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# GROWTH, HAEMATOLOGICAL AND SERUM BIOCHEMICAL INDICES OF BROILER CHICKENS FED BANANA PEEL MEAL AS REPLACEMENT FOR MAIZE IN THE SEMI-ARID ZONE OF NIGERIA

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**ABSTRACT***:* An experiment was conducted to investigate the replacement of maize with banana peel meal in broiler diets. One hundred and twenty (120) Anak 2000 broiler chicken were used for the study. Four diets were formulated using banana peel meal at 0%, 5%, 10%, and 15% levels in the respected diets. The birds were randomly allotted to dietary treatments in a completely randomized design. Each treatment consists of thirty birds with ten birds per replicate. The experiment lasted for eight weeks; feed and water were given *ad libitum.* The productive performance results indicated high significant (P<0.05) difference in final weight, daily weight gain and feed conversion ratio among the treatment group at different levels of replacement. Haematological indices and serum biochemical indices also followed similar pattern as the productive performance by revealing high significant (P<0.05) difference at different levels of maize replacement with banana peel meal in Packed cell volume (PCV), Red blood cell (RBC), Haemoglobin (Hb), White blood cell (WBC), Mean corpuscular volume (MCV), Mean corpuscular Haemoglobin (MCH), Haemoglobin concentration (Hb), Heterophils and Lymphocytes. The serum biochemical indices revealed high significant (P<0.05) difference in total protein, albumen, glucose, total bilurobin, potassium, sodium and chloride. In view of the above, up to 15% replacement of maize with banana peel meal has no adverse effect on performance and blood components of broiler chickens with concomitant reduction in feed cost ₦/kg and feed cost per kg gain.

**Keywords:** Broiler Chicken, Banana Peel, Maize, Growth and Blood Components

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## INTRODUCTION

Nigeria like many other developing countries is currently faced with the shortage and high cost of conventional feed for poultry. Payne (1990) observed that the increasing worldwide need for energy and protein sources for ration formulation for poultry may in the long run delay or even halt the complete industrialization of the poultry industry. It is in light of this that efforts are geared towards investigation into the utilization of some cheap and readily available alternative sources of some energy and protein feed stuffs for monogastric animals. This has been the main focus of animal nutritionist in the country. The search was precipitated by high cost of most conventional feedstuffs which have always been in high demand by humans.

The poultry industry fall short of its own aim of self-sufficiency in animal protein consumption in the country that is 5 g/caput per day which is below recommended level of 35 g/caput per day (FAO, 2010). Constraints which include low level of income, poor management, high mortality rate and poor chicks quality is still believed to be responsible for the shortfall in production (Adesimi and Awoyomi, 1989; Aihonsu and Sunmola, 1999; Alimi, 2001 and Geidam *et al*., 2006). However, the biggest impediment to livestock production in developing countries is high cost of feed ingredient (El-Deek et al., 2009). In Poultry enterprise feed cost represents 65 – 75% of its production cost (Kekeocha, 1984).

Banana peels are outer covers of banana fruit and by-product of household consumption and banana processing factories. The proportion which is wasted as peel is 18 -20% (Dividich et al., 1976). The peel contains 0.9% crude protein, 1.7% crude fat, 59.0% carbohydrate and 31.70% crude fibre, and if properly processed, it could be a high quality and cheap source of carbohydrate and minerals for livestock (Ahwange, 2008). Tartrakoon *et al*. (1999) also reported that the peel has high energy content but low in protein. However, anti-nutritional factors such as hydro-cyanide, oxalate, phytate and saponins have been reported in banana peels by Ahwange (2008) which affect their utilization in poultry. This experiment was carried out to investigate the effect of replacing maize with graded levels of banana peel meal on the growth, haematological and serum biochemical indices of broiler chickens.



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## MATERIAL AND METHODS

### Experimental Stock and Management

One hundred and twenty day old mixed sex Anak 2000 broiler chicks were brooded for seven days. At one week of age, the chicks were randomly assigned to four dietary treatments of 30 birds with 10 birds per replicate in a completely randomized design. Each group was given one of the experimental diets and clean drinking water was given *ad libitum* throughout the 8 weeks experimental period. The birds were vaccinated against the common poultry diseases in the area. Gomboru vaccine at 2 and 5 weeks of age and Newcastle vaccine (Lasota) at 3 weeks of age.

