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Effect of graded levels of dried ginger (*Zingiber officinale*) root meal on the performance and carcass parameters of growing rabbits

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Target Audience: *Researchers, Livestock Farmers, Feed Millers*

Abstract

Twenty-four (24) apparently healthy rabbits of mixed sexes were used to determine the effect of dried ginger root meal (GRM) on feed and water intake, body weight gain and carcass parameters. The rabbits were randomly assigned by weight to four experimental treatments of seven replicates each. The feeding trial lasted for eight weeks. GRM was incorporated in the diets of rabbits at 0%, 15%, 25% and 35% for groups T1, T2, T3, and T4, respectively. Rabbits were housed in individual cages. Water and feed were administered ad libitum. Data was collected on water and feed intake, body weight gain, and carcass indices. Data was subjected to analysis of variance and significant differences separated using Least Significant Difference. The results showed inclusion of ginger root meal in rabbit diets significantly ($p<0.05$) influenced weekly feed intake in the 7^{th} and 8^{th} weeks. Weekly water intake was significantly ($p<0.05$) affected in the 2^{nd}, 5^{th}, 6^{th}, 7^{th} and 8^{th} week. Ginger root meal had no effect ($p>0.05$) on final body weight, weight gain, eviscerated weight and singed weights. The finding of this study showed that feed and water intake were influenced by GRM inclusion in rabbit diet while up to 35% GRM can be included in rabbits diet without debilitating effect on their body weights

Keywords: *Feed additive, Phyto-additive, Root meal, Grower Rabbit*

Description of Problem

Livestock agriculture has played a significant role in the livelihood for humans and in the supply of animal protein to man (1). Animal protein is essential for human nutrition due to its balanced amino acid profile (2). Rabbits have potentials to resolve the low animal protein supply in developing economies (3). Some of the characteristics of rabbits that give them advantage above other livestock include rapid growth rate, requirement for small capital investment and space, requirement for little technical and managerial skills, high fecundity, short gestation period and, the ability to survive solely on various forages (16, 14, 17, 18, 15, 19). To this end, most research geared towards meeting the animal protein requirement is targeting production and productivity of rabbits. Competition between man and livestock for ingredients used for food and feed has led to the shortage of conventional feedstuffs such as maize, soybeans and groundnut cake, used for compounding livestock feeds (4). And efforts toward meeting animal protein supply needs of man must also be targeted at resolving this contest. Furthermore, the relatively scarce conventional feedstuff has influenced the quest for cheaper non-conventional feed materials that can meet the animal feed requirements. According to (5), such feedstuffs should be cost effective, being capable of totally or partially replacing the scarce and expensive conventional feedstuff. In this regard, works on a number of agricultural products and by-products where undertaken and reported (5, 28). In this light phyto-feed additives has been studied (29, 30), in addition to their medicinal

value, as possible partial or total substitute for conventional feedstuff (5). (31) pointed out that feed additives could include nutritional or non- nutritional substances that can alleviate cost post production. To this end (5) totally replaced maize with ginger waste in rabbit diet and reported no negative effect on growth performance.

Ginger (*Zingiber officinale*) is an aromatic herb, possessing tuberous stem root (rhizome) (20). Proximate constituents of ginger has been reported (29, 30). Apart from the medicinal value it has been reported that feed intake was observed to be higher among rabbits fed higher levels of ginger root powder in diets (6). Ginger may act as a pro-nutrient because of the vast active ingredients it contains (7). It thus, is a potential alternative to antimicrobial growth promoters (AGP). As a growth promoter, ginger was reported to promote feed intake and feed conversion (8) and body weight gain (9) in broilers. Birds fed ginger produced higher carcass weights compared to untreated birds (10). (23) noted that with the level of pharmacologically active compounds and feed nutrients present in ginger rhizome, it could be incorporated into monogastric feeding systems as feed additive. Since feed additives are either nutritional or non-nutritional (31), a feeding trial with ginger waste totally replacing maize had no negative effect on growth of rabbit (5). With these documented attributes of ginger, it is therefore necessary to investigate the effect of this rhizome on body weight, feed and water intake of rabbits in this clime and extend its results to farmers.

