International Journal of Research in Agriculture and Forestry
Volume 6, Issue 6, 2019, PP 32-36
ISSN 2394-5907 (Print) & ISSN 2394-5915 (Online)

Effects of Processed Irish Potato (Solanumtuberosum .L) Meal as a Source of Energy on the Internal Organ Weights of Finisher Broilers

Iwuanyanwu, U.P[1], Patricio De los Ríos[2*] and E.O. Ahaotu[3]

[1]Department of Crop Production Technology, Imo State Polytechnic, Umuagwo, Owerri, Nigeria
[2]Universidad Católica de Temuco, Facultad de Recursos Naturales, Departamento de Ciencias Biológicas y Químicas, Casilla 15-D, Temuco, Chile
[3]Department of Animal Production and Health Technology, Imo State Polytechnic, Umuagwo, P.M.B 1472 Owerri, Nigeria

***Corresponding Author:** Patricio De los Ríos, Universidad Católica de Temuco, Facultad de Recursos Naturales, Departamento de Ciencias Biológicas y Químicas, Casilla 15-D, Temuco, Chile, Email: emmaocy@yahoo.com*

ABSTRACT

A total of 120 Anak 2000 broiler finisher birds were used in a 56 days feeding trial in a completely randomized design in a deep litter house to assess the effect of processed Irish potato meal on the internal organ weights of broiler finisher birds. Five replacement levels of the formulated feed: 0%, 12.5%, 25%, 37.5% and 50% Processed Irish Potato Meal (PIPM)were used for treatments, 1, 2, 3, 4 and 5 respectively with 0% PIPM as control. Treatments were replicated thrice. The broiler birds were fed the experimental diets four weeks after a one-week stabilization period. Feed and water were given ad libitum, while medication and vaccination were appropriately applied. The deep litter house was provided with standard facilities. Measurements of internal organ weights of birds were taken with a sensitive weighing balance (Mettler Toledo B 90001 – S brand). Considering the results of the weights of intestine, heart, gizzard, liver and crop, it appeared that the 37.5% level of PIPM is the optimal replacement level for maize grain.

Keywords: *Poultry feed, Processed Irish Potato Meal, Maize Grain, Organ Weight, Broiler Finisher.*

INTRODUCTION

The white or Irish potato (Solanumtuberosum), also called the "earth apple", is grown in nearly all parts of the tropical and subtropical world and in warmer areas of the temperate regions. It has remained for centuries an important staple for many tropical communities (Ogunjobi et al., 2005). Solanumtuberosum is the fourth largest yielding crop plant in the world, producing nearly 300 million metric tons of tubers per annum (Jones et al., 1996). The potato peels are rich in phytonutrients (Brown, 2007), carbohydrates, high in starch (8-28%) but with only about 1-4% protein. CIP (1985) reported that potato starch is a large-grained starch containing 25% amylose and 73% amylopectin and high phosphate content. A large amount of potato peels are discarded during processing for chips by many industries. These peels constitute a potential source of livestock feed ingredient. The major limitation in the useof potato peels for livestock feeding is its low protein content. Protein enrichment of potato peels through inexpensive means is therefore desirable.Feed constitutes the greatest input in animal production not only for milk, meat or eggs but for growth and body maintenance (Ahaotu, 2018).Thus, the cheaper the feed source without sacrificing its quality, the better the return to the farmer (Ahaotu 2007 and Madubuike et al., 2003).

Onu et al. (2008) stated that feeds and feeding have been shown to account for 65% to 85% of the total cost of commercial poultry production. The livestock producer appears most hit in terms of scarcity and high cost of livestock feed (Ahaotu et al. 2018b). Ahaotu et al. (2017) reported that Nigeria, like most other developing countries suffer greatly from shortage and high cost of livestock feeds, especially those supplying protein. This situation is as a result of the competition between man and livestock for the available conventional protein feeds such as meat meal, fish meal, maize grain, spent grain, sorghum and wheat offal (Ahaotu, 2018b, Ihenetu, 2010, Abia and Akujobi, 2008).

