EFFECT OF DIETARY SUPPLEMENTATION OF TUMERIC POWDER ON GROWTH AND REPRODUCTIVE PERFORMANCE OF RABBIT DOES

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ABSTRACT
A 35-day experiment was conducted to ascertain the effects of Tumeric powder (TP) on some reproductive and growth characteristics of rabbit does. A total of 24 first time bred does of 15 days pregnant were randomly allotted into four dietary groups of six rabbits per group, where each rabbit in a group is a replicate. The four experimental diets were as follows: Control (T1; without TP), T2; with 0.1% TP, T3; with 0.15% TP, T4; with 0.25% TP. The result showed increased weight and corresponding average daily feed intake at lower inclusion rates of 0.1%. Litter size and litter weight were influence at 0.15% and 0.25%.
Keywords: Rabbit, Tumeric powder, weight, Reproduction, Diet

INTRODUCTION
Turmeric is a golden spices derived from the rhizome of the *Curcuma longa* plant, which belongs to the Zingiberaceae family (Gupta *et al.,* 2013). Since ancient times, turmeric has been used as the principal ingredient of dishes originating from Bangladesh and India for its color, flavor, and taste. It is also used in social and religious ceremonies in Ayurvedic and folk medicines against various ailments, including gastric, hepatic, gynecological, and infectious diseases (Gupta *et al.,* 2013; Hasan and Mahmud, 2014). Dry turmeric contains 69.43% carbohydrates, 6.3% proteins, 5.1% oils, 3.5% minerals, and other elements (Islam *et al.,* 2002). Medicinal values and antioxidant properties of some turmeric varieties have already been reported (Qader *et al.,* 2011; Denre, 2014)
Tumeric in recent studies have shown great potentials to improve reproduction in some livestock. Dietary turmeric powder has been reported to increase rabbit viability and fecundity (the number of live born and weaned pups), as well as the production and growth of ovarian follicles by altering both the release of ovarian hormones and the response of ovaries to gonadotropin. (Sirotkin *et al.,* 2018).
Rabbits have a high reproductive rate compared to other livestock. They become sexually mature within a few months of birth and have relatively short pregnancies. They produce large litters and are unique in that they can be rebred immediately after kindling.
These qualities in rabbit production has drawn more attention of farmers to its production as a sure way to increase protein availability. Rabbit meat has been reported to be a good quality source of protein (Paraveez *et al.*, 2015). Due to limited research on ways to improve and maintain good reproductive abilities in rabbit, the effect of turmeric rhizomes grown in the south eastern part of Nigeria was used to ascertain its effects on some reproductive parameters in rabbit does.

MATERIALS AND METHODS
Study location and Processing of test ingredients; The experiment was carried out at the Rabbit Unit, Department of Animal Science, University of Agriculture and Environmental Sciences, Umuagwo, Imo State South eastern Nigeria. Tumeric rhizomes were purchased from relief market Owerri, Imo State, south eastern Nigeria. After collection, the test ingredient was washed, grated and spread under the sun for four days, until they became crispy. After drying, the tumeric was taken to the local mill where it was ground to powder.
Experimental animal, design and management; A total of 24 first time bred rabbit does of average weight of 2.5kg were gotten from the Rabbit Farm, University of Agriculture and Environmental Sciences Umuagwo. Crossing of the does was made by introducing 6 newzealand white bucks of age 6 months randomly to mate 30 New Zealand White does of average weight of 2.5kg, after 15 days, pregnancy was ascertained by palpation of the uterine region, during which 24 pregnant does were selected and randomly distributed into the four dietary treatment groups. The rabbits were housed in

an automated cage unit of 24 rooms capacity, where each rabbit occupied a single room. Throughout the experiment which lasted for 35 days, feed and water were made available *ad-libitum*.

Experimental diets layout;
The diets were formulated to be isocaloric according to NRC (1994) recommendations as shown in Table 1 for all treatment groups. The experimental diets were laid out as shown below:
Diet 1: Control- containing no Tumeric powder (TP); Diet 2: Containing 0.10% (10g/kg) TP supplementation; Diet 3: containing 0.15% (15g/kg) TP supplementation; Diet 4: containing 0.25% (25g/kg) TP supplementation

Table 1: Ingredients and composition of experimental diets

Ingredients	T1 (control- no TP)-kg	T2 (0.10% TP)-kg	T3 (0.15% TP)-kg	T4 (0.25% TP)-kg
Yellow maize	10	10	10	10
Soya bean	8.5	8.5	8.5	8.5
Wheat offal	50	50	50	50
Palm kernel cake	30	30	30	30
Vit-min Premix	0.4	0.4	0.4	0.4
Coccidiostat	0.1	0.1	0.1	0.1
Limestone	1.00	1.00	1.00	1.00
Tumeric powder	0.00	0.10	0.15	0.25
TOTAL	**100**	**100.1**	**100.15**	**100.25**

