INTERACTION EFFECT OF BREEDS OF GOAT AND LEVELS OF TURMERIC POWDER INCLUSION ON MILK YIELD FOR 12 WEEKS POST-KIDDING

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ABSTRACT

The study was conducted to evaluate interaction effect of breeds of goat and levels of turmeric powder (TP) inclusion on milk yield for 12 weeks post-kidding. Forty-five lactating Does comprising of 15 Kalahari Red (KR), 15 KalaWAD and 15 West African Dwarf (WAD) were used. The Does were randomly allotted to 3 treatments comprising of 5 Does of same breed per treatment. Three diets, that is concentrate diet (CD) as T0; CD+2g/kg TP as T2; and CD+5g/kg TP as T5 were fed at 5% bodyweight during pregnancy and for 12 weeks of lactation. Data obtained were arranged in a 3x3 factorial layout in a completely randomized design, while ANOVA was done using SAS 9.1. Results obtained revealed that KR fed T0 had the highest significant ($p<0.05$) milk yield (1100.00ml/24hrs) at 1st week of lactation compared to other dietary treatments. KR fed T2 had the overall best performance in terms of milk yield from 2nd to 12th week of lactation except at week 5 where KR fed T0 had the highest significant ($p<0.05$) value of 1160ml/24hrs. Peak value ($p<0.05$) of 1560ml/24hrs was recorded for KR fed T2 at 4th week of lactation, whereas WAD fed T0 had the lowest values for milk yield from weeks 1 to 12 with a peak value of 464.67ml/24hrs at 6th week of lactation. It could be concluded from the results of the study that feeding of concentrate diet with TP especially at the rate of 2g/kg of concentrate to KR Does generally improved the milk yield compared to other breeds of goat used and TP levels.

Keywords: Lactation, Kalahari Red, West African Dwarf, KalaWAD goats, Supplementation

INTRODUCTION

Goats are important for the supply of high quality protein in milk through conversion of feed from non-competitive sources. In developing countries like Nigeria, sheep and goats are often kept in marginal environments with scarce grazing and unfavourable climatic conditions (FAO, 2019). Goats are the third ranking source of milk after cows and buffaloes (Devendra, 1980). Goats are dairy animals of the poor because of the lower capital investment and production costs required, and the animals' rapid generation turnover (and thus earlier milk production compared to other dairy animals), short pregnancies and milk supply in quantities that are suitable for immediate household consumption (FAO, 2019). The efficiency of milk production is dependent on high milk yields. Development of milk production from goats by small farmers in the tropics can complement commercial milk production especially from cows, and it is important for alleviation of undernutrition and malnutrition due to its high nutritional content (FAO, 2010) among the rural dwellers, people with lactose intolerance and other health challenges.

Turmeric (*Curcuma longa*) is believed to have spread from South-East Asia to nearby places like Indonesia, China, Japan and other South Pacific Islands and from there to tropical West and East Africa (Velayudhan *et al.*, 2012). The active ingredients found in turmeric are curcumin, demethoxycurcumin, bisdemethoxycurcumin (Wuthi-Udomler *et al*., 2000) and tetrahydrocurcuminoids (Osawa *et al*., 1995). The curcumin contained in turmeric is believed to have a wide range of biological effects such as anti-inflammatory, antioxidant, anti-tumour, antibacterial, and antiviral activities among others (Prasad *et al*., 2011). Despite the usefulness of turmeric to livestock production, there is no information on its effect on milk yield of goats, thus necessitating conduct of this study

MATERIALS AND METHODS

Preparation of turmeric powder

Fresh turmeric rhizomes were sourced from Oyo State. The rhizomes were sorted, washed, drained and spread in a dry cool to allow drying. Slicing was done afterwards using sharp knives into smaller pieces and thereafter oven dried at 60^{o}C to a constant weight. The dried rhizomes were milled into fine powder using electric blender before its inclusion in the experimental diet and for necessary laboratory analyses.

Animal Management Procedure

A total of 45 matured non-pregnant, and non-lactating Does of at least parity one within age range of 2-2$^{1}/_{2}$ years were sourced from IFSERAR, Federal University of Agriculture Abeokuta, Nigeria. These included 15 Kalahari Red (KR), 15 KalaWAD (KW) and 15 West African Dwarf (WAD) Does. The Does were synchronized after flushing with 1st and 2nd intramuscular injection of Lutalyse® according to the procedure of Heise (2012). Thereafter, mating was done when the synchronized Does came on heat by introducing 6 healthy and proven KR bucks (i.e. 2 bucks per goat breed) into the pens where the Does were housed for at least 5 hours/day for a week. The Does were randomly allotted to 3 treatment groups comprising of 5 Does of same breed per treatment. Flock treatment was carried out prior to mating.

