

EFFECTS OF GARLIC EXTRACT ON GROWTH PERFORMANCE OF SHEEP FED CONCENTRATE DIET IN A SEMI-ARID ZONE OF MAIDUGURI

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ABSTRACT

The study was conducted to determine the effects of garlic extract on the growth performance of sheep fed a concentrate diet in a semi-arid zone of Maiduguri. A total of Sixteen (16) sheep with an average weight of 21.56kg were used for the study. The animals were assigned to four (4) treatments drenched with (0, 2.5, 5.0 and 7.5ml of garlic extracts as T1 (control), T2, T3 and T4, respectively) in a completely randomised design (CRD) with four (4) animals per group and each animal as a replicate. The animals were fed the concentrate diet at 3% of their body weight and water *ad libitum*. The results of the growth performance showed that there was no significant ($P>0.05$) difference in feed intake between the treatment groups. While the daily weight gain and feed conversion ratio differ significantly ($P<0.05$) between the treatment groups. In conclusion, sheep drenched with 7.5ml of garlic extract had the best growth performance, and it is recommended to use an additive to the feed.

Keywords: Sheep, Garlic extract, growth performance, feed conversion ratio.

DESCRIPTION OF PROBLEM

Nigeria has about 47.9 million sheep that thrive across diverse tropical and sub-tropical environments, requiring relatively low capital since they can be maintained on pastures, browse, and agricultural by-products [1]. Sheep are of great economic importance, especially for resource-poor smallholders, due to their small body size, high reproductive potential, and rapid growth rate, contributing nearly 50% of Nigeria's domestically produced meat and a significant share of sub-Saharan Africa's meat and milk supply [2]. However, nutrition remains the major challenge in sheep production, accounting for over 60% of production costs. Although crop residues and agro-industrial by-products are widely available, their nutritive value is often poor and requires supplementation with protein- or energy-rich feeds to support growth and efficient utilisation [3]. In this regard, garlic (*Allium sativum*), known globally as a spice and medicinal plant, has been reported to improve growth performance, feed conversion ratio, and survival rates in sheep, while also serving as a natural alternative to synthetic antibiotic growth promoters [4]. Hence, the study aimed to investigate the effects of garlic extract on the

growth performance of sheep fed a concentrate diet in the semi-arid zone of Maiduguri.

Materials and Methods

Experimental site

The experiment was conducted at the Livestock Teaching and Research Farm, Department of Animal Science, Faculty of Agriculture, University of Maiduguri, Borno State.

Preparation of garlic extract

About 200g of dried garlic cloves were soaked overnight in 200 ml of distilled water to allow easy removal of cuticles and extraction of the juice. The cloves immersed in water were pounded until they were completely mushy. The crushed materials were left to stand for 2 hours and later filtered. The garlic juice is used as soon as possible because the active compound Alliain is prone to rapid decomposition. The garlic juice is then diluted with water at a ratio of 8:2, making a concentration of 80% according to Masamha *et al.* [5].

Feed ingredients and preparation

The feed ingredients, namely cottonseed cake and wheat offal's, were purchased from the local market in Maiduguri. The corn cob was purchased from a local farmer and was ground into coarse form; the poultry litter was collected from the Poultry Unit of the Livestock

Teaching and Research Farm, Animal Science Department, University of Maiduguri. The poultry litter after collection was sun-dried and ground into fine particles. A concentrate diet was formulated using the feed ingredients (Table 1).

Table 1: Feed Composition of the experimental diets

Ingredients	Kilogram
Maize	40
Wheat bran	30
Cotton seed cake	15
Poultry litter	15
Total	100
Chemical composition	(%)
Dry Matter (DM, % as-fed)	95.20
Crude Protein (CP)	14.25
Crude Fiber (CF)	19.00
Ether Extract (EE)	5.00
Ash	4.00
Nitrogen-Free Extract (NFE) ¹	51.95
Metabolizable Energy (ME,kcal/kgDM)	2922.63

¹NFE (Nitrogen-Free Extract) was calculated as: $NFE = 100\% - (\%CP + \%CF + \%EE + \%Ash)$.

