

## Nutritional evaluation of graded levels of fermented maize milling waste (maize gluten) in rabbit diet

<sup>1</sup>Sobayo, R. A., <sup>2</sup>Okubanjo, O A., <sup>2</sup>Adeyemi, O.A and <sup>1</sup>Usman J. M.

<sup>1</sup>Federal College of Forestry, P M B 5054, Ibadan, Nigeria.

<sup>2</sup>Department of Animal Production, Olabisi Onabanjo University, Ayetoro Campus

### Abstract

A 70-day feeding trial was conducted with thirty-six 7 weeks old weaned rabbits (mixed breed and sexes), with initial average live weight of 0.81 kg to evaluate the nutritional effects of replacing maize at 0, 25, and 50% with maize or corn gluten in rabbit diets. Maize gluten is fermented maize milling waste sun dried for three days. The diets were offered to the rabbits which were randomly divided into three (3) groups of 12 rabbits each and each group sub-divided into four (4) replicates of 3 rabbits each in a completely randomized experiment. There was a significant effect ( $P < 0.05$ ) of the treatments on the average daily feed intake of the rabbits as the levels of maize gluten increased. The average weight gain and feed conversion ratio were not significantly ( $P > 0.05$ ) affected by the dietary treatments, nevertheless, the FCR increased across the treatments. Graded levels of maize gluten had no significant ( $P > 0.05$ ) effect on carcass dressing percentage. The percent pelt decreased significantly ( $P < 0.05$ ) as level of maize gluten increased. Furthermore, liver and meat cooking loss percentage values showed significant differences ( $P < 0.05$ ) due to the graded levels of corn gluten fed. The sensory evaluation studies were not statistically affected ( $P > 0.05$ ).

**Keywords:** Rabbits, maize-gluten, carcass.

### Introduction

The past few years have witnessed a rapid growth in the human population of developing countries including Nigeria with resultant increase in the demand for protein of animal origin. One of the objectives of the National Agricultural policy is improving the diet quality of Nigerians at reasonable cost. The use of micro-livestock and short cycle animals has been suggested. Feed supply has remained a major constraint in animal production due to the ever increasing cost of conventional feed stuffs occasioned by the competition between man and livestock for cereal grain (Amaefule *et al.*, 2004). The need to harness the potential of the numerous agro-industrial by-products and the so-called wastes as part replacement for the more expensive ones

have been advocated (Umoh, 1984; Aletor, 1986 and Babatunde *et al.*, 1987). It has been stated that rabbits are traditionally raised on high roughage diets (Iyeghe-Erakpotohor *et al.*, 2002; Fapohunda *et al.*, 2005). This study was therefore aimed at investigating the nutritional effects of replacing maize with fermented maize milling waste (maize or corn gluten) on the performance, carcass characteristics and organoleptic qualities of rabbits.

### Materials and Methods

#### *Experimental site*

The study was carried out at the Teaching and Research Farm, University of Ibadan, Ibadan, Nigeria. Situated in the Rain Forest vegetation zone, the area has a humid climate with mean

annual rainfall and temperature of 1037mm and 35.7°C respectively. Relative humidity averages 82% throughout the year.

#### *Experimental Animals and Diets*

A total of thirty six (36) 7 weeks old weaned rabbits (mixed breed and sexes) were used in a ten- week experiment. The proximate composition of the test ingredients is presented in Table 1. There were 3 experimental diets and four replications of the three treatments in a completely randomized design. There were 3 rabbits per pen or cage. The diets included a conventional rabbit grower formulation containing 19% crude protein and 3009.72 ME (kcal/kg) in which maize gluten replaced 0, 25 and 50% of the maize. The rabbits were divided into 3 treatment groups of 12 rabbits each, and each group subdivided into 4 replicates of 3 rabbits per replicate cage. The experimental diets were randomly assigned to the different groups of rabbits in completely randomized experiment. Feed and water were given *ad libitum*.

Daily record of feed intake and weekly record of weight gain were kept. By the end of the tenth week, a rabbit in each replicate was randomly selected, weighed and slaughtered by sticking to sever the jugular veins and carotid arteries for carcass and meat product quality analysis. Proximate analyses were carried out by the method of A. O. A. C. (1995) and data collected were subjected to analysis of variance using model for completely randomized design and were statistical significances were observed, the means were compared using Duncan multiple range test (Steel and Torrie, 1980).