### Experimental diet

The banana peels were sourced locally within Maiduguri metropolis. They were cleaned, sun dried, milled and incorporated into the experimental diets. Four experimental diets (starter and finisher mashes) were formulated (Tables 1 and 2) to contain 0% (control), 5%, 10%, and 15% levels of banana peel meal as a replacement for maize in the diets.

**Table 1** - Composition of the Experimental Broiler Starter Diets

| | Levels of inclusion of the banana peel meal | | | |
|---|---|---|---|---|
| **Ingredient** | **$T_1$ (control)** | **$T_2$ (5%)** | **$T_3$ (10%)** | **$T_4$ (15%)** |
| Maize | 35.36 | 30.36 | 25.36 | 20.36 |
| Banana peel meal | 0.00 | 5.00 | 10.00 | 15.00 |
| Wheat Offal | 8.84 | 8.84 | 8.84 | 8.84 |
| FullFat Soybean | 51.89 | 51.89 | 51.89 | 51.89 |
| Bone Meal | 3.0 | 3.0 | 3.0 | 3.0 |
| Limestone | 0.10 | 0.10 | 0.10 | 0.10 |
| Salt | 0.35 | 0.35 | 0.35 | 0.35 |
| Methionine | 0.20 | 0.20 | 0.20 | 0.20 |
| Premix* | 0.25 | 0.25 | 0.25 | 0.25 |
| **Total** | **100** | **100** | **100** | **100** |
| **Proximate Composition** | | | | |
| Dry Matter (DM) | 91.50 | 90.40 | 90.20 | 88.80 |
| Crude Protein (CP) | 24.02 | 23.85 | 23.69 | 23.53 |
| Crude Fibre (CF) | 3.90 | 4.40 | 4.90 | 5.40 |
| Ether Extract (EE) | 11.21 | 11.74 | 12.27 | 12.79 |
| Energy (kcal/kg) | 3173 | 3127 | 3108 | 3055 |
| Ash (%) | 3.41 | 4.08 | 4.74 | 5.40 |
| Nitrogen free extract (NFE) | 48.90 | 46.33 | 44.60 | 41.68 |

*Bio-mix starter supplied/kg: Vit.A=100000IU, Vit.D3=2000IU, Vit.E=23000mg, Vit.K3=2000mg, Vit.B1=1800mg, Vit.B2=5500mg, Niacin=27,500mg, Panthothenic Acid=7500mg, Vit.B6=3000mg, Vit.B12=15mg, Folic Acid=750mg, Biotin H2=60mg, Choline chloride=300000mg, Cobalt=200mg, Copper= 3000mg, iodine=1000mg, Iron=20000mg, Manganese=40000mg, Zinc=30000mg, Selenium=200mg, Anti-oxidant= 1250mg.

**Table 2** - Composition of the Experimental Broiler Finisher Diets

| | Levels of inclusion of the banana peel meal | | | |
|---|---|---|---|---|
| **Ingredient** | **$T_1$ (control)** | **$T_2$ (5%)** | **$T_3$ (10%)** | **$T_4$ (15%)** |
| Maize | 46.45 | 41.45 | 36.45 | 31.45 |
| Banana peel meal | 0.00 | 5.00 | 10.00 | 15.00 |
| Wheat Offal | 11.61 | 11.61 | 11.61 | 11.61 |
| Full Fat Soybean | 37.44 | 37.44 | 37.44 | 37.44 |
| Bone Meal | 3.50 | 3.50 | 3.50 | 3.50 |
| Limestone | 0.20 | 0.20 | 0.20 | 0.20 |
| Salt | 0.35 | 0.35 | 0.35 | 0.35 |
| Methionine | 0.20 | 0.20 | 0.20 | 0.20 |
| Premix* | 0.25 | 0.25 | 0.25 | 0.25 |
| **Total** | **100** | **100** | **100** | **100** |
| **Proximate Composition** | | | | |
| Dry Matter (DM) | 90.40 | 91.10 | 90.70 | 81.60 |
| Crude Protein (CP) | 20.07 | 19.90 | 19.03 | 18.00 |
| Crude Fibre (CF) | 3.89 | 4.49 | 4.88 | 5.38 |
| Ether Extract (EE) | 9.19 | 9.72 | 10.25 | 10.78 |
| Energy (kcal/kg) | 3050 | 3084 | 3034 | 3017 |
| Ash (%) | 4.19 | 3.73 | 5.38 | 5.06 |
| Nitrogen free extract (NFE) | 53.06 | 53.26 | 51.16 | 50.38 |

