# GUT MORPHOLOGY OF HYLA RABBITS FED GRADED LEVELS OF WATERMELON WASTE WITH WHEAT OFFAL AS ABSORBENT

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**ABSTRACT**
This study was conducted to evaluate gut morphology of Hyla rabbits fed graded levels of watermelon waste with wheat offal as absorbent. Forty five Hyla rabbits of 5-6 months of age were used for this experiment. The experiment lasted for six months. The rabbits were allotted to five dietary treatments (0%, 10%, 20%, 30% and 40%) in a completely randomized design with 9 rabbits per treatment. Data were collected on weight and length of segments of gastro intestinal tracts (GIT) of the rabbits and subjected to Analysis of Variance (ANOVA) using SAS version 9.3.1. Based on the results, watermelon waste with wheat offal (WRWO) had a significant effect on the gut of hyla rabbits by improving the morphological characteristics. The inclusion of watermelon with wheat offal as absorbent at 30% can support gut morphology of rabbits without any adverse effect on their GIT.
***Keywords: Gut morphology, gastro intestinal tract, hyla rabbits, watermelon rind, wheat offal.***

## INTRODUCTION

Rabbit husbandry is a crucial component of small-scale animal farming, providing a sustainable source of meat and other valuable products. Rabbit is a pseudo-ruminant that has a fast growing and breeding rate (Hassan *et al*., 2012). Among monogastric animals, rabbit has been reported to utilize fibrous materials for production of meat (Gidenne, 2000). The meat from rabbit meat surpasses meat from other farm animals in protein content (Aduku and Olukosi, 1990). It also contains low cholesterol, fewer calories and a lower percentage of fat (Mailafia *et al.*, 2010) compared to beef, pork, chicken or lamb (Lane, 1999). The rabbit meat is in the categories of white meat and it is prescribed safe for consumption by patients with different diseases conditions and for people on strict diets who wish to cut down on fat intake (Ahsan, 2014). The efficient utilization of unconventional feed resources is essential for optimizing rabbit production systems and ensuring their economic viability.

Watermelon is one of the major underutilized fruits, the juice or pulp from watermelon is used for human utilization, while rinds and seeds are major solid wastes of fruit industries (Dubey *et al*., 2021). Olosunde *et al*. (2023) reported that watermelon waste can be processed into unconventional feedstuff by mixing it with wheat offal as absorbent. There is need for supplementation of conventional feed ingredients with under-utilized unconventional feedstuff such as watermelon waste, an agro-industrial by products, as a means of reducing production cost as well as competition between man and livestock for food. Wheat offal, a byproduct of wheat milling, is known for its absorbent qualities and has been explored as a dietary additive in various livestock diets. Wheat offal is a high fibrous feed material containing non-starch polysaccharides (NSP).

The combination of watermelon waste and wheat offal in rabbit diets not only addresses the challenge of waste disposal but also explores the potential synergistic effects of these components on rabbit health and productivity. The gastrointestinal tract of rabbits plays a pivotal role in the digestion and absorption of nutrients, directly influencing their overall performance. Thus, this study was conducted to assess gut morphometry of Hyla rabbits fed graded levels of watermelon waste with wheat offal as absorbent.

## MATERIALS AND METHODS

The experiment was conducted at Bora, Federal College of Animal health and Production Technology, Ibadan. Forty-five Hyla adult rabbits of 5-6 months of age were used for the experiment. The experiment lasted for six months. Watermelon wastes was collected from different fruit markets in

Ibadan. The samples were thoroughly washed to remove sand particles. The rind was sliced to smaller pieces using knife, then ground into a paste form, and mixed with wheat offal as absorbent at ratio of 1:1 and sun-dried for 3 days. The sample was stored in an air tight container prior to mixing with other feed ingredients and used in the formulation of rabbit diets. The five experimental diets formulated were: $T_1$ – without watermelon waste and wheat offal, $T_2$ – 10% inclusion of watermelon waste and wheat offal, $T_3$ – 20% inclusion of watermelon waste and wheat offal, $T_4$ - 30% inclusion of watermelon waste and wheat offal and $T_5$ - 40% inclusion of watermelon waste and wheat offal (Table 1). Completely Randomized Design (CRD) was used for this experiment with five treatments and three replicates. A total of nine animals were randomly allotted into each of the five treatments which were replicated three times with three animals per replicate. The diets were fed to the rabbits based on 4% of their body weight on dry matter basis.