#### **Results**

The results of performance characteristics of rabbits are presented in Table 3. Daily feed intake was significantly affected ( $P<0.05$ ) with rabbits on corn gluten- based diets consuming more than

the control group. Average daily weight gain, though, not significantly affected ( $P>0.05$ ), was found to decrease across the dietary treatments with increased inclusion level of fermented maize milling waste. Feed conversion ratio was not affected ( $P>0.05$ ) by the levels of maize gluten fed, nevertheless, it increased progressively across the treatments. Information on rabbits' carcass quality expressed as % of live weight, the viscera and meat product quality measures expressed as % of dressed weight are presented in Table 4. Graded levels of maize gluten had no significant ( $P>0.05$ ) effect on carcass dressing percentage. Inclusion of corn gluten in the diets to replace maize lowered significantly ( $P<0.05$ ) the percent pelt. The heaviest pelt was produced by rabbits fed 0% corn gluten. The percent GIT and heart indicated a progressive ( $P>0.05$ ) increment with increasing level of the test ingredient. The lung, spleen and kidney did not follow any significantly discernable pattern. Meanwhile, percent liver value was significantly ( $P<0.05$ ) affected with rabbits fed 50% of the test ingredient having lowest value. Dietary levels of the fermented maize milling waste were found not to influence rabbits' cut up parts. A significant ( $P<0.05$ ) effect of dietary treatments on cooking loss percent was observed with lowest value in 50% corn gluten. The result of the palatability scores of rabbits fed test diets are shown in Table 5. There were no significant effects on the sensory evaluation of rabbit meat, tenderness and juiciness ratings.

#### **Discussion**

The increased feed intake without corresponding increase in weight may be ascribed to lower energy concentration per kg of feed with the rabbits increasing intake to meet their energy requirement ( Hill and Dansky, 1954). Cheeke and Amberg (1972) had reported that increased crude fibre provided as straw resulted in increased voluntary feed intake in growing rabbit. Also,

**Table 2:** Composition of experimental diets

Ingredients	Levels of maize gluten		
	0%	25%	50%
Maize	48.00	36.00	24.00
Corn/maize gluten	-	12.00	24.00
Soya bean	25.00	25.00	25.00
Rice-bran	24.00	24.00	24.00
Bone meal	2.00	2.00	2.00
Salt	0.75	0.75	0.75
*Premix	0.25	0.25	0.25
<b>Total</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>
Crude protein	19.10	18.05	17.18
Ether extract	4.20	3.37	4.15
Crude fibre	10.48	14.22	15.21
Ash	4.09	4.12	5.31
ME (kcal/kg)	3009.72	2858.76	2707.81

Vitamin- mineral premix per kg of diet vit. A=4,000,000 I.U, vit. D3=800,000 I. U, vit. E= 10,000 mg, vit. K3= 1,200 mg, vit B= 1,000 mg, vit B2= 1,500 mg, vit. B6 = 500 mg, Niacin = 10,000 mg, Biotin = 15 mg, Panthothenate = 4,500 mg, vit. B12 = 10 mg, Folic acid = 200 mg, choline chloride = 120,000 mg, Manganese = 60,000 mg, Iron = 15,000 mg Zinc = 15,000 mg, Copper = 800 mg, Iodine 400 mg, Cobalt = 80 mg Selenium = 40 mg.

**Table 3:** Performance of rabbits fed graded levels of maize-gluten

Parameter	Level of maize-gluten			
	0	25	50	SEM
Initial wt(g)	807.00	810.00	800.00	
Av. final wt.( g)	1687.15	1570.33	1440.23	0.24
Av. wt. gain (g)	880.13	760.19	640.14	0.22
Av.daily .wt. gain (g)	12.57	10.86	9.14	3.07
Av daily Feed intake (g)	82.97 <sup>b</sup>	86.19 <sup>a</sup>	87.37 <sup>a</sup>	1.29
Feed conv. ratio	6.60	7.94	8.23	2.10

Mean within the same row with differing superscript are significantly different (P<0.05).