Materials and Methods

This study was conducted in the rabbitary unit of the Federal University of Agriculture Livestock Teaching and Research farm, Makurdi, located on latitude 7^{o} 48′33.6″N and longitude 8^{o} 37′12.7″E (https://www.google.com/maps) in the River Benue trough. The experiment lasted for eight weeks. Apparently healthy, twenty four (24) mixed sex grower rabbits were subjected to the intensive management. Ivermectin® was administered against ecto and endo-parasites according to manufacturer's specifications. The rabbits were balanced by weight into four treatments (T1, T2, T3 and T4) with six replicates of three bucks and three does in a Completely Randomized Design (CRD). Dried ginger rhizomes were purchased from a local market and milled into powder. This was incorporated into the formulated diet at different levels (T1=0%, T2=15%, T3=25%, and T4=35%). The diets were iso-nitrogenous and iso-caloric. The composition of diets is presented in Table 1. Feed and water were offered *ad libitum*. Water and feed intake, body weight gain were measured daily. Weight of feed consumed was obtained by subtracting quantity of daily feed leftover from daily feed offered to each rabbit. The cumulative daily feed consumed for the week was taken as weekly feed intake. Water intake was measured by subtracting daily water left over from the daily volume of water served to each rabbit. The daily evaporated volume of water was further subtracted from the result obtained to give the daily water intake. Water of evaporation was determined by placing an equal volume of water served in a similar drinker, used for the rabbits, in an empty cage within the hutch. The daily differences in volume of water is evaporative loss. A modification of the procedure of (32). The cumulative daily water intake for each rabbit form the weekly water intake for that replicate. Total weight gain was determined at the end of the study by subtracting the initial body weight from the final body weight. At the end of the experimental period, six rabbits per treatment were selected (made up of three bucks and three does) and sacrificed according to recommendation (22). Eviscerated weight was recorded after removal of the gastrointestinal tract and visceral organs. Singed weight was

obtained after the rabbit carcasses were passed over fire to char the fur. Eviscerated and singed weights were determined according to methods described by (21). All data obtained were subjected to the analysis of variance (ANOVA) using Statistical Package for Social Sciences (IBM® SPSS version 21, 2011). Significantly different means were separated using least significant difference (LSD).

Table 1: Ingredients composition and calculated analysis of experimental diets

	Treatments			
Ingredient	**T1 (0%)**	**T2 (15%)**	**T3 (25%)**	**T4 (35%)**
Maize	39.70	24.86	15.90	7.80
Maize Offal	14.40	14.95	13.00	10.00
SBM	19.70	21.30	22.60	24.00
Ginger	0.00	15.00	25.00	35.00
Rice Bran	0.80	0.75	1.00	1.40
Rice Offal	22.40	20.14	19.5	18.8
Bone ash	2.50	2.50	2.50	2.50
Salt	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated Analysis				
CP	15.05	15.01	15.00	15.01
CF	12.03	11.87	11.91	11.87
Fats	3.84	3.99	4.15	4.32
Energy	2501.58	2505.00	2500.91	2503.01
Phosphorus	1.23	1.68	1.98	2.28
Calcium	0.97	1.28	1.48	1.68

T= Treatment, %= Percentage, SBM= Soy Bean Meal, CF=Crude Fibre, CP= Crude Protein.
Mineral Vitamin premix contents; Vit A, 10,000,000 I.U; Vit D3, 2,000,000 I.U; Vit E, 20,000 mg; Vit K3, 2,000 mg; B1, 3000 mg; B2, 5000mg; niacin, 45,000 mg; calcium pantothenate, 10,000 mg; vitamin B6, 4,000 mg; B12, 20 mg; choline chloride , 300,000 mg; folic acid, 1,000 mg; biotin, 50 mg; manganese, 300,000 mg; iron, 120,000 mg; zinc, 80,000 mg; copper, 8,500 mg; iodine, 1,500 mg; cobalt, 300 mg; selenium, 120 mg; antioxidants, 120,000 mg.

Results and Discussion

The effect of dried ginger root meal on the feed intake of rabbit is presented in Table 2. The result showed that there were no significant ($p>0.05$) differences among treatment means up to week 6. Weekly feed intake differed significantly ($p<0.05$)) in week 7 and 8. T4 had the highest feed intake ($p<0.05$) in weeks 7 and 8 while T1 was the least. However, the value of T4 was not different from those of T2 and T3 in weeks 7 and 8. In this study, feed intake increased as ginger levels increased. This corroborated the report of (5) that feed intake increase with level of ginger in the diet of rabbits. .The finding of this study thus corroborated previous reports of (5 and 12). This could be due to the fact that ginger tends to enhance palatability and stimulate appetite (13).

