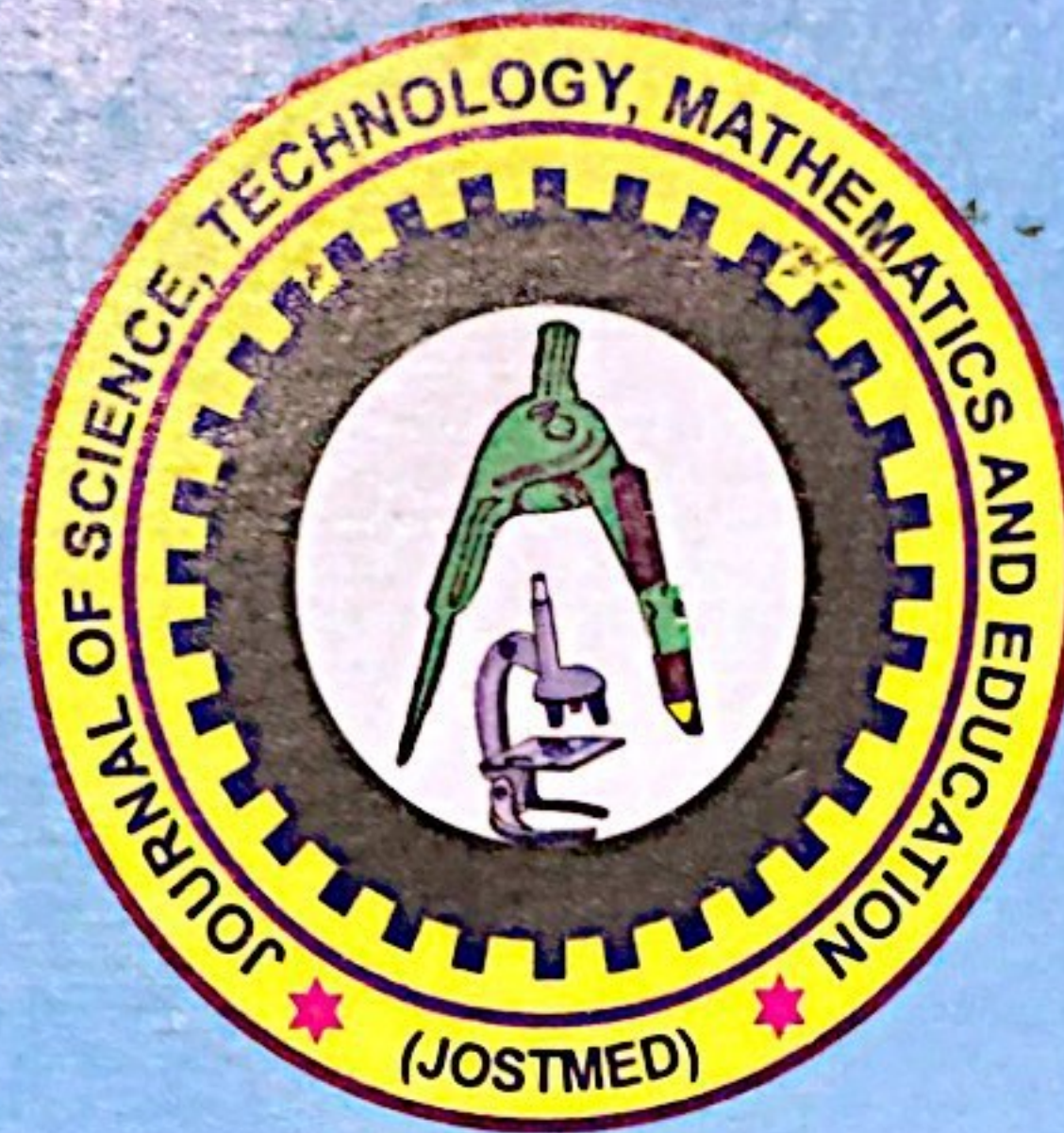


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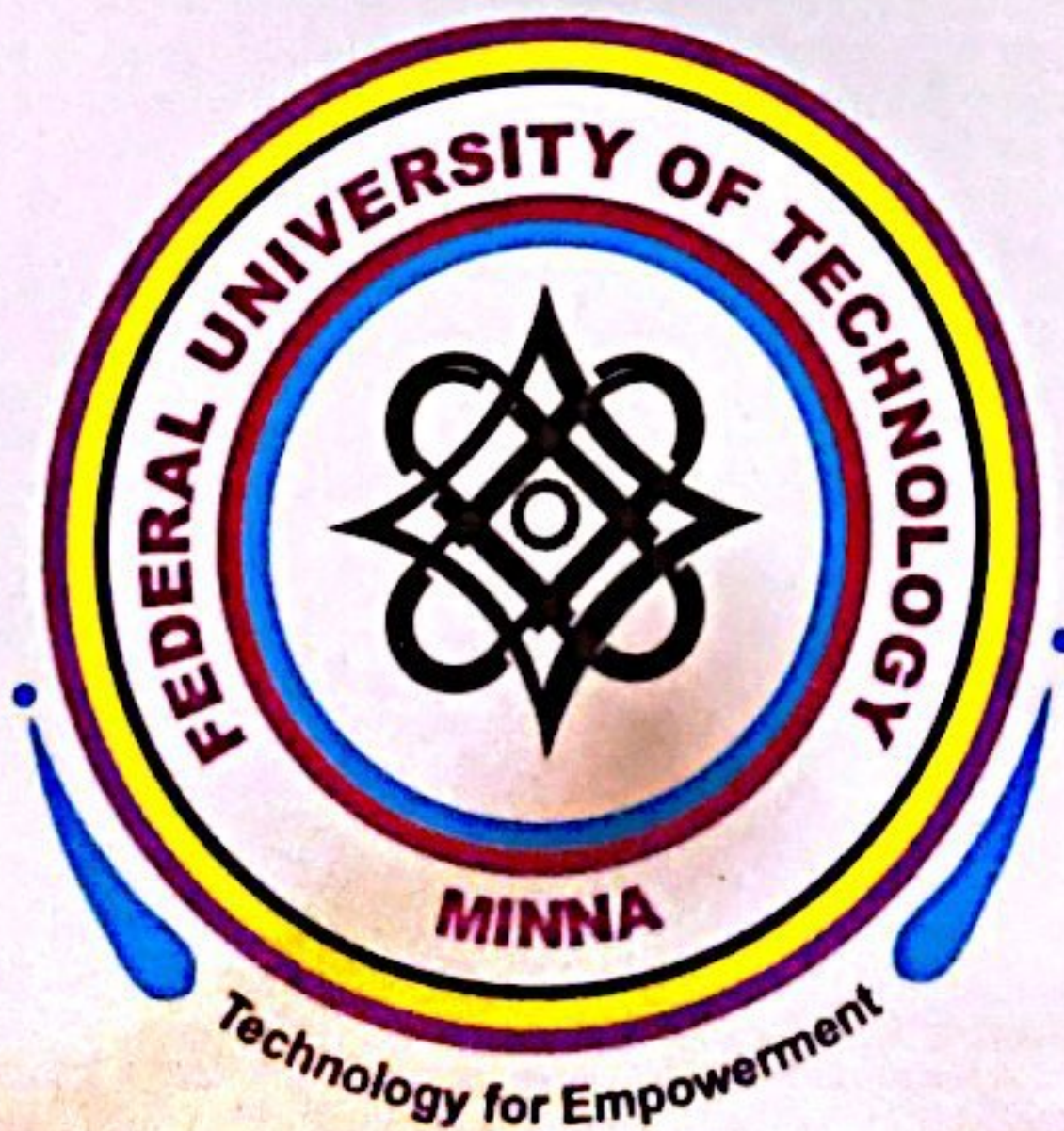


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GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF GUINEA PIGS (*Cavia porcellus*) FED DIETS CONTAINING PLANTAIN PEEL MEAL AS A REPLACEMENT FOR MAIZE

