

STUDY OF THE IMPACT OF SOME FACTORS ON THE GESTATION LENGTH OF ANGLO-NUBIAN GOATS REARED IN FOOTHILLS

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Abstract

Data is presented from 140 records of pregnancies and births of goats of the Anglo-Nubian breed, bred in the farm of the Research Institute of Mountain Stockbreeding and Agriculture - Troyan, Bulgaria. The data was used to determine the influence of sex, type of delivery and parity on the gestation length (GL) in goats. The delivery season is not taken into account, as it is always in the winter. There was a significant difference in the GL of goats that gave birth to singles and twins ($p < 0.001$). The GL for all kids born as singles was 151.1 ± 0.4 and twins 149.2 ± 0.3 days. No significant difference was observed between the GL of goat that gave birth to male (151.2 ± 0.7) and female (151 ± 0.6) singles. A difference of more than one day was found between the GL of goats that gave birth to male and female twins (148.2 ± 0.6 and 149.9 ± 1 , respectively). The GL in goats that gave birth to twins of different sexes was 149.4 ± 0.4 days, and in goats from the first to the fifth parity (149.2 ± 0.6 ; 149.9 ± 0.5 ; 149.0 ± 0.6 ; 150.5 ± 0.6 ; 150.9 ± 0.7 days) respectively.

Key words: gestation length, goats, parity, sex, type of birth.

INTRODUCTION

Anglo-Nubian is a British breed of goat that is the product of a composite crossbreeding between native British breeds, East Asian goats with pendulous ears and Nubian bucks (Lazarov et al., 1995).

The Anglo-Nubian breed is spread on all continents. In some places, it is raised as purebred or more commonly is used in crossbreeding programs in different regions of the world (Stemmer et al., 2009).

The first import of the breed to Bulgaria took place in 1985 in RIMSA in the town of Troyan (Zunev, 1991), and over the years the breed was used for improvement and reproduction in crossbreeding with Bulgarian White Dairy goat breed (Todorova et al., 2021) (Figure 1).

In recent years, the breed has become more and more relevant for farmers in Bulgaria, and for this reason it is of interest for research work.

Gestation length is a physiological variable that is of economic importance in most animal species (Satue et al., 2011). This value is strictly defined for each animal species, but varies within the breed and is affected by various factors such as season of delivery and

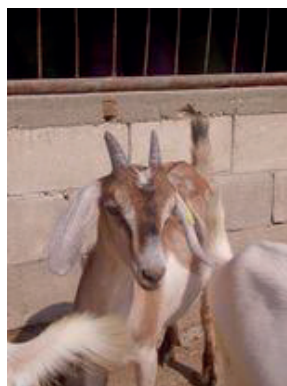


Figure 1. Cross F1 Anglo-Nubian x Bulgarian White Dairy Goat

age of the mother (Mellado et al., 2000; Haldar & Ghosh, 2015).

Bushara (2010) summarized several studies on the gestation length in Nubian goats in Sudan, such as El-naim (1979), who reported a gestation of 146.5 ± 1 days, Jubartalla (1998) with 143-149 days and Elabid (2002) with 148.57 ± 3.6 days.

Yagoub et al. (2013) reported 147.1 ± 0.8 days of gestation length for Nubian goats reared in Sudan. Praharani et al. (2016) reported

150.25±1.39 days of gestation for Anglo-Nubian goats in Indonesia, and Mia et al., (1996) - 148.41±0.84 days for Anglo-Nubian goats reared intensively in Bangladesh.

Peaker (1978) reported that the type of delivery reliably affected the gestation length in Saanian goats. In contrast, Zunev (1991) reported that in goats of the Bulgarian White Dairy breed bred under the same climate conditions and technology as those in the present study, the type, sex, birth weight of the kids and the age of the mother did not have a significant effect on gestation length of the goat mothers.

According to Dickson-Urdaneta et al. (2000), gestation length was also greatly affected by farm management. The feeding of the goats and the season of delivery are also factors to be taken into account.

According to Bushara (2010), provision of amount of energy level in pregnant doe feed would accelerate in growth rate of fetus that ultimately result in shortening gestation period. Last but not least, Joshi et al. (2018) draws attention to the fact that the farm location affects the productive and reproductive performance of goats and in particular the length of pregnancy. The author summarizes the results of studies by Sharma et al. (2017) and Parajuli et al. (2015) who reported that goats reared at higher altitudes had a longer gestation length compared to goats reared at lower altitudes.

