

## Research Article



# Reproduction and Milk Production Performance of Saanen Dairy Goat in Southern Togo (West Africa)

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**Abstract** | Milk and dairy products consumption increase in Togo due to gradual change in diet and demand of an ever-expanding population. However, local dairy production, exclusively cow's dairy, cannot cover the needs of the country which do the powdered milk importation. To diversify dairy production, an experimental breeding of Saanen dairy goat imported from Belgium was undertaken in southern Togo early year 2020. This study evaluates reproduction and milk production performance of Saanen dairy goat raised in southern Togo. The animals are raised in permanent stable and fed with local fodders. They are subjected to veterinary care against trypanosomiasis and parasites. The mineral supplement was provided by the lick stone. Water was constantly served to the animals. The kids are fed with powdered milk replacing their mother's milk until weaning to avoid the Caprine Arthritis Encephalitis Virus. They are fed with local fodders after weaning. Were collected through regular controls: litter size, birth weight, type of kidding (single or twin), mother's parity, age at first kidding, interval between kidding, milk yield and lactation length. The results reveal that litter size ranged from 1 to 2 with an average of 1.37 for primiparous against 1.50 and 1.62 for multiparous. The birth weight depended to sex, parity and type of kidding and ranged from 2.55 to 3.04 kg. The age at first kidding was 450 days while the interval between births ranged from 360 to 720 days. Lactation length ranged from 157.63 to 214.41 days for milk daily production of 1.55 to 1.98 liter/goat. The study reveals Saanen dairy goat adaptation to local conditions of southern Togo.

**Keywords** | Togo, Saanen dairy goat, Adaptation, Reproduction, Milk production, Performance

**Received** | January 05, 2024; **Accepted** | January 30, 2024; **Published** | April 15, 2024

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**Citation** | Mawussi EB, Assah AK, Kulo EA (2024). Reproduction and milk production performance of Saanen dairy goat in Southern Togo (West Africa). *Adv. Anim. Vet. Sci.*, 12(6):1028-1033.

**DOI** | <https://dx.doi.org/10.17582/journal.aavs/2024/12.6.1028.1033>

**ISSN (Online)** | 2307-8316



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## INTRODUCTION

Reproduction and milk production performances are determining parameters of the productivity of dairy goat farms. The ability of goats to adapt to food allows them to be raised in various conditions (Alexandre and Mandonnet, 2005). Milk consumption is increasing in Togo due to the increased need for dairy products due to the gradual change in diet and the demand of an ever-expanding population. However, local dairy production, exclusively from cow, cannot cover the needs of the country

which do powdered milk importation. The local Djallonké goat is raised in all regions of Togo for its meat production and because of its trypanotolerance (Djagba *et al.*, 2020). The low milk productivity of the local Djallonké goat is due to its limited genetic dairy potential. This leads to the difficulties to exploit its milk for human consumption. Exotic dairy goats imported from Europe produce more milk in West Africa than local breed cows (Vissoh *et al.*, 2015; Kassa *et al.*, 2015). Alpine goats raised in southern Benin give 2 liters of milk per goat per day in average compared to 0.36 liters of milk produced per local cow

per day (Vissoh *et al.*, 2015; Kassa *et al.*, 2015). In order to contribute to the diversification of dairy production in Togo, the goat dairy sector can be explored. The breeding of Saanen dairy goat imported from Belgium was recently undertaken in southern Togo in year 2020 for its adaptation to local conditions. The objective of this study is to evaluate reproductive and milk production performances of Saanen goat raised in southern Togo.

