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Research Article

Apparent Nutrient Digestibility and Serum Biochemical Indices of Grower Pigs Fed Graded Levels of Rice Offal Supplemented with Enzyme

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Abstract

A 56-days feeding trial was conducted to investigate the nutrient digestibility and serum biochemical indices of grower pigs fed graded levels of rice offal supplemented with enzyme. Thirty (30) mixed local breeds of weaner pigs with an average of 7kg were sourced within Wukari. The pigs were divided into five dietary treatment groups of 6, replicated thrice with 2 animals per replicate in a completely randomized design. Five dietary treatments were compounded using Maize Offal (MO), Rice Offal (RO) and Brewers Dried Grain (BDG). Diet [1] serves as control with 100% maize offal, while diet 2 is a mixture of RO and BDG, diet 4 is BDG and finally diet 5 is RO. Diets 2-5 were supplemented with 0.2kg/100kg Quadraxyme. All parameters measured in nutrient digestibility were significantly different ($P<0.05$) while there was no significant difference in all parameters measured in serum biochemical. Also, the value obtained from this study was all within the normal ranges for pigs and can therefore be used by farmers for better results.

Introduction

The acute deficit of animal protein intake in Nigeria is a serious concern and there is urgent need to work assiduously to reduce the deficit. The average Nigeria does not have access to recommended animal protein requirements compared to developed countries. In their report FAO [1] recommended 56g of animal protein intake for growing and developing individuals per day, whereas Christopher D et al. [2] reported that Nigerians consume only 15g of animal protein per day, this is grossly inadequate and far less than the recommended intake. There has been a call for substantial increase in the intake of protein of animal origin in developing countries like Nigeria. According to Unigwe CR [3], Energy malnutrition (PEM) continues to be a serious public health issue in many developing nations, and there is need to boost daily protein consumption, particularly animal protein. The major limitation to achieving this goal is the high cost of feed that has hampered mass production of livestock to boost protein intake. The bulk expenses on livestock production go to feed alone. The scarcity of conventional foods has hindered the growth of the livestock industry. In an attempt to boost livestock production, animal nutritionists have tried to harness and utilize agro industrial by-products that are not directly utilized by man, in an attempt to reduce cost of production and reduce competition between humans and animals for conventional feed. A large number of alternative feedstuffs that have potential as livestock feed ingredients abound in Nigeria [4]. It has been stated Ojewola GS [5] that research into the use of cheaper industrial by-products and waste has been intensified in the last few years to determine the efficiency of their utilization in terms of growth and production. The search for cheaper sources of feed ingredients for livestock feeding in Nigeria and many developing countries will continue, as

long as the protein requirement in human diet has not been met [4]. Therefore, there should be an emphasis on developing diets that are less expensive while yet providing the necessary nutrients without affecting the body's physiological health. One alternative novel feed ingredient that is receiving attention is rice offal. Rice offal is a by-product of the rice milling industry and it is almost virtually free and readily available all year round. According to Tiough SM et al. [6], Rice offal as an agro-industrial by-product is widely available in tropical countries and is used in an attempt to meet the feeding requirements of farm animals. A major limitation to the use of rice offal, however, is its high fibre content, low nitrogen and energy level. Hence the need for treatment with rumen filtrates or enzymes which can lead to improvement in nutritional quality and greater utilization. The importance of crude fibre in the diet of pigs cannot be over emphasized. Apart from the crude fibre importance of rice offal, it can also enhance the metabolizable energy of the diet because of the presence of broken particles of rice present. The proximate composition of rice offal was reported by Achonwa CC et al. & Maikano A et al. [7,8] to be 94.42% Dry Matter (DM), 5% Crude Protein (CP), 30.39% crude fibre (CF), 3.40% ether extract (EE), 16.67% ash and 46.10% nitrogen free extract (NFE). In this study, it's being used as a fibre source in piggery diet. If found successful, it will go a long way to reduce the cost of production as it's extremely cheaper than wheat offal or maize offal. The importance of dietary fibre in pig production cannot be over-emphasised. Dietary Fibre (DF) has important role in the complex interaction between the diet, the endogenous enzymes, the mucousa and the commensal microflora - all of which are considered important in the assimilation of nutrients and a key component for optimal intestinal health [9]. This study was therefore designed to evaluate apparent digestibility and serum bio-chemical indices of grower pigs that fed graded levels of rice offal, supplemented with enzyme.