The aim of the present study was to determine the impact of sex, type of delivery and parturition order on the gestation length in Anglo-Nubian goats reared in foot-hill regions.

MATERIALS AND METHODS

Geographical location

The study was conducted on the farm of the Experimental Base of the Research Institute of Mountain Stockbreeding and Agriculture of Troyan, Bulgaria. The site is located 380 m above sea level, (42° 53' 39" N /24° 42' 57" E). Climate is temperate-continental with a pronounced mountain influence, with four seasons, without fogs and strong winds. The average temperature for February and March in the last ten years has varied between 3.5 - 6.01°C, and the average precipitation amount has been 49.7 - 59.5 mm.

Animals

All animals were reared under the same conditions. During the period from May to October, the animals were pasture-raised and supplemented with concentrated feed, whereas during the winter period the animals were barn-raised and fed with a ration containing 2 kg of hay and 0.8 kg of concentrated feed per head. Free access to water and salt was provided. The goats were vaccinated against enterotoxemia, dewormed and injected with vitamins A, D and E (Vialiton, Biovet). Goats were inseminated by hand as each "jump" recorded in an insemination diary. The gestation length was calculated from the date of insemination to the date of delivery of the goats.

A few days before the expected delivery, the goats are separated into individual boxes and are under the supervision of breeders. Immediately after delivery, the weight of the kids was measured with electronic scales and recorded in a diary. The newborn kids together with their mothers stayed in the individual pens for five days. After that, they were separated into pens of ten kids, where they remained until weaning.

Experimental setup

Data from a total of 140 gestation and delivery records of Anglo-Nubian goats are presented. The data were used to determine the influence of sex, type of delivery and parturition order on the gestation length in goats. The season of delivery is not taken into account, as it is always in February and March.

According to the type of delivery, the gestation length of goats that gave birth to single (48), twin (77) and triplet kids (15) was examined. According to parity, the data is distributed as follows - goats of first, second, third, fourth and fifth parity on the first parity - 33 heads, on the second - 29 heads, on the third - 28 heads, on the fourth - 22 heads and on the fifth - 28 heads. The impact of birth weight on the gestation length of goats that gave birth to singles was examined, as the weight of the kids was divided into <3.3 and ≥3.3 kg.

Statistical analysis

One-way ANOVA was used for statistical comparison. The differences were tested by Student t-test.

RESULTS AND DISCUSSIONS

Table 1 shows the impact of the type of delivery on the gestation length of studied goats.

The present results show that the pregnancy of goats that had single kids was significantly longer by 1.9 days than that of goats with twins ($p < 0.001$). No significant difference was observed in the gestation length of goats that gave birth to twins and those with triplets. As can be seen from Table 1, the maximum period of gestation length in goats that gave birth to twins and those that gave birth to triplets was the same - 157 days. These results are consistent data by Zunev (1991) for Bulgarian White Dairy goat breed raised under identical climate conditions and technology as those of the present study with 151.5 days for goats that gave birth to single kids and 150.05 days of gestation for goats that gave birth to twins.

Table 1. Impact of the type of delivery on the gestation length

Goats giving birth to	n	$\bar{x} \pm Sx$	min.	max.
singles total	48	^{a***} 151.1±0.4	144	160
twins total	77	^{****} 149.2±0.3	141	157
triplets total	15	^{NS} 149.2±0.9	140	157

Note: a - singles in total/twins in total; **** $p < 0.001$, NS- not significant.

The author points out that animals that had triplets had 2.23 days shorter gestation than those that had singles.

For their two-year study of gestation length in Bulgarian White Dairy goats reared under identical conditions to the present study, Stoycheva et al. (2018) reported 151.8 days of gestation for goats that had single kids and 150.8 days for goats with twins.

In their 15-year study of Anglo-Nubian goats in Peru raised at 20 m above sea level and in a temperate climate, Naver & Custodi (1984) reported 150.8 days of gestation for goats with singles, 150.8 days for goats with twins, and 147.1 days for goats with triplets.