*Bio-mix finisher supplied/kg: Vit.A=8500IU, Vit.D3=1500IU, Vit.E=10000mg, Vit.K3=2000mg, Vit.B1=1500mg, Vit.B2=1600mg, Niacin=4000mg, Panthothenic Acid=20000mg, Vit.B6=5000mg, Vit.B12=1500mg, Folic Acid=10mg, Biotin H2=500mg, Choline chloride=175000mg, Cobalt=200mg, Copper=3000mg, iodine=1000mg, Iron= 20000mg, Manganese=40000mg, Zinc=30000mg, Selenium=200mg, Anti-oxidant= 1250mg.



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**Data Collection**

**Performance parameters:** Individual body weight of the birds was obtained to the nearest 0.1 g on the first day of the study and weekly thereafter. Feed intake was measured on daily basis while feed conversion ratio was calculated as the ratio of the feed intake to the body weight gain.

**Blood collection and analysis:** At the end of week eight, blood samples were collected from three birds in each group (i.e. 1 bird per replicate) for determination of haematological and serum biochemical indices. The birds were fasted overnight and blood samples was collected early the next morning via the wing-vein by means of sterile disposable (21-guage) syringe and needle, and then placed into sets of sample bottles. One set contained diapotassium salts of ethylene daiamine tetra-acetic acid (EDTA) and the samples were used for haematological study; the other samples in anticoagulant-free bottles were used for the determination of serum biochemical indices. Packed cell volumes (PCV), red blood cell (RBC), white blood cell (WBC) and haemoglobin concentration (Hb) were analyzed according to the methods outlined by Bush (1975). Mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were calculated by the formula of Schalm *et al.* (1985). The serum biochemical indices measured were the level of total protein, albumin, glucose, cholesterol, chlorine, sodium, potassium, creatinine total bilirubin, and urea were analyzed according to the methods outlined by Bush (1975) and WHO (1980). Proximate composition of the experimental diets was carried out according to the methods of AOAC (1980).

**Statistical Analysis**

All data collected were subjected to analysis of variance using Statistix (2003) and where means differed, they were separated using the least significant difference (LSD).

## RESULTS AND DISCUSSION

The crude protein values for the broiler starter and finisher are within the range of 22 – 24% and 19 – 20% reported by Olomu (1995), Kekeocha (1984) and Williamson and Payne (1978), who also stated that maximum weight gain in broiler chickens was not only a function of the birds good management and housing, but also a function of the feed given to the chickens.

The ether extract (EE) values reported in this study were lower than the values of (22.30%) reported by Samy (1999) for plant protein sources. And the ash was within the reported values by NIS (1989). The range of values (4.60 – 5.06%) obtained in this study was adequate to provide the necessary mineral such as calcium and phosphorus needed for development of bones. The energy values were slightly higher than the values of 2800 Kcal/kg and 3000 Kcal/kg recommended by Olomu (1995) for the starter and finisher respectively which may be as a result of banana peel meal carbohydrate content (59.00%) reported by Ahwange (2008).

The productive performances of broiler chickens fed varying levels of banana peel meal are presented in Table 3. The final body weight revealed significant (P<0.05) difference among the treatment group in the (control), but the range obtained in this research is lower than the value 2495 g/bird reported by Olomu (1995). The significantly (P<0.05) lower body weight obtained in the birds fed 15% banana peel meal, may be related to the poor feed conversion ratio (FCR) of the birds as the banana peel meal inclusion level increased in the diets. This observation concurs with the work of Tewe (1983) who reported that broiler chickens fed banana peel meal beyond 7.5% level showed significant (P<0.05) reduction in body weight gain. Same author also reported that broiler chickens fed 30% banana peel meal gained the least weight and have the poorest feed conversion ratio. Similarly, Gohl (1982) reported that level of banana peel meal above 10% is detrimental to growth and feed efficiency of broiler chicken.

