

## Effects of Garlic and Tiger Nut on Milk Yield, Milk Composition and Mammary Morphometric Traits of West African Dwarf Goats

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**Target Audience:** Animal Scientists, Dairy Researchers, Animal Nutritionist and Goat Farmers.

### Abstract

*This study investigated the effects of garlic and tiger nut on Milk Yield, Milk Composition and Mammary Morphometric traits on West African Dwarf Goats. The study was conducted at the small ruminant unit of the Directorate of university farm of Federal university of Agriculture Abeokuta Ogun State Nigeria. The study started around November and lasted till June. Fourteen lactating WAD Goats in their fifth parity of weight range between 15 – 28kg were synchronized and used for this experiment. The goats were divided into seven groups: control groups, 25g of tiger nut per kg of feed, 50g of tiger nut per kg of feed, 75g of tiger nut per kg of feed, 25g of garlic per kg of feed, 50g of garlic per kg of feed, 75g of garlic per kg of feed. The animals were raised intensively with good feeding and housing conditions. Milk was collected using 500ml graduated plastic beaker measured and weighed thereafter. These approaches were continued for 12 weeks postpartum after which the kids were weaned and the dam rebred. A portion of the milk (30ml) collected from each dam was taken to the laboratory to determine the composition of the milk using Lactoscan (Latoscan milk analyzer). Udder morphometric traits such as Udder circumference, Udder width, Udder length, Teat circumference, Teat width, Distance between the teat and Height of the teat ground were measured using a standard measuring tape. Data collected was subjected to one way analysis of variance in a completely randomized design. The results showed that the milk composition were not significantly ( $P>0.05$ ) affected by the treatment. Significant ( $P<0.05$ ) differences were obtained in the milk yield. The milk yield is higher in treatment six (50g of garlic per kg) compared to other treatment groups. Significant ( $p<0.05$ ) was also observed in the parameters of udder morphometric traits across the treatment groups. In conclusion, Goats fed garlic had higher milk yield, low fat and better mammary morphometric traits. Further research on the effect of tiger nut on lactating West African Dwarf Goats is recommended.*

**Keywords:** Garlic, Tigernut, Milk yield, Milk composition, Mammary morphometric traits, goat

**Description of Problem** with useful products like meat, milk and skin.  
Over the years, goats have provided mankind Goats are unique in subsistence animal

husbandry on account of their adaptability to harsh environmental conditions and catholic taste for common and local feed stuffs, mostly roughages and plant by-products. The West African Dwarf goats in particular have been reported to be trypanotolerant, hence their huge population in Southern Nigeria (1). Indigenous goats in Nigeria are mainly kept for meat production with their milk rarely used for human consumption (2; 3). However, there is a growing awareness of the importance of goats as a source of milk for man (4).

Although, there is an affinity for milk products in the country; the dairy industry still remains rural and traditional with Fulani pastoralists controlling more than 95 percent of the national herd. The increasing demand for milk and its product in Nigeria has made it imperative to look at ways of increasing milk production (4,5) and goat milk is of interest due to variation in yield and composition from breed to breed. The variation in milk composition affects product yield and quantity (6). Due to breed, age, parity, plane of nutrition, season, lactation stage and environmental differences, milk yield and composition may differ among different ruminant species (7,8). The quantity of milk produced is a function of udder parameters (9, 3, 10). Milk yield which is the quantity of milk produced from the mammary gland of lactating goats has a lot of nutritional benefit to the offspring. Growth of kids depends essentially on the milk production of the ewes. (3).