Materials and Methods

The study area

The study was conducted at the swine unit of the Teaching and Research Farm of the Department of Animal Production and Health, Federal University, Wukari, Taraba State, Nigeria. Wukari is located at longitude 90'47'0" E and latitude 7051'0" N of the equator. The vegetation of the area is predominantly characteristic of savannah zone and with major climatic season of wet or rainy season which starts in November and ends in March or April [10].

Experimental design and animals management

Thirty (30) mixed local breeds of weaner pigs with an average weight of 7kg were sourced within Wukari metropolis. The pigs were divided into five dietary treatment groups of 6, replicated thrice with 2 animals per replicate in a completely randomized design. Each pen was provided with feeders, drinkers and wallows. Animals were dewormed before the commencement of the experiment with all management practices observed as they were fed ad libitum as the experiment lasted for 56 days.

Experimental diets

Five dietary treatments were compounded using Maize Offal (MO), Rice Offal (RO) and brewers dried grain (BDG). Diet 1 serves as control with 100% maize offal, while diet 2 is a mixture of MO and RO diet 3 is a mixture of RO and BDG, diet 4 is BDG and finally diet 5 is RO. Diet 2-5 were supplemented with 0.2kg/100kg Quadraxyme (Table 1).

Table 1: Ingredient composition of experimental diets.

Note: **Premix composition (per kg of diet):** Vitamin A; 12500 IU, Vitamin D3; 2500 IU, Vitamin E; 50.00mg, Vitamin K3; 250mg, Vitamin B1; 3.00mg, Vitamin B2; 6.0mg, Vitamin B6; 6.00mg, Niacin; 40mg, Calcium pantothenic; 10mg, Biotin; 0.08mg, Vitamin B12; 0.25mg, Folic acid; 1.00mg, Chlorine chloride; 300mg, Manganese; 100mg, Iron; 50mg, Zinc; 45mg, Copper; 2.00mg, Iodine; 1.55mg, Cobalt; 0.25mg, Selenium; 0.10mg, Antioxidant; 200mg.

Enzyme composition (per kg of diet): Amylase; 110,000 units, Cellulose; 500,000 units, Xylanase; 100,000 units, Lipase; 10,000 units, Pectinase; 30,000 units, Dunits; 4,000 units.

Ingredients (%)	Dietary Treatments				
	T_1	T_2	T_3	T4	T_5
Maize	48.00	47.80	47.80	47.80	47.80
Soya bean meal	25.00	25.00	25.00	25.00	25.00
Maize offal	25.00	12.50	0.00	0.00	0.00
Rice offal	0.00	12.50	12.50	0.00	25.00
Brewer dried grain (BDG)	0.00	0.00	12.50	25.00	0.00
Bone meal	1.00	1.00	1.00	1.00	1.00
Salt	0.30	0.30	0.30	0.30	0.30
Methionine	0.30	0.30	0.30	0.30	0.30
Lysine	0.20	0.20	0.20	0.20	0.20
Premix	0.20	0.20	0.20	0.20	0.20
Enzyme	0.00	0.20	0.20	0.20	0.20
Total	100	100	100	100	100

Data Collection

Digestibility trials

At the end of the feeding trial, fifteen (15) experimental pigs (3 per treatment) were randomly selected for digestibility trial. The pigs were separately kept for 5 days to acclimatize. The pigs were starved for 12 hours to clear the gut of previous meals, especially as markers will not be used. Feeds were collected on daily basis every morning (7:30am-8:30am), sun dried and weighed daily until there was constant weight. At the end of 7 days collection, feaces from each replicate were mixed, ground and representative samples taken to laboratory for composition determination. Dry Matter Digestibility (DMD) was calculated from the difference between DM intake and faecal DM output expressed as percentage of DM intake. Digestibility of other nutrients was calculated from the difference between nutrients intake on nutrient output in faeces. The percentage of nutrients Dry Matter (DM), Crude Protein (CP), Crude Fibre (CF), ash and Ether Extract (EE) were estimated as

described by McDonald P et al. [11].

