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Original Research Paper

Physical appearance and organoleptic properties of poultry meat fed *Aspergillus niger* hydrolyzed cassava peel meal based diet

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The experiment investigate the organoleptic properties of chickens fed different proportions of hydrolyzed cassava peel meal based diet of 0%,25%,50%,75% and 100% respectively. The chickens were randomly allocated to five dietary treatments A - E using a completely randomized design. Each treatment group contained two replicates of three broiler chickens. Group A chickens (A_1 and A_2) were fed with the control diet while Groups B to E were administered with experimental diets containing 25%, 50%, 75%, 100% of hydrolyzed cassava peels respectively for 42 days. Sensory qualities of thigh muscles of the chickens boiled in a microwave oven for four minutes were then assessed by an eight member panel that rated the meat for colour, flavor, tenderness and overall acceptability on a nine point hedonic scale. There was a significant difference ($P < 0.05$) in the colour, tenderness and juiceness of the chickens in groups A to E as cassava peel inclusion increased across the groups.There was however no significant difference in overall acceptability and flavour of the chickens across the groups A to E. It was then concluded that replacement of maize in chicken feeds by up to 50% hydrolyzed cassava peels produced the best organoleptic properties of the meat.

Key words: Organoleptic properties,cassava peel, broilers,groupings, hydrolysis, feeding trials, hydrolysis, meal based diet.

INTRODUCTION

Food scarcity is a plague in many developing countries of the world, including Nigeria where daily intake of animal protein per capital falls far below the normal intake as recommended by FAO (1986), is not in doubt. To alleviate this situation, it has been realized that broiler production is the fastest and easiest route (Larry, 1993;Dipeolu et al*.,* 1996;Nworgu et al*.,* 2000) since they are prolific, possess a high feed conversion ratio and are accepted by all, irrespective of religion. However, feed cost is presently very high and makes up to 60-70% (Larry, 1993) or 70-80% (Oruwari et al*.,* 1995*)* of the total cost of production in Nigeria compared to 50-70% in developed countries (Thackie and Flenscher, 1995). This therefore highlights the importance of feed management to broiler producers. Thus, it is necessary to reduce the cost of feeds in order to have cheaper products without affecting profits. Since energy source constitutes 45-60% of finished feeds for monogastric animals (Steiner et al.,1994) and birds eat to satisfy their energy requirement (Sibbald, 1982). Worldwide consumption of poultry meat is growing up as in developed well as in developing countries, in 1999 the world production of broiler chickens reached 40 billion and expects continued growth until 2020 (Bilgili, 2002). Cassava peels which is available in large quantity has been investigated to serve as alternative main energy source in broiler feedstuffs (Adeyemo et al.,2013). Several experiments to design the new composition of compound feed after application of various alternatives and various models for maximizing yield and quality of meat chickens (McDonald and Evans, 1977; Gonzalez-Alcorta et al., 1994; Berri, 2000; Lee et al., 2003, 2004; Khojasteh and Shivazad, 2006; Haščík et al., 2005).

Sensory analysis is unequivocally assigning in the scientific methods. It is one of the oldest means of quality control, but in principle is an essential part of the mandatory assessment of food quality, while also examining the deeper study of the interdependence between physiological and psychological phenomena in the very process of perception of sensory qualities. Many authors note that the sensory analysis, allowing manufacturers to identify, understand and respond to consumer preferences more effectively (Hashim et al., 1995; Owens and Sams, 1998; Liu et al. 2004; Fanatic et al., 2007; Saha et al., 2009) and in addition the identification of sensory characteristics and consumer preferences, helping manufacturers to increase competition in the market for other producers (Tabilo et al., 1999; Tan et al., 2001; Lawlor et al., 2003; Ponte et al. 2004; Young et al., 2004).

The aim of this study is to investigate the effect of different percentages of fungal hydrolyzed cassava peels used as replacement for maize in chicken meal based diet on the organoleptic properties of the fed chickens.