Consequently, some unconventional materials have been used to feed poultry with good results. For instance Ipomoea asarifolia leaf (Ekenyem, 2004); Moringa oleifera leaf (Ahaotu et al., 2013); Rubber seed cake (Ahaotu, 1999); Rice mill waste (Amaefula et al. 2003); Raw Sword bean (Ahaotu et al., 2015a), Citrus pulp (Faniyi, 2002) and Wild cocoyam meal (Ahaotu, 2018 and Onu et al. 2001), red sandalwood (Pterocarpus santolinoides) (Ayo –Enwerem et al., 2017), Amaranthus spinosus (green leaf) (Ahaotu et al., 2015b) among others. Processed Irish potato meal could be a potential source of feed for poultry (Abia and Akujobi, 2008).

It has 3180 Kcal/ Kg metabolisable energy and a good mineral profile although it has low lysine and methionine contents (Ahaotu et al., 2018a).It is however capable of reducing the cost of poultry production. This experiment was therefore conducted to evaluate the effects of PIPM as a source of energy on the internal organ weights of finisher broilers with a view to achieving high production at reduced cost and by making animal protein available and affordable to consumers.

MATERIALS AND METHODS

The experiment was carried out in teaching and Research Farm of Imo State Polytechnic, Umuagwo, Imo State, Nigeria. The study area is situated at Longitude 70010611E.

Procurement of Experimental Birds and Brooding

A total of 130 – four weeks– old Anak broiler birds procured from Anthony and Patience Farms at Atta in Ikeduru Local Government Area, Imo State, Nigeria were used for this experiment. They were fed commercial finisher feed "Top brand" for stabilization. After one week, 120 broiler birds were selected on the basis of apparent viability and good conformation and assigned to five dietary treatments of fifty birds per treatment and replicated thrice.

Table1. *Proximate Analysis of Processed (Unfermented) Irish Potato meal*

Nutrients	**Percentages (%)**
Ash	1.40
Ether Extract	0.04
Crude Fibre	6.90
Carbohydrate	21.41
Crude protein	5.52
Moisture	75.31
Energy	3220
Elemental Analysis %	
Calcium	0.34
Phosphorus	0.49
Iron	0.006
Potassium	0.407
Sodium	0.03
Silica Free Ash	3.15
Essential Amino Acid %	
Lysine	0.07
Methionine	0.03
Vitamin Analysis%	
Thiamine	0.009
Riboflavin	0.004
Niacin	0.015
Ascorbic Acid	0.016

Processing of Irish Potato Tubers

Irish potato tubers used for this experiment were bought from Eke – Ukwu Market in Owerri, Imo State, Nigeria. Irish potato tubers were sliced and sun dried to a moisture content of 10% and milled to produce processed sweet potato meal. Processed Irish potato meal was subjected to proximate analysis (Table 1) at the Animal Nutrition Laboratory, Imo State Polytechnic Umuagwo, and Nigeria using standard methods (AOAC, 2001) which was the basis for experimental feed formulation. The mineral analysis was carried out by the method of Grueling (2000), while gross energy was

determined with a Gallenkamp Oxygen Adiabatic Bomb Calorimeter. Formulation of the experimental diets: Five experimental broiler finisher diets containing (0%, 12.5%, 25%, 37.5% and 50% PIPM for treatments 1, 2, 3, 4 and 5 respectively were formulated in which 0% PIPM, (T1) was the control (Table 2). The ingredients were thoroughly mixed to ensure homogeneity and sent to hammer mill for grinding. The feed was fortified with vitamin premix and synthetic amino acids in line with National Research Council recommendation (NRC, 2004).

Feeding and Brooding

The experimental birds were divided according to five dietary treatments in a deep litter house made up of two hundred and fifty birds and replicated three times in a completely randomized design. Adequate number of feeders and drinkers were provided for the birds to achieve and ad libitum access to feed and water. Regular observation and manipulation of the brooder facilities regulated the room temperature.

Data Collection and Analysis

Initial internal organ weights of the birds were measured at the inception of the experiment (5 weeks old), and subsequently on weekly basis to evaluate organ rate. The weight at the end of the experiment (9-weeks-old) was measured. Data were collected from each treatment group and subjected to one way analysis of variance (Steel and Torrie 1980), while differences in means were separated by the Duncan multiple Range Test as outline by Gordon and Gordon (2004).