Contrary to the present finding, Ageeb (1992) found for Baggara pasture-raised goats in Sudan that the gestation length was significantly affected by the type of delivery ($p < 0.05$), as goats that were pregnant with

twins had a longer gestation (149.9 days) compared to those who gave birth to one kid (145.1 days).

The present results are also in conflict with what was found by Moaeen-ud-Din et al. (2008) who reported a gestation length of 149.9±1.9 days for goats bearing singles, 150.0±2.1 days in goats with twins and 151.0±2.5 days in goats of Matou breed in China bearing triplets reared in subtropical climate. These differences are likely determined by factors such as the age of the goats, the season of delivery, and others. According to Asdell (1929), Mellado et al. (2000), Kudouda (1985), and Bushara (2010), in Sudanese Nubian goats, gestation length was not reliably affected by the number of kids born. Table 2 shows the impact of the gender of the kid on the gestation length

Table 2. Impact of the sex of the kid on the gestation length

Goats giving birth to	n	$\bar{x} \pm Sx$	min.	max.
male singles	22	151.2±0.7 ^{NS}	144	160
female singles	26	151±0.6 ^{NS}	146	158
male twins	18	148.2±0.6 ^{NS}	145	155
female twins	14	149.9±1 ^{NS}	141	157
same-sex twins	45	149±0.4 ^{NS}	141	157

Note: NS- not significant.

To examine the effect of kid gender on gestation length, we also divided goats according to delivery type. There is almost no difference in the gestation length between goats that gave birth to single males and single females. Goat mothers that gave birth to female twins had a 1.7 day longer gestation than those who gave birth to male twins. The gestation of goats that gave birth to twins of different sexes was shorter than that of goats that gave birth to twins of the same sex (Table 2). The present findings are in agreement with those reported by Stoycheva et al. (2018) in Bulgarian White Dairy goats. The authors reported 151.9 days of gestation for male singles and 151.7 days in female, 150.3 days for male twins, 151.3 days for female and 150.9 days in heterosexual, respectively.

According to Hafez (1993), ewes that gave birth to male lambs had longer gestation than those that gave birth to females. According to Ageeb (1992), the gender of the kid has a significant effect on the gestation length in Baggara goats. In contrast to Hafez (1993), the aforementioned author found that goats that gave birth to female kids had a longer gestation period than goats that gave birth to male kids. This conclusion in the present study can only be confirmed in goats that gave birth to same-sex twins.

Bushara (2010) summarized the studies of El-naim (1979) and Kudouda (1985) in Sudanese Nubian goats and Mishra et al. (1979) in Indian Sirohi goats - according to them, the sex of the newborn kid has no significant effect on the gestation length in goats.

Table 3 shows the influence of parity on the gestation length.

Table 3. Effect of parity on the gestation length

Goats giving birth to	n	$\bar{x} \pm Sx$	min.	max.
first	33	149.2±0.6 ^{NS}	141	160
second	29	149.9±0.5 ^{NS}	146	157
third	28	149.0±0.6 ^{NS}	140	155
fourth	22	150.5±0.6 ^{NS}	145	157
fifth	28	150.9±0.7 ^{NS}	141	159

Note: NS - not significant.

The gestation length, according to parities in the present study, varied between 140 and 160 days. The widest range of variation in first-parity goats and fifth-parity goats was observed. The longest gestation was registered in fifth-parity goats and the shortest in third-parity goats. The difference between them is 1.9 days. The present findings show that as maternal age/parity increases, so does the gestation length.

Present data are in agreement with those found by Zunev (1991) for Bulgarian White Dairy goat breed, reared under conditions identical to those of present study. The author reported a 149.4-day gestation period for second-parity goats, 150.3-day for third-parity goats, and 150.5 days for fourth-parity goats.

Silva et al. (2021) present data on Anglo-Nubian goats in semi-arid regions of Brazil at an altitude of 534 m. with semi-intensive farming. Deliveries were spread over December, April and August. The first-parity goats in this study had the longest gestation (152 days), and the third-parity goats had the shortest (144 days). The gestation of goats giving birth for the second, fourth and fifth time was 148, 148 and 149 days respectively.

In Hair goats raised at 1600 m above sea level in the Eastern Anatolia region of Turkey, deliveries were similar to those in the present study from February to April. Bolacali (2019) reported gestation length for first, second, third and fourth parities with 149.1; 148.5; 149 and 148.3 days respectively.

