European Journal of Science, Innovation and Technology
ISSN 2786-4936
Vol. 2 No. 1 (2022)

Growth Responses of Weaner Rabbits to Dietary Ginger (*Zinger officinale*) and Garlic (*Allium sativum*)

Ntinya C. Johnson[1], Victor M. Ogbamgba[1] and James T. Mbachiantim[2]
[1]Rivers State University, Port Harcourt, Department of Animal Science, Nigeria
[2]Federal University of Agriculture, Makurdi, Department of Nutrition and Dietetics, Nigeria

Abstract. The growth performance responses of weaner rabbits to dietary ginger or combined ginger/garlic were investigated. 18 males New Zealand White rabbits with initial body weights (BW) ranging between 485-500 grams were used in the investigation. The animals were similarly managed during the first week; the period of pre-conditioning of the animals to their new environments. At the end of the pre-conditioning period, the animals were randomly assigned to three experimental diets: diet 1 (T_1) was the negative control diet contained no ginger or garlic, diet 2 (T_2) the first positive diet containing ginger at the rate of 20g/kg of diet while the third diet (T_3) the second positive diet contained ginger and garlic at 10g of ginger + 10g of garlic/kg of diet, respectively. The animals were fed at 5% of their BW for 4 weeks; and thus in the overall the experiment lasted for 5 weeks. The feed intakes of the animals were closely monitored throughout the study period; which enabled the determination of total feed intakes upon which average daily feed intakes (ADFI) were computed. At the end of trial all rabbits in all the treatments were re-weighed to obtain their final BW from where the average daily weight gain (ADG) were computed. From the ADFI and ADG data feed efficiencies (FE) were determined. There were no significant ($P > 0.05$) differences in the ADFI amongst all dietary treatments. However, the ADG of the positive control diets (T_2 and T_3) were significantly ($P < 0.05$) superior to the control diet (T_1). Nevertheless, animals on the T_3 diet gained at the best rate as T_3 animals ADG were significantly ($P < 0.05$) better compared with the T_2 animals. The trend in the ADG was mirrored in the FE data. Therefore, it was concluded that ginger and garlic improved weaner rabbits' growth performance but the performance was better enhanced with combined dietary ginger and garlic.

Key words: Ginger, Garlic, Growth Performance and Rabbit

Introduction

Young and actively growing animals, such as weaned rabbits are candidates for many environmental stressors such as pathogenic organisms leading to different disease conditions that often culminate in suppressing the growth of the animal and in extreme cases results in the eventual death of the animal (Hoerr, 1998; NRC, 2012). This usually negatively affects the profit margin of the animal farmer. Meanwhile rabbit production has recently become a very popular aspect of micro-livestock production whose meat is highly cherished by consumers. The reasons for these are not farfetched as rabbit meat falls in the group of white meats believed to have better nutritional advantages compared to the red meats, such as beef and mutton (Ajala, 1990; NRC, 1991). Additionally, compared to other livestock and poultry, rabbit does not solely depend on grains and therefore does not skyrocket grain prices where they are produced, since it does not create competition between it and humans for grain consumptions (NRC, 1991) as it does practice caecotrophy (NRC, 2012). This again makes its production cheaper relatively speaking compared to other livestock and poultry.

At present there are bans on the use of antibiotics as growth and reproduction performance promoters. This therefore has led to searches for alternatives to antibiotics. To this point therefore, phytobiotics have been speculated as possible alternatives to antibiotics. This is related to the fact that phytobiotics possess antimicrobial, antiviral, antifungal and to a large extent very potent against some enteric parasites (Friedman, 2007). Ginger contains gingerol while garlic contains allicin with high potencies of medicinal properties, such as

relieving from gastrointestinal irritation (Murray, 1995; Tsai, Cole & Simmons, 2006). They also contain certain antioxidants. Additionally, they possess antibacterial, antiviral and antifungal properties and as such can improve digestion and absorption of nutrients, even in pregnancy leading to describing ginger for instance to be similar to turmeric (Smith et al., 2004). Ginger is also effective against nausea and vomiting (Jeffrey & Aahley, 2003).

