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# The Effect of Ginger (*Zingiber officinale* Roscoe) Waste Meal on Growth Performance, Carcass Characteristics, Serum Lipid and Serum Cholesterol Profiles of Rabbit

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**Abstract:** Six weeks old twenty five growing rabbits of mixed sexes and breeds were used to evaluate the utilization of ginger waste meal (GWM) as energy substitute for maize in the diet of growing rabbits and the effects on growth performance, carcass characteristics, serum lipids and serum cholesterol profiles. Fives diets containing GWM at 0, 10, 20, 30 and 40% levels with the 40% level replacing maize completely were formulated. Five rabbits each were randomly assigned to each of the five diets. Rabbits were housed individually in cages in complete randomization and fed the respective diets and water *ad libitum* for the 8 weeks of the experiment. Significant differences (P<0.05) were observed among the five dietary treatments with respect to daily feed intake, water consumption, water/feed ratio, total serum lipids and cholesterol levels. The results showed that the inclusion of ginger waste meal in the diet will stimulate increased water consumption and also induce hypocholesterolemic and hypolipidemic effects on the rabbit without negative effects on growth performance.

**Key words:** Ginger waste meal, growing rabbits, growth performance, carcass characteristics, serum, lipids, cholesterol

## Introduction

The supply of qualitative animal protein in sufficient quantity and at affordable cost has continued to remain a dream yet to be realized and indeed a perennial problem and a major challenge to the livestock industry in Nigeria and in most developing countries. High costs of feed due to shortage and unavailability of conventional feedstuffs for compounding livestock rations has been the major cause of rising cost of animal products. Efforts aimed at increasing animal protein supply must necessarily address the competition between man and livestock for feed sources which has often resulted into shortage of such conventional feedstuffs like maize, soya beans and groundnut cake for compounding livestock feeds. (Amaefule *et al*., 2004; Olupona and Balogun, 2004). This limitation imposed by scarcity of the conventional feedstuffs has made it necessary to source for alternative and cheaper feed materials to supply nutrients in livestock rations. Such materials would totally or partially substitute the expensive and relatively unavailable conventional feedstuffs and this will directly reduce production cost and improve profitability. Agricultural and agro-industrial by-products have been the major focus of research. The rhizome of ginger - a plant extensively cultivated in Nigeria and many other countries of the world, is processed into various products for human consumption. The by-product herein referred to as Ginger Waste Meal is not currently utilized by man nor is there any record of it's use in livestock rations (Onimisi *et al*., 2006). It has high concentration of carbohydrates (Dei-tutu and Risch, 1976) and could therefore be a cheap and locally available substitute for maize in livestock diets.

The emerging interest in rabbit production in Nigeria is a good development that can improve the supply of animal protein thereby reduce the current acute shortage. Rabbits are highly prolific animals with short generation interval, short gestation period and a good ability to convert a wide range of feedstuffs to edible meat (Oluokun and Olaloku, 1999; Agunbiade *et al*., 1999; Olupona and Balogun, 2004).

The current quest for lean meat and reduced consumption of cholesterol form the objectives of this work. The ginger rhizome is known to lower blood cholesterol level in man. This study was therefore carried out to evaluate the influence of ginger waste meal on performance, carcass quality, water consumption and serum lipids and cholesterol levels of rabbit.

## Materials and Methods

**Ginger waste meal (gwm):** The GWM used for this work was obtained from Belphins Nigeria Limited, Kaduna, Nigeria. The company processes ginger into various products. The meal is a by-product obtained from the extraction of oleoresin using ethanol. The meal samples

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Table 1: Composition of the experimental rabbit diets

