

## GASTROINTESTINAL TRACT MORPHOMETRY AND VISCERAL ORGAN WEIGHTS OF GROWER RABBIT FED DRIED GINGER (*Zingiberofficinale*) ROOT MEAL

OCHEFU, J., EMMANUEL, B. and ONHO, S. C.

Department of Animal Breeding and Physiology, Federal University of Agriculture, Makurdi.  
+234-8054565596 jochefu@gmail.com

### ABSTRACT

Twenty-eight grower rabbits of mixed sexes and breeds were used in the study to determine the effect of dietary Dried Ginger Root Meal (DGRM) on gastrointestinal tract morphometry and visceral organ weights. The rabbits were assigned by weight (average weight 557.09g) to four dietary treatments in a completely randomized design. Each treatment had seven replicates. Four treatment diets; T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> were formulated to include 0%, 15%, 25% and 35% of DGRM respectively and were administered to the rabbits. The experiment lasted for 8 weeks. Six rabbits were randomly selected from each treatment and sacrificed and eviscerated. Results showed that mean relative weights of the stomach, oesophagus and pancreas as well as the mean lengths of the oesophagus and intestines did not show any significant ( $P > 0.05$ ) variation. It was found that significant differences ( $P < 0.05$ ) existed in the mean lengths of the proximal colon and caecum as well as the mean relative weights of the liver, kidneys, heart and lungs in rabbits fed DGRM. It can be concluded that the inclusion of DGRM in the diets of growing rabbits significantly ( $P < 0.05$ ) increased the length of the caecum and visceral organs weight.

**Keywords:** Rabbit, Ginger, Morphometry, GIT, Visceral

Correspondence: jochefu@ymail.com. 234-8054565596

### INTRODUCTION

Physiological response of animals to feedstuff and feed additive greatly affect their productivity. Feed expenditure is an important factor in animal production to which many studies are geared in a bid to reduce the cost. Optimum productivity is also enhanced in some quarters with the use of antibiotics and synthetic feed additives (Falcão-e-Cunha *et al.*, 2007). But the use of these additives has been banned in animal feed in parts of the globe due to their residual and detrimental effect on the animals and the consumers (USDA, 2005). To this end, non-conventional alternatives which are apparently safe, cheap and can be easily sourced are being studied as a way of circumventing these challenges for the small-holder livestock producer. Muhammad *et al.* (2009) affirmed that natural additives (phytogenic feed additives) are being used in current researches to maximize the net return for the livestock producer and minimize expenditure on feed. Herbs such as ginger (*Zingiber officinale*) have been reported to possess antimicrobial, anti-inflammatory, antiparasitic and immunomodulatory properties (Muhammad *et al.*, 2009). It also enhance palatability and feed intake (Horton *et al.*, 1991). Onu and Aja (2011) advanced reasons for the usage of ginger in animal diets. Ginger waste meal was shown to have hypocholesterolemic and hypolipidemic activity (Omaga *et al.*, 2007). Adanlawo and Dairo (2007) also showed that ethanolic extract of ginger has no health challenging effect on tissue (brain, liver, stomach, small intestine, kidney and serum) of rabbits. On this note, this study was design to investigate the effect of ginger root meal inclusion in rabbit diet on gastrointestinal and visceral organs of rabbits.

### MATERIALS AND METHODS

This study was conducted at the Rabbitary unit of the Federal University of Agriculture Livestock Teaching and Research Farm, Makurdi, located on latitude 7° 48'33.6"N and longitude 8° 37'12.7"E (<https://www.google.com/maps>). Apparently healthy, twenty-eight (28) rabbits of mixed breed and sex with average weight of 557.09g were used for the study. The 8 weeks experiment was set in a completely randomized design (CRD). The rabbits were randomized by weight into four treatments with seven (7) replicates each. Treatment one (T<sub>1 control</sub>) diet contained 0% DGRM. The other treatments, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub>, had diets with 15%, 25% and 35% of DGRM inclusion respectively. The

diets were iso-caloric and iso-nitrogenous. At the end of the feeding trial, six (6) rabbits from each treatment were sacrificed according to the method recommended (Joseph *et al.*, 1994). Liver, heart, lungs, kidneys, stomach were carefully harvested after evisceration and weighed as percent body weight. The length of the gastrointestinal tract organs, oesophagus, small intestine, caecum, colon was measured in centimetres (cm) using a flexible measuring tape. Data collected were subjected to analysis of variance (ANOVA), using SPSS<sup>®</sup> Version 21.0 and the means were separated using Least Significant Difference (LSD).

