

Original research Articles

REPRODUCTIVE PERFORMANCE OF BREEDER RABBITS FED DIETS WITH GRADED LEVELS OF ORANGE PULP MEAL AS ENERGY SOURCE.

ABSTRACT

The study was designed to access the reproductive performance of breeder rabbits fed graded levels of orange pulp meal (OPM). The pulps were gathered, sun-dried and milled prior to proximate analysis and feed formulation. Four experimental diets were formulated to supply 18% crude protein and 2600KcalME/kg of Metabolizable energy. Diet 1 was control, while OPM replaced maize at 20, 40, and 60% for diets 2, 3, and 4, respectively. Forty (40), eight weeks old rabbits (32 does and 8 bucks) of a crossed between American chinchilla and Newzealand white rabbits used for the experiment were weighed and distributed into four groups with ten rabbits (8 does and 2 bucks) . Groups were randomly assigned to one of the four dietary treatments in a completely randomized design. Animals were raised under the experimental condition until sexual maturity at five months. At sexual maturity, does and bucks of the same treatment were crossed, does kindled within thirty two (32) days. Four parities were obtained during the experiment. Data collected were subjected to analysis of variance and significant means separated by Duncan's multiple range test. The rabbits did not vary significantly in their mean daily feed intake but differed in their mean weekly weight gain. Does on treatment diets had significant higher average litter size at birth and average litter size at weaning. Average litter weights at birth and at weaning were statistically similar. The mortality was not due to treatment effect. It was therefore concluded that orange pulp meal could replace 60% of maize in the diets of breeder rabbits without adverse effect on reproductive performance.

Keywords: *Breeder Rabbits, Litter size, Litter weight, Orange pulp, Energy source.*

INTRODUCTION

Rabbits are unique animals of small sizes with short generation interval, highly prolific, rapid growth rate, and genetic diversity and have the ability to utilize forages and agricultural by-products as a major diet component [1].

They are raised to provide an alternative meat for man due to the short fall in production from other conventional sources, like poultry, cattle, sheep and goats.

In animal production, feeding plays a vital role in attaining the optimum productivity and quality per quantity of animal products [2]. Concentrates are vital ingredients for growth and production of rabbits, but this is affected adversely due to the high cost of feed/feedstuffs owing to the stiff competition between man and animals (mostly monogastrics) that feed highly from grains and oil seeds [3].

Considering the cost implication and the availability of these feedstuffs, animal nutritionists have sort for alternative feedstuffs to enhance administration of good balanced feed at relatively lower cost to rabbits.

Incorporating agro-by products into animal diet is one way in solving the problem of feed shortage and high cost [4]

Orange pulp Meal (OPM) has proven to be a unique energy source in the partial replacement of maize, sorghum and wheat in rabbits ration [5]. Orange pulp Meal (OPM) contains high level of energy amounting to 3756.14KcalME/kg, minerals, and vitamins. The all year round availability of orange waste makes it a unique product in feeding rabbits. With rabbits undergoing coprophagy and cecotrophy (pseudo-rumination and gut fermentation), where large fibre substances are absorbed into the caecum and acted upon by special bacteria and enzymes into absorbable nutrients like simple sugar, starches and amino acids, utilization of Orange pulp meal is advantageous at Pre-partum, partum and post-partum stages of production [5][6]. There is dearth of information on the utilization of orange pulp meal as energy source in breeders rabbit ration. This study therefore evaluates the litter traits performance of breeder rabbits fed diets with orange pulp meal as an alternative energy source.

MATERIAL AND METHODS

Experimental site

The feeding trial was conducted in the Department of Animal Science Teaching and Research Farm, University of Calabar, Nigeria, while the chemical analysis was conducted at the Central Laboratory of the University of Uyo, Nigeria.

52 **Processing of experimental material**

53 Sweet orange wastes (mesocarp and endocarp were obtained from local fruit juice processing industry at Export
54 processing Zone in Calabar municipality of Cross River State, Nigeria. They were chunked into smaller pieces and
55 sundried to a moisture content of 10-12%. The sun dried samples were milled using a small local grinder and stored
56 prior to chemical analysis and feed formulation.

57 **Proximate Analysis**

58 Proximate analysis of the orange pulp meal and the experimental diets were carried out to determine their proximate
59 composition [7]. The fractions determined were the crude protein, ether extracts, crude fibre, and ash. The Nitrogen
60 Free Extract (NFE) was determined as a difference.