Table2. *Percentage Composition of Experimental Finisher Rations*

Ingredients	**Treatments and % Inclusion**				
	A	B	C	D	E
Maize	50	37.5	25	12.5	0
PIPM	0.00	12.5	25	37.5	50
Fish Meal	2	2	2	2	2
Soya Full Fat	14	14	14	14	14
Wheat Offal	10	10	10	10	10
Palm Kernel Cake	5	5	5	5	5
Spent Grain	6	6	6	6	6
Bone Meal	9.15	9.15	9.15	9.15	9.15
DL- Methionine	0.2	0.2	0.2	0.2	0.2
Common Salt	0.25	0.3	0.3	0.3	0.3
Premix (Broiler)	0.4	0.4	0.4	0.4	0.4
Total	100.00	100.00	100.00	100.00	100.00
Calculated Nutrient Composition %					
Crude Protein %	17.90	17.62	17.04	16.52	14.50
Ether Extract	3.50	3.30	2.87	2.43	1.92
CrudeFibre	4.66	4.45	4.24	4.03	3.83
Calcium	3.77	3.84	3.95	3.99	4.06
Phosphorus	1.85	1.94	2.20	2.45	2.62
Methionine + Cystine	0.33	0.31	0.30	0.27	0.26
ME(Kcal/kg)	2652.55	2620.80	2589.05	2553.30	2525.50

2.5kg of premix/tone contain; vitamin A 10,000 I.U; Vitamin D_3 20,000 I.U; Vitamin E 12,000 I.U; Vitamin K 2.5g; Thiamine 1.5g; Riboflavin 5g; Pyriboflavin (B6) 1.5g; Vitamin B_{12} 10mg; Biotin 2mg, Niacin 15g, Panthotenic acid 5g, Zinc 50g, Iron 15g, Copper 5g, Iodine 1.4g, Selenium 100mg, Cobalt 300g, BHT 125G.

Result and Discussion

The internal organ characteristics of the broiler finisher (Table 3) showed that significant difference ($P<0.05$) existed between birds in various treatments the internal organs. Birds on the control diet (T_1) were significantly ($P<0.05$) heavier than birds on T_2 and T_3 which were also significantly ($P<0.05$) heavier than birds on T_4 and T_5 only in weights of intestine and liver. Birds on the different treatment diets significantly ($P<0.05$) varied in their feed intake. Additional values of PIPM resulted in additional feed intake. Tewe (1996), Horton (1998), Akintomide and Antai (2012) reported anti-nutritional effects of PIPM arising from glycoalkaloids, which reduced availability, absorption and utilization of nutrients for productive purposes.

Consequently, birds fed 50% PIPM (T_5) consumed more feed than those on other treatments in an attempt to satisfy their body

requirements (Oboh, 1996). The trend was that increasing level of PIPM reduced nutrient availability and thus reduced weights of organs, which was traceable to higher dietary fiber of feeds with increasing PIPM. This result agrees with (Ofukwu and Okwor, 2001) who observed that higher dietary fiber depressed organ weights in poultry birds.

Table3. *Organ Weights of Anak Broiler Finisher Birds*

Parameters	T1	T2	T3	T4	T5	SEM
Heart Weight (g)	6.1^{c}	7.35^{a}	8.33^{b}	9.11^{b}	11.1^{e}	0.43*
Gizzard Weight (g)	40.1^{a}	45.2^{b}	45.1^{b}	60.3^{c}	65.4^{d}	1.01*
Liver Weight (g)	35.4^{a}	31.3^{b}	30.1^{b}	28.9^{c}	20.3^{d}	0.39*
Crop Weight (g)	8.5^{a}	9.3^{ab}	9.3^{ab}	9.9^{b}	12.8^{c}	1.65*
Weight of Intestine (g)	180^{a}	165^{b}	150^{c}	135^{d}	90^{e}	2.96*

A, b, c, d, e means within the same row with different superscripts are significantly different (P<0.05).

CONCLUSION

The use of PIPM to replace Maize Grain was achieved without any deleterious effect on the broiler finisher birds. Considering the results on weights of crop, heart and gizzard, it appears that the optimum replacement value of PIPM for Maize Grain is 37.5% level. The cost of broiler finisher production is observed to have significantly reduced following the inclusion and increasing levels of PIPM in the diet thereby reducing the cost of poultry production and making poultry meat affordable to consumers.