Garlic and its products are rich in bioactive organosulphur compounds such as allicin, allixin and allylsulfides, which give garlic products antimicrobial, antioxidant, anti-inflammatory, immunomodulatory, antihypertensive, cancer-preventive,

antihyperlipidemic and other physiological properties (11). Thus, garlic is known worldwide as a “medicine and food homology” that is superior to traditional and alternative medicines (12). A large body of literature has studied the effects of dietary supplementation with garlic products on the growth performance and product quality of monogastric animals (mainly poultry and pigs), with some studies observing preliminary beneficial effects (13,14). Tiger nut (*Cyperus esculentus*) is one of the underutilized crops, it is often cultivated for its nutritive edible nuts and has high content of soluble glucose of 21 % (15). In spite of the numerous health benefits of garlic and tiger nut as human diet, its prospect in dairy animals production has not been delve into extensively. Hence, this study is aimed at evaluating the effect of garlic and tiger nut on milk yield, milk composition and mammary morphometric traits of West African Goats.

## Materials and Methods

### Experimental Site

The study was conducted at the Small Ruminant Unit of the Directorate of University Farms of Federal University of Agriculture, Abeokuta, Ogun State, Nigeria, which lies between the rainforest vegetation zone of South-Western Nigeria on Latitude 7°13'49.46"N, and Longitude 3°26'11.98"E and an altitude 76m above sea level.

### Experimental Animals and their Management

The study was carried out using 14 lactating West African Dwarf (WAD) Goats in their fifth parity and live weight ranging from 15 to 28kg. The animals were managed intensively in raised wooden floor house with good ventilation and had access to water

*ad libitum*. The experimental pens were disinfected thoroughly before the commencement of the experiment. The pens were equipped with feeding trough and drinking troughs for the animals. The lactating WAD Goats were fed on concentrate feed and freshly cut cashew leaves (*Anacardium occidentale*) and *Panicum maximum* as basal diet.

**Preparation of Test Ingredient**

Garlic and Tiger nut were purchased in an open market in Abeokuta. The garlic and tiger nut were sorted to remove foreign materials and dust particles. After sorting the tiger nut was cleaned by washing with clean water. It was well drained and spread on clean trays to air dry about a day. After that it was oven dried at 60° C and grinded into powder and then added to the diet that was used for the experiment.

**Experimental diet**

**Table 1: Percentage composition of the experimental diet**

<b>Ingredients</b>	<b>Percentage</b>
Maize	10
Wheat Offal	30
Palm kernel cake	28
Rice bran	20
Bone meal	2
Salt	2
Groundnut cake	8
Total	100
<b>Calculated Nutrients</b>	
Metabolic energy	2296.6kcal/kg
Crude protein	17.145%
Crude fibre	9.01%
Ether extract	6.11%

**Experimental design**

The fourteen (14) lactating West African Dwarf Does were allotted to seven (7) treatments with two replicate per treatment in which garlic and tiger nut were administered into different proportions which include 0g/kg of garlic and tiger nut, 25g/kg of tiger nut, 50g/kg of tiger nut, 75g/kg of tiger nut, 25g/kg of garlic, 50g/kg of garlic, 75g/kg of garlic and the animals were fed at 5% body weight.

**Milk Yield and Milk Composition**

Within 24hr after kidding, the dams and kids were weighed to know the parturition weight and birth weight. The kids were allowed to suckle the dams for 7 days postpartum to consume colostrum, establish strong dam-kid relationship (forestall rejection of kids by their dams) and prevent kid mortality as they are non-dairy animals. Hand milking of the animals was adopted. The kids were separated from the dam over-night for 12h

overnight (19.00h-07.00h) and re-introduced to their dams after milking. The milk was collected using 500ml graduated plastic beaker measured and weighed thereafter. Values obtained were multiplied by a factor of 2 to get the milk yield for 24hr. These approaches were continued for 12 weeks postpartum after which the kids were weaned and the dam rebred. A portion of the milk (30ml) collected from each dam was taken to the laboratory to determine the composition of the milk using Lactoscan (Latoscan milk analyzer).

