Milk yield and rectal temperature in West African Dwarf goats as affected by wattle and litter size

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Abstract

This study was conducted to investigate milk yield and rectal temperature in West African Dwarf (WAD) goats as affected by wattle and litter size. A total of 28 lactating does were used for the experiment. 13 does had wattle (bilateral) while 15 had no wattle. 14 does had twin birth while the other 14 had single birth. The goats were fed at 5% body weight with combination of concentrate and grass (Panicum maximum and Pennisetum purpureum) in ratio 50:50 twice per day in the morning and evening (zero grazing). The lactating does were hand milked once per day (08.00) and thrice per week for the period of 12 weeks. The goats were housed in cross ventilated pens with slatted floor. Rectal temperature was taken after milking of each animals using digital thermometer. Data collected were analysed using SAS (2010) in a randomized complete block design. The results showed that wattle and litter size had significant effect on milk yield and rectal temperature in WAD goats. Wattled animals produce significantly (P<0.05) higher milk yield of 297.72 g/day compared to their non-wattled counterparts (255.11 g/day). Animals with wattle however had higher rectal temperature of 39.35°C compared to animals without wattle (39.23°C). Also twin littered does produced daily milk milk yield of 292.74 g/day significantly (P<0.05) higher than single littered counterparts (257.04 g/day). The interaction between wattle and litter size showed that there was no significant difference in daily milk yield in wattled animals regardless of the litter size. However, in non-wattle animals, does with twin birth produced daily milk yield of 283 g/day significantly (P<0.05) higher than 235 g/day for does with single birth. Also, wattled does with single birth had significantly (P<0.05) higher rectal temperature of 39.43°C when compared with wattled does with twin birth. However, in non-wattle animals, does with single birth had significantly lower rectal temperature of 39.18°C as compared with does with twin birth (39.29°C). It was concluded that WAD goats with wattle and twin birth produces more milk than those without wattle and single birth. Therefore, WAD goats with wattle should be selected for lactation purpose especially those with twin birth.

Keywords: wattle, litter size, WAD goats, milk yield, rectal temperature

Introduction

Wattle (the cartilaginous tissue surrounded by dense fibrous connective tissue hanging on the neck of some ruminants (Robert, 1994)) occurrence in West African Dwarf (WAD) goats varies from bilateral, unilateral to non-wattled. Prominent among its benefits is the thermoregulatory functions and the association of this trait to reproduction such as higher prolificacy, higher milk yield, litter size, fertility index and conception rate. Varied expression of this wattle trait may represent some adaptive mechanisms related to adaptation and survival in different ecological zones within the rainforest, mangrove swamps

and coastal regions in Southern Nigerian. (Odubote, 1994a). Several research findings (Osinowo *et al.* 1988; Shongjia *et al.* 1992; Ozoje, 2002; Ozoje and Mgbere, 2002) have reported some positive associations between wattle traits and livestock performances, namely; growth, reproduction and heat tolerance. Odubote (1994) observed significant effect of wattle on yearling weight of WAD goats and concluded that bilateral wattled goats were heavier than non-wattled. Also, Ozoje (2002) reported positive association of wattle incidence with tail length and neck circumference in WAD goats, while Osinowo *et al.* (1990) observed higher weaning weight in wattled lambs than non-wattled in Yankassa lambs. Higher lambing rate in ewes with wattle was reported by Casu *et al.* (1970) while Shongjia *et al.* (1992) observed significantly higher litter size and milk yield in wattled Saanen does.

Litter size or prolificacy has a very significant influence on reproduction efficiency. A number of biological factors influence the actual size in a flock of goats (Bearden and Fuquay, 2000). Age or parity of does and year of kidding influences litter size under tropical conditions and year of kidding significantly affects prolificacy in Alpine and Nubian goats.

Temperature and season are important environmental factors that influence milk yield. Body temperature is one of the good indicators of good health in animal. Its variation above and below normal is a measure of the animal ability to resist stress factors of the environment.

Environmental temperature ranging from -5 to 24°C is comfortable range for lactating animals (Rock and Thomas, 1983). Beyond 25°C, milk yield and constituents, e.g. fat are reduced owing to heat stress which can affect the secretion of regulatory hormones like thyroxin, growth hormone and insulin.

West African Dwarf (WAD) goat, a predominant breed of the humid and sub humid zones of Nigeria is characterized by small size with matured body weight varying between 20-25 kg, and possess the ability to survive, adapt and reproduce under harsh condition (Ozoje, 2002). The majorities of these goats are found in the rural areas where they serve as source of income and meat to the rural populace. The animals have been found to possess good potentials for milk production producing over 330 ml/day/goat (Williams *et al.*, 2012). Also, this breed is known to display a wide range of qualitative variations in wattle and non-wattle traits. The objective of this study therefore, is to evaluate the milk yield and rectal temperature in WAD goats as affected by wattle and litter size.