At the end of the experiment, feed was withdrawn for 12 hours from the rabbits so as to empty their gastro-intestinal tracts (GITs) before slaughtering as described by Akinmutimi and Osuagwu (2008) and to reduce the variability in body weight due to intestinal contents. Segments of the gastro-intestinal tract like stomach, small intestine, colon, caecum and entire GIT were weighed and their respective lengths determined using digital weighing scale (with a minimum sensitivity of 0.1g) and a measuring tape, respectively. The relative length and weight of the gastrointestinal tract cuts were expressed in percentages of entire gastrointestinal tract length and live weight, respectively. Data collected on carcass characteristics were subjected to Analysis of Variance (ANOVA) using SAS version 9.3.1.

**Table 1: Gross composition of experimental diets**

| Ingredient | $T_1$ (0%) | $T_2$ (10%) | $T_3$ (20%) | $T_4$ (30%) | $T_5$ (40%) |
|---|---|---|---|---|---|
| Maize | 40.00 | 30.00 | 20.00 | 10.00 | 0.00 |
| Watermelon/Wheat offal | 0.00 | 10.00 | 20.00 | 30.00 | 40.00 |
| Soybean Meal | 5.50 | 5.50 | 5.50 | 5.50 | 5.50 |
| Palm kernel cake | 30.00 | 30.00 | 30.00 | 30.00 | 30.00 |
| Groundnut cake | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| Rice bran | 12.00 | 12.00 | 12.00 | 12.00 | 12.00 |
| Fish Meal | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| Bone meal | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Common Salt | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Lysine | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Methionine | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Total | 100 | 100 | 100 | 100 | 100 |

$T_1$ – Without watermelon waste and wheat offal; $T_2$ – 10% inclusion of watermelon waste and wheat offal; $T_3$ – 20% inclusion of watermelon waste and wheat offal; $T_4$ - 30% inclusion of watermelon waste and wheat offal; $T_5$ - 40% inclusion of watermelon waste and wheat offal

**RESULTS AND DISCUSSION**

The weights of stomach and total GIT were significantly affected by the dietary treatment (Table 2). There was no significant difference ($p > 0.05$) in the weights of small intestine, caecum and colon among the treatments. The weight of stomach of rabbits fed 30% inclusion of WRWO (T4) (143.38 ± 11.5g) and the weight of total GIT obtained in rabbits fed 30% inclusion of WRWO (327.93 ± 18.98g) were higher than others. Weights of the small intestine, colon and total GIT fluctuated with increasing levels of WRWO in the diets. The observation may be due to difference in weight at slaughter, difference in increase in weight of organs due bulkiness of the diets and increased retention time with increase in fibre levels. Yu and Chiou (1979) reported an age-related decrease in relative gut segment weights of rabbits.

These authors observed linear increases from early life to the maturity stage at 8 weeks of age, and thereafter declined in contrast to rapid body weight gain. The weights of the various GIT segments when expressed as a percentage of the total GIT weight were not significantly ($p > 0.05$) affected by

dietary treatments (Table 2). The values obtained were lower to values reported by Ortserga (2002) and Ozung *et al*. (2011). The authors replaced rice offal with graded levels of melon seed offal and