Due to the potencies of ginger and garlic against pathogens, including enteric parasites, there is the possibility that their combined effects may be more potent or synergistic in suppressing the negative effects of environmental stressors, thereby enabling enhanced growth of the animal, such as rabbit by improving their health-status; condition known to be highly correlated to enhancing growth. Therefore, the objectives of this study is to investigate the combined effects of dietary ginger and garlic in comparison to ginger alone, respectively in weaned rabbits.

Materials and Methods

Experimental Animals and Housing

Eighteen (18) male New Zealand White rabbits aged 7-8 weeks and weighing between 485-500 grams were acquired for the current study. Prior to introducing the animals to their hutches, the floor, feeding and water troughs were thoroughly cleaned to ensure largely a pathogen-free environment. After weighing the animals, they were randomly assigned to their individual hutches of 6 rabbits per treatment. They were pre-conditioned to their new environment prior to presenting them with their experimental diets. During this period, the animals in the three treatment groups were similarly managed with the same diet that consisted mostly of grower mash and legume (*Centrosema pubescens*). The study lasted for 5 weeks consisting of 1 week of adaptation and 4 weeks of study.

Experimental Diets and Procedure

There were 3 diets: diet 1 (T_1, the negative control diet; does not contain either dietary ginger or garlic), diet 2 (T_2, contained dietary ginger at 20g/kg of diet) and diet 3 (T_3, contained both dietary ginger and garlic at 20g/kg of diet; consisting of 10g ginger and 10g garlic). There were thus 3 dietary treatments with 6 replications per treatment. The incorporation of the measured amounts of ginger and garlic were by a simple process of mixing and homogenization with the grower mash. The rabbits were fed at 5% of their BW for 4 weeks. However, *Centrosema pubescens* were served twice a week in place of the experimental diets to enable the rabbits practice caecotrophy during the 4 weeks of the trial. This means experimental diets were served for 5 days in a week. Normally, the different diets were weighed into individual feeders depending on the rate of diet disappearance from the feeders. Water was offered *ad libitum*.

Therefore, average daily feed intake (ADFI) was computed as the total amount of feed served divided by the number of days of the experiment. Average daily gain (ADG) was determined by computing the total weight gained during the trial period divided by the number of days of study. Finally, feed efficiency (FE), that is, gains to feed ratio (gain/feed) for the period of study were also computed.

Data Collection, Design and Statistical Analysis

Data obtained for ADFI, ADG and FE were subjected to analysis of variance (ANOVA) using general linear model (GLM) procedure of SAS. Treatment means were compared using Bonferoni's test and an α-level of *0.05* probability was used for all statistical comparisons to determine significance of the mean differences amongst treatment groups. The design used was a completely randomized and therefore the model was: $Y_{ij} = \mu + X_i + E_{ij}$; where Y_{ij} = individual

observation of the treatment, μ = population mean, X_i = effect of the i^{th} diet and E_{ij} = the error term.

Results and Discussion

All animals in each dietary treatment group ingested their rations normally and thus also grew throughout the experimental period. The results of the ADFI, ADG and FE determined for the study period is shown in Table 1.

Table 1. Growth performance of weaner rabbits fed ginger and ginger/garlic-based diets

Item	Diets			SEM	*P-value*
	T_1	T_2	T_3		
ADFI (g/d)	26.71	26.69	26.70	0.03	0.23
ADG (g/d)	12.84^a	14.52^b	18.75^c	0.04	0.03
FE	0.47^a	0.52^b	0.69^c	0.03	0.02

Note: Means within each row with different superscripts differ significantly ($P < 0.05$). SEM = standard error of the mean.

As shown in Table 1, there were no significant ($P > 0.05$) differences in the ADFI amongst the three dietary treatment groups. This observation in this study is not surprising as the animals were of similar ages and BW coupled with the fact that they were randomly allotted to the experimental diets. However, despite the similarity in the ADFI across treatments, animals on the positive control diets (T_2 and T_3) gained at a better rate compared with the negative control diet (T_1); but the animals on the T_3 diet showed the best ADG comparatively speaking. Accordingly, therefore, while T_1 animals gained almost 13 grams per day, animals of T_2 and T_3 gained about 15 and 19 grams per day, respectively. This translated into superior or better gains of about 13.1% and 46%, respectively for the T_2 and T_3 diets over the animals of T_1 diet. Furthermore, the scenarios observed with the ADG were also mirrored in the FE of the diets despite the similarity in the ADFI. The FE of T_1 diet was 47% whereas those of T_2 and T_3 diets were 52% and 69%, respectively. This therefore, results in better FE of about 11% and about 47%, respectively for T_2 and T_3 diets over that of T_1 diet. These differences in daily gain rates and in feed efficiency in the commercial settings translate into huge economic gains on the part of the animal farmer.