Materials and Methods

Experimental site

The experiment was carried out at the Goat Unit of Directorate of University Farms (DUFARMS), Federal University of Agriculture, Abeokuta Nigeria; latitude $7^{0}5.5 - 7^{0}8N$, longitude $3^{0}2.5E$ and 76 meters above sea level. The climate is humid and vegetation zone is rain forest. Mean annual rainfall, temperature and humidity recorded at Ogun-Osun River Basin Development Authority about 2 km away from the location are 1037mm, $34.7^{0}c$ and 82% respectively (OORBDA, 2014).

Experimental animals and their management

Twenty eight WAD goats which comprises 13 wattled (bilateral) and 15 non-wattle were used for the experiment. 14 does had single birth while the remaining fourteen had twins. The goats were maintained under intensive management system (zero grazing). The animal were fed at 5% body weight with combination of concentrate

and grass (*Panicum maximum* and *Pennisetum purpureum*) in ratio 50:50 twice per day in the morning and evening. The weight of the does ranges from 15-24 kg. The concentrate contained maize, palm kernel cake, bone meal, groundnut cake and salt (Table 1). The animals were housed in a cross ventilated pen divided into compartments. The pens were raised a little above the ground with a wooden slated floor. Routine management practices carried out were observation of the animals, cleaning of pens and provision of clean water daily.

Data collection and experimental procedure

After parturition, kids were allowed to suckle their dams for 2 weeks. Thereafter milk was collected by hand milking the animals once per day and thrice per week for 12 weeks. Kids were separated by 5pm in the evening and dams were hand milked at 8:00 am the following morning. This gave 15 hours milk yield. The 15 hours milk yield was divided by 15 and multiplied by 24 and recorded as daily milk yield in gramme. Rectal temperatures were also taken by inserting digital thermometer inside the rectum of the animals after milking the animals and recorded in degree Celsius (^{0}C). The research covered 8 months period (Nov. 2014 to July 2015). The data collected were analyzed using analyses of variance (ANOVA) in a randomized complete block design (SAS, 2010) as follows;

$$Y_{ij} = \mu + A_i + B_j + AB_{ij} + E_{ij}$$

Where,

Y_{ij} = Milk yield, rectal temperature

μ = Overall mean

A_i = Fixed effect of Wattle (i=1-2)

B_j = Fixed effect of Litter size (j=1-2)

AB_{ij} = Interaction effect of wattle and litter size

E_{ij} = Random error

Table 1: Composition of the concentrate fed to animals

Ingredients	% Composition
Maize	20
Groundnut cake	10
Palm kernel cake	30
Wheat Offal	35
Bone meal	2.5
Salt	2.5
Total	100
Calculated analysis	
Crude protein	17.85
Crude fibre	7.48
Ether extract	4.43
Calcium	1.05
Available phosphorus	0.56
Metabolizable energy (Kcal/Kg)	2257.80

Results

The results of analysis of variance of milk yield and rectal temperature in WAD goats as affected by wattle and litter size are summarized in Table 2. Wattle significantly affected milk yield ($P < 0.05$). Animals with wattle had significantly higher milk yield of 297.72±5.93 g/day/goat compared to 255.11±7.16 g/day/goat for their non-wattled counterparts. Also wattle significantly ($P < 0.05$) affected rectal temperature. Animals with wattle had significantly ($P<0.05$) higher rectal temperature of 39.35±0.03 ^{0}C when compared to 39.23±0.03 for their non-wattled counterparts. Litter size also significantly ($P<0.05$) affected milk yield. Does that had twin birth produced higher milk yield of 292.74±7.42 g/day/goat compared to 257.04±5.88 for non-wattle animals. However, rectal temperature was not significantly affected by litter size. The interaction between wattle and litter size

showed that there was no significant difference in milk yield in wattled animals regardless of the litter size. (Table 3). However, animals without wattle having twin birth significantly (P<0.05) produced higher milk yield of 283.86±13.73 g/day/goat compared to non-wattled animals with single birth (235.94±7.48 g/day/goat). On the other hand, wattled animals with single birth had significantly (P<0.05) higher rectal temperature of 39.43±0.04 ^{0}C compared to 39.30±0.03 ^{0}C for wattled animals with twin birth. Also the rectal temperature of non-wattled animals with single birth was significantly (P<0.05) lower (39.18±0.04 ^{0}C) compared to rectal temperature of 39.29±0.04 ^{0}C for non-wattled animals with twin birth.