**Table 3 -** Productive performance of broilers fed graded levels of banana peel meal (BPM)

| | Inclusion levels BPM | | | | |
|---|---|---|---|---|---|
| **Parameters** | **$T_1$ (control)** | **$T_2$ (5%)** | **$T_3$ (10%)** | **$T_4$ (15%)** | **SEM ±** |
| Initial Weight (g/bird) | 66.40 | 66.66 | 66.55 | 66.51 | 11.710 |
| Final Weight (g/bird) | 1548.00$^a$ | 1154.40$^b$ | 1190.00$^b$ | 981.70$^c$ | 33.222* |
| Daily Feed Intake (g/bird) | 82.99 | 80.90 | 80.56 | 80.77 | 0.667 |
| Daily Weight Gain (g/bird) | 41.78$^a$ | 33.45$^{ab}$ | 41.60$^a$ | 25.67$^c$ | 0.595* |
| Feed Conversion Ratio | 1.99$^a$ | 2.42$^b$ | 1.94$^a$ | 3.15$^c$ | 0.210* |
| Mortality (%) | 16.67 | 15.00 | 13.33 | 33.33 | NA |
| Feed Cost ₦/kg | 87.01 | 85.30 | 83.64 | 81.89 | NA |
| Feed Cost / kg gain | 99.36 | 89.84 | 85.06 | 69.36 | NA |

$^{a, b, c}$ Means within the same row bearing different superscripts differ significantly (P<0.05); * = significant (P<0.05); NA = Not Statistically Analyzed; SEM = standard error of mean

The feed intake indicated no significant (P>0.05) difference among the treatment group. This observation tallies with the report of Tewe (1983) who reported that as the banana peel meal levels increases in the diet of broiler chicken, there was reduction in growth, feed intake and feed efficiency. The result of this study also did not



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tally with the values of up to 160 g/bird/day feed intake reported by Olomu (1995). This may be attributed to the anti-nutritional factor (Tannins) in banana peel which may affect its utilization by poultry (Ahwange, 2008) and Kumar (1991). Though the tannins content was not analysed in this study, but it was reported by Bressani et al. (1982) and Jansman (1993) that unconventional plant feed sources contained tannins which is build up for resistance of pest.

The daily weight gain indicated high significant ($P<0.05$) difference in the control group and 10% replacement of maize with banana peel meal, the finding is similar to the report of Calvent (1978) and Hunter (1981) who observed that high fibre feed in the diets of animal depressed growth. The significant ($P<0.05$) difference obtained in the daily weight gain among the replacement levels could be attributed to levels of the limiting amino acids in soyabean meal. These levels were adequate to meet the amino acid need of the birds. The methionine level in all the diets probably improved the biological value of the feeds (Abasiekong and Tyokpat, 2000)

The feed conversion ratio showed high significant ($P<0.05$) difference among the treatment group in the control (0%) and 10% levels of replacement with similar pattern to final body weight and daily weight gain. The result of the feed conversion ratio in this study is contrary to the report of Tewe (1983) who reported that banana peel meal beyond 7.5% indicated poor feed conversion efficiency. Similarly Dividich *et al*. (1976) reported 31.70% crude fibre content for banana peel, but if processed properly, they could be a high quality and cheap source of carbohydrate and mineral for livestock. The significantly ($P<0.05$) lower feed conversion ratio indicated in 15% replacement of maize with banana peel meal may be as a result of high crude fibre in the banana peel meal and anti-nutritional factors such as hydrocyanide, phytate and saponin which were not affected by processing as reported by Dividich *et al.* (1976) and tannin by Ahwange (2008).

The mortality record was high at 15% replacement of maize with banana peel meal compared to the (control) group. Post – mortem result showed no evidence of any disease. The chickens' death may be attributed to anti-nutritional factors in banana peel as reported by Ahwange (2008), and heat prostration as a result of high ambient temperature (40 – 43$^{o}$C) during the study period. Similarly, Compose et al. (1981) observed that mortality rate was high when temperature was changed from 18.3 to 37.8$^{o}$C.

The feed cost ₦/kg and feed cost/kg gain was not statistically analyzed but it was observed that there was reduction in the feed cost ₦/kg and feed cost/kg gain, as the level of banana peel meal increased in the diets. This observation agreed with the report of Apata and Ojo (2000) that the high cost of feed was largely due to the exorbitant price and scarcity of conventional ingredient and that this could be lowered by using non-conventional feed ingredients.

