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Full Length Research Paper

Reproductive performance of rabbits fed maize-milling waste based diets

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The influence of maize-milling waste on the reproductive performance of rabbits was assessed. The treatments comprised of autoclaved and unautoclaved maize-milling waste, groundnut cake/maize meal diets formulated with 0 (I), 25 (II), 50 (III), 75 (IV) and 100% (V) replacement of maize with maize-milling waste. Each of the diets contains 18% crude protein and was unpelleted. There were two parity periods and the duration was 15 weeks. In the first parity period, the conception rates were 33.33, 100, 75, 66.66 and 75% for treatments I, II, III, IV and V, respectively, while the second parity conceptions rates were 50, 75 and 50% for treatments II, III and IV, respectively. No conceptions were observed for treatments I and V. The first breeding trials had abortion rates of 50 and 25% for treatments II and V, respectively. Autoclaved maize-milling waste was used for the second breeding trials. Autoclaving maize milling waste was observed to improve the nutritional value of the diets and neither abortion nor still births were seen for the second parity period. Therefore, simple diet comprising maize-milling waste and groundnut cake can support normal growth and reproduction of rabbits for meat production.

Key words: Rabbits, maize-milling waste, reproduction.

INTRODUCTION

Inadequate animal protein in the diets of people in developing countries has called for the integration of some non-conventional meat sources into the farming system as sources of animal proteins. Productivity of these livestock will depend to a large extent on their ability to utilize feeds that have no value in human feeding. This is because surplus can rarely be mentioned because human population is fast outrunning the available food supplies (Omole, 1983). Rabbits have a number of characteristics that might be advantageous to small holder subsistence type integrated farming system. The small body size, short generation internal, rapid growth rate, genetic diversity and high reproductive potentials are characteristics, which make rabbits suitable as meat producing small livestock in developing countries (Arijeniwa, 2000). Although rabbits can survive on all forage diet, optimum performance can only be ensured in a mixed feeding regime involving forage and formulated feeds (Harris et al., 1984; Cheeke et al., 1987; Arijeniwa 2000). While, some studies have been carried out on the replacement or supplementation of cereal grains in rabbit pellet as alternative protein/energy source (Omole and Ajayi, 1876; Eshiett et al., 1984) little is known about the potential of cereal by-products in rabbit nutrition. Raharjo et al. (1986) however noted that cereal by-product has high digestible energy content for rabbits. The aim of this study was to evaluate the reproductive performance of breeding rabbits fed waste maize-milling waste based diets.

MATERIALS AND METHODS

Maize-milling waste, a by product from the processing of corn flour and rice husk were purchased from a local mill. The maize-milling was sun-dried at temperature between 31–35°C for three days and

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Table 1. Composition and chemical analysis of diets I and II (g/100g).

Ingredient	Treatments				
	I	II	III	IV	V
Replacement (%) levels of maize for maize milling waste	0	25	50	75	100
Yellow maize	62	46.5	31	15.5	-
Maize milling waste	-	15.5	31	46.5	62
Groundnut cake	21.6	21.6	21.6	21.6	21.6
Rice husk	5	5	5	5	5
Tridax meal	5	5	5	5	5
Bone meal	2.5	2.5	2.5	2.5	2.5
Molasses	3.0	3.0	3.0	3.0	3.0
Vit/min.premix	0.8	0.8	0.8	0.8	0.8
$CuSo_4.5H_2O$	0.1	0.1	0.1	0.1	0.1
Chemical analysis based on unautoclaved maize-milling waste					
Dry matter (%)	86.53	88.95	88.30	86.30	86.70
Crude protein (%)	19.25	18.81	19.69	19.30	19.47
Ether extract (%)	11.25	10.65	1.65	11.85	11.75
Crude fibre (%)	4.94	6.58	7.62	7.76	7.93
Ash (%)	4.97	5.20	4.99	5.41	5.70
Chemical analysis based on autoclaved maize-milling waste					
Dry matter (%)	96.71	92.61	92.52	92.78	95.99
Crude protein (%)	19.21	18.83	20.56	18.38	20.15
Ether extract (%)	12.40	11.90	13.40	13.10	13.55
Crude fibre (%)	4.96	6.85	7.22	7.93	7.99
Ash (%)	5.58	6.10	6.10	5.86	5.76

stored in air-tight polythene bags prior to use in the experimental diets. Tridax meal was prepared from *Tridax procubens*, washed, sun-dried, milled and also stored in polythene bags. All other feed ingredients were assembled and incorporated with either autoclaved or unautoclaved maize-milling waste. The maize-milling waste replaced between 25 to 100% of the conventional ingredients (yellow corn). Two different treatments given to maize-milling waste were used for the first and second breeding trials. While unautoclaved maize-milling waste was used for the first, autoclaved maize-milling waste was used for the second breeding trial respectively. Autoclaving is the process of steam heating of feedstuffs to improve their nutritive value in other to destroy micro-organisms and anti-nutritive factors that may be present. Maize-milling waste was autoclaved at 121°C and 100 x 10^3 Nm^{-3} for 25min. The product was thereafter sun-dried before incorporation into the experimental diets.