## RESULT AND DISCUSSION

The results of relative weight and length of the gastrointestinal tract of rabbits is presented in Table 1. The results showed that the mean lengths of the proximal colon and caecum varied significantly ( $P < 0.05$ ) among the treatment means.  $T_4$  had higher proximal colon length than the control, but it compared with  $T_2$  and  $T_3$ . Similarly, the mean length of caecum of  $T_4$  was higher than  $T_1$  and  $T_2$  but similar to  $T_3$ . Increased lengths of the proximal colon and caecum may be attributed to the increased intake of high dietary fibre causing distension in some segments of the intestine. Yu and Chiou (1997) reported that increase in feed intake will increase hindgut fermentation which may lead to the development of the caecal weights and length. The results of relative weight of the rabbits are presented in Table 2. All parameters measured varied significantly ( $P < 0.05$ ) among treatment means. Mean organ weights of the rabbits on DGRM were higher significantly ( $P < 0.05$ ) than the control. Omage *et al.* (2007) reported higher mean liver weight values (14.81 – 17.71g) than the finding of this study. The mean weights of the left and right kidneys were similar for each treatment. The significant kidney weights ( $P < 0.05$ ) of rabbits could be attributed to the diet. Significantly ( $P < 0.05$ ) higher mean heart weight may also be attributed to dietary effects. Omage *et al.* (2007) reported mean heart weight of rabbit between 0.05 – 1.01g, which varied significantly for different inclusion levels of ginger. Mean lung weight in  $T_4$  was higher than  $T_1$  but compared with  $T_2$  and  $T_3$ . Increase in weights of visceral organs could have a debilitating effect on their functions (Greener, 2015). Walter *et al.* (1939) reported that increase in metabolism results to increase in organ weight.

**Table 1: Relative weight (percentage of body weight) and length (cm) gastrointestinal tract of grower rabbits fed Dried Ginger (*Zingiber officinale*) Root Meal (DGRM).**

| Parameters        | Treatment (Mean $\pm$ SEM)    |                                |                                |                               |
|-------------------|-------------------------------|--------------------------------|--------------------------------|-------------------------------|
|                   | $T_1$ (0%)                    | $T_2$ (15%)                    | $T_3$ (25%)                    | $T_4$ (35%)                   |
| <b>GIT Weight</b> |                               |                                |                                |                               |
| Oesophagus        | 0.12 $\pm$ 0.02               | 0.09 $\pm$ 0.01                | 0.09 $\pm$ 0.02                | 0.11 $\pm$ 0.01               |
| Stomach           | 5.23 $\pm$ 0.28               | 5.31 $\pm$ 0.45                | 4.31 $\pm$ 0.42                | 4.92 $\pm$ 0.25               |
| Pancreas          | 0.09 $\pm$ 0.04               | 0.06 $\pm$ 0.01                | 0.04 $\pm$ 0.01                | 0.04 $\pm$ 0.01               |
| <b>GIT Length</b> |                               |                                |                                |                               |
| Oesophagus        | 11.88 $\pm$ 0.95              | 11.38 $\pm$ 0.50               | 11.30 $\pm$ 0.30               | 11.36 $\pm$ 0.61              |
| Small intestine   | 280.50 $\pm$ 11.59            | 272.08 $\pm$ 10.96             | 275.50 $\pm$ 14.90             | 279.83 $\pm$ 4.94             |
| Proximal colon    | 29.42 $\pm$ 1.97 <sup>b</sup> | 31.75 $\pm$ 1.28 <sup>ab</sup> | 30.60 $\pm$ 1.33 <sup>ab</sup> | 34.33 $\pm$ 0.88 <sup>a</sup> |
| Distal colon      | 75.28 $\pm$ 8.87              | 69.67 $\pm$ 1.23               | 73.40 $\pm$ 5.90               | 79.17 $\pm$ 3.72              |
| Caecum            | 44.75 $\pm$ 1.29 <sup>b</sup> | 45.55 $\pm$ 2.10 <sup>b</sup>  | 48.30 $\pm$ 1.22 <sup>ab</sup> | 51.17 $\pm$ 1.66 <sup>a</sup> |