Discussion

The present study revealed that wattle and litter size had significant effect on daily milk yield and rectal temperature in WAD goats. Wattled animals produced higher daily milk yield compared to their non-wattled counterparts. This is in agreement with the findings of Osinowo *et al.* (1988) who reported that wattle had some benefits in thermoregulatory functions with resultant effects on reproductive traits such as higher prolificacy and higher milk yield. Several authors; Osinowo *et al* (1990), Ozoje (2002), Ozoje and Mgbere, (2002) have also reported some positive associations between wattle traits and livestock performances, namely; growth, reproduction and heat tolerance. Shongjia *et al.* (1992) also observed significantly higher litter size and milk yield in wattled Saanen does. Also, Adedeji (2012) reported significant effects of wattle traits on most of the body dimensions of WAD bucks indicating that wattle is an adaptive feature in WAD goats thus influencing their better performance which can causes the increase in milk yield of WAD goats compared with

Table 2. Effect of wattle and litter size (Main effect) on milk yield and rectal temperature in WAD goats

Source of variation	Subclass	No. of observation	Milk yield (g/day/goat)	Rectal temperature (^{0}C)
Wattle	Wattled	468	297.72±5.93^{a}	39.35±0.03^{a}
	Non-wattle	540	255.11±7.16$^{?}$	39.23±0.03^{b}
Litter size	1	504	257.04±5.88$^{?}$	39.27±0.03
	2	504	292.74±7.42^{a}	39.30±0.03

$^{a, b, c}$ means within the column within the same group with different superscript are significantly different.

Table 3: Least square means showing the effect of wattle and litter size on milk yield and rectal temperature (interaction) in WAD goats

Source of variation	Subclass	No. of observation	Wattle	No. of observation	Non-wattle
Milk yield (g/day)	Litter size				
	1	180	295.03±8.83^{a}	324	235.94±7.48^{b}
	2	288	299.40±7.90^{a}	216	283.86±13.73^{a}
Rectal temperature (^{0}C)	1	180	39.43±0.04^{a}	324	39.18±0.04^{c}
	2	288	39.30±0.03^{b}	216	39.29±0.04^{bc}

$^{a, b, c}$ means within the column within the same group with different superscript are significantly different.

non-wattle animals. The higher milk yield in wattled animals in this study could be as a result of thermoregulatory benefits of wattle. It should be noted that rectal temperature in wattled does was slightly higher than non-wattle animals. Regardless of this the animals adapted positively resulting in higher milk yield. The significant effect of wattle on rectal temperature is similar to the findings of Odubote (1994b) which showed that higher rectal temperature was recorded in wattled WAD goats when compared with non-wattled animals. The differences recorded in rectal temperature of WAD goats with wattle and non-wattle could also be as a result of the season the research was carried out (Nov. – July). This covered a period of early dry season, late dry season and early raining season. This is also in agreement with the findings of Sleiman and Abi Saab (1995), Butswat *et al.* (2000), Marai *et al.* (2007) and Sanusi (2008). They all reported higher rectal temperature, respiratory rate and pulse rate during the late dry season among different breeds of sheep.

The research also revealed that does with single births had lower milk yield compared to those with twin birth. This is in agreement with the findings of several authors; Peris *et al.* (1997), Zaharadden (2006), Carnicella *et al.* (2008), Hamed *et al.* (2009), El-Abid and Abu Nikhaila (2010) and Ibnelbachyr (2015). The authors reported increased milk yield with increase in litter size where goats with twins had more milk yield compared to those that had singles. It is also similar to the findings of Haldar *et al.* (2014) who observed that body weight, parity and previous litter size have positive influence on multiple births in Black Bengal goats. This difference in milk yield due to litter size in this study could be attributed to the extra pressure or stimulation on the mammary gland as a result of the additional suckling of the second kid. Though some genes have been identified for influencing litter size in goats (An *et al.*, 2009; Chu et al., 2011; Feng *et al.*, 2011), certain body weight along with desirable body condition at certain age and parity may be necessary for optimum metabolic requirements which in turn influence hypophyseal-pituitary-gonadal axis for more ovulation that ultimately determine the number of successful fertilization and subsequently litter size (Perry et al., 1991; Tummaruk et al., 2007). Also body condition score, higher live weight, age, physical strength and less slopped rump angles were found to be associated with increase possibility of multiple births in does (Constantinou, 1989; Mellado *et al.*, 2008) and in ewes (Hall *et al.*, 1994; Gonzalez *et al.*, 1997; Gaskins *et al.*, 2005; Aliyari *et al.*, 2012). It may be assumed that does with higher previous litter size may have potential to give multiple births in subsequent kidding (Haldar *et al.*, 2014).

Conclusion

Wattle and litter size had significant effect on milk yield and rectal temperature in WAD goats. WAD goats with wattle and twin birth produces more milk than those without wattle and single birth. Also wattled does had higher rectal temperature than non-wattle counterparts. Therefore, WAD goats with wattle should be selected for lactation purpose especially those with twin birth.

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