## MATERIALS AND METHODS

### STUDY AREA

The experiment was carried out at Ferme Terre Vivante du Togo located about fifty kilometers from Lomé (political and economic capital of Togo) in the Prefecture of Avé, with geographical coordinates: 01° 01' 47" 73 East longitude and 06° 26' 58" 18 North latitude. The vegetation of study area is consisting of gallery forests along watercourses, numerous forest islands, tree savannahs and grassy savannahs. The area enjoys a tropical Guinean climate characterized by two rainy seasons and two dry seasons of unequal duration. The long rainy season goes from March to mid-June and the short rainy season from mid-September to the end of October. Annual rainfall is on average 1200 mm. The average temperature of the locality is 27.2°C. There are several ethnic groups among which the Ewe constitute the majority and indigenous ethnic group. The main activity is traditional agriculture practiced by almost 80% of the population. The Avé prefecture is located in the maritime region of Togo with Lomé city, political and economic capital of the country. Maritime region of Togo is in extreme southwest of the country along the coast of Gulf of Guinea. The presence of capital Lomé in maritime region makes this part of the country the most equipped in infrastructure. Lomé offers several other advantages, notably the concentration of 63.4% of companies operating in Togo.

### MANAGEMENT OF ANIMALS

The animals, Saanen breed, were imported from Belgium. The initial population consisted of six dairy goats and a male breeder. They are raised in permanent stable in a goat shed allowing their distribution according to sex, age and physiological state. They are subjected to an adaptive diet based on local fodders (Figure 1). The method of distributing fodder to the goat in stable was adopted. From kidding to weaning, the kids are fed powdered milk replacing their mother's milk until weaning to avoid the Caprine Arthritis Encephalitis Virus. The mineral supplementation was well provided by the lick stone. Water was served constantly and regularly monitored. The health care administered concerned the internal and external deworming every two months. Milking of lactating goats was done twice a day (morning/evening).



**Figure 1:** Feeding of Saanen dairy goats with local fodder.

### PERFORMANCE CONTROLS

There was recorded during regular controls, the litter size, sex, type of kidding (single, double), live body weight of kids at birth, parity of goat mother, age at first kidding, interval between successive kidding, lactation length and daily milk production.

### DATA HANDLING

Statistical analyses of data collected were carried out using SISVAR version 5.6 (Ferreira, 2011). The data were subjected to analysis of variance (ANOVA) to determine the means. Duncan's test was used to compare and to discriminate means. Statistical significance was declared at  $P < 0.05$  (95% confidence). The results were expressed as means  $\pm$  standard deviations.

## RESULTS AND DISCUSSION

### LITTER SIZE

Litter size ranged statistically significance from 1 to 2 with an average of 1.37 for primiparous and 1.50 to 1.62 for multiparous (Table 1). Statistical analysis revealed significant difference between litter size means at  $P < 0.05$ . Litter size increases with parity from the first kidding to the third ( $P < 0.05$ ). This phenomenon can be explained by the expression of hormonal mechanisms in terms of parental maturity (Santosa *et al.*, 2022). The lowest litter size recorded in this study (1.37) is comparable to 1.32 reported for Maradi goats by Marichatou *et al.* (2002) and to 1.35 reported by Santosa *et al.* (2022) for the same Saanen breed. The highest litter size recorded during the present study (1.62) is lower than 1.77 reported for Nubian breed by Meza-Herrera *et al.* (2014) and lower than 1.74 recorded for local Korean goats by Song *et al.* (2006) but higher than 1.58 reported for Alpine breed by Meza-Herrera *et al.* (2014). The difference between litter size values may be attributed to environmental rearing conditions such

as animal housing conditions, animal management, type of food, food availability, food distributing method, and animal health management. There are also breeds more prolific than others, this could have an impact on litter size as reported by Akpa *et al.* (2010), Hrbud *et al.* (2014) and Meza-Herrera *et al.* (2014).

**Table 1:** Litter size of Saanen goats in southern Togo.

Parity	Animal number	Average litter size
<b>Primiparous</b>		
First kidding	7	1.37±0.04c
<b>Multiparous</b>		
Second kidding	6	1.50±0.05b
Third kidding	7	1.62±0.06a

Means in the same column affected in superscript by different alphabet letters are significantly different ( $P < 0.05$ ) with using ANOVA and significance test of Duncan.