Serum bio-chemical analysis

Serological samples were collected into anticoagulant free tubes. Serum obtained after blood sample was allowed to stand for 2 hours at room temperature and centrifuged 2000 revolution per minute (rpm) for 10 minutes to separate the cells from the Serum. The Serum biochemical parameters to be determined are total protein, albumin, globulin, glucose, nitrogen urea and cholesterol according to Biuret methods as described by Weishbaum TE [12].

Statistical analysis

Data collected were subjected to Analysis of Variance using JMP SAS [13] version. Significant level of difference among treatment means were separated using the same statistical tool.

Result and Discussion

The result of proximate composition of maize offal, rice offal and brewers dried grain is presented in Table 2. All parameters fell within normal range. The nutrient digestibility of pigs fed graded levels of rice offal supplemented with enzyme is shown in Table 3. The result shows significant (P<0.05) difference in all parameters measured in accordance with the report of Mafimidiwo AN et al. [14], however in contrast with that of Akande KE et al. [15]. Dry Matter (DM) digestibility was lowest in T2 (57.24%), and highest in T5 (63.89%). The values reported in this study are lower than 74.26 -78.96% reported by Mafimidiwo AN [14]. Crude Protein (CP) digestibility was highest in T5 (66.78%) and lowest in T2 (53.74%). Crude protein digestibility increased slightly from T3-T5. This is also in agreement with findings of [14], however, lower values of 21.13-50.55% were reported by Adebiyi OA et al. [16]. Ash digestibility was highest in T5 (77.71%), and least in T2 (37.88%). As can be observed, it increased slightly from T2 -T5. This is also in agreement with the findings of [14], and also within the range of 56.95 -60.59% reported by Akande KE et al. [15]. Ether extract digestibility did not follow a particular pattern as the highest value was in T5 (82.36%), while the least was in T4 (63.14%). These values fall with reported values by SAS [13], however, slightly higher than (52.13 -73.93%) reported by Wafar RJ et al. [17]. The nitrogen free extract digestibility did not follow a particular pattern. The highest value was in T5 (89.11%), followed by T2 (82.31%) and the least in T3 (76.62%). This agrees with findings of [17], but slightly higher than 51.43- 59.39% reported by Akande KE et al. [15]. Results of dietary treatments on serum biochemical indices are as presented in Table 4. All parameters measured were not significantly different. The cholesterol value was highest T5 (4.92mg/dl), followed by T3 (4.82mg/dl), and the least in T1 (4.15mg/dl).

Table 2: Proximate composition of Maize, Rice offals and Brewers dried grain.

Parameter (%)	Dietary Treatments				
	T_1 (MO)	T_2 (MX1)	T_3 (MX2)	T_4 (BDG)	T_5 (RO)
Moisture	5.70	5.85	5.90	5.70	4.86
Dry matter	94.30	95.01	96.24	94.30	95.14
Crude protein	18.10	18.21	18.18	18.15	18.00
Ash	5.32	5.23	5.66	5.18	5.14
Ether extract	3.10	3.18	3.15	3.01	3.03
Nitrogen free extract	48.57	48.48	48.12	47.78	47.66
Crude fibre	19.30	19.21	19.48	20.18	21.31

Note: MO - Maize Offal; MX1 - Combination of maize and rice offal; MX2 - Combination of rice offal and Brewers Dried Grain (BDG); BDG - Brewers Dried Grain; RO- Rice Offal.

Table 3: Nutrient digestibility of grower pigs fed maize, rice offals and Brewer dried grain.

Parameter (%)	Dietary treatments					SEM	P-VALUE
	T_1	T2	T_3	T_4	T_5		
Dried matter digestibility	57.27^{b}	57.24^{b}	61.89^{ab}	61.87^{ab}	63.89^{a}	1.89	0.11*
Crude protein	53.78^{b}	53.74^{b}	63.11^{ab}	63.15^{ab}	66.78^{a}	1.89	0.01*
Crude fibre digestibility	47.41^{b}	69.68^{a}	62.01^{ab}	62.08^{ab}	69.71^{a}	3.6	0.02*
ASH	37.98^{a}	37.88^{a}	61.02^{b}	64.51^{b}	77.71^{a}	2.91	0.02*
Ether extract	63.36^{b}	76.70^{ab}	76.60^{ab}	63.14^{b}	82.36^{a}	3.07	0.01*
Nitrogen free extract	81.70^{b}	82.31^{b}	76.62^{c}	81.50^{b}	89.11^{a}	0.94	0.01*

Note: abc treatment means on the same row bearing different superscripts are significantly different (P<0.05).