61 **Experimental Diets**

62 Four experimental diets were formulated (Table 1) to supply the crude protein value of 18% and a Metabolizable
63 energy of about 2600kcalME/kg. Diet 1 was control while orange waste (pulp) meal was used to replace maize at
64 20%, 40% and 60% levels for diets 2, 3 and 4, respectively.

65 A total of forty (40) rabbits, ten (10) weeks old cross breed New Zealand white x American chinchilla rabbits
66 consisting of eight males and 32 females were purchased from a private farm in Calabar municipality for the
67 experiment.

68 The rabbits were weighed and randomly distributed into four groups of eight females and two males. Groups were
69 randomly distributed to one of the four experimental diets described earlier and fed to sexual maturity at five
70 months. Each treatment was replicated twice with four females and one male.

71 The animals were housed individually in wooden cages of dimension 120x60x50cm in a two tier hutch.
72 Concentrates and water were provided in concrete crocks. Equal quantity of experimental diets (120g/animal) was
73 offered across the groups.

74 At sexual maturity, does were weighed and introduced to the bucks with the same treatment for mating. After
75 successful mating, males were returned to their individual cages and the mating dates recorded.

76 Pregnancy diagnosis was done by palpation and weight method. Does were supplied wooden nesting boxes on day
77 25 of pregnancy.

78 Data collected include feed intake and weight gain during pregnancy and lactation, litter size and weights, still
79 births. Kindling rate = (number of does kindled / number of does mated) x 100 and kitten mortality at 7 days post
80 partum. Four parities were obtained and the experiment lasted for 5 months.

81 The experimental design employed was the completely randomized design, data collections were subjected to the
82 analysis of variance ANOVA procedures (SAS, 1995) and the significant means separated using Duncan Multiple
83 Range Test.

84

85 **Table 1: Composition of Experimental Diets**

Ingredients	Levels of orange waste meal (OWM)			
	0%	20%	40%	60%
Maize	45.50	36.40	27.30	18.20
OWM	-	9.10	18.20	27.30
Soybean	15.20	15.20	15.20	15.20
Wheat offal	25.00	25.00	25.00	25.00
Bone meal	3.00	3.00	3.00	3.00
Palm kernel cake	10.00	10.00	10.00	10.00
Salt	0.50	0.50	0.50	0.50
Lysine	0.20	0.20	0.20	0.20
Methionine	0.10	0.10	0.10	0.10
*Vitamin/mineral premix	0.50	0.50	0.50	0.50
TOTAL	100.00	100.00	100.00	100.00
Determined analysis				
% Crude protein	18.06	18.00	18.00	18.02
ME(Kcal/kg)	2609	2601	2602	2604

*Grower mineral premix containing the following per kg. Vitamin A, 8,000,000IU; Vitamin D3, 1,600,000IU; Vitamin E, 5,000IU; Vitamin K, 2,000mg; Thiamine, 1,500mg; Riboflavin B2 4,000mg; Pyridoxine B6, 1,500mg; Anti oxidant, 125g; Niacin, 1,500mg; Vitamin B12, 10mg; Panthotenic acids, 5,000mg; Folic acid, 500mg; Biotin, 20mg; Choline chloride 200r, manganese, 80g; Zinc, 50g; iron, 20g; Iron, 20g; copper, 5g; Iodine 1.2g; Selenium, 200mg; Cobalt,

200mg

RESULTS AND DISCUSSION

The proximate composition of the orange pulp meal relative to maize is presented to Table 2.

Table 2: Proximate composition of orange pulp and maize

Constituents (%DM)	Orange pulp meal	Maize	± SEM
Crude protein	5.60	9.05	1.21
Crude fibre	9.60	2.52	1.33
Ash	3.90	1.74	0.73
Carbohydrate	80.23	82.75	0.79
Crude fat	0.67	3.94	0.9

Means are values of triplicate determination

Maize contained higher percentage of crude protein (9.05%) and fats (3.94%) relative to orange pulp (5.60% and 1.67%, respectively), while the orange pulp was superior to maize in ash content. Maize and orange pulps were similar in their carbohydrate composition, whereas orange pulp had the higher crude fibre content of 8.6%. Breeder Rabbits have the capacity to effectively digest fibrous food, hence would utilized the high energy of the orange pulp meal.

Maize was richer in all the minerals monitored except for iron where orange pulp had superior value (220.24mg/100g). Prevalence of third trimester pregnancy anemia been attributed to low level of iron in the blood among animals.

The vitamins A, C and B – carotene compositions were 0.11, 2.06 and 0.07mg/100g, respectively.

The performance of breeder rabbits fed graded levels of orange pulp meal (OPM) is presented in Table 3.