### BIRTH WEIGHT OF KIDS

Live weight of kids at birth varied from 2.55 to 3.04 kg depending to sex, type of kidding (single, double) and parity (Table 2). These values are comparable to those reported 3.06 kg by Ince (2010) for the same breed, 3.27 kg reported by Ahuya *et al.* (2009) for Toggenburg breed and 3.87 kg obtained by Chunyan *et al.* (2008) for Boer breed. Males are heavier at birth ( $P < 0.05$ ) than females, 3.04 kg for male kid against 2.73 kg for female (Table 2). The variation in birth weight of kids according to sex have been observed by Meza-Herrera *et al.* (2014) who reported an average birth weight of 3.00 kg for males and 2.77 kg for females. Farina (1989) recorded in Burundi a birth weight of 1.97 kg for males against 1.73 kg for females. The higher weight of males has been explained by effect of sex hormone. The female hormone, estrogen, could restrict the growth of the body's bones so that the female's growth rate is limited (Bushara *et al.*, 2013). In this study, the kids born single are heavier ( $P < 0.05$ ) than those born double, 3.04 kg for single born compared to 2.73 kg twin (Table 2). The higher birth weight of kids born single can be explained by the smaller size of twins and triplets in the uterus (Bushara *et al.*, 2013). Chemineau *et al.* (1985) reported for Creole breed that kids born single are heavier than those born multiple i.e. 2.03 kg for simple against 1.67 kg for doubles compared to 1.38 kg and 1.04 kg for triples and quadruples respectively. Farina (1989) reported higher birth weight of 1.91 kg for singles born against 1.79 kg for multiples born. In both male and female kid, the mean birth weight showed significant difference ( $P < 0.05$ ) and increased from first kidding (2.72 kg) to second kidding (2.93 kg) and to third kidding (3.02 kg) in this study (Table 2). It depends then to parity and age of goat. The same observations were done by Duričić *et al.* (2012) and Ibnelbachyr (2015) who respectively reported that for the Boer and Draa breeds,

kids from multiparous goats were heavier than those from primiparous mothers. This phenomenon can be attributed to the expression of hormonal mechanisms in connection with parent mature (Santosa *et al.*, 2022).

**Table 2:** Average birth weight of Saanen goat kids in southern Togo.

Kidding/Parity	Animal number	Birth weight	
		Male	Female
<b>Type of kidding</b>			
Simple	5	3.04±0.09a	2.75±0.07b
Doublet	16	2.73±0.06c	2.56±0.05c
<b>Primiparous</b>			
First kidding	5	2.72±0.06c	2.55±0.05c
Second kidding	4	2.93±0.08b	2.74±0.07b
Third kidding	6	3.02±0.09a	2.89±0.08a

Means in the same column affected in superscript by different alphabet letters are significantly different ( $P < 0.05$ ) with using ANOVA and significance test of Duncan.

**Table 3:** Average age at first kidding and interval between kidding of Saanen dairy goat in southern Togo.

Parity	Animal number	Age at first kidding (days)	Interval between kidding (days)
<b>Primiparous</b>			
First kidding	5	450±2.88	720±2.08a
<b>Multiparous</b>			
First kidding to second	5	-	720±2.08a
Second kidding to third	6	-	360±1.88b

Means in the same column affected in superscript by different alphabet letters are significantly different ( $P < 0.05$ ) with using ANOVA and significance test of Duncan.