As previously stated, ginger and garlic have the potencies via their bioactive compounds of gingerol and allicin, respectively as possible phytobiotics that can serve as alternatives to antibiotics, especially now that there are public pressures for the discontinuation of antibiotics uses as additives in animal diets. Ginger and garlic have been shown to possess antibacterial, antifungal, antiviral, antiparasitic and other health-related benefits (Ankri & Mirelman, 1999). The improvements demonstrated by dietary ginger and garlic therefore, might not be unconnected with the abilities of ginger and garlic through their bioactive compounds significantly improved the rabbit gut environment and micro-flora as a result of the susceptibility of pathogenic bacteria to the bioactive compounds of ginger and garlic (Ankri & Mirelman, 1999; Reeds et al., 1993).

It should also be stated that in the modus operandi of ginger and garlic the beneficial bacteria are usually unaffected as they are not sensitive to ginger and garlic inhibitory effects (Gibson, 2001). Here again, it is known that the growing animals gastro-intestinal tract and the skeletal musculature draw from the same source of nutrients and are in effect competes for the deposition of nutrients (Reeds et al., 1993). About 6% of net energy is usually lost due to microbial utilization of glucose in the small intestine (NRC, 2012) and these bacteria require amino acids in relatively similar proportional amounts. Thus, it was possible that the positive

control diets would have conferred a nutrient sparing effect resulting to the significant ADG and FE for the T_2 and T_3 diets relative to the T_1 diet. These findings agree with the data of Cullen et al. (2005). Nevertheless, the improvements in daily gain and FE were better when dietary ginger and garlic were combined than when dietary ginger was given alone.

Conclusions

The combination of dietary ginger and garlic improved daily gain and feed efficiency in the weaned rabbit than when dietary ginger was served alone.

References

Ajala, A. A. (1990). A note on rabbit feeding in the traditional farming system of Nigeria and implication for extension activities. *J. Appl. Rabbit Res., 12*, 280-282.

Ankri, S. & Mirelman, D. (1999). Antimicrobial properties of allicin from garlic. *Microbes and Infect., 2*(2), 125-129.

Cullen, S. P., Monahan, F. J., Callan, J. J., & O'Doherty, J. V. (2005). The effect of dietary garlic and rosemary on grower-finisher pig performance and sensory characteristics of pork. *Irish J. Agric. Food Res., 44*, 57-67.

Friedman, M. (2007). Overview of antibacterial, antitoxin, antiviral and antifungal activities of ten flavonoids and teas. *Mol. Nutr. Food Res., 51*, 116-134.

Gibson, G. R. (2001). Prebiotics for improved gut health. *Food Sci. Technol. Abstracts, 3731*.

Hoerr, F. J. (1998). Pathogenesis of enteric diseases. *Poult. Sci., 77*, 1150-1155.

Jeffrey, D. & Aahley, H. (2003). Nausea and vomiting at pregnancy. *Am. Fam. Physician, 68*(1), 121-128.

Murray, M. T. (1995). *The healing power of herbs* (2nd ed.). Prima Publishing, Rocklin, CA, pp. 121-129.

NRC. (1991). *Micro-livestock little known small animals with promising economic future*. National Academy Press, Washington, DC, pp. 1-13.

NRC. (2012). *Nutrient Requirements of Swine* (11th ed.). Natl. Acad. Press, Washington, D. C.

Reeds, P. J., Burrin, D. G., Davis, T. A., & Fiorotto, M. L. (1993). Post-natal growth of gut and muscle: competitors or collaborators. *Proceedings of the Nutrition Society, 52*, 57-67.

Smith, C., Crowther, C., Williams, K., Hotham, N., & McMillan, V. A. (2004). Randomized controlled trial of ginger to treat nausea and vomiting in pregnancy. *Obstet. Gynaecol., 103*, 639-645.

Tsai, Y., Cole, L. L., & Simmons, V. (2006). Antiviral properties of garlic: in vitro effects on influenza B, herpes simplex and coxsackle viruses. *Planta Med., 15*, 460-463.