The haematological parameters (Table 4) showed significant ($P<0.05$) difference in all the blood components at different inclusion levels of the banana peel meals except in monocytes, eosinophils and basophils. The PCV values are similar to the range of 30 – 33% reported by Swenson (1970) which indicated that the birds were neither dehydrated nor anaemic. The RBC, WBC, and Hb values obtained in this study were within the range of 2.5 – 3.2 x $10^6$ /mm$^3$, 9 – 31 x $10^3$ /mm$^3$ and 6.5 – 9 g/dl reported by Swenson (1970) and CCAC (1980). The MCV, MCH and MCHC range of values observed were within the values reported by Swenson (1970). The herophils and lymphocytes values were within the normal range of 25 – 30% and 55 – 60% reported by Swenson (1977). It has been observed by Esonu et al. (2001) that hematological constituents reflect the responsiveness of the animal to its internal and external environments which include feed and feeding.

The monocytes, eosinophills and basophills showed no significant ($P>0.05$) difference among the treatment group, but the range of values observed were similar to the range of values reported by Swenson (1977). This is an indication of adequate production of anti-bodies and no bacterial infection or allergic condition among the bird as observed in this study. The observation concurs with the report of Dukes (1975) and CCAC (1980).

**Table 4 -** Haematological Parameters of Broiler Chicken fed Graded Levels of Banana peel Meal (BPM)

| | Inclusion levels BPM | | | | |
|---|---|---|---|---|---|
| **Parameters** | **$T_1$ (control)** | **$T_2$ (5%)** | **$T_3$ (10%)** | **$T_4$ (15%)** | **SEM** |
| Packed cell volume (%) | 30.69$^{a}$ | 27.67$^{ab}$ | 24.67$^{b}$ | 30.00$^{a}$ | 1.472* |
| Heamoglobin (g/l) | 8.10$^{a}$ | 7.10$^{a}$ | 5.70$^{b}$ | 7.60$^{a}$ | 0.449* |
| Red blood cells ($10^6$/mm$^3$) | 3.17$^{a}$ | 2.75$^{b}$ | 2.13 | 3.06$^{ab}$ | 0.172* |
| White blood cells ($10^3$/mm$^3$) | 18.50$^{a}$ | 17.33$^{ab}$ | 16.83$^{b}$ | 18.00$^{ab}$ | 0.527* |
| Mean corpuscular volume (fl) | 96.67$^{b}$ | 100.83$^{b}$ | 115.27$^{a}$ | 97.90$^{b}$ | 1.820* |
| Mean corpuscular haemoglobin (pg) | 25.70$^{ab}$ | 25.80$^{ab}$ | 26.80$^{a}$ | 24.77$^{a}$ | 0.804* |
| Mean haemoglobin conc. (g/dl) | 26.37$^{a}$ | 25.60$^{a}$ | 23.27$^{b}$ | 25.30$^{a}$ | 0.744* |
| Heterophils (%) | 28.33$^{c}$ | 25.67$^{d}$ | 38.33$^{a}$ | 34.00$^{b}$ | 0.913* |
| Lymphocytes (%) | 63.00$^{a}$ | 66.67$^{a}$ | 544.67$^{b}$ | 58.00$^{b}$ | 1.616* |
| Monocytes (%) | 4.33 | 3.33 | 3.00 | 4.67 | 1.155$^{NS}$ |
| Eosinophils (%) | 4.33 | 4.33 | 3.67 | 3.33 | 0.745$^{NS}$ |
| Basophils (%) | 0.00 | 0.00 | 0.33 | 0.00 | 0.236$^{NS}$ |

$^{a, b, c}$ Means within the same row bearing different superscripts differ significantly ($P<0.05$); * = significant ($P<0.05$); NA = Not Statistically Analyzed; SEM = standard error of mean



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The serum biochemical indices observed in (Table 5) were all within normal ranges reported by Dukes (1975) and Swenson (1970) for broiler chickens. The biochemical indices were not adversely affected by including 15% banana peel meals in broiler diets.