**Note:** T = Treatment

**Table 2: Relative weights of some visceral organs of grower rabbits fed Dried Ginger (*Zingiber officinale*) Root Meal (DGRM)**

| Parameters   | Treatment (Mean $\pm$ SEM)   |                               |                               |                               |
|--------------|------------------------------|-------------------------------|-------------------------------|-------------------------------|
|              | T <sub>1</sub> (0%)          | T <sub>2</sub> (15%)          | T <sub>3</sub> (25%)          | T <sub>4</sub> (35%)          |
| Liver        | 2.42 $\pm$ 0.03 <sup>b</sup> | 2.48 $\pm$ 0.06 <sup>b</sup>  | 2.77 $\pm$ 0.11 <sup>a</sup>  | 2.77 $\pm$ 0.12 <sup>a</sup>  |
| Left kidney  | 0.27 $\pm$ 0.02 <sup>b</sup> | 0.33 $\pm$ 0.01 <sup>a</sup>  | 0.33 $\pm$ 0.02 <sup>a</sup>  | 0.32 $\pm$ 0.01 <sup>a</sup>  |
| Right kidney | 0.26 $\pm$ 0.11 <sup>b</sup> | 0.33 $\pm$ 0.02 <sup>a</sup>  | 0.32 $\pm$ 0.03 <sup>a</sup>  | 0.32 $\pm$ 0.02 <sup>a</sup>  |
| Heart        | 0.18 $\pm$ 0.02 <sup>b</sup> | 0.20 $\pm$ 0.01 <sup>ab</sup> | 0.23 $\pm$ 0.02 <sup>a</sup>  | 0.25 $\pm$ 0.01 <sup>a</sup>  |
| Paired lungs | 0.39 $\pm$ 0.02 <sup>b</sup> | 0.56 $\pm$ 0.07 <sup>a</sup>  | 0.53 $\pm$ 0.04 <sup>ab</sup> | 0.46 $\pm$ 0.05 <sup>ab</sup> |

**CONCLUSION**

It can be concluded from this study that dietary inclusion of ginger root meal in rabbit should be lower than 15% of the diet. A prolonged usage of this additive in rabbit diet is not encouraged.

**REFERENCES**

- Adanlawo, I. G and Dairo, F.A.S. (2007). Nutrient and Anti-Nutrient Constituents of Ginger (*Zingiber officinale*, Roscoe) and the Influence of its Ethanolic Extract on some Serum Enzymes in Albino Rats. *International Journal of Biological Chemistry*. 1:38-46.
- Caspar, W. (2003): Herbs and Botanicals as Feed Additives in Monogastric Animals. *Asian-Australian Journal of Animal Science*, 16(2):282-289
- Falcão-e-Cunha, L., Castro-Solla, L., Maertens, L., Marounek, M., Pinheiro, V., Freire, J. and Mourão, J. L. (2007). Alternatives to antibiotic growth promoters in rabbit feeding: A review. *World Rabbit Science*, 15: 127 – 140.
- Greener K. (2015): Rabbit Anatomy – Rabbit Body Systems. Just Rabbit.com <https://www.justrabbits.com/rabbit-anatomy.html#urinary>
- Horton, G. M. J., Blethen, D. B. and Prasad, B. M. (1991): The Effect of Garlic (*Allium sativum*) on Feed Palatability of Horses and Feed Consumption, Selected Performance and Blood Parameters in Sheep and Swine. *Canadian Journal of Animal Science*, 71:60-610
- Joseph K. J., Awosanya B. and Adebua B.A. (1994). The effects of pre-slaughter withholding of feed and water from rabbits on their carcass yield and meat quality. *Nigerian Journal of Animal Production* 21: 164 – 169
- Muhammad, J., Durrani, F., Hafeez, A., Khan, R. and Ahmad, I. (2009): Effects of Aqueous Extract of Plant Mixture on Carcass Quality of Broiler Chicks. *Journal of Agriculture and Biological Sciences* 4(1): 37-40.
- Omage, J. J., Onimisi, P. A., Adegbite, E. K. and Agunbiade, M. O. (2007): The Effect of Ginger (*Zingiber officinale* Roscoe) Waste Meal on Growth Performance, Carcass Characteristics, Serum Lipid and serum Cholesterol Profiles of Rabbit. *Pakistan Journal of Nutrition*, 6(4): 359-362
- Onu, P. N. and Aja, P. M. (2011): Growth and Haematological Indices of Weaned Rabbits Fed Garlic (*Allium sativum*) and Ginger (*Zingiber officinale*) Supplemented Diets. *International Journal of Food, agriculture and Veterinary Sciences*, 1(1):51-59.

United States Department of Agriculture (USDA) National Organic Program (2005). Official Status Listing of Organic Certification Agencies Currently under Assessment by USDA for compliance with the International Organization for Standardization (ISO) Guide 65. <http://www.ams.usda.gov/lsg/arc/iso65.htm>

Walter, F. and Addis, T. (1939): Organ Work and Organ Weight. *Journal of Experimental Medicine*, 69(3):467-83.

Yu, B. and Chiou, W. S. (1997): The Morphological Changes in Intestinal Mucosa in Growing Rabbits. *Laboratory Animals*, 31:254-263.