MATERIALS AND METHODS

Aspergillus niger was isolated from cassava peel collected from cassava peel dumpsite. A modified method of Ali et.al., (1991) was used to delignify the cassava peel which was autoclaved for one hour at 121 ^{0}C with 5% (w/v) NaOH. The autoclaved materials were filtered through muslin cloth, neutralized with dilute acids (0.1M H_2SO_4), and then washed with water. They were finally washed in distilled water and dried at 70°C in a regulated oven (Gallenkamp). Each was then grinded with domestic blender (Nakai, Japan Mx- 736) for increased surface area. Mineral salts medium (MSM) was prepared for cultivation of fungal isolate using the compositions as shown below {g/l}.

KH_2PO_4 ,10g;$(NH_4)_2SO_4$,10.5 g ; $MgSO_4.7H_2O$, 0.3g; $CaCl_2$, 0.5 g; $FeSO_4$, 0.013g ; $MnSO_4.H_2O$ 0.04; $ZnSO_4.7H_2O$ 0.04; Yeast extract 0.5g; Cassava peel (40g). Aspergillus niger was grown in this composed medium under a pH of 5.0, concentration 3% and 35^{o}Cfor five days after which the culture filtrate was filtered with whatman under suction. 100ppm of the cellulase enzyme was incorporated into cassava peel so as to hydrolyze it. The cassava peel was then air dried and then used to replace maize in broiler chicken feeds for groups A to E (0 , 25 , 50 , 75 and 100% respectively). Also, unhydrolyzed cassava peel was used to replace maize 100% for group F. Starter and finisher diets at 0, 25, 50, 75 and 100% replacement value for maize were composed to meet the NRC (1984) nutrient requirement of broiler chickens. The chickens were fed starter diet for the first three weeks of the feeding trials and then fed finisher diets from the fourth to the sixth week. Soya bean oil was added to obtain equal metabolizable energy.

Chickens Grouping and Feeding

The chickens were randomly allocated to six dietary treatments A - F using a completely randomized design. Each treatment group contained two replicates of three broiler chickens each. Group A chickens (A1 and A2) were fed with the control diet (0% hydrolyzed cassava peel as main carbon source). Groups B-E (in replicates 1 and 2) were administered with experimental diets containing 25, 50, 75, and 100% of hydrolyzed cassava peels respectively replacing maize while group F (F1 and F2) were fed with diet containing 100% unhydrolyzed cassava peels replacing maize as the main carbon source (Tables 1 and 2). Feed and water were supplied *ad libitum* for the six weeks feeding trial period. Vaccine and drugs were administered as at when due. Chickens in group A –E recorded 0% mortality while chickens in group F fed 100% unhydrolyzed cassava peel recorded 100% mortality.The chickens (A-E) were then slaughtered (two per group), sensory evaluation was conducted on the meat boiled in a microwave oven for four minutes by an eight member panel that rated the meat for colour, flavor, tenderness and overall acceptability on a nine point hedonic scale. The cooking losses were determined by comparing weight of meat before and after microwave cooking.

RESULTS AND DISCUSSION

The physical appearances of the chickens after 42 days of feeding trials are as shown on plates 3.1- 3.5. Growth of feathers decreased respectively as the hydrolyzed cassava peel inclusion level increases in the feed with chickens fed 0 – 50% cassava inclusion based meal diet having feathers covering the whole of their body while chickens fed 75 and 100% hydrolyzed cassava peel based diets have some body parts not covered by feather after the 42days feeding trials. Also, all the chickens look physically healthy with no deformity of legs nor body parts. Chickens fed 100 % hydrolyzed cassava peel inclusion are the most active and this might be due to the fact that they do not gain sufficient energy from their feed since they also have the lowest feed conversion ratio (Adeyemo et al.,2013) , however, all the chickens were active irrespective of the level of inclusion of hydrolyzed cassava peel in the feed. Chicken sizes also decreased accordingly as hydrolyzed cassava peel inclusion increases respectively in feeds.