**Udder Dimensions**

Udder circumference: taken as distance round the mid udder region

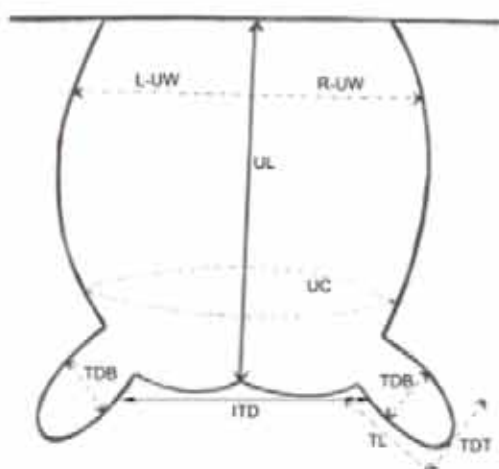
Udder width: taken as horizontal distance from one end of the udder to the other

Distance between teats: estimated by measuring the distance between the right and left teat; from the middle point of the teat.

Teat length: distance between the tips of the teat to the base of the teat.

Teat circumference: distance round the mid teat region.

Teat floor distance: the minimum distance between teat head and ground.



R-UW \_\_\_\_\_ Right udder width  
 UL \_\_\_\_\_ Udder length  
 UC \_\_\_\_\_ Udder circumference  
 TL \_\_\_\_\_ Teat Length

**Statistical analysis**

Data collected was subjected to one way analysis of variance. Means were separated using Duncan Multiple Range Test (SAS, 1999).

$$Y_{ij} = \mu + T_i + \epsilon_{ijk}$$

Where;

$Y_{ij}$  = Individual observation

$\mu$  = Overall mean

$T_i$  = Effect of treatment

$\epsilon_{ijk}$  = Experimental error

**Results**

Table 2 shows the effect of garlic and tiger nut on milk yield and milk composition of lactating West African Dwarf (WAD) Goats. There was significant ( $p < 0.05$ ) difference in the milk yield across the treatment groups. Goats on 50g of garlic per kg of feed had the highest proportion of milk yield (241.9ml) than other goats in the remaining treatments. Significant ( $p < 0.05$ ) difference was observed in the freezing point. Does on 50g of garlic per kg of feed had the highest proportion of freezing point (- 0.56). Other parameters (Fat, Protein, SNF, Lactose, Water, Density, Salt, pH, and temperature) were not significantly ( $p > 0.05$ ) different.

Table 3 shows the effect of garlic and tiger nut on morphometric traits on WAD Does. Significant ( $p < 0.05$ ) difference was observed across the treatment groups. Does on 50g of garlic per kg of feed and 0g of garlic per kg of feed had the highest proportion of udder circumference. The same trend was observed in the proportion of udder length (20.13cm), udder width (18.12cm) and teat

**Table 2: Effect of tiger nut and garlic on Milk Composition of lactating West Africa Dwarf Goats (WAD)**

PARAMETERS	Dietary treatments (g/kg)				Tigernut			SEM	P-value
	Garlic				25	50	75		
	0	25	50	75	25	50	75		
MKY	113.9 <sup>ab</sup>	40.75 <sup>b</sup>	48.13 <sup>b</sup>	42.65 <sup>b</sup>	163.9 <sup>ab</sup>	241.9 <sup>a</sup>	208.8 <sup>a</sup>	15.5	0.000
FAT	2.59	3.88	2.19	1.74	0.52	0.12	0.52	0.411	0.138
PROTEIN	3.46	3.72	3.43	3.54	3.57	3.50	3.51	0.027	0.101
SNF	8.29	8.96	8.23	8.49	8.48	8.29	8.36	0.068	0.061
DENSITY	20.13	20.97	19.71	20.45	21.12	21.09	20.75	0.194	0.374
LACTOSE	4.88	5.22	4.82	4.97	5.00	4.83	4.90	0.039	0.076
SALT	1.02	1.09	1.01	1.05	1.05	1.03	1.04	0.008	0.260
WATER	0.00	0.00	0.65	0.00	0.00	0.00	0.00	0.094	0.451
TEMP	30.46	31.53	30.70	31.81	31.01	30.24	31.68	0.268	0.610
PH	9.21	9.20	9.03	9.27	9.31	9.13	9.16	0.061	0.934
CONDUCT	4.16	4.37	4.61	3.54	5.00	4.42	4.34	0.216	0.737
FP	-0.58 <sup>ab</sup>	-0.64 <sup>b</sup>	-0.57 <sup>ab</sup>	-0.59 <sup>ab</sup>	-0.59 <sup>ab</sup>	-0.56 <sup>a</sup>	-0.58 <sup>ab</sup>	0.006	0.028