| | Level of GWM | | | | |
|---|---|---|---|---|---|
| Ingredient | Control% | 10% | 20% | 30% | 40% |
| Maize | 57 | 48 | 38 | 252 | 0 |
| Soya beans (full fat) | 24.25 | 23.25 | 23.2 | 26 | 41.2 |
| Wheat offal | 15 | 15 | 15 | 15 | 15 |
| Ginger waste meal | 0 | 10 | 20 | 30 | 40 |
| (GWM) | 3 | 3 | 3 | 3 | 3 |
| Limestone | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Common salt | 0.2 | 0.2 | 0.25 | 0.25 | 0.25 |
| Methionine | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Vitamin - Mineral premix | | | | | |
| Calculated Analysis | 3020.75 | 2982.55 | 2942.8 | 2905.36 | 2870.4 |
| Energy (ME Kcals/kg) | 17.25 | 16.32 | 15.61 | 15.79 | 19.83 |
| Crude protein % | 2.71 | 3.35 | 4.04 | 4.87 | 6.32 |
| Crude fibre % | 7.42 | 7.09 | 6.9 | 7.11 | 9.06 |
| Ether Extract % | 3.12 | 3.82 | 4.56 | 5.39 | 6.63 |
| Ash % | 1.26 | 1.29.06 | 1.33 | 1.38 | 1.45 |
| Calcium % | 0.46 | 0.46 | 0.46 | 0.47 | 0.53 |
| Phosphorus % | 1.05 | 1.00 | 0.96 | 1.01 | 1.42 |
| Lysine % | 0.55 | 0.54 | 0.57 | 0.58 | 0.64 |
| Methionine % | | | | | |

*Vitamin-mineral premix provide per kg of diet vit A. 13,340iu; vit $D_3$. 2680.i.u; vit E. 10.i.u; vit K, 2.68 mg; Calcium pantothenate, 10.68mg; vit $B_{12}$, 0.022mg; folic acid, 0.668mg; choline chloride, 400mg; chlorotetracycline, 26.68mg; manganese, 133.34mg; iron, 66.68mg; zinc, 53.34mg ; copper, 3.2mg, iodine, 1.86mg; cobalt, 0.268mg, selenium, 0.108mg.

were subjected to proximate and mineral analysis (AOAC, 1990).

**Experimental animals:** Twenty five young rabbits of about 6 weeks old and of mixed breed and sexes were grouped into five with similar weight and each group was allotted one of the five treatment diets which contained 0, 10, 20, 30 and 40% GWM respectively with the 40% level completely replacing maize (Table 1). Diets were isocaloric and isonitrogenous. Rabbits were housed individually in cages in complete randomization and fed the treatment diets and water ad lib for the 8 weeks of the experiment.

**Data collection:** Daily feed intake and water consumption were measured as the difference between the quantity supplied and the remnant. Water evaporative losses were accounted for in the measurement. Weight gain was measured weekly. Daily weight gain, feed conversion ratio and water/feed ratio were computed for each rabbit.

At the end of the study, 3 rabbits per treatment were randomly selected, weighed and slaughtered for carcass evaluation after fasting for about 12 hours. Live weight and dressed weight were measured and used to calculate dressing percentage for each rabbit. The weights of the intestine, liver and some other organs were taken. These organs may show directly the effect of the treatment diets on the animal.

Three rabbits per treatment were randomly selected, weighed and bled. The blood samples were collected into containers for serum preparation which was done by allowing the blood to clot for one hour and then the serum prepared by centrifugation at 2000 g for 20 minutes. The serum samples were assayed for total lipids and total cholesterol. The total serum lipids were determined by the sulphosphovanillin method while the total cholesterol was determined by the ILCA's method both as described by Stroev and Makarova, 1989.

**Statistical analysis:** All the data obtained were subjected to analysis of variance as described by Steel and Torrie, 1980 and differences of means determined by the Duncan Multiple Range Test.

## Results and Discussion

The growth performance, water consumption, serum total lipids and cholesterol profiles of the rabbits fed the various levels of GWM in the diets are shown in Table 2. The results of the carcass analysis are shown in Table 3. There were no significant differences in weight gain, final live weight and feed conversion efficiency among the treatments ($P>0.05$) but there were significant differences ($P<0.05$) with respect to feed intake, water intake and water/feed intake. Serum cholesterol levels were significantly lower ($P<0.05$) in GWM groups compared to the control while the total lipids were lowered only in Treatments IV and V compared to other treatment.

