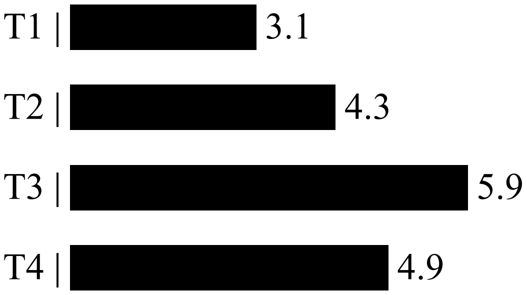

Figure 2. Average Daily Gain (g/day)

Discussion

The results show that lambs' growth performance and endocrine activity were improved by ginger supplementation, especially at T2 1.0%. Previous research has shown that phytogenic can increase nutrient digestion and utilization [6], and this study confirms that lambs given 1.0% ginger had better final body weight, average daily gain, and feed conversion ratio (FCR) than control lambs.

Serum GH levels have been found to rise in line with enhanced growth performance. Protein synthesis, lipolysis, and lean tissue accretion are all significantly influenced by GH [5 , 4]. Lambs given ginger as a supplement may have better antioxidant levels, which in turn decreases metabolic stress and improves somatotroph function, as shown by [3].

Ginger may promote GH production and activity by increasing the availability of amino acids and stimulating digestive enzymes, as noted by [2]. By influencing the composition of the intestinal microbiota and the digestion process, phytogenic chemicals increase feed efficiency [1].

Interestingly, increasing the supplementation level to 1.5% did not yield additional benefits and was associated with a slight decline in

ISSN 2072-3857

performance. This may indicate a threshold effect, where excessive inclusion could negatively influence palatability or metabolic balance. [7].

The current research provides confidence to the theory that phytogenic additions could enhance development and metabolic balance by modifying endocrine responses. Further research is required because increased GH also suggests possible advantages for carcass composition and skeletal muscle accretion.

Conclusion

Incorporating ginger powder into the diet of Karadi male lambs at a level of 1.0% significantly improved growth performance and elevated serum growth hormone levels. This level appears to be optimal for maximizing both productive and hormonal responses. Ginger can therefore be considered a viable natural alternative to synthetic growth promoters in sheep production, with added benefits related to endocrine regulation.

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ISSN 2072-3857