### AGE AT FIRST KIDDING

The age at first kidding is a reproductive parameter which provides information on the precocity of young female goats to enter into reproduction. In this study, the average age at first kidding was 450 days (Table 3). It exceeds the range of 360 days reported by Payne and Wilson (1999) for tropical goats. The comparable value of 407.9 days was reported for highland goats in Ethiopia by Mengistie *et al.* (2013). In most cases, the age at first kidding of goats in the tropics is between 18 and 26 months i.e. 540 and 780 days as reported by Le Gal and Planchenault (1993). The puberty delay is due to slow growth of animals attributable to tropical conditions (Freitas *et al.*, 2004; Zarazaga *et al.*, 2005). Body growth and age at puberty are linked to undernutrition which can delay puberty by up to a year (Gordon, 2004; Sakurai *et al.*, 2004). Optimal management of goats in breeding would allow a first kidding at the age of 12 to 13 months (Mayeriya *et al.*, 2017). Alpine and Saanen dairy goats have a higher probability to enter

into reproduction at age of 210 days or 7 months with a high optimal weight (Nadon, 2017). The average age at first kidding of 450 days, recorded in this study, exceeded double value of 210 days reported by Nadon (2017) for Alpine and Saanen dairy goats. This could be explained by the difference in breeding management, food availability and environmental conditions.

**INTERVAL BETWEEN SUCCESSIVE KIDDING**

The interval between successive kidding is a measure which indicates that how goats become quickly carriers again and give birth to kids (Steele, 1996). It constitutes one of the significant reproduction performances. Average interval between successive kidding in this study showed significant difference (P<0.05) and ranged from 360 to 720 days (Table 3). This is higher than the average interval of 307.9 days reported in Ethiopian highland goats (Mengistie et al., 2013). The kidding interval depends on breeds, food availability and farm objectives. It has been reported that meat-type goats have a shorter kidding interval than dairy-type goats (Devendra, 1990). In this study, the primiparous goats have the longest kidding interval of 720 days, this reveals that the goat parity influences kidding interval. This is due to the fact that the primiparous goats continue to grow and may compete with fetuses nutritionally during pregnancy, affect adversely fetal growth and development, thus extend the kidding interval (Ayizanga et al., 2018).

**MILK YIELD**

In this study, daily milk yield mean showed significant difference (P<0.05) and ranged from 1.55 to 1.98 liter per goat per day (Table 4). These results are comparable to those reported by Offoumon et al. (2023) in Benin and Nziku et al. (2017) in Tanzania for the same Saanen breed. However, they are lower than those expressed in temperate environments as in Italy by Serradilla (2001) who concluded that exotic breeds with high milk yield have a better milk yield in origin country. In this study, Saanen goats with a single kidding produced less milk (1.55 liter/day) (P<0.05) than Saanen goats with twin kidding (1.90 liter/day) (Table 4). This observation has been done by other authors (Offoumon et al., 2023; Sauviant et al., 2012). Indeed, Offoumon et al. (2023) reported for the same Saanen breed that goat having multiple kidding have an average daily milk production of 2.1 liter/day for twin kidding, 2.6 liter/day for triple kidding and 2.8 liter/day for quadruple kidding against 1.8 liter/day for a single kidding. Sauviant et al. (2012) reported that goats having given birth to 2 kids and more than 3 kids have respectively an increase in milk production of 0.31 kg/day and 0.54 kg/day more than the milk production of goats given a single kid. In this study, the daily milk yield mean showed significant difference (P<0.05) and increased from first kidding (1.63 Liter) to second kidding (1.80 Liter) and to third (1.98 Liter)

(Table 4). It depends to parity and age of goat. Like in the current study, Arnal et al. (2018) observed that Saanen goats that kidded youngest had a lower milk production levels and milk yield increased with parity from first to fourth kidding on average. Assan (2015) observed that the first lactation goats have the lowest milk yield, while the third lactation goats had the highest milk yield. Praharani et al. (2021) had shown that the first lactation produced lower milk (125.62 liters) than the second (148.94 liters) and the third (185.68 liters).