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Abstract

An eight weeks (56 days) feeding trial was conducted on 4 – 6 weeks' old growing guinea pigs totaling 24 of mixed sexes, to evaluate their growth performance when fed diets containing graded levels of plantain peel meal (*Musa paradisiaca*) at 0 %, 10 %, 20 % and 30 % dietary inclusion levels, to form Diet T₁, T₂, T₃ and T₄ respectively. The animals were randomly divided into four groups of six animals each and each group sub-divided into three replicates of two guinea pigs per replicate in a Completely Randomized Design experiment (CRD). The experimental diets and clean drinking water were offered to the growing guinea pigs ad libitum. Data were collected on feed intake and weight gain. At the end of the 8th week, three animals were randomly selected per treatment (one from each replicate), slaughtered with a knife by severing their jugular veins and their carcass characteristics determined. Results show that there were no significant ($p > 0.05$) differences in initial body weight, final body weight, total body weight gain and total feed intake among the treatments. However, feed conversion ratio (FCR) was significantly ($p < 0.05$) better for the Control Diet than for the plantain peel meal diets. There were no significant ($p > 0.05$) differences in all the carcass characteristics determined and in all the cut-up parts between guinea pigs fed diets containing varying levels of plantain peel meal. The heart showed significant ($p < 0.05$) differences; all the other organs such as thorax, intestine, liver, kidney, gall bladder, lungs and spleen showed no significant ($p > 0.05$) differences among the treatments. Hence, it can be concluded that plantain peel meal can be included up to 30 % in the diet of growing guinea pigs with no detrimental effects on their growth performance and carcass characteristics.

Keywords: Growth performance, carcass characteristics, plantain peel meal, guinea pigs.

Introduction

In Nigeria, the animal protein intake has been on the decline as a result of the ever increasing population (World Health Organization, 1985). Due to the inability of the conventional livestock to bridge the ever widening gap between animal protein supply and demand in Nigeria, attention has now been shifted on the microlivestock; for them to make significant contributions towards improving the status of animal protein consumption in Nigeria. These microlivestock include rabbit, grasscutter, snail and guinea pig. Guinea pig (*Cavia porcellus*) is a rodent considered to be a very promising microlivestock species for rural development because it requires little capital, equipment, space and labour (Nr-International Managers of the Livestock Production Programme, 2006). It provides an inexpensive, readily available and high quality meat that is nutritious and has higher protein content than that of poultry, pork, mutton and beef (Numbela and Valencia, 2003). Guinea pig originated in the Andes Mountain of South America, where they are still of importance as meat animals and have a role in religious ceremonies and local medicine (Muller-Hey, 1984).

In the tropical and subtropical countries of the world, there is active search for alternative feed resources for animal feeding. This is to allow the total or partial substitution of cereals, such as maize, traditionally employed for feeding livestock, because of their high cost and competition between man and livestock. Plantain peel is amongst the feed ingredients that are regarded as wastes that could potentially substitute for conventional ingredient like maize, due to its agro-ecological advantages in tropical areas, such as high yields in fruits (Machin, 1992). Plantain

peels have been used by certain researchers as potential feed ingredients in monogastrics (Nwokolo, 1990; Scott, 1992). Ajayi et al. (2006) fed sun-dried ripe plantain peel meal to weaner rabbits as a replacement for maize and determined that it can be used to replace maize up to 75 % in the diet of rabbit so as to reduce the total feed cost which constitute above 60 % of production cost. Less attention has been paid to the potential advantage of the use of an integrated plantain peel-guinea pig production system (González, 1994), where the use of the peel could decrease the feeding costs in guinea pig production (González and Díaz, 1997). Hence, the objective of this study was to evaluate the growth performance and carcass characteristics of growing guinea pigs fed graded levels of plantain peel meal as a replacement for maize.

Materials and Methods

Study Location: The experiment was carried out at the Rabbitry Unit of Niger State Ministry of Livestock and Fisheries, Bosso, Minna. Minna is located on latitude 9° 28' to 9° 37' North and between longitude 6° 23' to 6° 33' East. It has an annual mean precipitation range of 1000 – 1500 mm and temperature range of 28°C to 34°C (NSADP, 1995).

Preparation of Plantain Peel Meal: Plantain peels were collected from restaurants and eateries within Minna metropolis. They were then sun-dried for between 5-7 days, during the months of February and March, until properly dried. Thereafter, they were milled using an attrition mill and sieved through a 2 mm sieve. The ground powdery product obtained were then stored in plastic containers until needed for compounding of the experimental diets.