a,b,c means on the same row with different superscripts are significantly different ( $p < 0.05$ ) SEM = Standard error of Mean. SNF = Solid non fat, CONDUCT. = Conductivity, TEMP = Temperature, FP = Freezing point, MKY = Milk yield

circumference (4.68cm). Highest proportion of teat length (3.18cm) was observed in does on 75g of garlic per kg of feed. The highest proportion of teat width (2.31cm) was observed in 25g of tiger nut per kg of feed. The same trend was observed in the proportion of teat from ground. The highest proportion of distance between teat (11.75cm) was observed in does on Control diet.

#### **Correlation among the milk yield, some milk composition and mammary morphometric traits**

The correlation among milk yield, mammary morphometric traits and some milk composition is presented in Table 4. Milk yield was correlated with udder circumference ( $r=0.63$ ,  $p<0.0001$ ), udder length ( $r = 0.73$ ,  $p<0.0001$ ) and udder width ( $r = 0.52$ ,  $p<0.0001$ ). Milk yield also had positive correlation with teat measurements ( $p<0.0001$ ). The correlation between udder

**Table 3: Effect of garlic and tiger nut on Mammary Morphometric traits of lactating west African Dwarf Goats (WAD)**

Dietary treatments (g/kg)									
PARAMETER	Garlic				Tigernut			SEM	P-value
	0	25	50	75	25	50	75		
<b>S</b>									
UC (cm)	34.00 <sup>a</sup>	24.75 <sup>bc</sup>	23.75 <sup>bc</sup>	21.00 <sup>c</sup>	27.50 <sup>b</sup>	34.00 <sup>a</sup>	33.75 <sup>ab</sup>	0.882	0.000
UL (cm)	17.12 <sup>b</sup>	13.62 <sup>c</sup>	14.88 <sup>bc</sup>	13.25 <sup>d</sup>	17.25 <sup>b</sup>	20.13 <sup>a</sup>	18.50 <sup>ab</sup>	0.454	0.000
UW (cm)	17.62 <sup>ab</sup>	14.37 <sup>bc</sup>	13.87 <sup>c</sup>	12.62 <sup>d</sup>	15.37 <sup>bc</sup>	18.12 <sup>a</sup>	16.50 <sup>b</sup>	0.356	0.000
TL (Cm)	1.93 <sup>e</sup>	2.62 <sup>bc</sup>	2.00 <sup>c</sup>	2.12 <sup>bc</sup>	3.00 <sup>ab</sup>	2.87 <sup>b</sup>	3.18 <sup>a</sup>	0.081	0.000
TC (cm)	3.10 <sup>b</sup>	3.25 <sup>b</sup>	3.18 <sup>b</sup>	3.21 <sup>b</sup>	4.25 <sup>ab</sup>	4.68 <sup>a</sup>	4.62 <sup>a</sup>	0.108	0.000
DBT (cm)	11.75 <sup>a</sup>	8.12 <sup>c</sup>	8.87 <sup>bc</sup>	9.00 <sup>bc</sup>	9.50 <sup>b</sup>	10.75 <sup>ab</sup>	10.62 <sup>ab</sup>	0.256	0.000
TW (cm)	1.50 <sup>e</sup>	2.31 <sup>a</sup>	2.00 <sup>ab</sup>	1.87 <sup>b</sup>	1.81 <sup>b</sup>	2.00 <sup>ab</sup>	2.15 <sup>a</sup>	0.062	0.000
TG (cm)	15.75 <sup>c</sup>	20.00 <sup>a</sup>	16.87 <sup>bc</sup>	16.87 <sup>bc</sup>	18.12 <sup>ab</sup>	16.87 <sup>bc</sup>	15.50 <sup>c</sup>	0.263	0.000