Table 4: Serum biochemical parameters of grower pigs fed rice offal supplemented with enzyme.

Parameter (%)	Dietary Treatments					SEM	P-VALUE
	T_1	T_2	T_3	T_4	T_5		
Cholesterol (mg/dl)	4.15	4.43	4.82	4.45	4.92	0.34	0.13^{ns}
Protein (g/dl)	47.77	52.17	51.10	50.61	49.22	0.21	0.12^{ns}
Glucose (mg/dl)	6.30	5.94	6.20	6.40	6.42	0.38	0.66^{ns}
Urea (mmol/l)	4.71	4.83	4.82	5.59	5.41	0.39	0.31^{ns}
Albumin (g/dl)	27.16	27.93	28.10	27.81	27.94	0.65	0.71^{ns}
Globulin (g/dl)	34.46	35.01	34.88	36.01	37.66	1.13	0.21^{ns}
Creatinine (g/dl)	95.24	94.88	95.01	95.68	96.21	3.02	0.08^{ns}

Note: Means with different superscripts on the same row are significantly different (P<0.05)

ns = not significant

SEM = standard error of means.

The range values of 4.15- 4.92mg/d; is in agreement with Aro SO et al. [18] but lower than 8.12-16.20mg/dl reported by Olaiya OD et al. [19] and slightly higher than 2.53-3.63mg/dl reported by Aya VE et al. [20]. Serum biochemical analysis is used to determine the level of heart attack, liver damage and to evaluate protein quality and amino acid utilization in animal [21]. Serum protein was not significantly affected by dietary treatment. Pigs on T2 (52.17g/dl) had the highest value, while pigs in control group had the lowest value (T1 = 47.77g/dl). The serum protein, albumin and globulin increased slightly from T1 -T5 levels of inclusion, suggesting that RO diets were not nutritionally inferior to MO in control diet even at 100% dietary levels of inclusion and the pigs were in good condition of health. This is in agreement with the findings of Aguihe PC et al. [22]. However, the serum glucose was lower than 16.20-22.10g/dl reported by Aguihe PC et al. [22], and it increased slightly with increased level of RO inclusion from T1-T5. So also, the serum cholesterol level increased with increased levels of RO in the diet. All parameters examined were within normal range for healthy pigs as reported by Mitruka BM et al. [23] and Banerjee GC [24]. The normal range could be related to the nutritional adequacy and safety of the test ingredients given to pigs.

Conclusion

The result of this study revealed and suggested that rice offal has advantages over maize offal and brewers dried grain as a fibre source as regards nutrient digestibility and serum biochemical indices when incorporated without any deleterious effect in the diet of pigs and is therefore recommended for feed formulation.