The Experimental Diets: The ingredients used in formulating the experimental diets were maize, groundnut cake, wheat offal, palm kernel cake, fish meal, bone meal, salt, lysine, methionine, palm oil and premix. They were all purchased from agro-veterinary and feed milling stores in Minna. Plantain peel meal were included in the experimental diets at 0, 10, 20 and 30 % dietary inclusion levels to form Diet T₁, Diet T₂, Diet T₃ and Diet T₄ respectively. The percentage composition of the experimental diets is shown in Table 1.

Table 1: Percentage and calculated composition of the experimental diets

Ingredients	Diet T ₁	Diet T ₂	Diet T ₃	Diet T ₄
Maize	50.00	40.00	30.00	20.00
Plantain peel meal	0.00	10.00	20.00	30.00
Groundnut Cake	26.15	23.65	23.65	23.65
Wheat offal	11.00	13.50	13.50	13.50
Palm kennel cake	6.00	6.00	6.00	6.00
Fish meal	2.00	2.00	2.00	2.00
Bone meal	2.00	2.00	2.00	2.00
Salt	0.20	0.20	0.20	0.20
Lysine	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20
Palm oil	2.00	2.00	2.00	2.00
*Premix	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated Composition				
Metabolizable energy	2769	2696	2730	2707
Crude protein	20.77	20.43	20.09	20.07

*Premix has the following composition: Vitamin A = 7,500, 00 IU, D = 500, 000 IU, E = 1,000 IU, B₁ = 375 mg, B₂ = 125 mg, B₃ = 500 mg, B₆ = 150 mg, B₁₂ = 2.5 mg, K = 15 mg, C = 10 mg and folic acid = 150 mg. Minerals: Ca = 12.5 mg, Cu = 8.0 mg, I = 0.8 mg, Se = 100 mg, Mg = 0.25 mg, chlorine = 250 mg, pantothenic acid = 144 mg.

T₁ = Diet 1 with 0% Plantain Peel meal
T₃ = Diet 3 with 20% Plantain Peel meal

T₂ = Diet 2 with 10% Plantain Peel meal
T₄ = Diet 4 with 30% Plantain Peel meal

Experimental Animals and their Management

The animals used for this experiment were obtained from Kontagora in Niger State. Twenty-four (24) growing guinea pigs aged between 4-6 weeks were randomly allotted to four dietary treatments with three replicates each; and with two animals per replicate. The guinea pigs were placed in individual hutches made up of wood and wire mesh, measuring 60 cm x 65 cm x 60 cm. Before the arrival of the animals, the hutches were cleaned and thoroughly disinfected using MORIGAD®. Cleaned and disinfected feeders and drinkers were placed in the hutches. On arrival, the guinea pigs were acclimatized in the hutches for one week; during this time, they were fed the control diet and forages. Antibiotics and coccidiostats were then administered to the animals before the commencement of the experiment as prophylactic treatments against bacteria and coccidia infections. The experiment lasted for eight weeks. On commencement of the experiment, the guinea pigs were fed the experimental diets twice daily, in the morning and in the evening; to ensure that feed were always available to them. Supplemental forages were offered to the animals in the evening as extra sources of fibre. Clean drinking water were also offered daily to the animals.

Parameters Determined

Feed were weighed daily before being offered to the animals per replicate and the leftover (uneaten) feed removed the following day and weighed. Daily feed consumption per replicate were obtained by subtracting the weight of the leftover feed from the weight of the feed supplied. The body weights of the guinea pigs were also taken at the beginning of the experiment. Thereafter, the guinea pigs were weighed weekly with a top loading weighing scale (measuring to the nearest 0.01 g), to determine their weekly weight gains. Body weight gain for each week was obtained by difference between body weight of the preceding week and the present week. At the end of the growth trial, three guinea pigs from each treatment were randomly selected for carcass analysis. The guinea pigs were kept off feed for 12 hours before slaughter. They were slaughtered with a knife by severing the jugular vein after which they were kept head down in order to drain them of blood so as to get their slaughter weight. They were then skinned using a sharp knife, eviscerated, and the cut-up parts were removed carefully and weighed.