It is therefore recommended that 37.5% level of processed Irish potato meal for maize grain is adopted considering the cost effectiveness and final weights potentials of broiler finisher. However, higher levels such as 50% could be adopted if fortified with yeast or exogenous enzyme to improve fiber digestion.

REFERENCES

[1] Abia, S.A and Akujobi, R (2008). Replacement value of processed sweet potato meal for maize grain on the performance of broiler finisher Department of Animal Production and Health Technology, Imo State Polytechnic, Nigeria. 88 Pp.

[2] Ahaotu, E.O, Amadinze, C and Ahaotu, Esther.O (2018a).Carcass and Organ Weight Indices of Feeding Different Levels of Pawpaw Leaf Meal (Carica papaya) on Finisher Broiler Birds. Journal of Meat Science and Technology. 06 (1): 01-04.

[3] Ahaotu, E.O, Onyegbula, T and Ahaotu, Esther O (2018b). Haematological Characteristics and Organoleptic Test of Feeding Different Levels of Pawpaw (Carica papaya) Leaf Meal on Finisher Broiler Birds. International Journal of Animal and Veterinary Sciences. 05: 10-14.

[4] Ahaotu, E.O, B.U. Ekenyem and E. Aggrey (2017). Sustainability of sweet orange (Citrus sinensis) peel meal on the performance of finisher Broilers. J. Agric. Sci. Pract. 2: 27-32.

[5] Ahaotu, E.O, S.A. Adeyeye and N. Nnorom (2015a). Effects of Amaranthus spinosus (green leaf) on the performance of broiler chicks. Scientific Journal of Veterinary Advances, 4(3): 21-24.

[6] Ahaotu, E.O, S.A. Adeyeye and V.N. Okonkwo (2015b). Replacement value of sweet orange (Citrus sinensis) peels for wheat offals in the performance of broiler starter diets. Scientific Journal of Animal Science. 4(3): 42-50.

[7] Ahaotu, E.O, C.F Ezeafulukwe C.M Ayo-Enwerem and B.U. Ekenyem (2013).Effects of Enzyme Fortified Raw Moringa Seed (Moringa oleifera) Waste Diets on Nutrient Utilization and Haematological Parameters of Broilers. Inter J Appl Sci Engr, 1(1): 25-30.

[8] Ahaotu, E.O (2018a). Performance and Carcass Characteristics of Starter Broiler Birds Fed Processed Cocoyam (Xanthosoma sagittifulium) Corm Meal. Journal of Poultry Science and Technology. 6 (1): 05-09.

[9] Ahaotu, E.O (2008b). Toad Meat Meal as a Viable Feed Ingredient in Starter Broiler Rations. Veterinary Research International 6 (1):32-35.

[10] Ahaotu, E.O (2007). Replacement Value of Feather Meal for Fishmeal on the Performance of Broiler and Pullet Chicks. Ph.D Dissertation; Imo State University, Owerri, Nigeria. pp 23-29.

[11] Ahaotu, E.O (1999). Replacement Value of Rubber Seed Cake for Groundnut Cake on the Performance of Broiler Chicks form 0-9 Weeks of age. M.Sc Thesis, Imo State University, Owerri, Nigeria. pp 34 – 39.

[12] Akintomide, M. J. and Antai, S. P. (2012). Protein Enrichment of Irish potato (Solaniumtuberosium) peels through Solid Substrate Fermentation by Saccharomyces cerevisiae and Aspergillus Niger. Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT). Volume 1, Issue 5 (Nov. - Dec. 2012), PP 15-19

[13] Amaefula, K.U; Nwogu, R.K and Ohazuluike, N. (2003). Influence of Treatment of Rice Mill Waste on its Nutritional Value for Broiler. Journal of Substitution Agric and Environment 6(1): 196-203

[14] AOAC (Association of Official Analytical Chemists) (2001).Official Methods of Analysis. Revised Edition, Washington D.C, 1004Pp.