Table 3: Mineral composition of orange pulp and maize

Constituents (mg/100g)	Orange pulp meal	Maize	±SEM
Calcium	1.63	48.30	3.41
Magnesium	4.90	107.90	5.07
Sodium	1.53	59.20	3.38
Potassium	1.81	324.80	8.98
Iron	200.54	4.80	6.99
Phosphorus	14.54	299.60	8.44

Means are values of triplicate determination

Mean daily feed intake of does during gestation and lactation

The mean daily feed intake ranged from 74.21g in does fed 60% OPM diet to 77.59g in does on 20% OPM diet. The variation in the mean daily feed intake was not significant ($p>0.05$) among the treatment groups. Non significant differences in feed in take among treatments suggests general acceptability of feed by rabbits. Animals eat to satisfy the energy requirement; therefore similarities in the feed intake among the treatment groups suggest that the energy intake of the feed were adequate for the rabbits during gestation and lactation periods. The mean daily feed intake observed in the experiment was higher than the range (36.39-48.31g) reported by [8] for rabbits fed cassava peels. The range (65-80g) reported by [9] was similar to findings of this research. Most authors reported a range of 70-85g as the mean daily feed intake for breeder rabbits.

Mean weekly weight gain of does during gestation and lactation period

Does eating diet containing 20% OPM had the highest weight gain, followed by does on 40% OPM while does on control diet recorded the lowest weight gain. The mean daily weight gain of pregnant does reduced with increasing levels of OPM in the diet. This may be attributed to the high demand of nutrients by the growing foetus, therefore most of the nutrient obtained by does were channeled towards the growth of the foetus and in the synthesis of milk [10] during lactation. The result of this experiment agrees with findings of [11] and [12]. The authors observed a decrease in the mean weight gain of rabbits during pregnancy and lactation.

118 **Mean litter size at birth**

119 Variation in the mean litter size at birth was significant ($p < 0.05$) among the treatment groups. The values increased
120 with increasing levels of OPM in the diet. Does on the control diet recorded the least litter size at birth. The result
121 suggests that the OPM diets were suitable and supplied necessary nutrients required by the gestating animals.
122 [[11];[13];[5]].

123 **Average litter weight at birth**

124 Average litter weight at birth showed no significant ($p < 0.05$) different among treatment groups. However, kittens
125 from does fed the treatment diets recorded higher weight at birth than from does fed control diet. The birth weight
126 range (21-60.5g) for kittens reported by [14] agree with the report of this study.

127 **Mean litter size at weaning**

128 Mean litter size at weaning varied significantly ($p < 0.05$) among treatment groups. Does fed 60% OPM diet had the
129 highest litter size at weaning, while does fed 20% OPM and control diets were statistically similar in their mean
130 litter size at weaning. Superior performance and survivability of the kittens suggest that the treatment diets at 60%
131 provided sufficient amount of necessary nutrients that enabled the rabbits produce quality milk [12].

132 **Average Litter weight at weaning**

133 Average litter weight at weaning showed no significant ($p > 0.05$) among the treatment groups.

134 The average litter weight from this experiment was in the range (1275 - 2112.7g) reported by [15] for breeder
135 rabbits fed agro industrial by products and mixed forage.

136 **Mortality**

137 The average mortality ranged from 28.30% in rabbits fed 60% OPM to 34.25% in rabbits on control diet. The
138 variation in average mortality was not significant ($p > 0.05$). Most of the does, especially during the first parity were
139 in experienced and failed to remove their furs to provide heat to the kittens. Most of the kittens died as a result of
140 cold stress rather than the treatment effect.

141

142 **Table 4 - Litter Traits Performance of Rabbits fed Orange Pulp Meal**

PARAMETER	Percentage level of Orange peel meal (OPM)				± SEM
	0%	20%	40%	60%	
Mean daily feed intake of gestating and lactating does (g)	77.14	77.59	75.88	74.21	0.57
Mean weekly weight gain of gestating and lactating does (g)	220.40 ^b	382.82 ^a	355.42 ^a	300.96 ^a	5.99
Average litter weight at birth(g)	45.56	57.81	53.29	56.73	1.09
Average litter size at birth(g)	5.38 ^b	5.17 ^b	6.56 ^a	6.51 ^a	0.39
Average litter weight at weaning(g)	3.42 ^b	3.52 ^b	4.33 ^a	4.67 ^a	0.38
Average litter size at weaning(g)	1871.58	1665.08	1812.43	1847.33	4.48
Average Mortality (%)	34.25	31.77	33.46	28.30	0.76

143 The means of the same row with different superscript are significantly different (p<0.05).

144 SEM: Standard error of mean

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