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Hormonal profile and reproductive performance of male and female rabbits fed diets containing garlic bulb (*Allium sativum)* meal

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Abstract

An experiment was conducted with 24 buck and 24 doe rabbits of about 5-8 months. The animals were fed diets containing garlic flour meal to determine the effect on the hormonal profile and reproductive performance of the rabbits. The 48 rabbits were separated according to their sexes (buck and doe) and divided into four treatment groups with four rabbits consequently replicated three times in a completely randomized design. Dietary levels of 0.0, 5.0, 10.0 and 15.0% of garlic flour meal were used to formulate the diet for rabbits. At the end of this trial, different parameters on hormonal profile and reproductive performance were determined. All the parameters of hormonal profile were significantly (P<0.05) different thereby maintaining similar values except luteinizing hormone which had slight value fluctuation. The highest value of testosterone and progesterone were recorded in the diet containing 15.0% garlic flour meal. Similarly, the parameters on reproductive performance exhibited significant (P<0.05) difference. Partum weight and litter weight at birth showed a higher value as garlic meal was increased. The results of this study indicated that 15.0% dietary level of garlic flour meal proved acceptable for hormonal profile and reproductive performance of rabbit.

Keywords: Garlic flour meal, Rabbit Bucks and Does, Hormonal profile and Reproductive performance.

Introduction

Rabbit is one of the monogastric animals that have small body size and irregular reproductive performance. This characteristic has made them an undesirable stock in a competitive economic situation (Iheukwumere *et al.*, 2004). However, rabbits have some potential if their reproductive performance is improved. The performance is prominent having short gestation period, high prolificacy and ability to rebred immediately after parturition all leading to short generation interval (Ogundele and Apata, 2006). Rabbits not only thrive well with different kinds of grasses but also on formulated feed, converting them into useful animal products such as meat, wool, skin and even animal dungs to increase soil fertility (Gomez *et al*., 2004). The meat is characteristically rich in protein and low in cholesterol and sodium hence a better alternative for beef and pork.

In spite of all these potentials of rabbit, the industry is constrained of poor ejaculation and fertility rate to increase their population. A number of attempts have been made by renounced animal scientist to improve the reproductive performance of rabbits using imported human fertility drugs such as pergonal (Chibundu, 2005). These drugs are not only expensive but are relatively scarce even when they were needed. In view of this, there is increased interest by most animal physiologist to identify cheap and readily available local

materials that could enhance reproductive performance in farm animals (Adedeji *et al*., 2006).

Garlic (*Allium sativum*) is a recognized feed additive which belongs to the group of a herbaceous bulbous plant in the family *Alleaceae* is one in the series to be investigated upon for its effect on reproductive performance in farm animals. Garlic contains ascorbic acid and histidine as important anti-oxidative constituents. Ortserga *et al.* (2008) reported the use of garlic flour in the diets of growing rabbits improved feed conversion ratio (FCR). Ademola *et al*. (2005) also reported that garlic has the potential of enhancing body weight gain and has antimicrobial activity when fed in mixture with ginger in broiler diets. However, information on the reproductive performance and hormonal influence on farm animal using garlic is scanty or non in existence. Hence, this study is designed therefore to assess the effects of garlic on hormonal profile and reproductive performance of rabbits.

Materials and methods

The experiment was carried out at the Teaching and Research rabbitry farm, Federal College of Agriculture Ishiagu, Ebonyi State. The College is located at about three kilometers (3km) away from Ishiagu main town (Jiwuba *et al*., 2016). Forty-eight pubertal New Zealand male and female rabbits comprising twenty-four bucks and twenty four does aged 5-8 months weighing 1500-2000 grams were used to evaluate hormonal profile and reproductive performance. A two-week pre-experimental period was allowed to enable the animals acclimatize before the commencement of the trial which lasted for twelve weeks.

Fresh garlic bulbs (*Alluim sativum*) for the trial were sourced from Open market in Abia State. The garlic bulbs were winnowed and all adhering fibre materials removed. The bulbs were splitted into cloves and macerated into smaller pieces using kitchen knife. The sliced garlic were air-dried under shade for five days to prevent volatilization of garlic clove nutrients which were ground using harmer mill and then air-dried again for three days at atmospheric temperature of 35-45°C. The air-dried samples were milled into fine particle sizes using laboratory milling machines and the milled samples sieved with 2mm test sieve to produce a dried garlic flour meal for the feed formulation into 0.0%, 5.0%, 10.0% and 15.0% garlic flour meal.