[15] Ayo-Enwerem, M.C; Ahaotu, E.O; Nwogu, C. M. and Opara, J. (2017). Growth performance of starter broilers fed diets containing red sandalwood (Pterocarpus santolinoides) leaf meal. Direct Research Journal of Veterinary Medicine and Animal Science. 2 (4): 106-109.

[16] Brown, C. (2007). Breeding for Potato Nutrition Enhancement, American Journal of Potato Research, and 81(1): 335-339.

[17] CIP (1985).International Potato Center. Annual Report, Lima, Peru, 1985, 23.

[18] Ekenyem, B.U (2004). Non-ruminant Livestock Responses to Varying Dietary Levels of Ipomea Asarifolia Leaf Meal. Ph.D Dissertation, Imo State University, Owerri, Nigeria.

[19] Faniyi, G.F (2002). Replacement of Wheat Offal with Untreated Citrus Pulp in Broiler Chick Diets. Tropical Animal Production Investment, 5:96-100.

[20] Gordon, S.P and Gordon, F.S (2004). Contemporary Statistics. A Computer Approach. Mc Graw – Hill Publishers, U.S.A 695pp.

[21] Grueling, H.T (2000). The Chemical Analysis of Tissues. Revised Edition. Cornell University Press, U.S.A 498pp.

[22] Horton, D (1998). Potatoes – Production, Marketing and Programme for developing Countries. West view Press, U.S.A 244Pp.

[23] Ihenetu, N.N (2010). Effect of processed sweet potato meal on the performance of broiler starter. Department of Animal Production and Health Technology, Imo State Polytechnic, Umuagwo, Nigeria. 39 Pp.

[24] Jones, A., Dukes, P. D and Schalk, J.M (1986). Breeding Vegetable Crops, in M. J. Bassett (Ed.) Sweet Potato Breeding.1- 35pp.

[25] Madubuike, F.N; Agiang, E.A; Ekenyem, B.U and Ahaotu, E.O (2003). Replacement Value of Rubber Seedcake for Groundnut Cake on the Performance of Starter Broiler. J. Agric and Food Science, 1:21-27.

[26] NRC (National Research Council) (2004). Nutrient Requirement of Poultry. Revised Edition. National Academy Press, Washington D.C.

[27] Oboh, S.O (1986). Biochemical Composition and utilization of sweet potato in broiler ration. Ph.D Dissertation, University of Ibadan, Nigeria.

[28] Ofukwu, R.A and Okwor, A.I (2001). The effect of Zenobiotic Stilboestrolmonobenzoate on the growth performance and carcass quality of broiler chickens. Proc. Of Ann. Conf. Anim. Sci, Assoc of Nig. 74 – 76Pp.

[29] Ogunjobi, A.A, Adebayo-Tayo, B.C and Ogunshe, A. A (2005). Microbiological, proximate analysis and sensory evaluation of processed Irish potato fermented in brine solution, African Journal of Biotechnology, 4(12):1409-1412.

[30] Onu, P.N; Otuma, M.O; Nwakpu, P.E and Ahaotu, E.O (2008). Enzyme and Probiotic Supplementation of Maize Processing Waste Based Diets for Weaned Rabbits. Agric Soc. of Nig. 42:644-648.

[31] Onu, P.N; Madubuike, F.N; B.O Esonu and D.O Onu (2001). The Effect of Wild Cocoyam (Caladium bicolor) on the Performance and Internal Organ Weight of Finisher Broilers. Journal of Science; Agric, Food Technology Environment 1:9-24.

[32] Steel, R.C. and Torrie, J.H (1980).Principles and Procedures of Statistics–A Biometrical Approach .3rd Edition. McGraw – Hill Book Coy N.Y; U.S.A.

[33] Tewe, O.O (1996). Biochemistry and utilization of sweet potato for Animal feed. Implications for food security in Africa. Tropical Root Crops. 3 rd Ann. Symp. Area, Ghana.

Citation: *Iwuanyanwu, U.P, Patricio De los Ríos and E.O. Ahaotu, "Effects of Processed Irish Potato (Solanumtuberosum .L) Meal as a Source of Energy on the Internal Organ Weights of Finisher Broilers", International Journal of Research in Agriculture and Forestry, 6(6), 2019, pp 32-36.*