Table 3 shows the effect of dietary levels of hydrolyzed cassava peel meal on the organoleptic properties of broiler chickens. An eight member panel consisting of people

Table 1. Composition of the Experimental Broiler Starter Diet (%)

Ingredients	A (0%) Control	B (25%) Cpm	C (50%) Cpm	D (75%) Cpm	E (100%) Cpm	F (100%) Cpm
Maize	45.00	33.75	22.50	11.25	-	-
Hydrolyzed Cassava peels	-	11.25	22.50	33.75	45	-
Unhydrolyzed Cassava peel	-	-	-	-	-	45
Soya bean meal	15.00	15.00	15.00	15.00	15.00	15.00
Groundnut cake	20.00	20.00	20.00	20.00	20.00	20.00
Brewers dried grain	10.00	10.00	10.00	10.00	10.00	10.00
Wheat offal	4.45	3.95	3.45	2.95	2.45	1.95
Fish meal (72%)	1.50	1.50	1.50	1.50	1.50	1.50
Soya Bean oil	0.50	0.50	0.50	0.50	0.50	0.50
Bone meal	2.50	2.50	2.50	2.50	2.50	2.50
Oyster shell	0.30	0.30	0.30	0.30	0.30	0.30
Salt (NaCl)	0.30	0.30	0.30	0.30	0.30	0.30
*Vit/min premix	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10	0.10
Total	100	100	100	100	100	100
Proximate Composition						
Crude Protein(%)	24.42	23.86	23.30	22.74	22.17	22.17
Crude Fibre (%)	4.25	4.41	4.55	4.71	4.86	7.63
Metabolizable Energy (Kcal/kg)	2811.86	2649.72	2480.60	2332.13	2183.66	2183.66

* Vit. A,, 4,000,000 IU; Vit. D3, 800,000 IU; Tocopherols, 4,000 IU; Vit. K3, 800mg; Folacin, 200 mg; Thiamine, 600 mg; Riboflavin, 1,800 mg; Niacin,6,000 mg; Calcium Panthothenate, 2,000 mg; Pyridoxine, 600 mg; Cyanocobalamin,4 mg; Biotin, 8 mg; Manganese, 30,000 mg; Zinc, 20,000 mg; Iron,8,000 mg; Choline chloride, 80,000 mg; Copper, 2,000mg; Iodine, 480 mg; Cobalt, 80 mg; Selenium, 40 mg; BHT, 25,000; Anticaking agent, 6,000 mg. Cpm is cassava peel meal. Values were calculated from published composition of the ingredients (NRC,1984) while Metabolizable energy was calculated from its predicted data(Pauzenga,1985).

Table 2: Composition of the Experimental Broiler Finisher Diet (%)

Ingredients	A (0%) Control	B (25%) Cpm	C (50%) Cpm	D (75%) Cpm	E (100%) Cpm	F (100%) Cpm
Maize	45.00	33.75	22.50	11.25	-	-
Hydrolyzed Cassava peels	-	11.25	22.50	33.75	45	-
Unhydrolyzed Cassava peel	-	-	-	-	-	45
Soya bean meal	8.00	8.00	8.00	8.00	8.00	8.00
Groundnut cake	15.00	15.00	15.00	15.00	15.00	15.00
Brewers dried grain	10.00	10.00	10.00	10.00	10.00	10.00
Wheat offal	15.50	15.50	14.50	14.00	13.50	13.00
Fish meal (72%)	1.50	1.50	1.50	1.50	1.50	1.50
Soya Bean oil	0.50	1.0	1.50	2.0	2.50	3.00
Bone meal	2.50	2.50	2.50	2.50	2.50	2.50
Oyster shell	0.30	0.30	0.30	0.30	0.30	0.30
Salt (NaCl)	0.50	0.50	0.50	0.50	0.50	0.50
*Vit/min premix	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100
Proximate Composition						
Crude Protein(%)	24.42	23.86	23.30	22.74	22.17	22.17
Crude Fibre (%)	4.25	4.41	4.55	4.71	4.86	7.63
Metabolizable Energy (Kcal/kg)	2811.86	2649.72	2480.60	2332.13	2183.66	2183.66