Table 1: composition of experimental diets

	Dietary level (%)			
Ingredients	**0.00**	**5.00**	**10.00**	**15.00**
Maize	47.00	47.00	47.00	47.00
PKC	19.00	18.05	17.10	16.00
Garlic flour	-	0.95	1.90	2.85
Soya bean	16.00	16.00	16.00	16.00
Wheat offal	12.00	12.00	12.00	12.00
Fish meal	2.00	2.00	2.00	2.00
Bone meal	1.00	1.00	1.00	1.00
Oyster shell	2.00	2.00	2.00	2.00
Salt	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Vit/Premix	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated analysis				
Crude Protein (%)	18.19	18.02	17.85	17.68
Metabolisable energy (Kcal/kg)	2740.83	2720.17	2699.1	2678.6
Crude fibre (%)	5.32	3.38	4.96	4.96

Management of experimental animals

The rabbits were housed in a four 4-tier rabbit cage, which had a total of 24 hutches of six hutches per tier previously cleaned, washed and disinfected before the onset of the trial. The cages were located inside a rabbit building equipped with windows for proper ventilation. Each hutch, which accommodated two rabbits, was fitted with aluminum drinkers and feeders. However all the 24 buck used for this experiment were marked to determine their performance and then kept in deep-litter. The rabbits were divided into four treatment groups consisting of four rabbits which were replicated three times in a completely randomized design. Semen was collected twice a week for twelve) weeks by massage method. The semen of marked buck was introduced into the corresponding oestrus doe using catheter instrument for hormonal profile evaluation. Hormones were analysed using standard Elisha (enzyme linked immunosorbent assay) kit according to methods described by McDonald (1975) and Nowshari *et al*. (1999). The kids were produced by immunodetrics. Data were collected based on male and female hormonal profile and reproductive performance of the rabbits.

All the data collected from this study were subjected to analysis of variance (Steel and Torrie 1980). Treatment means when significant were separated by the use of Duncan's New Multiple Range Test as described by Obi (1990).

Results and discussion

The result of proximate composition of the feed is presented in Table 2. All the parameters examined had similar range in their values. Crude protein and crude fibre values of the feed met the requirement of adult rabbits. The values were similar to that reported by Aduku and Olukosi (1990). Moisture and ether extract decreased as dietary levels of garlic increased. This may be as a result of nutrient status of the feed. The values of nitrogen free extract (NFE) which equally decreased may be attributed to depression in residual oil contained in test ingredient.

The effect of garlic flour meal on hormonal profile of both male and female rabbits is presented in Table 3. Testosterone values as presented on the work increased in ascending order as dietary levels increased. The values were significantly ($P<0.05$) different. The follicle stimulating hormone (FSH) had a higher value at 15% garlic diet. The observation was in agreement with the findings of Iheukwumere *et al.* (2004) who reported increased (FSH) level in supper ovulated goat using pergonal. In addition the values of (FSH) and interstitial cell stimulating hormone were similar ($P<0.05$) among rabbits fed garlic flour diets, however, they differed significantly ($P<0.05$) from the control diet. This could be attributed to increased metabolism and utilization efficiency of nutrient by the rabbits as a result of garlic flour meal. The observation agrees with the report of Lozano *et al*. (2000) who used West Africa dwarf goats in their studies. The luteinizing hormone (LH) indicated low value range as compared to the work of Iheukwumere *et al.* (2008) who recorded a range between 3.06 – 3.60 in their study. This may be as a result of non-super ovulation on LH secretion surge which may be attributed to genetic effect of the rabbit. However the values recorded in this work fluctuated as diet levels increased. Estradiol hormone values in female differed ($P<0.05$) and increased as dietary levels increased. The higher values from treatment 5.00 – 15.00 as compared to control treatment might be due to low oestradiol level in the circulation during early luteal phase. Consequently, it was

observed that rabbits on the control group showed the lowest serum oestradiol when compared with rabbits on other treatment level. These results also agreed with the report of Iheukwumere *et al.* (2008) having used pergonal in the study. Progesterone decreased in values as dietary levels increased while (LH) fluctuated in values as dietary levels increase.