Hoque et al. (2002) reported that gestation length was strongly influenced by parity in goats from three breed groups in Bangladesh. Second-parity goats had the longest 148-day gestation period, and fifth-parity goats the shortest - 144.9 days.

According to Asdell (1929), there is a very clear difference in the gestation length between young and older mothers. The author relates this not to the number of deliveries (parity), but rather to the age of the mothers. That is, gestation is shorter in young animals than in older ones.

Table 4. Impact of the birth weight of single kids on the gestation length

Singles	\bar{x}	Sx	min.	max.
≥3.3	150.9 ^{NS}	0.53	146	158
<3.3	151.3 ^{NS}	0.87	144	160

Note: NS - not significant.

From the point of view of the birth weight of the kids, we can see that the difference is small and insignificant. These data are in agreement with those presented by Stoycheva et al. (2018) in Bulgarian White Dairy goats.

According to Zunev (1991), in goats of the Bulgarian White Dairy goat breed, the kids born with the lowest live weight had the shortest embryonic period.

CONCLUSIONS

It was established that the gestation length of goats of the Anglo-Nubian breed raised in the foothills of the Republic of Bulgaria is a relatively constant value, with slight variations depending on some factors.

A significant difference was found in the gestation length of goats that gave birth to single kids and those that gave birth to twins. The average gestation length for all goats that gave birth to single kids was 151.1 ± 0.4 , and for twins 149.2 ± 0.3 days.

As the age of the mother/parities increased, so did the gestation length, as it was the longest in the fifth parity with 150.9 ± 0.7 .

The present research could be useful in organizing work processes and managing goat farms.