EXPERIMENTAL DIETS

T0: Basal concentrate diet (Control)

T2: Basal concentrate diet + 2g/kg turmeric powder

T5: Basal concentrate diet + 5g/kg turmeric powder

The basal concentrate diet is composed of maize (15kg); wheat offal (42kg); palm kernel cake (30kg); soybean meal (4kg); groundnut cake (3kg); bone meal (3kg); limestone (1.5kg); common salt (1kg); and premix (0.5kg). The dietary treatments were used for flushing of the Does for 2 weeks before the commencement and throughout the experimental period.

FEEDING TRIAL

The pregnant Does were fed individually with experimental concentrate diets for 24 weeks (162 days) until when all the Does kidded. The Does were also fed the diets during lactation phase that lasted for 12 weeks. The diets were administered at 5% body weight throughout the feeding trial. Stall feeding was done using *Brachiaria ruziziensis*. Cool and clean drinkable water was provided for the Does *ad libitum*.

Milk Collection Procedure

Milk was collected from all the Does for 12 weeks starting from a week after kidding by hand milking. Kids were allowed to suckle by themselves before the cisterns are emptied by draining the milk contained in them manually each time milk is collected. The kids are usually separated from the dams for 4hours after which milk produced during the period by individual Does housed in a separate wooden cubicle is collected. At the time of milk yield collection, a neat napkin dipped in warm water is used to clean the udder, followed by slight massaging of the udder with a full palm after which the teats (left and right) on the udder are put in between the thumb and fourth finger; and stripped up-down until the cisterns are empty. Milk collected from each Doe for the 4hrs of separation is measured using a measuring cylinder.

Milk yield (ml/24hrs) = Milk collected per Doe after 4hrs of separation (ml) x 6

Proximate and Fibre Analysis of Concentrate, Turmeric powder and Grass Fed

Samples taken from dietary concentrates, turmeric powder and *Brachiaria ruziziensis* were milled, and kept until when needed for proximate composition (AOAC, 2005) and fibre fractions (Van Soest, 1991).

STATISTICAL ANALYSIS

Data obtained were arranged in a 3x3 factorial layout in a completely randomized design, while ANOVA was done using the procedures of SAS (2004). Significant level was taken at 5% probability, while means was separated using Duncan's multiple range test of the same statistical package.

RESULTS AND DISCUSSION

The proximate and fibre fraction compositions of the basal experimental concentrate diet is presented in Table 1. The crude protein (CP) of the diet (16.49%) was sufficient to meet the need of the Does during pregnancy and lactation according to the report of NRC (2007) which recommends CP ranges of 13-14% and 12-17% for goats during pregnancy and lactation respectively.

Table 1: Proximate and fibre fraction compositions of basal experimental concentrate diet

Parameters (%)	TM-0
Dry Matter	88.19
Crude Protein	16.49
Ether Extract	2.48
Crude Fibre	27.50
Ash	10.98
Nitrogen Free Extract	41.74
Organic Matter	89.02
Neutral Detergent Fibre	62.67
Acid Detergent Fibre	38.00
Acid Detergent Lignin	10.67
Hemicellulose	24.67
Cellulose	27.33
*ME (MJ/kg DM)	12.27

ME= Metabolisable Energy

*Calculated using De Boever *et al.* (1997) equation

The interaction effect of breeds of goat and levels of turmeric powder inclusion on milk yield from 1st week of kidding to 12 weeks post-kidding in Table 2 showed that KR fed T0 had the highest significant ($p<0.05$) milk yield at 1st week of lactation compared to other dietary treatments. This might be due to the fact that it recorded the highest level of oxytocin and reasonable level of prolactin within 24hrs of kidding. KR fed T2 had the overall best performance in terms of milk yield from 2nd to 12th week of lactation except at weeks 2 (KR fed T5); 5 (KR fed T0); and 10 (KR fed T5). Peak value of 1560ml/24hrs was recorded for KR fed T2 at the 4th week of lactation which was the highest significant ($p<0.05$) milk yield obtained for the study. The lowest milk yield (240mls/24hrs) recorded for KR was for those fed T0 at weeks 11 and 12 of the study. KW compared favourably with KR in terms of milk yield, where KW fed T2 had the peak value of 1040ml/24hrs at week 4, whereas lowest value (375ml/24hrs) was recorded for KW fed T0 at the 12th week. WAD fed T0 had the lowest values for milk yield from weeks 1 to 12 with peak value of 790ml/24hrs which was recorded for WAD fed T2 at the 2nd week of lactation. Lowest milk yield of 206.67ml/24hrs was recorded for WAD fed T0 at week 12. The results obtained corroborate that of Mardalena *et al.* (2011) who reported that milk of Etawah dairy goats supplemented with diets containing antioxidant at 0.02%, 0.04% and 0.06% inclusion levels had improved milk yield compared to those without antioxidant supplementation.