a,b,c means on the same row with different superscripts are significantly different p(<0.05)

SEM = Standard error of Mean, UC= Udder circumference, UL = Udder length, UW = Udder width, TL= Teat length, TC= Teat circumference, DBT= Distance between teat, TW= Teat width, TG = Teat to ground.

measurement and milk composition was not significant, however, there was low positive correlation among teat width, teat to ground and protein.

**Discussion**

Among the factors that affect milk yield, feeding is major (16) since feed consumed is transmuted to milk production rather than weight gain. The results obtained in this study shows that the treatments influenced the milk yield, milk composition, and morphometric traits of West African Dwarf (WAD) Does. Milk yield was higher in treatment group of goats fed with 50g of garlic per kg of feed. The result of this study is in support of the study of 17 who recorded that garlic supplementation in goat feed can increase milk production. This condition is thought to result in energy savings that were originally used in methane synthesis being

diverted to milk production. 17. The milk composition parameters were not significantly different across the treatment except the freezing point. However, there was a decrease in fat content of the milk as inclusion level increased. This is in tandem with the study of 18, who reported that the dietary addition of raw garlic at a range 30 to 70g/kg of feed can efficiently reduce the concentration of fat in goat milk. The possible reason for this decrease in milk fat is that acetate from the rumen which is used in the synthesis of milk fat is decreased by dietary supplementation of garlic (19).

The mammary morphometric traits of West African Dwarf (WAD) Goat were significantly affected by the treatments. The highest morphometric parameters (udder circumference, udder length and udder width) at 50g implies higher milk yield. Correlation between milk yield and

**Table 4: Correlation matrix between milk yield, some physiochemical properties of milk and mammary morphometric traits of lactating West African Dwarf (WAD) Does**

	MKY	FAT	PRO	DEN	PH
UC	0.63***	-0.9*	-0.10	0.18	-0.07
UL	0.73***	-0.16	-0.19	-0.03	-0.01
UW	0.52***	-0.09	-0.09	0.06	-0.01
TL	0.42**	-0.02	0.15	0.15	-0.05
TC	0.52***	-0.21	-0.00	0.7	-0.05
DBT	0.38**	-0.16	-0.15	0.00	-0.10
TW	0.04	0.05	0.31*	0.20	0.05
TG	-0.20	0.14	0.30*	0.13	0.05

\*\*\*p<0.001, \*\*p<0.01, \*p<0.05

UC= Udder circumference, UL = Udder length, UW = Udder width, TL= Teat length, TC= Teat circumference, DBT = Distance between teat, TW = Teat width, TG = Teat to ground. MKY = Milk yield, PRO= Protein, DEN= Density.

mammary morphometric traits shows that the udder morphometric significantly influenced milk yield. It was also reported by 20 that the larger the udder and teat sizes the higher the milk produced by WAD.

#### Conclusion and Application

Based on the result of this study, the following conclusions were drawn:

- I. Goats fed at 50g of garlic per kg of feed had higher milk yield, low milk fat and better mammary traits.
- II. Teat width and teat from the ground was higher in goats fed with 25g of tiger nut per kg of feed.

#### Recommendations

Based on the conclusion above, the following recommendations are made:

1. Feeding goat with garlic supplementation is best because of its beneficial effect on milk yield, milk composition and mammary morphometric traits.
2. 50g of garlic supplementation per kg of feed is recommended

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