REFERENCES

- Ageeb, A. A. (1992). Production and reproduction characteristics of a flock of Baggara goats of South Kordofan, Sudan. *Sudan Journal of Animal Production*, 5, 11–24.
- Asdell, S. A. (1929). Variations in the duration of gestation in the goat. *Journal of Agriculture Science (Cambridge)*, 19, 382–396.
- Bolacali, M., Ozturk, Y., Yilmaz, O., Kucuk, M., & Karli, M. A. (2019). Effect of Non-Genetic Factors on The Reproductive Performance and Milk Yield Characteristics of Hair Goats. *Kocatepe Veterinary Journal*, 12(1), 52–61.
- Bushara H. El. T. A. (2010). *Assessment of Some Productive and Reproductive Traits of Sudan Desert Goats under Conventional and Supplemented Feeding Systems*. Ph. D. Thesis. University of Khartoum. Sudan.
- Dickson-Urdaneta, L., Torres-Hernaandez, G., Becerril-Pearez, C., Gonzalez-Cossio, F., Osorio-Arce, M., GarcoAa-Betancourt, O. (2000). Comparison of Alpine and Nubian goats for some reproductive traits under dry tropical conditions. *Small Ruminant Research*, 36, 91–95.
- Elabid, K. E. (2002). *Studies on some productive and reproductive traits of Sudan Nubian goats under village and small holder system*. Ph. D. Thesis, University of Khartoum.
- El-naim, Y. V. (1979). *Some reproductive and productive traits of Sudan Nubian goats*. M.V.Sc. Thesis, University of Khartoum. Sudan.
- Hafez, E. S. E. (1993). *Reproduction in Farm Animals*. 6th Edition.. Philadelphia, USA: Lea and Febige Publishing House, 320–321.
- Haldar, C., & Ghosh, S. (2015). Dynamics and regulation of goat reproduction, *International Journal of Current Research and Academic Review*, 3(8), 20–36.
- Hoque, M. A., Amin, M. R. & Baik, D. H. (2002). Genetic and Non-genetic Causes of Variation in Gestation Length, Litter Size and Litter Weight in Goats, *Asian australian journal of animal sciences*, 15(6), 772–776.
- Joshi A., D. Kalauni & N. Bhattarai. (2018). Factors Affecting Productive and Reproductive Traits of Indigenous Goats in Nepal. *Archives of Veterinary Science and Medicine* 1, 019–027.
- Jubartalla, K. A. (1998). *Effect of energy and protein sources on some productive and reproductive potential of Sudan Nubian goats*. Ph. D. Thesis, University of Khartoum, Sudan.
- Kudouda, M. E. M. (1985). *Growth, reproductive and productive performance of Sudanese Nubian goats*. M. Sc. (Agric.), Thesis, University of Khartoum, Sudan.
- Lazarov, V., Mihailova, L., Zunev, P., & N. Masalski. (1995). *Goat breeding. national animal selection and breeding service*. Sofia, BG: Agropres Publishing House, 1–62.
- Mellado, M., Amaro, J. L., Garcia, J. E., & Lara, L. M. (2000). Factors affecting gestation length in goats and the effect of gestation period on kid survival. *The Journal of Agricultural Science*, 135, 85–89.
- Mia, M. M., Ali, A. & Bhuiyan, A. K. F. H. (1996). The reproductive performance of Black Bengal, Barbari, Barbari X Black Bengal and Anglo-Nubian goats. *Indian Veterinary Journal*, 73(10), 1048–1052.
- Mishra, R. K., Nivsarkar, A. E., & Arora, C. L. (1979). A note on the analysis of gestation length in Sirohi goats. *Indian Journal of Animal Science*, 49(11), 967–968.
- Moaeeen-ud-Din, M., Yang L. G., Chen, S. L., Zhang, Z. R., Xiao, J. Z. Wen, Q. Y., & Dai. M. (2008). Reproductive performance of Matou goat under subtropical monsoonal climate of Central China. *Tropical Animal Health and Production*, 40, 17–23.
- Naver, M. V. & Custodio, M. A. C. (1984). Reproductive Behavior of Anglo Nubian Goats in an Ariel Environment in Perú. *Ceiba*, 25(2), 101–112.
- Parajuli, A. K., Kolachhapati, M. R., Bhattarai, N. & Devkota N. R. (2015). Effect of non genetic factors on reproductive performance of hill goat in Nawalparasi, Nepal. *Nepalese Journal of Animal Science*, 29–40.
- Peaker (1978). Gestation Period and Litter Size in the Goat. *British Veterinary Journal*, 134(4), 379–383.
- Praharani, L., Supriyati, & Krisnan, R. (2016). A Preliminary Study on Some Reproductive Traits and Heterosis Effects of Anglo Nubian and Etawah Grade Crossbred Does. *Proceedings of International Seminar on Livestock Production and Veterinary Technology*, 252–260.
- Satue, K., Felipe, M., Mota, J., & Munoz, A. (2011). Factors influencing gestational length in mares: A review. *Livestock Science*, 136, 287–294.
- Sharma, S., Bhattarai, N., & Sapkota, S. (2017). Evaluation of Reproductive Efficiency of Nepalese Hill Goat (*Capra hircus* L.) in Western Nepal.

- International Journal of Livestock Research*, 7, 107-116.
- Silva, I. W. H., Moura, J. F. P., Santos Júnior, E., Dias-Silva, T. P., Pereira Filho, J. M., Bezerra, L. R., & Oliveira, J. P. F. (2021). Dairy goat production in the semi-arid region: productive and reproductive analysis, and the influence of the adoption of hygienic practices on milk quality. *Arquivo Brasileiro de Medicina Veterinária e Zootecnia*, 73(5), 1147-1158.
- Stemmer, A., Siegmund-Schultze, M, Gall, Ch., & Zárate, A. V. (2009). Development and worldwide distribution of the Anglonubian goat. *Tropical and Subtropical Agroecosystems*, 11, 185-188.
- Stoycheva, S., Dimitrova, Ts., Ivanova, S., & Zunev, P. (2018). Influence of sex of birth and type of birth of the kids on the gestation length of Bulgarian with dairy goats. Proceedings of the IX *International Agricultural Symposium "Agrosym 2018"*, 1736-1739.
- Todorova, V., Todorov, D., Borislavov, R., & Borislavov, N. (2021). Breeding program of the Anglo-Nubian breed of goats in Bulgaria. *Association of Dairy Goat Breeders, Ruse*, 1-96.
- Yagoub, M. S., Alqurashi, A. M., & Elsheikh, A. S. (2013). Some reproductive traits of female Nubian goats. *The Journal of American Science*, 9, 385-389.
- Zunev, P. (1991). *Phenotypic and genotypic characteristics of the core Bulgarian White Dairy breed of goats*. Ph.D. Thesis, Agricultural Academy, Sofia.