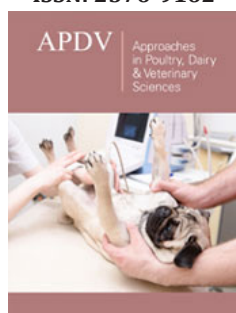


Apparent Nutrient Digestibility and Serum Biochemical Indices of Grower Pigs Fed Graded Levels of Rice Offal Supplemented with Enzyme

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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 Quadroxyme. All parameters measured in nutrient digestibility were significantly ($P < 0.05$) different, while there was no significant difference in all parameters measured in serum biochemical. Also, the values obtained from this study were all within the normal ranges for pigs and can therefore be used by farmers for better results.

Keywords: Parameters; Supplemented; Randomized; Daily protein; Nutrient

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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 [1] recommended 56g of animal protein intake for growing and developing individuals per day, whereas [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 [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 goes to feed alone. The scarcity of conventional feeds has hindered the growth of 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 feed stuff that have potential as livestock feed ingredients abound in Nigeria [4]. It has been stated [5] that research into the use of cheaper industrial by-products and wastes have been intensified in the last few years to determine the efficiency of their utilization in term 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 nutrient 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 rice milling industry and it is almost virtually free and readily available all year round. According to [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 filtrate or enzymes which can lead to improvement in nutritional quality and greater utilization. The importance of crude fibre in the diet of pig cannot be over emphasized. Apart from the crude fibre importance of rice offal, it can also enhance metabolizable energy of the diet because of the presence of broken particles of rice present. The proximate composition of rice offal was reported by [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, its 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 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 7°51'0"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 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.

Ingredients (%)	Dietary treatments				
	T ₁	T ₂	T ₃	T ₄	T ₅
Maize	48.00	47.8	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

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.

Data Collection

Digestibility trials

At the end of the feeding trial, fifteen 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 marker 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, faeces 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 [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 [12].

Statistical analysis

Data collected were subjected to Analysis of Variance using JMP SAS [13] version [13]. 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 [14], however in contrast with that of [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 [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% was reported by [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 [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 falls with reported values by [13], however, slightly higher than (52.13-73.93%) reported by [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 [15]. Results of dietary treatments on serum biochemical indices is 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). The range values of 4.15-4.92mg/d; is in

agreement with [18] but lower than 8.12-16.20mg/dl reported by [19] and slightly higher than 2.53-3.63mg/dl reported by [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 the 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 [22]. However, the serum glucose was lower than 16.20-22.10g/dl reported by [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 [23] and [24]. The normal range could be related to the nutritional adequacy and safety of the test ingredients given to pigs.

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	T ₂	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 superscript on the same row are significantly different (P<0.05)

ns = not significant

SEM = standard error of means

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 regard nutrient digestibility and serum biochemical indices when incorporated without any deleterious effect in the diet of pigs and is therefore recommended for feed formulation..

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