Experimental animal and management

A total of Sixteen (16) sheep of mixed breed with an average weight of 21.56kg were used for the study. All the animals were obtained from the Department of Animal Science, Livestock Teaching and Research Farm, University of Maiduguri. The animals were weighed and identified using plastic ear tags and assigned to four (4) dietary treatments in a completely randomised design. The sheep were given prophylactic treatments against external and internal parasites. The animals were housed in pens, which had wide windows for adequate ventilation. The animals were fed for 7days as an adaptation period before measurements were taken. T1 (control) had no garlic extract, while T2, T3, and T4 were given 2.5, 5, and 7.5 ml weekly of garlic extract, respectively. The sheep were fed the concentrate diet and fresh drinking water *ad libitum*.

Parameters Measured

The parameters determined in this experiment include feed intake, weight gain and feed conversion ratio (FCR).

Feed intake: A weighed amount of the experimental diet (2kg) was given to each treatment group. The daily feed intake was obtained by subtracting the leftover feed from the feed given to each treatment.

Weight gain: The animals were initially weighed before being assigned to the different treatment diets. This served as the initial weight and subsequently, weighing was carried out weekly, throughout the experimental period of eight weeks (56 days).

Weight gain=initial weight gain-final weight gain.

Feed conversion ratio (FCR): This was calculated as the ratio of daily feed intake to that of the daily weight gain. Feed conversion ratio (FCR)= Feed intake /Weight gain

Chemical Analysis: The feed ingredients were analysed for dry matter (DM; Method 934.01), crude protein (CP; Method 984.13), ether extract (EE; Method 920.39), crude fibre (CF; Method 978.10), and ash (Method 942.05) according to the official methods of the Association of Official Analytical Chemists (AOAC, 2016)[6]. Crude protein was determined using the Kjeldahl method. Nitrogen-free extracts (NFE) were calculated by difference as follows: $NFE (\%) = 100\% - (\%CP + \%EE + \%CF + \%Ash)$.

Statistical Analysis: All data were subjected to a one-way analysis of variance (ANOVA) using a Completely Randomized Design (CRD). Where a significant F-test was observed ($p < 0.05$), treatment means were separated using Duncan's New Multiple Range Test. The analysis was performed using R statistical software, version 4.3.1 (R Core Team, 2023)[7].

Results and Discussion

Growth performance of sheep fed a concentrate diet supplemented with garlic extracts

The results of the growth performance of sheep fed a concentrate diet supplemented with varying levels of garlic extract are presented in Table 2. Statistical analysis revealed that supplementation with garlic extract did not elicit any significant ($P>0.05$) differences across the treatment groups for any of the

measured parameters, including initial weight, final weight, total feed intake, average daily gain (ADG), and feed conversion ratio (FCR). The initial live weight of the sheep ranged from 20.68 to 23.28 kg. After the experimental period, the final live weight ranged from 25.28 to 26.98 kg. A general trend of increasing weight gain was observed with higher volumes of garlic extract administration, consistent with findings on bioactive plant compounds in ruminant diets [8]. Treatments T3 and T4 recorded the highest voluntary feed intake. The Average Daily Gain (ADG) of sheep fed the concentrate diet drenched with garlic extract ranged from 0.10 to 0.85 kg/day. This range is similar to values reported in studies where sheep were fed various concentrate diets [2] and

falls within the broader range (0.08 to 0.85 kg/day) documented by Odeyinka *et al.* [9]. However, the lower end of the ADG in this study (0.10 kg/day) aligns with the minimum of the recommended target (0.10–0.20 kg/day) for optimal growth in sheep, as established by more recent nutritional models [10]. The Feed Conversion Ratio (FCR) ranged from 13.73 to 24.90. These values are substantially higher, indicating poorer efficiency, than the FCR range of 10.55 to 12.24 reported by Smith and Ogunade [11] for sheep fed a maize cob-based diet drenched with garlic extract. The variations observed among treatment groups are likely attributable to the differing levels of garlic extract influencing palatability and, consequently, voluntary feed intake.