* Vit. A,, 4,000,000 *Vit. D3, 800,000 IU; Tocopherols, 4,000 IU; Vit. K3, 800mg; Folacin, 200 mg; Thiamine, 600 mg; Riboflavin, 1,800 mg; Niacin,6,000 mg; Calcium Panthothenate, 2,000 mg; Pyridoxine, 600 mg; Cyanocobalamin,4 mg; Biotin, 8 mg; Manganese, 30,000 mg; Zinc, 20,000 mg; Iron,8,000 mg; Choline chloride, 80,000 mg; Copper, 2,000mg; Iodine, 480 mg; Cobalt, 80 mg; Selenium, 40 mg; BHT, 25,000; Anticaking agent, 6,000 mg. Cpm is cassava peel meal.Values were calculated from published composition of the ingredients(NRC, 1984) while Metabolizable energy was calculated from its predicted data(Pauzenga,1985).

Plate 3.1: Broiler chickens fed 0% hydrolysed cassava peel based diet

Plate 3.2 :Broiler chickens fed 25% hydrolysed cassava peel based diet

Plate 3.3: Broiler chickens fed 50% hydrolysed cassava peel based diet

Plate 3.4: Broiler chickens fed 75% hydrolysed cassava peel based diet.

Plate 3.5: Broiler chickens fed 100% hydrolysed cassava peel based diet

Table 3 .Effects of Dietary Levels of hydrolyzed Cassava Peel Meals on Organoleptic Properties of Broiler Chicken Meat

Sensory Quality Scores	Diet A Cpm (0 %)	Diet B Cpm (25%)	Diet C Cpm (50%)	Diet D Cpm (75%)	Diet E Cpm(100%)	S.E.M
Colour	8.1^{c}	8.0^{c}	7.5^{b}	7.1^{ab}	6.7^{a}	0.04
Flavour	7.6^{b}	7.0^{b}	7.4^{ab}	6.7^{a}	6.0^{a}	0.02
Tenderness	7.9^{b}	7.4^{ab}	7.3^{a}	7.3^{a}	6.7^{c}	0.06
Juiceness	7.2^{b}	7.0^{b}	7.4^{ab}	6.7^{a}	6.0^{a}	0.02
Overall Acceptability	8.1^{c}	8.1^{c}	8.7^{c}	7.6^{b}	7.1^{a}	0.03

^{abc} Means within a row with different superscript differ significantly ($p < 0.05$)
Rated on a nine point hedonic scale 9 = Extremely like Pale, tender or juicy. SEM = Standard error of means
1=Extremely dislike, deep, tough.

who are conversant with the meat of broiler chickens was set up to evaluate the microwaved meat of the chickens on a nine point hedonic scale that tested colour, flavour, tenderness, juiceness and overall acceptability with nine representing extremely like, pale, tender and juicy while one represents extremely dislike, deep, tough and dry.There was a significant difference (P <0.05) in the colour, tenderness and juiceness of the chickens in groups A to E as level of cassava peel inclusion in chicken feed increased across the groups. There is no significant difference between the control group A and the experimental group B fed 25% hydrolyzed cassava peel based diet in term of colour, tenderness, flavour and overall acceptability but these differ significantly from those in groups C and D (P<0.05) which also differ significantly from group E fed 100% hydrolyzed cassava peel based diet as main energy source. There was also no significant difference between the control group A and the experimental groups B and C in term of overall acceptability, however there is significant difference in overall acceptability of the chickens in groups D and E (P<0.05). Also, the control group, groups B and C differ significantly from groups D and E fed 75% and 100% hydrolyzed cassava peel based diet respectively.The most acceptable of the chickens are those in group C that fed on fifty per cent hydrolyzed cassava peel inclusion in feed with an average hedonic scale of 8.7 while the least overall acceptable chickens are those from group E that fed on hunded per cent hydrolyzed cassava peel inclusion in feed as carbon source with an hedonic scale of 7.1

Conclusion

The experiment verified the impact of cassava inclusion on the organoleptic properties of chickens fed varying percentages of hydrolyzed cassava peel based diet. The use of fungal enzymes has helped to make cassava peels utilizable to monogastric as energy source thereby providing an alternative energy source for chickens in feed. Apart from this, it has also help to improve the sensory properties of chickens as those fed 50% cassava based meal are more acceptable on the overall organoleptic properties on which the hedonic scale is based.

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