**Table 2: Gut organ weights of Hyla rabbits fed graded levels of watermelon waste with wheat offal as absorbent**

| Parameters | $T_1$ (0%) | $T_2$ (10%) | $T_3$ (20%) | $T_4$ (30%) | $T_5$ (40%) | SEM (±) |
|---|---|---|---|---|---|---|
| Stomach (g) | 97.37$^{ab}$ | 99.23$^{ab}$ | 81.70$^{ab}$ | 143.38$^{a}$ | 55.31$^{b}$ | 11.15 |
| Stomach (%) | 37.94 | 38.36 | 32.79 | 43.43 | 32,54 | 3.93 |
| Small intestine (g) | 30.39 | 36.65 | 52.07 | 48.75 | 28.82 | 4.17 |
| Small intestine (%) | 12.21 | 17.34 | 21.42 | 14.18 | 18.28 | 1.72 |
| Colon (g) | 21.32 | 21.90 | 25.82 | 25.66 | 28.31 | 3.82 |
| Colon (%) | 9.25 | 9.37 | 9,91 | 7.86 | 15.91 | 1.92 |
| Caecum (g) | 95.29 | 87.78 | 98.29 | 110.15 | 49.43 | 11.38 |
| Caecum (%) | 34.94 | 34.93 | 35.87 | 35.83 | 33.26 | 4.09 |
| Total GIT (g) | 244.38$^{ab}$ | 245.65$^{ab}$ | 257.89$^{b}$ | 327.93$^{a}$ | 161.87$^{b}$ | 18.98 |

$^{a, b,}$ means of different superscripts along the same row are statistically significant ($P < 0.05$)
$T_1$ – Without watermelon waste and wheat offal; $T_2$ – 10% inclusion of watermelon waste and wheat offal; $T_3$ – 20% inclusion of watermelon waste and wheat offal; $T_4$ - 30% inclusion of watermelon waste and wheat offal; $T_5$ - 40% inclusion of watermelon waste and wheat offal
SEM (±) – Standard error mean

cassava peel meal respectively in the diets of growing rabbits. The total GIT length and its segments like small intestine were significantly ($p < 0.05$) affected by dietary treatments (Table 3). There was no significant difference ($p < 0.05$) in the lengths of stomach, colon and caecum of the rabbits feed the different treatments. The values obtained were similar to the observations of Ortserga (2002). The small intestine showed a decrease in length with increasing levels of watermelon waste in diet, thus suggesting that residual of phytochemicals might have a sloughing off effect on the walls of the small intestine, thereby affecting its length as reported by Ozung *et al*. (2011). When linear measurements were expressed as a percentage of the total GIT length, the stomach, small intestine, colon and caecum were not significantly ($p > 0.05$) affected by dietary treatments (Table 3). This could be due to the increased fibre level and ash content of the diets as the levels of WRWO increases.

**Table 3: Gut morphology of Hyla rabbits fed graded levels of watermelon waste with wheat offal as absorbent**

| Parameters | $T_1$ (0%) | $T_2$ (10%) | $T_3$ (20%) | $T_4$ (30%) | $T_5$ (40%) | SEM (±) |
|---|---|---|---|---|---|---|
| Stomach (cm) | 14.63 | 15.88 | 16.38 | 16.63 | 15.50 | 0.60 |
| Stomach (%) | 4.61 | 3.96 | 4.48 | 4.48 | 4.78 | 0.17 |
| Small intestine (cm) | 249.5$^{b}$ | 312.0$^{a}$ | 275.0$^{ab}$ | 278.5$^{ab}$ | 243.5$^{b}$ | 8.76 |
| Small intestine (%) | 78.10 | 76.94 | 75.54 | 75.24 | 75.58 | 0.91 |
| Colon (cm) | 125.88 | 134.50 | 135.13 | 137.75 | 133.25 | 1.70 |
| Colon (%) | 7.72 | 8.60 | 9.63 | 10.21 | 10.42 | 0.49 |
| Caecum (cm) | 31.70 | 42.25 | 37.88 | 37.25 | 32.88 | 2.04 |
| Caecum (%) | 9.56 | 10.50 | 10.35 | 10.07 | 10.25 | 0.54 |
| Total GIT (cm) | 421.70$^{ab}$ | 504.63$^{a}$ | 464.38$^{ab}$ | 470.13$^{ab}$ | 425.13$^{ab}$ | 10.75 |

$^{a, b,}$ means of different superscripts along the same row are statistically significant ($P < 0.05$)
SEM (±) – Standard error mean
GIT – Gastro intestinal tract

## CONCLUSION

Based on the results, watermelon waste with wheat offal (WRWO) had a significant effect on the gut of Hyla rabbits by improving the morphological characteristics. The inclusion of watermelon waste

with wheat offal as absorbent at 30% could support optimum gut morphology of Hyla rabbit without adverse effect on their GIT.

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