Twenty (20) white does (Chinchilla x New Zealand white) with an average live weight of 1.65 ± 0.25 kg were used for the study. Each rabbit was individually caged and offered a daily pre-experimental period diet of 45 g of commercial rabbit pellets and 40 g of wilted *Tridax procumbens* prior to the introduction of experimental diets. An adjustment/flushing period of 14 days was allowed with a gradual substitution of experimental diets for commercial pellets within the first week. The animals were offered feed and water twice daily at 8 h and 16 h. Each doe was weighed weekly from the day it was bred to 56 days post partum and weighing was usually before feeding.

The reproduction performance of does were assessed using the following parameters: conception rates, gestation length, reproductive efficiency, doe weights at birth, feed consumption during gestation, protein intake (% crude protein x feed consumption) and mortality. Data obtained were subjected to one-way analysis of variance where differences existed; mean comparisons were tested using Duncan Multiple Range Test (Steel and Terrie, 1980).

RESULTS AND DISCUSSION

The composition and chemical analyses of experimental diets I and II (unautoclaved and autoclaved maize-milling waste) respectively are shown in Table 1. While the autoclaved maize-milling waste was superior in dry matter, ether extract and ash content the differences in other nutrients were similar. The reproductive performance of does in the two breeding periods is presented in Tables 2 and 3. High conception rates (50% and 100%) were generally observed for all dietary treatments in the two parties except for the control group in the first breeding trial with a conception rate of 33.33%.

Table 2. Reproductive performance of does fed unautoclaved maize milling waste.

Parameters	Treatment diets					
	I	II	III	IV	V	SEM
Conception rates (%)	33.33^{a}	100.00^{b}	75.00^{c}	66.67^{a}	75.00^{c}	8.33
Gestation length (days)	34	32	30.33	31.50	32.00	3.78
Reproductive efficiency (%)	25.00^{a}	50.00^{b}	75.00^{c}	66.67^{d}	50.00^{b}	11.79
Abortion (%)	-	50.00^{a}	-	-	25.00^{b}	8.33
Non conception (%)	66.67^{a}	-	25.00^{b}	33.33^{c}	25.00^{b}	8.33
No. of litters	3.00^{a}	4.00^{b}	1.67^{c}	4.00^{b}	4.00^{b}	0.19
No. of still births	3.00^{a}	2.50^{a}	1.67^{b}	1.50^{b}	-	0.53

Within rows, mean with different superscripts differ significantly at P<0.05.

Table 3. Reproduction performance of does fed autoclaved maize milling waste .

Parameters	Treatment diets					
	I	II	III	IV	V	SEM
Conception rates (%)	0.00^{a}	50.00^{b}	75.00^{c}	50.00^{b}	0.00^{a}	3.02
Gestation length (days)	0.00^{a}	33.00^{b}	32.00^{c}	32.00^{b}	0.00^{a}	2.41
Reproductive efficiency (%)	0.00^{a}	50.00^{b}	75.33^{c}	50.00^{b}	0.00^{a}	7.07
Abortion (%)	-	-	-	-	-	0.00
Non conception (%)	100.00^{a}	50.00^{b}	25.00^{c}	50.00^{b}	100.00	7.07
No. of litters	0.00^{a}	5.00^{b}	3.33^{c}	5.00^{b}	0.00^{a}	0.11

Within rows, mean with different superscripts differ significantly at P<0.05.

Similarly high conception rates of 67 to 100% were reported in New Zealand white breeds rabbits (Mineev et al., 1979; Sanchez et al., 1985; Raharjo et al., 1986). Non-conception observed in does on the control diets and treatment V in the second parity (Table 3) and low conception rate for the control (33.33%) in the first parity (Tables 2) may be attributed to some physiological problems in the does. Anoestrus/infertility in a female rabbit could be genetically induced resulting in reproductive tract malformations (Berepubo and Umanah, 1996). However, infection or inflammation in any part of the reproductive tract by pathogenic organisms could cause varying types of changes leading to infertility (Arthur, 1979). Many microbial agents could be responsible. They include a host of gram negative and positive bacteria and more recently mycoplasmal organisms such as the urea plasma. These have been found to cause metritis, endometritis, vaginitis and cervicitis. Furthermore, food processing waste are among substances identified to be hazardous to reproduction but infertility in this study could also be attributed to the single service per pregnancy with possible aspermic ejaculation from the bucks involved in the fertilization process (Szendro et al.,1984).

