GROWTH PERFORMANCE AND ECONOMIC BENEFITS OF MALE AND FEMALE RABBITS FED DIETS SUPPLEMENTED WITH TURMERIC (*Curcuma Longa*) POWDER

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ABSTRACT
Sixty four (7-8 weeks old) crossbred male and female rabbits that weighed between 600 and 800g were used to determine the effect of inclusion of Turmeric (Curcuma longa) powder on growth and economic benefits of male and female rabbits. The rabbits are on sex (male and female) basis and four inclusion levels (0%, 0.5%, 1.0% and 1.5%) of turmeric were randomly allotted in a 2x4 factorial arrangement. Data were collected on growth performance and analysed using ANOVA. Significant ($p<0.05$) differences were obtained on weight gain and daily. Highest ($p<0.05$) total weight gain (785.13g) was obtained with buck fed diet that contained 1.0% turmeric inclusion while doe fed with diet containing 0.5% turmeric inclusion had least (442.25g). Feed intake was ($P<0.05$) highest (116.13g) with doe fed diet containing 1.5% turmeric inclusion and least (96.62g) and similar ($P>0.0\%$) among buck and doe fed diet with 0.5% turmeric inclusion. Cost of feed per 25kg and kilogram diets were significant ($P<0.05$) with turmeric inclusion. Turmeric inclusion at 1.5% was highest (N2363.50) in both buck and doe while the least (N2100) was at 0% in both buck and doe. Highest ($P<0.05$) cost per daily feed intake (N10.98) was obtained among doe fed supplemented turmeric at 1.5% with turmeric inclusion and buck (N10.53) but lowest (N8.79) was recorded with doe on 0.5% turmeric inclusion. The study concluded that turmeric inclusion had no detrimental effect of growth performance of male and female rabbits. However, 0.5% inclusion could be assumed as economic inclusion level for efficient feed utilization, least cost diet formulation and optimum profit in male and female rabbit production enterprise

Key words: Rabbit, turmeric, growth performance, economic

Introduction
Phytobiotics are plant derived products added to the Livestock feeds in order to improve performance. Leaves, roots, flowers and the whole plants are used for production of phytobiotics products. These products may comprise the dried form of whole plants or their parts or extracts of some valuable ingredients (Grashhorn, 2010).
Utilization of phytobiotics as Natural Growth Promoters (NGPs) has been identified as effective alternative to antibiotics (Panda *et al.*, 2009). Example of phytobiotics includes garlic, turmeric, ginger etc. Phytobiotics as NGPs are highly developed as feed additives, improve immunity, growth performance and effective in improving the health of the digestive tract (Panda *et al.*, 2009). Phytobiotic are also known to be an effective antimicrobial and anticoccidia (Panda *et al.*, 2006). Feeding diets containing phytobiotics may result in the inhibition of the growth and colonization of entero-pathogenic microbes in the digestive tract, thus contributing to the balance of gut microflora and ecology (Harris *et al.*, 2001).
Much attention has been focused on the use of herbal medicines and their derivatives in healing different ailments related to oxidative stress (*Lee and Pack*, 2003). Turmeric (*Curcuma longa*), is a very important herb in Indian Ayurvedic medicine. It has been used for centuries in the Indian traditional system of medicine as a spice and a natural food colour. It is also seen as an excellent natural antibiotic. Curcumin is the active ingredient in turmeric and it contains three components, namely curcumin, demethoxycurcumin and methoxycurcumin, all which are referred to the curcuminoids (Aggarwal *et al.*, 2003).
Curcumin as the main active compound furnishes turmeric with its characteristics yellow colour and is recognized as being responsible for most of its therapeutic effects,

such as antibacterial, antifungal, anti-protozoa, antiviral, antioxidant, anti-inflammatory, and hypo-cholesterolemic, activities (Chattopadhyay *et al.*, 2004).

On the other hand rabbit, (*Oryctolagus cunniculus*) is one of the animals that can be reared successfully at family level (FAO, 1996). This species of animal presents the favourable biological characteristics as most monogastric species. Indeed, rabbit is characterized by a short gestation interval and a high prolificacy which encourages the genetic progress (Beaumont *et al.*, 2003). Rabbit is used as laboratory animal in the field of medicine research and biotechnological application (Chantry-Darmon, 2003) and can therefore be categorized as multi-purpose animal for research and human uses.