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CONCLUSION AND RECOMMENDATION

It could be concluded from the results of the study that feeding of concentrate diet containing turmeric powder especially at the rate of 2g/kg of concentrate to Kalahari Red Does generally improved the milk yield of the goat compared to other breeds of goat used and turmeric powder inclusion levels.

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Table 1: Interaction effect of breeds of goat and levels of Turmeric powder inclusion on milk yield from 1st week of kidding to 12 weeks post-kidding

	Kalahari Red			KalaWAD			West African Dwarf		
Weeks	T0	T2	T5	T0	T2	T5	T0	T2	T5	SEM
1 (ml/24hrs)	1100.00^{a}	882.00^{abc}	938.67^{abc}	790.00^{abc}	880.00^{abc}	1000.00^{abc}	373.33^{d}	560.00^{cd}	638.00^{bcd}	52.54
2 (ml/24hrs)	700.00^{bc}	1270.00^{ab}	1386.67^{a}	690.00^{bc}	1140.00^{ab}	950.00^{abc}	400.00^{c}	790.00^{abc}	630.00^{bc}	78.90
3 (ml/24hrs)	1140.00^{ab}	1500.00^{a}	853.33^{ab}	610.00^{b}	980.00^{ab}	560.00^{b}	393.33^{b}	682.50^{b}	525.00^{b}	92.00
4 (ml/24hrs)	1220.00^{ab}	1560.00^{a}	853.33^{bc}	690.00^{bc}	820.00^{bc}	1040.00^{abc}	413.33^{c}	555.00^{bc}	412.75^{c}	90.78
5 (ml/24hrs)	1160.00^{a}	920.00^{ab}	866.67^{abc}	570.00^{bc}	860.00^{abc}	890.00^{abc}	453.33^{c}	530.00^{bc}	465.00^{c}	56.61
6 (ml/24hrs)	620.00^{bcd}	1020.00^{a}	916.67^{ab}	630.00^{bcd}	835.00^{abc}	830.00^{abc}	464.67^{d}	590.00^{bcd}	510.00^{cd}	45.57
7 (ml/24hrs)	480.00^{cd}	923.33^{a}	900.00^{a}	550.00^{bcd}	740.00^{abc}	800.00^{ab}	409.00^{d}	490.00^{cd}	397.50^{d}	45.41
8 (ml/24hrs)	280.00^{c}	1536.67^{a}	890.00^{b}	460.00^{bc}	743.00^{bc}	655.00^{bc}	388.67^{c}	423.25^{bc}	362.50^{c}	80.50
9 (ml/24hrs)	360.00^{b}	773.33^{a}	766.67^{a}	540.00^{ab}	550.00^{ab}	715.00^{a}	320.00^{b}	460.00^{ab}	365.00^{b}	41.92
10 (ml/24hrs)	330.00^{b}	656.67^{a}	726.67^{a}	415.00^{b}	680.00^{a}	650.00^{a}	266.67^{b}	495.00^{ab}	411.50^{b}	35.50
11 (ml/24hrs)	240.00^{d}	720.00^{a}	600.00^{ab}	450.00^{bc}	615.00^{ab}	650.00^{a}	320.00^{d}	392.50^{cd}	372.50^{cd}	32.30
12 (ml/24hrs)	240.00^{de}	701.33^{a}	559.67^{ab}	375.00^{cd}	525.00^{bc}	625.00^{ab}	206.67^{e}	397.25^{cd}	302.25^{de}	33.82

^{abcde} Means on the same row having different superscripts are significantly different ($p<0.05$)

T0 *is without Turmeric*; T2 *is 2g/kg Turmeric Powder Inclusion*; T5 *is 5g/kg Turmeric Powder Inclusion*