Length of gestation period of does in different treatment groups fed unautoclaved maize milling waste was not significantly (P<0.05) different from each other with an average of 31.4 days. The control group had longer gestation period of 34 days (Table 2). Prolonged gestation period of 33.7days for does fed diets containing 10% crude protein was reported by Omole (1982). However, protein insufficiency may not probably be the cause of prolong gestation in this study since does in the control diet consumed about 16.89 of crude protein per day. There were still births (3.00, 2.50, 1.67 and 1.50) for diets I, II, III and IV, respectively, coupled with 50 and 25% abortion rates for diets II and V, respectively. These could be traced to the presence of mycotoxins in the unautoclaved maize-milling waste. Numerous colonies of fungi suspected to be toxigenic were observed in the unautoclaved maize-milling waste used. They include *Aspergillus flavus, Aspergillus niger,*

Table 4. Relative growth performance of does (g) by state and parity (from day bred to 28 days after breeding

Treatment	Pregnant	Non-pregnant	Pregnant	Non-pregnant
I	166.67 ± 23.57[a]	107.64 ± 13.52[b]	-	79.34 ± 23.70[c]
II	152.20± 20.94[a]	-	136.11 ± 20.11[b]	73.33± 23.70[c]
III	161.71± 22.58[a]	130.68 ± 5.68[b]	19.89 ± 15.66[b]	51.02 ± 10.20[c]
IV	144.16± 24.90[a]	102.56 ± 10.47[b]	83.25 ± 23.35[c]	36.97 ± 9.36[d]
V	141.12± 18.89[a]	200.00 ± 40.82[b]	-	57.61 ± 14.49[c]
All	151.71 ± 8.12[a]	129.70 ± 13.09[a]	122.63 ± 10.32[b]	62.40 ± 7.84[c]

Within rows, mean with different superscripts differ significantly at P<0.05.

Penicillium sp. These are among the groups described as highly toxigenic by Rutledge (1976).

Conversely, autoclaved maize-milling waste was used in the second breeding trial. There were no abortions or stillbirths observed. Length of gestation period of does placed on diets II, III and IV were similar (32.33days) and was significantly different (P<0.05) from does placed on diets I and V where there was no conception (Table 3). Heat treatment decontaminates and controls mycotoxins. It has been found to decrease citrinin, a toxic content of maize by 80% after autoclaving at 120°C (Jackson and Siegler, 1978). Thus autoclaving is seen to improve the nutritive value of the diet as well as contain mycotoxin and citrinin, the toxic component of maize.

Another important parameter considered is relative growth during gestation. The data is presented in Table 4. Relative growth refers to the rate of change in weight during gestation based on doe's initial weight. Gravid does add weight at a faster rate than non-gravid ones. The relative body weights change irrespective of the state of the animal did not differ significantly (P>0.05) during the first breeding period when animals were put on unautoclaved maize-milling waste. However, significant differences (P<0.05) were observed in does relative body weight change in the second parity period. This may be attributed to improved utilization of feed, reduction in citrinin and elimination of toxigenic fungi as a result of autoclaving. Zumbado and Murillo (1988) reported similar improved growth performance in broiler fed autoclaved pejubaye palm (Bactris gasipens HBK) fruit meal. Generally, relative body weight changes observed in this study decreased from the first to second parity (Table 4). This observation corroborate the findings of Raharjo et al. (1986) who reported that body weight decreased with increasing parity. This indicates that dietary energy and/or protein intake were not adequate for intensive production by the does without the mobilization of body reserves. Accordingly, the significant differences (P<0.05) obtained among dietary treatment and states or does (Table 4) could be attributable to the parity effects. Parity effects have been known to be an important measure of carryover or cumulative effects affecting performance in animals over a long period of time.

In conclusion, autoclaving maize-milling waste before incorporation into diets can improve the nutritive value, neutralize toxin and retard mycotic growths. This is evidenced by the fact that neither abortion nor stillbirths were observed during the second breeding period (Table 3). From this study, it can be concluded that maize-milling waste can completely replace yellow maize in rabbit diets without any serious adverse effects on the reproductive performance of breeding rabbits.

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