The effect of ginger root meal on water intake is presented in Table 3. Significant ($p<0.05$) variations were observed in weeks 2, 5, 6, 7 and 8. Animals on diets containing ginger root meal drank more water, though T4 (35% ginger root meal) had higher mean water intake. Water intake of rabbits on ginger meal

diets throughout the experimental period was higher than the control. The finding of this study agrees with the report of (5). These workers observed that inclusion of ginger meal in diet will stimulate increase in water consumption of rabbit. (25) noted that 8-week old rabbits could consume about 475mls of water and (27) also documented that water utilization mechanism of rabbits may be more efficient than anticipated. However, the type of feed (dry, high protein and fiber diet) and the high ambient temperature could stimulate high water intake (24, 26)

Table 4 presents the effect of dried ginger root meal on the body weights and some carcass parameters of grower rabbits. The result showed no significant ($p>0.05$)) variation in the mean values of the parameters measured. The treatment means did not show any specific trend. The findings of this study agree with the earlier reports of (5, 10).

Table 2: Effect of ginger root meal on weekly feed intake of rabbits (Mean ± SEM)

	Treatments			
Weeks (g)	T1 (0%)	T2 (15%)	T3 (25%)	T4 (35%)
1	343.24±27.62	321.50±29.75	335.47±32.72	364.10±27.62
2	311.86±25.03	344.33±26.95	361.60±29.65	394.57±25.03
3	374.72±40.86	380.00±44.00	374.40±48.40	461.15±40.86
4	396.40±45.16	464.33±48.64	406.04±53.50	420.40±45.16
5	406.88±40.60	466.67±43.72	442.38±48.09	507.59±40.60
6	460.27±49.25	479.67±53.04	568.42±58.34	569.10±49.25
7	420.27±47.77^{b}	547.67±51.45^{ab}	557.03±56.59^{ab}	602.55±47.77^{a}
8	429.16±49.27^{b}	527.33±53.06^{ab}	589.57±58.36^{a}	601.02±49.27^{a}

a, b = means in the same row with different superscript are significantly different ($p<0.05$))
SEM= Standard Error of Mean, %= Percentage inclusion of ginger in diet, T= Treatment.

Table 3: The effect of ginger root meal on the weekly water intake of rabbits (Mean ± SEM)

	Treatments			
Weeks (mls)	**T1 (0%)**	**T2 (15%)**	**T3 (25%)**	**T4 (35%)**
1	82.38±16.88	103.17±18.18	141.37±19.99	120.25±16.88
2	133.50±26.35^{b}	156.25±28.37^{ab}	230.24±31.21^{a}	224.84±26.35^{a}
3	172.74±29.21	210.67±31.46	262.27±34.60	256.09±29.21
4	180.93±33.98	229.13±36.59	265.60±40.25	241.43±33.98
5	165.05±31.66^{b}	260.08±34.09^{ab}	293.43±33.98^{a}	312.98±31.66^{a}
6	202.99±37.48^{b}	188.03±40.36^{b}	255.94±44.40^{ab}	330.59±37.48^{a}
7	217.24±22.38^{b}	241.58±24.10^{b}	242.89±26.51^{b}	326.58±22.38^{a}
8	275.66±32.55^{b}	298.33±35.05^{ab}	350.66±38.56^{ab}	398.87±32.55^{a}

ab = means in the same row with different superscript are significantly different ($p<0.05$)
SEM= Standard Error of Mean, %= Percentage of ginger inclusion in diet, T= Treatment.

Table 4: Effect of ginger root meal on the body weight and carcass parameters of rabbit. (Mean ± SEM)

	Treatments			
Parameters	**T1 (0%)**	**T2 (15%)**	**T3 (25%)**	**T4 (35%)**
IBW	574.70±35.20	535.67±41.67	573.00±51.90	545.00±41.67
FBW	1284.40±45.00	1286.17±71.78	1281.60±96.30	1357.17±71.78
WG	709.70±51.30	750.50±64.55	708.60±83.30	812.17±64.55
EW	888.60±54.75	904.75±54.75	857.83±60.24	908.92±54.75
SW	804.08±54.81	821.52±54.81	763.50±60.30	819.17±54.81

SEM = Standard Error of Mean, IBW=Initial Body Weight, FBW=Final Body Weight, WG= Weight Gain, EW= Eviscerated Weight, SW=Singed Weight, T= Treatment, %= Percentage of ginger inclusion in diet.

Conclusion and Applications

It can be concluded from this experiment that:

1. The inclusion of ginger root meal at varying levels in the diet of the rabbits did not affect the body weight and carcass parameters measured.
2. Water and feed intake were however increased compared to the control.
3. GRM can be included in rabbit diets up to 35% without debilitating effect on their body weight.

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