Chemical Analysis

The proximate compositions of the plantain peel meal as well as that of the experimental diets were determined using the procedures of AOAC (1990).

Statistical Analysis

Data obtained from this research work were subjected to statistical analysis using SAS Package (Statistical Analytical Systems, 2000 Version) based on a Completely Randomized Design Model. Where the means were significant, they were separated using Duncan Multiple Range Tests as contained in the Package.

Results and Discussion

Table 2 shows the proximate composition and energy value of plantain peel meal. It shows that plantain peel meal has dry matter content of 93.00 %, crude protein content of 12.25 %, crude fibre content of 8.67 %, ash of 23.00 %, ether extract of 15.00 % and nitrogen free extract of 34.08 %. Estimated metabolizable energy (Pauzenga, 1984) was 2878 Kcal/kg. These results are similar to the nutritional value of plantain peels reported by Aduku, (1993). According to the author, plantain peel though a waste, has good nutritional value as it contains about 11 %

crude protein, 6 % crude fibre and 12 % ash. The metabolizable energy value of plantain peel is close to that of maize (3432 Kcal/kg) indicating that it can easily substitute for maize in the diet of guinea pigs.

The result of growth performance of guinea pigs fed diets containing varying levels of plantain peel meal is shown in Table 3. There were no significant ($p > 0.05$) differences in initial body weight, final body weight, total body weight gain and total feed intake among the treatments. However, feed conversion ratio (FCR) was significant ($p < 0.05$) among the treatments with guinea pigs on the Control Diet having significantly ($p < 0.05$) better FCR than the other plantain peel meal diets. Hence, FCR was not significantly ($p > 0.05$) different among the plantain peel meal diets, showing that increasing the dietary inclusion level of plantain peel meal from 10 % (Diet 2) to 30 % (Diet 4) did not significantly affect the growth performance parameters among the growing guinea pigs.

Table 2: Proximate composition and energy value of plantain peel meal

Parameters	% Composition
Moisture	7.00
Dry matter	93.00
Crude Protein	12.25
Crude fibre	8.67
Ash	23.00
Ether extract	15.00
Nitrogen free extract	34.08
Metabolizable energy (Kcal/kg)	2878

Table 3: Growth performance of growing guinea pigs fed diets containing varying levels of plantain peel meals as a replacement for maize

Parameter	T ₁	T ₂	T ₃	T ₄	SEM	LOS
Initial weight (g)	256.83	241.50	250.00	236.67	9.06	NS
Final weight (g)	551.30	520.42	551.67	525.25	9.71	NS
Total weight gain (g)	294.47	278.92	300.58	285.58	8.14	NS
Total feed intake (g)	1295.49	1497.64	1571.76	1571.76	54.50	NS
Feed conversion ratio	4.40 ^a	5.37 ^b	5.61 ^b	5.52 ^b	0.19	**

^{ab}Means with different superscripts on the same row were significantly ($p < 0.05$) different

T₁ = Diet 1 with 0% Plantain Peel meal

T₂ = Diet 2 with 10% Plantain Peel meal

T₃ = Diet 3 with 20% Plantain Peel meal

T₄ = Diet 4 with 30% Plantain Peel meal

SEM = Standard error of mean

LOS = Level of significance

NS = Not significant at $\alpha = 5\%$

** = Significant at $\alpha = 5\%$

There were no significant ($p > 0.05$) differences in all the carcass characteristics determined (slaughter weight, eviscerated weight and dressed weight); also there were no significant ($p > 0.05$) differences in all the cut-up parts (head, forelimbs, hindlimbs, neck, legs, skin and lumbar) between guinea pigs fed diets containing varying levels of plantain peel meal (Table 4 and Table 5). For the internal organs determined, only the heart showed significant ($p < 0.05$) differences among the treatments; all the other organs such as thorax, intestine, liver, kidney, gall bladder, lungs and spleen showed no significant ($p > 0.05$) differences among the treatments (Table 6). This result is similar to the findings of Ogunsipe and Agbede (2010) when they fed unripe plantain peels to weaner rabbits as a replacement for maize. Significant ($p < 0.05$) differences were found in the weight of the lungs, kidneys and heart between rabbits

fed diets containing unripe plantain peels replacing 0, 25, 50 and 75 % maize. They concluded that dietary treatments exert some influences on certain carcass and organ developments. Huss and Roca (1982) and Cicogna et al. (1992) reported a dressing percentage of 65 % and 76 % respectively for guinea pigs. The value reported in this present study is quite lower than those earlier reported. This may be due to breed differences as well as differences in climate and environmental conditions under which the guinea pigs were managed.