the result agrees with the earlier work of Esonu *et al.* (2003) which, showed that inclusion of a fibrous material in a feeding trial had an energy dilution effect on feed and consequently increased feed intake. Corn gluten is relatively fibrous and this could be responsible for the depression in the weight gain as fibre impaired digestion and absorption of nutrients (Fernandez and Jorgensen, 1986). The non significant difference in the dressing percentage indicated

that the inclusion levels of test ingredient had very little effect on the dressing percentage. The pelt percent was significantly influenced by the dietary treatments. This could be due to different levels of sub-cutaneous fat deposition as a result of various proportions of maize: maize gluten in the diets. Ready *et al.* (1977) reported 11% pelt in rabbits, a value higher than 9.12-9.55% obtained. Environmental factors might be responsible for the difference, as Nigeria rabbits

*Fermented maize waste in rabbit nutrition*

**Table 4:** Carcass, visceral and meat product qualities evaluation of rabbits fed raded levels of ma

Parameter	Levels of maize-gluten			SEM
	0	25	50	
<b>Carcass Quality</b>				
Carcass length	25.00	23.50	22.75	1.37
Dressing %	52.34	53.36	52.05	2.58
Blood %	2.12	4.56	3.92	1.72
Head %	8.77	8.55	10.19	1.26
Pelt %	9.55 <sup>a</sup>	9.19 <sup>ab</sup>	9.12 <sup>b</sup>	0.80
<b>Visceral Quality</b>				
GIT %	14.07	14.29	14.44	1.55
Lung %	0.51	0.50	0.44	0.09
Spleen %	0.04	0.02	0.04	0.01
Kidney %	0.51	0.55	0.52	0.08
Liver %	1.82 <sup>a</sup>	1.76 <sup>ab</sup>	1.23 <sup>b</sup>	0.33
Heart %	0.17	0.18	0.21	0.02
<b>Meat Product Quality</b>				
Shoulder %	11.84	11.05	10.69	1.19
Rib %	3.65	5.10	4.72	1.10
Loin %	7.60	8.69	8.96	1.31
Leg %	16.89	18.94	18.75	1.63
Meat: Bone Ratio	5.81	5.62	4.91	0.97
Cooking loss %	29.94 <sup>b</sup>	39.18 <sup>a</sup>	23.94 <sup>c</sup>	3.23

<sup>a,b,c</sup> Mean within the same row with differing superscripts are significantly different (P<0.05).

have less need for heavy fur as the temperate rabbits. Butcher *et al.* (1983) opined that external offal percent tended to increase as slaughter weight of rabbit increased. The empty gut, the lung, spleen, kidney and heart were not statistically influenced, the result agrees with the work of Joseph *et al.* (2000). The liver percent reported was significantly affected by the dietary treatments and decreased progressively with increasing inclusion level of corn gluten. It is probable that the test ingredient did not contain any anti-nutritional factor. According to Aderemi (2003), presence of anti nutritional factors have been associated with the enlargement of organs like liver and pancreas because of their higher

detoxification activity. The primal parts were not significantly affected. Davendra (1966) stated that division of a carcass into primal parts will enable comparison be made between various defined areas of the carcass. The observed increase in the maize gluten treated percent rabbits' leg and loin over the control might be due to breed, sex or method of cutting. The significant effect on cooking loss percent reported might be due to the fact that the cooking end point temperature employed was too high rather than dietary treatment effect. Pippen *et al.* (1969) opined that the component responsible for aroma or flavour are from lean portion and trapped or dissolved in the fat during cooking.

**Table 5: Sensory evaluation of rabbits fed graded levels of maize-gluten**

Parameter	Level of maize- gluten			SEM
	0	25	50	
Flavour	7.39	6.66	7.29	0.75
Juiciness	5.88	6.19	7.29	0.67
Tenderness	6.75	6.19	7.19	0.53
Over all acceptability	7.51	6.57	7.38	0.40

This perhaps, explains the lack of significant effect on the flavour among the treatments. Also, Awosanya (1988) observed that the only factor responsible for consumers' acceptability of rabbit meat is the age at which the animal is slaughtered; the younger the age, the more acceptable is its meat.

### Conclusion

From this study, it has been shown that rabbits fed graded levels of corn or maize gluten compared favourably with the control. Thus, it can be surmised that the material can be safely included in rabbit diet without any deleterious effect. The major drawback, however, of the product is its water content and this can be removed effectively through sun drying for 2-3 days to prevent the development or growth of mould in the entire ration.

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