Table 2: Proximate composition of the experimental diets

	Dietary level (%)			
Parameters	**0.00**	**5.00**	**10.00**	**15.00**
Dry Matter	85.00	82.00	84.00	86.00
Moisture	15.00	18.00	16.00	14.00
Crude Protein	14.50	13.50	13.80	13.90
Crude fibre	15.00	15.10	15.12	15.15
Ether Extract	3.10	3.05	3.00	3.00
Ash	11.50	11.10	10.80	10.50
Nitrogen Free Extract	7.15	7.12	7.10	7.08

Table 3: Effect of garlic flour meal on hormonal profile of male and female rabbits

	Dietary Levels				
Parameters	**0.00**	**5.00**	**10.00**	**15.00**	**SEM**
Male					
Testosterone (mg/ml)	3.42^{b}	5.65^{a}	5.75^{a}	5.80^{a}	0.58
FSH (IU/L)	0.60^{b}	1.20^{a}	1.35^{a}	1.40^{a}	0.18
ICSH (IU/L)	0.35^{b}	0.64^{a}	0.63^{a}	0.62^{o}	0.07
Female					
FSH (IU/L)	0.85^{b}	2.05^{a}	2.02^{a}	2.14^{a}	0.31
LH (IU/L)	0.90^{b}	2.15^{a}	3.14^{a}	2.35^{a}	0.46
Estradiol (IU/L)	150.15^{b}	170.50^{a}	176.20^{a}	175.30^{a}	6.09
Progesterone (mg/ul)	14.50^{b}	18.20^{a}	15.20^{b}	15.45^{b}	0.81

$^{a-b:}$ means with different superscript within the same row differ significantly (P<0.05).
SEM = Standard Error of mean.

The effect on garlic flour meal on reproductive performance of female (doe) rabbits is presented on Table 4. Prepartum and partum weights were significantly (P<0.05) different among the treatment groups. The values increased as dietary levels of garlic flour meal increased when compared with the control. The increase in body weight gain observed in this study for the treatment group has been earlier reported for broilers fed diets containing garlic flour meal (Ademola *et al*., 2005); thus an indication that garlic can be used as a growth promoter in monogastric diets. The number of does mated did not differ (P<0.05) significantly among the treatment groups. The gestation length differed (P<0.05) in their values with that of the control. However, treatment 2 to 4 values were within normal gestation period of rabbit. This explains that garlic could be using to enhance the gestation length. The values were in line with that of Iheukwumere *et al.* (2008) who had 31days in all treatment groups of their study. The litter size at birth increased in ascending order. This may be due to adequate nutrition at pregnancy which resulted to increase in survival rate: which may be attributed to the garlic flour. In addition, the survival rate is equally attributed to good sanitation and proper management of the kittens during the experimentation. The observed increase in litter size at weaning in this study did not

agreed with the finding of Agiang and Olawoyin (2007), who reported decreased litter size at weaning. This may be deduced to good practices and breed of rabbit. Similarly garlic (Ortserga *et al.*, 2008) is rich in antioxidants and contains high nutrient profile which may have positive effect on milk synthesis and milk let down which may have enhanced the survival rate and weaning weights of the kittens. Consequently, the values of average litter weights at weaning and at birth obtained in this study were similar to the report of Asuquo (1996) who indicated that higher litter weaning weights is associated with higher litter size.

Table 4: Effect of garlic flour meal on reproductive performance of female rabbits

	Dietary levels (%)				
Parameters	**0.00**	**5.00**	**10.00**	**15.00**	**SEM**
Prepartum weight (g)	1520.20^{b}	1540.30^{a}	1550.40^{a}	1545.25^{a}	6.61
Partum weight (g)	1720.40^{c}	1732.15^{bc}	1750.35^{ab}	1772.10^{a}	9.90
No. of Does mated	5.00	5.00	5.00	5.00	0.00
Gestation length (days)	37.00^{a}	30.00^{b}	31.00^{b}	29.00^{b}	1.80
Litter size @ birth	4.30^{b}	5.60^{a}	5.85^{a}	5.75^{b}	0.35
Litter size @ weaning	4.20^{b}	5.30^{a}	5.45^{a}	5.60^{a}	0.32
Survival rate (%)	60.00^{b}	80.00^{a}	83.00^{a}	84.00^{a}	5.67
Litter weight @ birth (g)	193.00^{b}	213.00^{ab}	221.00^{a}	225.00^{a}	7.12
Litter weight @ weaning	670.00^{b}	1120.00^{a}	1120.00^{a}	225.00^{a}	134.37

^{abc} means with different superscript within the same row differ significantly (P<0.05)

Conclusion

The study showed that garlic flour meal at 15% dietary level generally enhanced hormonal and reproductive performance of rabbits and therefore recommended for enhancement of rabbit production in terms of litter size, birth and weaning weights and general survivability of the kittens at birth and weaning.

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