**Table 5** - Serum Biochemical Indices of Broiler Chickens fed Graded Levels of Banana Peel Meal (BPM)

| | Inclusion levels BPM | | | | |
|---|---|---|---|---|---|
| **Parameters** | **$T_1$ (control)** | **$T_2$ (5%)** | **$T_3$ (10%)** | **$T_4$ (15%)** | **SEM** |
| Total protein (g/l) | $12.00^{a}$ | $8.00^{b}$ | $9.50^{ab}$ | $8.67^{ab}$ | 1.548* |
| Albumin (g/l) | $10.33^{a}$ | $7.00^{b}$ | $8.50^{b}$ | $7.67^{b}$ | 1.569* |
| Glucose (mmol/l) | $7.70^{c}$ | $9.00^{a}$ | $9.15^{a}$ | $8.67^{b}$ | 0.149* |
| Total cholesterol (mmol/l) | 1.37 | 0.90 | 1.00 | 1.13 | $0.217^{NS}$ |
| Urea (mmol/l) | 2.67 | 2.67 | 2.95 | 2.70 | $0.144^{NS}$ |
| Total bilirubin (µmol/l) | $9.33^{a}$ | $8.67^{ab}$ | $8.00^{ab}$ | $6.67^{b}$ | 3.324* |
| Potassium (mmol/l) | $2.83^{b}$ | $3.00^{b}$ | $4.25^{a}$ | $3.00^{b}$ | 0.334* |
| Sodium (mmol/l) | $108.67^{ab}$ | $110.00^{ab}$ | $123.00^{a}$ | $104.00^{b}$ | 6.449* |
| Chloride (mmol/l) | $91.33^{d}$ | $95.33^{c}$ | $103.00^{a}$ | $99.33^{b}$ | 5.033* |

$^{a, b, c}$ Means within the same row bearing different superscripts differ significantly (P<0.05); * = significant (P<0.05); NA = Not Statistically Analyzed; SEM = standard error of mean

## CONCLUSION

It was concluded that maize can be replaced by up to 10% banana peel meal without any adverse effects on the growth and health of broiler chickens.

## REFERENCES


Abasiekong SF and Tyokpat Y (2000). Effect of supplementary methionine and lysine on broiler chickens fed refermented brewers spent sorghum (*Sorghum Vulgare L.*) as chief dietary protein source. In Ukachuku, S. N., Ibeauchi, J. A., Ibe, S. N., Ezekwe, A. G. and Abasiekong, S. F. (eds), *Animal Production in the New Millenium: Challenges and options. Proceeding of the 25th Annual Conference of Nigeria Society of Animal Production*, Micheal Okpara University of Agriculture, Umudike, Nigeria. 19 – 23 March, 2000. *Pp 184 – 187.*

Adesimi AA and Awoyomi B (1989). Potentials of poultry insurance as a risk management technique for Nigerian Farmers. *IFE Journal of Agriculture* 11: 76 – 84.

Aihonsu JOY and Sunmola MA (1999). Optimal laying period for profitability and sustainable egg production. *IFE Journal of Agriculture*. 20: 67 – 80.

Alimi T (2001). Economic Rational of Integration in Poultry Production System. *Lesotho Society of Science,* 7: 138 – 156.

Ahwange BA (2008). Chemical Composition of *Musa Sapientum* (Banana) peels. *Journal of Food Technology*. 6(6): 263 – 266.

AOAC (1980). *Official method of analysis*. 13th Edition. Herwitz, W. Washinton D. C. Association of Official Analytical Chemists. 1018p.

Apata DF and Ojo U (2000). Efficiency of the *Trichodermia viride* enzymes complex in broiler starter fed cowpea testa based diet. In: Ukachukwu, S. N., Ibeauchi, J. A., Ibe, S. N., Ezekwe, A. G. and Abasiekong, S. F. (eds), *Animal Production in the New Millenium: Challenges and options. Proceeding of the 25th Annual NSAP conference*. Pp 132 – 134.

Bressani R, Elias LG and Braham JE (1982). Reduction of digestibility of legume proteins by tannins. *Journal of Plant Foods*. 4:43 – 55.

Bush BM (1975). *Veterinary laboratory manual*. William Heineman Medical Book Ltd. London, U. K. 447p.

Calvent CC (1978). Decrease absorption of Ca, Mg, Zn, and Pb by Human due as wheat bran. *Journal of Nutrition* 3(2):106 – 493.