References

1. FAO (1977) Food and Agriculture Organization, production yearbook, Rome, Italy, 50: 122-128.
2. Christopher D, Pierre C, Claude C (1997) Impact of livestock and fisheries on food availability and demand in 2020. American Journal of Agricultural Economics 9(5): 147-1475.
3. Unigwe CR (2011) The impact of replacement of maize with graded cassava root meal on the haematology and growth performance of starter broiler. Continental Journal of Animal and Veterinary Research 3(1): 1-6.
4. Ogundipe SO (1996) Sustainable Animal Production in Nigeria. Problems and Prospects of Livestock Extension. A paper presented at the ISNAR/ABU project.
5. Ojewola GS, Ukechukwu SN, Onyenucheya F (2000) Comparative carcass characteristics of indigenous turkey poults fed different agro-industrial products. 5th Proceeding of Annual Conference of Animal Science Association of Nigeria, Portharcourt, Nigeria.
6. Tiough SM, Kpehe AT, Shaahu DT, Mashi AM, Sarwuan GD (2020) Determination of the proximate composition of rice offal treated with rumen filtrate. Nigerian Journal of Animal Science and Technology (NJAST) 3(3): 101-106.
7. Achonwa CC, Ogbuewu IP, Ogundu EC, Kubkonmawa IH, Uchegbu MC, et al. (2017) Browse abundance and the methodologies for their selection as candidate feed resources in Nigeria. A review Nature Science 15(5): 82-94.
8. Maikano A (2007) Utilization of rice offal in practical ration of broilers. The Zoologist 5: 1-8.
9. Chen J, Li Y, Tian Y, Huang C, Li D, et al. (2015) Interaction between microbes and host intestinal health modulation by dietary nutrient and gut brain-endocrine immune axis. Current Protein and Peptide Science 16(17): 592-603.
10. Taraba State Government Dairy (TRSD) (2008) Taraba State official Dairy, Government Printing, Jalingo, Nigeria.
11. McDonald P, Edward RA, Greenhaigh JFD, Morgan CA (2002) Animal Nutrition. Scientific and Technical, John Willey and Sons. Inc, New York, USA.
12. Weishbaum TE (1940) An accurate and rapid method for the determination of proteins in small amounts of blood serum and plasma. America Clinical Pathology, p. 40A.
13. SAS (2014) SAS Software, SAS Institute Incm Carry, North Carolina, USA.
14. Mafimidiwo AN, Williams GA, Olayemi WA, Adesanya OF, Muhammad SB, et al. (2002) Influence of dietary replacement of urea-molasses treated rice husk for wheat offal on serum and haematological parameters of growing pigs. Journal of Global Biosciences 11(10): 9455-9467.
15. Akande KE, Danjuma E, Kudu YS (2023) Growth performance and nutrient digestibility of Ross 308 broiler chickens fed diets containing clove bud (syzygium aromaticum) as natural feed additive. Nigerian J Anim Sci 25(3): 127-133.
16. Adebiyi OA, Adeshola AT, Ekeh CC, Olumide MD (2020) Growth performance digestibility and gut morphology of grower pigs Fed diets substituted with watermelon waste. Animal Nutrition and Feed

Technology 20(1): 61-70.

17. Wafar RJ, Tarimbuka LI, Sini T, Adi ZA, Lamalang EB, et al. (2020) Growth performance and nutrient digestibility of weaner pigs fed cereal offals diets. Nigeria Journal of Animal Production 47(6): 129-134.
18. Aro SO, Akinmoyegun MB (2012) Haematology and red blood cell osmotic stability of pigs fed graded levels of fermented Cassava peel-based diets. 17th Proceedings of Annual Conference of Animal Science Association of Nigeria, Abuja, pp. 9-13.
19. Olaiya OD, Egbo ML, Kalla DJU, Adelowo VO, Bello AT, et al. (2023) Growth performance nutrient digestibility and haematological indices of weaner pigs fed diets containing graded levels of cabbage (Brassica Oleracea Var) waste leaf meal. Nigerian J Anim Sci 25(3): 134-142.
20. Aya VE, Ayanwale BA, Ijaiya AT, Aremu A (2013) Haematological and serum biochemistry indices of broiler chickens fed rumen filtrate fermented palm kernel meal-based diets. Proceeding of the 18th Annual Conference of Animal Science Association of Nigeria, Abuja, Nigeria, pp. 8-12.
21. Harper AE, Rodwell B, Mayes PA (1999) Review of Physiological Chemistry, Lang Medical Los Altos, California, USA, 9442, pp. 60-81, 188-216.
22. Aguihe PC, Kehinde AS, Iwu CJ (2012) Haematological and Serum Biochemical Indices of Broilers Fed Local Groundnut Cake Meal as a Replacement for Soyabean Meal. Proceeding of 17th Annual Conference of Animal Science Association of Nigeria, Abuja, Nigeria, pp. 9-13.
23. Mitruka BM, Rawnsley HM (1977) Clinical biochemical and haematological reference values in normal experimental animals. Mason Publishing Company, New York, USA, pp. 35-50.
24. Banerjee GC (1998) A textbook of Animal Husbandry. (8th edn), Oxford and IBH Publishing Co PT. Ltd, New Delhi, India.