M.Energy 2316kcal/kg; Crude protein 17.57%; Crude Fibre 10%; Crude Fat 3.74%

Data collection
Initial live weight of the rabbits was recorded at the beginning of the experiment and subsequently weighing was done on weekly basis, in the morning hours (7-9 am) till the end of the experiment.
At the end of the experiment, reproductive parameters such as litter size, gestation period (days), litter weight at birth, which was done by weighing the new born kits within 24 hours of birthing with a digital scale, maternal mortality rate was also ascertained within 48 hours of parturition.
Statistical Analysis
Data were analyzed using one-way analysis of variance (ANOVA) of SAS (SAS institute Inc. Cary, NC) software. Data were shown as the means and pooled SEM. Duncan's multiple range test was used to evaluate the differences between treatments and those differences will be considered statistically significant when $P<0.05$.

RESULTS AND DISCUSSION
Table 2. Reproductive performance of rabbit does fed diets supplemented with Tumeric powder

Parameters	T1 (0%)	T2 (0.10%)	T3 (0.15%)	T4 (0.25%)	SEM
Initial weight (g)	2515^{a}	2512^{a}	2511^{a}	2514^{a}	14.07
Final weight (g)	2865^{b}	2962^{a}	2861^{b}	2664^{c}	23.96
Weight gain (g)	350^{b}	450^{a}	350^{b}	150^{c}	32.98
Average daily feed intake(g)	99.48^{b}	104.35^{a}	104.45^{a}	100.63^{b}	11.35
Duration of pregnancy(days)	34.00^{a}	32.00^{b}	28.00^{c}	29.00^{c}	0.76
No of litters	3.00^{b}	4.00^{ab}	5.00^{a}	5.00^{a}	0.33
Litter weight(g)	25.00^{c}	35.00^{b}	40.00^{a}	40.00^{a}	1.89
Maternal mortality(%)	16.67	0.00	0.00	16.67	0.15

Means with different superscript on the same horizontal row are significantly different at $P<0.05$

Table 2 shows that supplementation of turmeric powder significantly (P<0.05) influenced weight gain of rabbit does at 0.25% inclusion level which has the lowest weight gain. Feed intake was affected by turmeric supplementation as there was slight increase in average daily feed intake across turmeric supplemented diets. Pregnancy duration was slightly affected by turmeric supplementation across treatment groups. Litter size and litter weight significantly increased with turmeric supplementation. Maternal mortality did not significantly (P>0.05) differ across treatment groups, although deaths were recorded in the T1 and T4, it's cause may be linked to first time experience of parturition.

Turmeric has been noted for its high antioxidant capacity (Qader *et al*., 2011) which have shown positive impacts on reproduction in diverse studies, for example turmeric has been shown to possess protective effect on reproductive functions in hypersensitive male rats (Ayodele *et al.,* 2015), this suggests the antioxidant capabilities of turmeric powder. Furthermore, potentials of curcumin in turmeric has shown to positively impact human semen quality (Katatzyna *et al.,* 2014), although more research on reproductive benefits of turmeric on female reproduction needs to be done, some recent studies point to greater potentials of turmeric influence on female reproduction. The study on the potential effect of turmeric powder supplementation on reproductive performance of laying hens and egg quality (Rajesh, *et al.,* 2018) expressed positive impacts, also (Sirotkin *et al.,* 2018) reported that dietary turmeric powder increased rabbit viability and fecundity. These reports agree to the results of this study on the effect of turmeric powder on reproductive performance in rabbits and there was positive impact on litter size and litter weight at birth just by inclusion at 0.15% and 0.25%. At 0.25% turmeric powder maintained a healthy weight for the rabbits does, this corresponds to the findings of Asma *et al*. (2009), that curcumin the active ingredient in turmeric inhibited adipogenesis in adipocytes.

Rabbits fed 0.15% and 0.25% turmeric supplementation had fewer duration of pregnancy (28 and 29 days respectively) than the control (34 days), this agrees with the report of Polasa *et al.* (1992) which reported that ovaries of rabbit fed high dose of turmeric may release more P4 initiation. This may suggest that oogenesis may be influenced by turmeric through expressions in ovarian hormones. The increase in litter size corresponds to the findings of Quiles *et al.* (2003) who reported that dietary turmeric can improve ovarian functions and growth performance in rabbit production.

CONCLUSION AND RECOMMENDATION

Dietary supplementation of tumeric powder on reproductive performance of rabbit does shows that turmeric has the potential to improve overall reproductive capabilities within the inclusion rates of 0.15% and 0.25% and may aid in weight loss at higher doses. Further studies are required to further ascertain its influence on other physiological parameters such as blood and endogenous hormones as well as the lethal dose if any on turmeric powder dietary supplementation in rabbit production.

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