Feed intake increased significantly in rabbits fed GWM over those of the control diet which contained no GWM. The increased feed intake which yielded no corresponding increase in weight may be due to lower concentration of energy per volume of feed. This is

Table 2: Growth performance, water consumption and serum total lipids and cholesterol levels of rabbits fed GWM

| | Level of GWM in diet (%) | | | | | | Sig. |
|---|---|---|---|---|---|---|---|
| Parameters | 0 | 10 | 20 | 30 | 40 | SEM | |
| Daily wt grain/rabbit (g) | 18.82 | 15.88 | 18.30 | 15.31 | 16.61 | 3.50 | NS |
| Daily feed intake/rabbit (g) | $42.22^{b}$ | $51.48^{ab}$ | $56.17^{a}$ | $54.49^{a}$ | $51.09^{ab}$ | 4.57 | * |
| Feed conversion ratio | 3.36 | 2.19 | 4.29 | 4.56 | 1.72 | 1.70 | NS |
| Daily water intake ml/day | $137.20^{d}$ | $224.53^{b}$ | $171.96^{c}$ | $178.80^{c}$ | $251.58^{a}$ | 6.60 | * |
| Water/feed ratio | $3.74^{b}$ | $4.68^{a}$ | $3.64^{b}$ | $4.24^{ab}$ | $4.78^{a}$ | 0.27 | * |
| Cholesterol (Mmol/L) | $6.63^{a}$ | $3.51^{b}$ | $3.90^{b}$ | $3.51^{b}$ | $4.56^{b}$ | 0.602 | * |
| Total lipids (g/l) | $1.77^{a}$ | 1.47 | 1.69 | 1.17 | 1.39 | 0.105 | * |

a, b,c: Mean with different superscripts along rows are significantly different (P<0.05).

Table 3: Carcass characteristics of rabbit fed graded levels of ginger waste meal

| | Level of GWM% | | | | | | |
|---|---|---|---|---|---|---|---|
| Parameter | 0 | 10 | 20 | 30 | 40 | SEM | Level of significance |
| Live weight (kg) | $1.58^{a}$ | $1.65^{a}$ | $1.50^{ab}$ | $1.40^{b}$ | $1.48^{ab}$ | 0.05 | * |
| Dressed weight (kg) | $1.20^{a}$ | $1.26^{a}$ | $1.12^{ab}$ | $1.00^{b}$ | $1.13^{ab}$ | 0.05 | * |
| Dressing % | 75.78 | 76.36 | 74.30 | $71.2^{8}$ | 75.28 | 1.60 | NS |
| Wgt of intestine (full) g | 155.67 | 163.0 | 148.0 | 148.0 | 164.67 | 8.42 | NS |
| Wgt of intestine (empty) g | 106.67 | 117.67 | 110.0 | 120.0 | 120.0 | 9.67 | NS |
| Length of intestine (cm) | $270.7^{ab}$ | $220.0^{ab}$ | $262.0^{b}$ | $262.0^{b}$ | $251.67^{b}$ | 6.87 | * |
| Weight of lung (g) | $5.0^{b}$ | $5.50^{ab}$ | $5.0^{b}$ | $5.0^{b}$ | $6.0^{a}$ | 0.30 | * |
| Weight of liver(g) | $14.82^{b}$ | $15.29^{b}$ | $17.38^{a}$ | $14.81^{b}$ | $17.71^{a}$ | 0.40 | * |
| Weight of kidney(g) | $3.47^{a}$ | $3.33^{a}$ | $2.58^{b}$ | $2.87^{ab}$ | $3.42^{a}$ | 0.19 | * |
| Weight of lung(g) | $0.31^{b}$ | $0.35^{ab}$ | $0.34^{ab}$ | $0.36^{ab}$ | $0.40^{a}$ | 0.02 | * |
| Weight of heart(g) | $0.70^{b}$ | $1.01^{a}$ | $0.72^{b}$ | $1.05^{a}$ | $1.01^{a}$ | 0.04 | * |

a,b,c: Means with different superscript on the same row are significantly different (P<0.05). NS = Non-significant difference (P>0.05).

occasioned by increasing level of fibre in the diet from 2.71% to 6.32% as the level of GWM increased. The rabbits therefore increased their intake to meet the energy requirements. Cheeke and Amberg, 1972 observed that increased crude fibre provided as straw resulted in increased voluntary feed intake in growing rabbits as a means of compensating for the lower energy density of the feeds.

The feed conversion efficiency of the rabbits that did not differ significantly may be due to the fact that rabbits can handle high levels of fibre in the diet due to the activities of microorganisms in the ceacum and the practice of coprophagy. Hence, though the inclusion of GWM in the diets increased the level of fibre from 2.71% in Treatment I to 6.32% in Treatment V, the range is still however within acceptable limits (upward of 10%) and therefore the ability of the rabbits to convert the feeds to edible meat was not significantly impaired.