Phytobiotics are relatively new class of feed additives and in recent years these feed additives have gained considerable attention in the poultry industry. This may be probably due to ban of most antibiotics usage in poultry and rabbit. Turmeric is an exemplary herb that has a wide array of health benefits at low cost and no adverse effects (Soni *et al.*, 1997) in livestock production. Due to some vitamins and minerals that turmeric contains, it has also been used as dietary supplementation on voluntary feed intake, nutrient digestibility and growth performance both in rabbit and poultry (Osawa *et al.*, 1995). However, there is dearth information on holistic effect of turmeric on growth and economic benefits and this therefore necessitates the present study.

Materials and Methods

The study was conducted at the Rabbitary unit of Federal College of Agriculture Farm, Institute of Agriculture Research and Training (IAR&T) Ibadan, Oyo State, Nigeria.

Turmeric rhizome was cut in order to increase the surface area and boiled for 30-45 minutes in water bath at 60°C to soften the turmeric and make grinding easy and also enhance its colour and flavour. Thereafter the boiled turmeric was air dried for 10 days and milled into fine powdery according to the method described by Jayaprakasha *et al.* (2005) and stored in air tight container until use.

A total of 64 (8 weeks old) comprising of 32 male (buck) and 32 female (doe) with weight range of 600-800g weaner rabbits was used for the study. The animals were purchased from a reputable farm and they were weighed and allotted into 4 treatments in a 2x4 factorial arrangement comprising of sex (male and female) of rabbits and four levels (0, 0.5, 1.0, 1.5%) of turmeric inclusion effect on growth performance and economic benefits. Each treatment having 8 replicates of 2 rabbits each. Before stocking, the pen (house) was cleaned thoroughly with detergent and water. These animals were fed with a grower diet containing 18% Crude Protein (CP) and 2500 kcal/kg Metabolizable Energy (ME). Feed and water were supplied *ad libitum* daily. All other routine management practices were observed. The study lasted for 10 weeks.

Rabbits were weighed individually at the beginning of the experiment and subsequently on weekly basis. Weight gain was determined by calculating the difference between the final body weight and the initial body weight. Feed intake was determined through deduction of leftover feed from supply. Cost per kilogram feed (N) and total feed intake per animal (kg/rabbit) was calculated using prevailing market price.

Data collected were analysed using ANOVA as contained in SAS (2002). Significant means were separated using Duncan Multiple Range Test as contained in SAS (2002).

Results and Discussion

Table 1 shows interaction between sex and inclusion level of Turmeric on growth of rabbits. Significant ($p<0.05$) differences were obtained on weight gain and daily. Highest ($p<0.05$) total weight gain (785.13g) was obtained with buck fed diet that contained 1.0% turmeric inclusion while doe fed with diet containing 0.5% turmeric inclusion had least (442.25g). Significant increase in body weight at 1.0% of the buck may be due to optimum antioxidant activity of Turmeric (*Curcuma longa) which aid* body tissue synthesis of rabbit. This was in agreement with findings of Osawa *et al.* (1995) who reported that increased weight gain is due to the antioxidant activity of turmeric. The result of weight gain was in agreement with report of Ramirez *et al.* (1999) on oral administration of turmeric in rabbit.

There was a significant difference ($p<0.05$) on daily feed intake. Feed intake was highest (116.13g) with does fed diet containing 1.5% turmeric inclusion and least (96.62g) among does fed diet with 0.5% turmeric inclusion. Bucks and does on 0.5% turmeric level of inclusion had least daily feed intake. Similar observations were made

by Emadi and Kermanshahi (2006) and Durrani *et al.* (2006) with chicks. They reported that at 0.5% level, turmeric significantly decreased feed consumption in chick. Also Omage *et al.* (2007) reported that there was significant difference in feed intake of rabbits fed varying level of ginger, therefore phytobiotics inclusion in the diets of non-ruminants are levels specific.

Table 2 shows effect of Turmeric inclusion on economic benefit of rabbits. There was significant difference ($p<0.05$) on cost of feed per 25kg diet. Turmeric inclusion at 1.5% was highest (N2363.50) in both buck and doe while the least (N2100) was at 0% in both buck and doe. Also there was significant difference ($p<0.05$) on cost per kg diet. Highest cost (N 94.54) per kg diet was recorded with 1.5% turmeric inclusion. Similarly, least (N84.00) cost per 25kg diet was obtained in male and female rabbit on 0.5% turmeric inclusion. There was significant difference ($p<0.05$) on cost per daily feed intake. Highest similar cost per daily feed intake (N10.98) was obtained among does fed supplemented turmeric at 1.5% with turmeric inclusion and buck (N10.53) but lowest (N8.79) was recorded with doe on 0.5% turmeric inclusion.