**Table 4:** Daily milk yield mean and lactation length average.

Kidding/parity	Animal number	Milk yield (Liter/day)	Lactation length (days)
<b>Type of kidding</b>			
Simple	5	1.55±0.02d	157.63±1.19e
Doublet	4	1.90±0.05a	165.42±1.23d
<b>Parity</b>			
<b>Primiparous</b>			
First kidding (Lactation 1)	5	1.63±0.03c	171.25±1.29c
<b>Multiparous</b>			
Second kidding (Lactation 2)	5	1.80±0.05b	193.18±1.38b
Third kidding (Lactation 3)	6	1.98±0.06a	214.41±1.42a

Means in the same column affected in superscript by different alphabet letters are significantly different (P< 0.05) with using ANOVA and significance test of Duncan.

**LACTATION LENGTH**

The duration of lactation is the period during which the goat after kidding produces milk. The mean lactation length recorded in this study showed significant difference (P<0.05) and ranged from 157.63 to 214.41 days. It gradually increased (P<0.05) from the first to the third (Table 4). It is low compared to that reported by Mioc et al. (2008) who stated that the Saanen breed had a lactation length of 266.81±1.95 days and the Alpine breed of 264.51±0.57 days. The difference in lactation length can be attributed to feed availability, environmental effect and breeder goals. Lactation length (P<0.05) increased with the parity and goat age, 171.25 days for first lactation compared to 193.18 and 214.41 days respectively for second and third kidding (Table 4). Like in the current study, Praharani et al. (2021) reported that the lactation length of the first lactation (170.10 days) showed shorter than the second lactation (215.20 days), while the third lactation (256.60 days) was longer than the second lactation which was between the first and third lactation.

**CONCLUSIONS AND RECOMMENDATIONS**

The current study evaluated the reproduction and milk production performance of Saanen dairy goat imported

from Belgium and raised in southern Togo conditions. The study found that the litter size and the live weight of kids at birth varied and depended to sex, type of kidding (single, double) and parity. Males are heavier at birth than females and the kids born single are heavier than those born twins. The goat parity influences kidding interval, the primiparous goats have the longest kidding intervals in comparison to that of the multiparous goats. The lactation length and the milk yield increased with kidding order from the primiparous goats to the multiparous goats. On base of results recorded in comparison to that of similar studies carried out in other countries, the study concluded that Saanen dairy goat imported from Belgium adapts to southern Togo conditions. Moreover, for the development of the goat dairy sector in Togo through the introduction of dairy goat breeding in rural areas, specific further studies are possible such as:

- impacts of environmental rearing conditions (diet, housing conditions, and health management) on capacity reproductive and milk production performance of dairy goat in rural areas of Togo,
- socio-cultural studies of dairy goat farming introduction and goat's milk consumption in rural areas
- potential impact of exotic dairy goat breed introduction on local communities including socio-economic aspects and adoption determinants.

## ACKNOWLEDGMENTS

The authors would like to thank TRAKOMULA Association in Belgium and Supporters for the donation of Saanen breed goats and for the financing of infrastructure as part of the installation of "Ferme Terre Vivante du Togo" and start of the activities of Saanen dairy goat breeding in southern Togo. They particularly thank Mr. Remy Schiffeleers, President of the TRAKOMULA Association for his multifaceted support and technical support during the Farm installation and Professor Nadine Buys, Department of Biosystems, Center for Animal Breeding and Genetics, KU Leuven, Leuven, Belgium, for ensuring the transport of Saanen dairy goats from Belgium to Togo. They also thank the Farm technicians for their daily work and their technical support in data collection.

## NOVELTY STATEMENT

The study of Reproduction and Milk Production Performance of Saanen Dairy Goat is novel conducted under Southern Togo. The novelty of this research is the first evaluation study of Saanen Dairy Goat adaptation to tropical conditions in Southern Togo in West Africa.

## AUTHOR'S CONTRIBUTION

MEB conceptualized the study, methodology, experimental

design, and have written the first draft of the manuscript. MEB and AAK worked on data acquisition and data analysis. KEA worked on supervision and validation. All authors read, revised and approved the final manuscript.

## CONFLICT OF INTEREST

The authors have declared no conflict of interest.

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