Inclusion of GWM in the diets of the rabbits stimulated increased daily water intake with the highest quantity recorded for treatment V which also contained the highest level of GWM. The value ranges between 137.20 – 251.58 ml/day. The differences in water consumption and in water/feed ratio did not follow a particular pattern. The increases in water intake may therefore be due to increases in feed consumption of the rabbits fed GWM.

GWM in rabbit diets is found to have lowering effects on the serum lipid and cholesterol levels. This may be due to the ginger oil. The use of vegetable oils for lowering cholesterol concentration has been reported (Stroev, 1989). Elevated blood cholesterol levels are the most important risk factor in heart disease alongside elevated blood pressure and some other factors. Hence, any medication, nutrient or procedure that reduces the level of the risk factors is of benefit in the prevention of heart disease (Omage *et al*., 2002). The hypolipidemic and hypocholesterolemic effects observed in this study coupled with observations that rabbit meat is generally low in total fat, saturated fat, cholesterol and sodium will make rabbit meat a safe and excellent source of animal protein for man.

The dressing percentage did not differ significantly among the dietary treatments (p>0.05).This observation is similar to the results obtained by (Agunbiade *et al*., 1999 , Oluokun and Olalokun, 1999 and Amaefule *et al*., 2004 who worked on other agro-industrial by-products. The weight of the intestines did not differ significantly (P>0.05) across treatments. However, lengths of intestine of the GWM treated rabbits were significantly higher than those on the control diet. Since the weights of the intestines (both full and empty) were not significantly different, it may be concluded that GWM in the diets did not cause increased musculature of the gut. There is no regular pattern in the weight of liver, kidney and heart and the length of intestines (Table 3). Hence the observed differences may not be due to the dietary treatments.

**Conclusion:** The results of this study indicated that the complete replacement of maize with GWM in rabbit diets did not adversely affect growth performance, but stimulated increased water intake and stimulates hypolipidemic and hypocholesterolemic effects on rabbits thereby increasing the safety margin of rabbit meat.

## References

Agunbiade, J.A., O.A. Adeyemi, O.E. Fashina, B.O. Ashorobi, M.O. Adebanjo and O.A. Waide, 1999. Cassava peels and leaves in the diet of rabbits; Effecty on performance and carcass characteristics. Nig. J. Anim. Prod., 26: 20-34.

Amaefule K.U., C.C. Nwaokoro and F.C. Iheukumere, 2004. The effect of feeding graded levels of raw pigeonpea seed (Cajanus cajans) meal on the performance, nutrient retention and carcass charcteristics of weaner rabbits. Nig. J. Anim. Prod., 31: 194-199.

AOAC, 1990. Official method of analysis, 15th edition. Association of Analytical Chemist. Washington, D.C.

Cheeke, P.R. and J.W. Amberg, 1972. Protein nutrition of the rabbit. Nutrition abstracts and reviews, 5: 259-263.

Oluokun, J.A. and E.A. Olalokun, 1999. The effect of graded levels of brewers' spent grains and kolanut pod meal on the performance characteristics and carcass quality of rabbits. Nig. J. Anim. Prod., 26: 71-77.

Olupona, J.A. and O.A. Balogun, 2004. Nutrient utilization by rabbits fed brewers'dried grains from different portions of barley, maize and sorghum. Nig. J. Anim. Prod., 31: 89-193.

Omage, J.J., I.A. Umar and G.S. Bawa, 2002. Effect of sesame (*Sesamum indicum* L.) seed oil on blood and liver lipid/cholesterol levels of rats fed a high fat diet. Nig.J. Exper. Appl. Bio., 3: 125-129.

Onimisi, P.A., I.I. Dafwang and J.J. Omage, 2006. 1: Growth performance and Water Consumption pattern of Broiler Chicks Fed Graded Levels of Ginger Waste Meal. Application of Appropriate Technology in Overcoming Environmental Barriers in Animal Agriculture in Nigeria. Pro. 31st Ann. Conf. Nigeria Soceity For Animal Production. March 13th-15th, 2006. Bayero University, Kano Nigeria.

Steel, R.G.D. and J.H. Torri, 1980. Principles and procedures of statistics: A Biometrical Approach. 2nd ed. McGraw Hill, Kogakusha Ltd. ,Tokyo.

Stroev, E.A. and V.G. Makarova, 1989. Lipid metabolism. Laboratory manual in biochemistry. M/R Publishers, Moscow., pp: 254-270.