Compose AC, Wilcox FH and Shaffner CS (1981). The influence of fast and low raises ambient temperature. *Poultry Science Journal*. 39 : 119 – 129.

CCAC (1980). *Guide to the care and use of experimental animal vol. 1*. Ottawa, Ontario, Canada, Canadian Council on Animals care. Pp. 85 – 90.

Dividich JL, Geoffrey F, Canope L and Chnost M (1976). Using waste banana as animal feed. *World Animal Review*. 67:123 – 132.

Dukes HH (1975). *Physiology of domestic animal*, 18th Edn. 2nd Printing. (Melvin J Swenson Edition) Cornell University press limited. U.K.

El-Deek AA, Asar MA, Hamdey SM and Abdalla AA (2009). Utilization of guava by-products in broiler finisher diets. *Egypt. Poultry Science Journal,* 29: 53-79





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Scienceline/Journal homepages: http://www.science-line.com/index/; http://www.ojafr.ir

Esonu BO, Emenalom OO, Udebibie ABI, Herbert U, Ekpo CF, Okoli IC and Iheukwumere FC (2001). Performance and blood chemistry of weaner pig fed raw mucuna (velvet bean) meal. *Tropical Journal of Animal Production and Investigation* 4:49-55.

FAO (2010). Paper 1: Livestock Research in Nigeria . *www.fao.org*

Geidam YA, Bukar MM and Ambaly AO (2006). Chick quality control: A key to sustainable poultry production in Nigeria. *Nigerian Veterinary Journal* 27:1-6.

Gohl B (1982). *Musa Paraclisiaca L*. Banana plantain or cooking banana. *Tropical feeds*. *Feed information summaries and nutritive values*. FAO, Rome.

Hunter JE (1981). Iron availability and absorption in rats fed sodium phytate. *Journal of Nutrition.* 3:841-850.

Jansman AJM (1993). Tannins in feed stuff for simple-stomached animals. *Nutritional Research Review*. 6:209 – 236.

Kekeocha CC (1984). *Pfizer poultry production handouts*. Pfizer Corporation, Nairobi, Kenya. 165 – 166.

Kumar R (1991). Anti-nutritional factors, the potential risk of toxicity and method to alleviate them. *Proceeding of FAO expert consultation held at the Malaysian Agricultural Research development Institution*. Kuala Lumpur. Malaysia. Pp 14-18.

NIS (1989). *Standard on specification for poultry diets.* Standard organization of Nigeria. Nigeria Industrial Standard. Federal Secretariat, Ikoyi, Lagos. Pp 10-12.

Olomu JM (1995). *Monogastric Animal Nutrition* Principles and Practice. A Jackem Publication, Benin City, Nigeria. Pp 19-118.

Payne WHJ (1990). *An introduction to animal husbandry in the tropics*. Longman Group limited U. K. pp 87-137.

Samy JC (1999). Proximate Analysis. In Christie, B. R. (ed). *The Handbook of plant science in Agriculture*. CRC Press, Inc, Boca Raton, Florida.

Schalm OW, Jain NC and Caroll EJ (1985). *Veterinary Haematology* (3rd Eds). Philadelphia, U.S.A. pp 807.

Statistix (2003). Statistix 8: user's manual Analytical software.

Swenson MJ, (1970). Physiological properties, cellular and chemical constituents of blood. In: *Duke's physiology of Domestic Animals*. 8th Edn. (M. J. Swenson Edition). Con-stock publishing associates. Cornell University press. Thaca and London.

Swenson MJ (1977). *Duke's Physiology of Domestic Animals*. 9th edition. Constock publishing associates a division of Cornell University press. Thaca and London. Pp 14-34.

Tartrakoon T, Chalearmsan N, Vearasil PT and Menlen UT (1999). The nutritive value of banana peel (*Musa sapietum*) in growing pigs. Deutcher Tropentag, Berlin.

Tewe OO (1983). Replacing maize with plantain peels in the diet of broiler. *Nutrition Reports International* 28(1):23-29.

Williamson G and Payne WJA. (1978). *An introduction to animal husbandry in the tropics.* 2nd ed. Longman Group Ltd. U. K., 87 – 137.

World Health Organization (WHO). (1980). *Manual of Basic techniques for health laboratory*. WHO, Geneva, Switzerland. Pp 175-434.



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