Table 4: Carcass characteristics of guinea pigs fed varying levels of plantain peel meal as a replacement for maize

Parameters	T ₁	T ₂	T ₃	T ₄	SEM	LOS
Live weight (g)	287.50	297.20	275.00	275.00	17.70	NS
Slaughter weight (%)	98.59	96.57	98.17	98.04	1.34	NS
Dressed weight (%)	57.56	56.88	60.88	66.29	6.60	NS
Eviscerated weight (%)	70.45	69.91	73.76	71.52	2.14	NS

T₁ = 0% plantain peel meal inclusion in the diet T₂ = 10% plantain peel meal inclusion in the diet
 T₃ = 20% plantain peel meal inclusion in the diet T₄ = 30% plantain peel meal inclusion in the diet
 NS = Not significantly different (p>0.05) LOS= Level of significance
 SEM = standard error of the mean

The non-significant differences among the treatments in the carcass characteristics, cut-up parts and internal organs is an indication that the carcass of the guinea pigs were not significantly (p>0.05) affected by the consumption of different levels of plantain peel meal diets. This could be a pointer to the nutritional adequacy of plantain peel meal in the diets of guinea pigs.

Conclusion

The result of this research work shows that growing guinea pigs can be fed with plantain peel meal based diets as a replacement for maize with no adverse effect on their growth performance and carcass characteristics. Hence, plantain peel meal can be included up to 30 % in the diet of growing guinea pigs as a replacement for maize.

Table 5: Cut-up parts of guinea pigs fed varying levels of plantain peel meal as a replacement for maize (expressed as % of live weight)

Parameters	T ₁	T ₂	T ₃	T ₄	SEM	LOS
Head	1.33	1.37	1.46	1.45	0.50	NS
Fore limbs	6.72	6.85	6.35	7.14	0.16	NS
Hind limbs	7.06	6.75	6.31	7.36	0.19	NS
Neck	4.30	4.70	4.47	4.60	0.16	NS
Legs	2.48	2.90	2.74	2.28	0.12	NS
Skin	12.89	13.04	12.88	12.42	0.35	NS
Lumbar	8.97	10.06	8.98	10.93	0.38	NS

T₁ = 0% plantain peel meal inclusion in the diet T₂ = 10% plantain peel meal inclusion in the diet
 T₃ = 20% plantain peel meal inclusion in the diet T₄ = 30% plantain peel meal inclusion in the diet
 NS = Not significantly different (p>0.05) LOS= Level of significance
 SEM = standard error of the mean

Table 6: Weight of internal organs of guinea pigs fed varying levels of plantain peel meal as a replacement for maize (expressed as % of live weight)

Parameters	T ₁	T ₂	T ₃	T ₄	SEM	LOS
Thorax	6.69	6.05	6.31	6.34	0.36	NS
Intestine	23.88	22.90	21.63	24.62	0.98	NS
Liver	5.05	4.13	4.08	3.75	0.24	NS
Kidney	1.19	1.20	1.35	1.40	0.10	NS
Gall bladder	0.11	0.10	0.10	0.09	0.01	NS
Lungs	1.06	1.21	1.13	1.18	0.03	NS
Heart	0.35 ^{ab}	0.29 ^b	0.36 ^{ab}	0.42 ^a	0.21	*
Spleen	0.00	0.00	0.00	0.02	0.00	NS

^{a,b} Means denoted by different superscripts were significantly different ($p < 0.05$)

T₁ = 0% plantain peel meal inclusion in the diet T₂ = 10% plantain peel meal inclusion in the diet
 T₃ = 20% plantain peel meal inclusion in the diet T₄ = 30% plantain peel meal inclusion in the diet
 NS = Not significantly different ($p > 0.05$) LOS = Level of significance
 SEM = standard error of the mean

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