There was a non-significant difference ($P>0.05$) on cost of feed per kg bodyweight, even though highest cost of feed per kg body weight was recorded with doe on 1.5% turmeric inclusion (N137.19) and lowest(N83.68g) with doe on 0.5% inclusion.

The result obtained for both buck and doe on cost per 25 kg diet, cost per kg diet, cost per daily feed intake and cost of fed per kg body weight was in agreement with that of Durrani *et al.* (2006) who noted that 0.5% inclusion level had highly favourable cost of feed than other treatment in chicks.

Conclusion

It could be concluded from the results obtained from this study that, turmeric inclusion had no detrimental effect of growth performance of male and female rabbits. However, 0.5% inclusion could be assumed as economic inclusion level for efficient feed utilization, least cost diet formulation and optimum profit in male and female rabbit production enterprise.

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Table 1: Interaction between sex and inclusion level of Turmeric on growth performance of rabbits

Parameters	Doe			Buck		
	Inclusion of Turmeric (%)			Inclusion of Turmeric (%)		
	0	0.5	1.0	1.5	0	0.5	1.0	1.5
Initial body weight (g)	----	707.25±26.76	711.38±33.84	702.13±49.44	694.50±5.67	690.38±51.57	697.38±31.28	703.88±24.51
Total weight gain (g)	652.13±132.22^{ab}	442.25±135.06^{b}	616.29±40.58^{ab}	719.25±130.79^{ab}	674.50±44.36^{ab}	560.00±54.0^{ab}	785.13±41.6^{a}	629.75±47.69^{ab}
ADWT(g/r/d)	9.31±1.89	8.09±1.05	8.80±0.58	10.28±1.87	9.64±0.63	8.00±0.77	11.22±0.59	8.99±0.68
ADFI (g/r/d)	107.82±1.66^{abc}	96.62 ±3.70^{d}	112.74 ±2.51^{ab}	116.13±1.69^{a}	105.15±2.65^{bc}	102.35±2.18^{cd}	105.09±3.11^{bc}	111.39 ±2.97^{ab}
FCR	12.98 ±2.36	12.59 ±1.76	12.98 ±0.90	12.59 ±2.39	11.01±0.49	13.05 ±0.89	9.42 ±0.35	12.57 ±0.92

abcd: means in the same row by factor with different superscripts differ significantly ($p<0.05$)
ADWG: Average daily weight gain
ADFI: Average daily feed intake
FCR: Feed conversion ratio

Table 2: Interaction between sex and inclusion level of Turmeric on economic benefits of rabbit s

Parameters	Doe			Buck		
	Inclusion of Turmeric (%)			Inclusion of Turmeric (%)		
	0	0.5	1.0	1.5	0	0.5	1.0	1.5
Cost of 25kg diet(₦)	2100.00 ± 0.00^{d}	2231.750± 0.00^{c}	2297.63 ± 0.00^{b}	2363.50 ± 0.00^{a}	2100.00 ±0.00^{d}	2231.75±0.00^{c}	2297.63±0.00^{b}	2363.50 ± 0.00^{a}
Cost per kg diet(₦/kg)	84.00 ±0.00^{d}	89.27 ±0.00^{c}	91.91±0.00^{b}	94.54 ±0.00^{a}	84.00 ±0.00^{d}	89.27 ±0.00^{c}	91.91 ± 0.00^{b}	94.54 ± 0.00^{a}
Cost of daily feed intake (₦)	9.06 ± 0.14^{bc}	8.79± 0.33^{c}	10.36 ± 0.23^{a}	10.98 ± 0.16^{a}	8.83 ± 0.22^{c}	9.13 ±0.19^{bc}	9.66 ±0.29^{b}	10.53 ±0.28^{a}
Cost of feed per body weight gain(₦/kg)	118.33±22.58	83.68 ±31.19	134.43 ±9.54	137.19±24.28	96.975±2.76	118.83±6.78	90.86 ±3.5	132.34±10.13

abcd: means in the same row by factor with different superscripts differ significantly ($p<0.05$)