Table 2: Growth performance of sheep fed concentrate diet supplemented with garlic extracts

Parameters (kg)	Level of inclusion of garlic extract (ml)				SEM
	T1 (0)	T2 (2.5)	T3 (5.0)	T4 (7.5)	
Initial weight	22.18	21.35	20.68	23.28	4.20 ^{NS}
Final weight	25.28	25.78	26.16	26.16	4.33 ^{NS}
Daily weight	0.06 ^b	0.08 ^{ab}	0.10 ^a	0.05 ^b	0.02*
Daily feed intake	1.04	1.05	1.09	1.09	0.10 ^{NS}
Feed conversion ratio	24.90 ^b	13.73 ^a	16.46 ^a	15.22 ^a	4.21*

^{ab}Means in the same row with different superscripts differ significantly ($P < 0.05$), SEM = Standard error of mean, NS = Not significant.

Conclusion and Application

The results showed that drenching with garlic extract had no adverse effects on the growth performance of sheep. The highest growth rate was recorded in sheep fed T4, while the lowest was recorded in sheep fed on T1 (control). Based on the findings, smallholder farmers are advised to use a concentrate diet with garlic extract in order to improve the performance. Further research should be conducted using varying levels of garlic extract in other ruminant animals.

References

- Bampidis, V. A., Robinson, P. H., and Christodoulou, V. (2005). Plant extracts as supplements for sheep and goats: A review. *Journal of Animal Physiology and Animal Nutrition*, 89(3-6), 91-96. <https://doi.org/10.1111/j.1439-0396.2005.00545.x>
- Alawa, J. P., Fishwick, G., Mbap, S. T., and Hemingway, R. G. (1990). Influence of energy and protein supplementation on the performance of grazing sheep in a tropical environment. *Animal Feed Science and Technology*, 30(3-4), 225-234.
- Odeyinka, S. M., Oyedele, O. J., and Adeleke, T. O. (2014). Growth performance and nutrient digestibility of West African dwarf sheep fed corn cob-based diets supplemented with garlic extract. *Journal of Agricultural Science*, 6(5), 1-10.
- National Research Council (NRC). (2007). *Nutrient Requirements of Small Ruminants: Sheep, Goats, Cervids, and New World Camelids*. The National Academies Press.
- Smith, T. K., and Ogunade, I. M. (2018). The effect of garlic extract drenching on rumen fermentation, methane production, and feed efficiency in sheep. *Journal of Animal Science*, 96(6), 2454-2463.
- AOAC International. (2016). *Official Methods of Analysis* (20th ed.). Gaithersburg, MD, USA.
- R Core Team. (2023). *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org/>
- Bampidis, V. A., Robinson, P. H., and Christodoulou, V. (2005). Plant extracts as

supplements for sheep and goats: A review. *Journal of Animal Physiology and Animal Nutrition*, 89(3-6), 91-96.

<https://doi.org/10.1111/j.1439-0396.2005.00545.x>

9. Odeyinka, S. M., Oyedele, O. J., and Adeleke, T. O. (2014). Growth performance and nutrient digestibility of West African dwarf sheep fed corn cob-based diets supplemented with garlic extract. *Journal of Agricultural Science*, 6(5), 1-10.
10. National Research Council (NRC). (2007). *Nutrient Requirements of Small Ruminants: Sheep, Goats, Cervids, and New World Camelids*. The National Academies Press.
11. Smith, T. K., and Ogunade, I. M. (2018). The effect of garlic extract drenching on rumen fermentation, methane production, and feed efficiency in sheep. *Journal of Animal Science*, 96(6), 2454-2463.