VETERINARSKI ARHIV 82 (4), 351-358, 2012

Reproductive performance of boer goats in a moderate climate zone

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ĐURIČIĆ, D., J. GRIZELJ, T. DOBRANIĆ, I. HARAPIN, S. VINCE, P. KOČILA, I. FOLNOŽIĆ, M. LIPAR, G. GREGURIĆ GRAČNER, M. SAMARDŽIJA: Reproductive performance of boer goats in a moderate climate zone. Vet. arhiv 82, 351-358, 2012.

ABSTRACT

The objective of this study was to determine the reproductive performance in Boer goats under semi-intensive management in north-western Croatia over three consecutive years. Sixty Boer does, aged 2 to 6 years, were divided into three groups. A total of 1.80 kids were born per doe (435 newborn in 242 pregnancies). Boer goat fertility was 93.44%. Does with single kids accounted for 22.53% (n = 98), with twins 49.20% (n = 107), triplets 18.62% (n = 27), quadruplets 7.35% (n = 8) and quintuplets 2.29% (n = 2). The average birth weight of Boer kids was 3.48 ± 0.04 kg (1.70 kg to 5.4 kg). The birth weight of goat kids in pluriparous Boer does was significantly ($P<0.05$) higher in comparison to kids in primiparous does by gender. The birth weight of Boer male goat kids was significantly ($P<0.05$) higher than female Boer kids. There was no impact from goat age, number of kiddings and birth weight. More than 76% of Boer does delivered in the winter and spring. It is supposed that after transferring from the southern to the northern hemisphere, Boer goats have gradually acclimated to a new seasonality.

Key words: birth weight, boer goat, goat kids gender, reproductive performance

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ISSN 0372-5480
Printed in Croatia

Introduction

Sheep and goats are seasonal breeders (seasonally polyoestrous) in the moderate climate region, with the breeding season becoming longer towards the equator (ZARROUK et al., 2001). The length of the breeding season is primarily the result of genetics and environmental interactions (BODIN et al., 1999; FABRE-NYS, 2000). Different factors, such as photoperiod, temperature, nutrition, breed and male effect, regulate physiological response. Seasonality is controlled by the number of dark hours the animal is exposed to (KARSCH et al., 1984; MALPAUX et al., 1994). During the night, the pituitary gland releases melatonin (CHEMINEAU and DELGADILLO, 1994; FABRE-NYS, 2000), which provides stimulation of the hypothalamus-hypophysis-ovarium axis. The natural breeding season of dairy goat breeds in the northern hemisphere is usually restricted to the period between September and November (beginning in late August and ending in late December to mid January) with a clear anoestrous period from February to the end of May (SHELTON, 1978; CORTEEL, 1977; CHEMINEAU et al., 1992). Tropical breeds of goat are thought to be aseasonally polyoestrus and can breed throughout the year (DELGADILLO, 2004). In tropical regions, the photoperiod is less important than temperature, rainfall, vegetation and herbal growth (dry and rainy seasons) (HAMBOLU and OJO, 1985). There is no impact of air temperature or rainfall on the reproductive performance of Boer goats in north-western Croatia (DJURICIC et al., 2010). Reproductive performance in goats is influenced by the age of goats at first kidding, kidding interval, litter size, and birth kid body weight and weaning weight (SONG et al., 2006). Reproductive performance is the productivity of the animal, herd or flock in terms of offspring produced, and can be expressed in many ways (prolificacy, fertility, fecundity, interkidding period and days open). Prolificacy, fertility and fecundity in small ruminants varies by breed, season, age, nutritional status, health, breeding management and farm supplies. The interkidding period is the period (in days) between two consecutive parturitions. The average interkidding period in goats in the northern hemisphere is about one year (from one kidding season to the next). The service period is the interval from partus to conception. Boer goats evolved in Southern Africa from indigenous African (and introduced European) goats (CASEY and VAN NIERKERK, 1988). This meat breed of goats has been described as having the ability of rapid acclimation and adaptation, low water turnover rates and low parasite infestation (ERASMUS, 2000; SHELTON, 1978), and therefore improved Boer goats are widespread throughout the world (MALAN, 2000). In southern Africa, the Boer goat is aseasonally polyoestrous, with the peak of sexual activity in autumn. The period of lowest sexual activity is usually during late spring and mid-summer (GREYLING, 2000; GREYLING and VAN DER NEST, 1990). Kiddings began in April and May and were very rapid during the period of vegetation growth (GREYLING and VAN DER NEST, 1990). The mean duration of the service period in Boer goats was recorded at 62.0 ± 20.2 days in South Africa

(GREYLING, 2000), as compared to 108.22 ± 4.42 days (values between 64.4 ± 8.30 days in autumn and 151.3 ± 2.66 days in winter) in northwest Croatia. The mean interkidding period in Boer goats was the longest in winter (309.70 ± 2.66 days) and the shortest in autumn (229.73 ± 8.29 days) (ĐURIČIĆ et al., 2009a). The average gestation length of Boer does in north-western Croatia was 148.87 ± 0.86 days, i.e. from 143 to 159 days (ĐURIČIĆ et al., 2009b).

Materials and methods

In this study, 60 Boer goats, aged from 2 to 6 years, were investigated. Goats were kept in a semi-intensive environment in north-western Croatia. Animals were kept at pasture, which primarily provided area for exercise, with access to stables during the night. Does were divided into three groups, and each group was paired with different bucks every year.

Feed concentrate (450 g) was provided twice daily at the same time (40% corn, 17% soybean, 16% oats, 16% barley, 8% wheat flour and 3% mineral and vitamin supplement for goats). According to standard farming practice, the animals had free access to good quality meadow hay (about 1.8 kg per doe daily) and drinking water. All does had equal opportunity to kid in all seasons. All goats were kept together with their kids from kidding until weaning (about 3-4 months of age). Boer kids suckled *ad libitum* and after 1-1.5 months were fed with concentrate and hay. Kids were weighed after parturition (when goats licked up newborns) with a spring balance (precision ± 0.05 kg). The winter season refers to January and February of the chosen year and December of the previous year.

North-western Croatia belongs to the moderate climate zone. It is a moderate wet region with mean annual precipitation of 870 mm per year and maximal insolation of 2000 hours per year (ZANINOVIC et al., 2008). All data were statistically analysed using ANOVA and the Tukey test of pos-hoc analysis. Statistically significant results were at $P<0.05$.

Results

Boer goats (n = 60) birthed 435 goat kids after 242 successful matings (only 17 matings were unsuccessful) in three consecutive years. The average birth weight (n = 435) was 3.48 ± 0.04 kg for all kids. Birth weight of goat kids in pluriparous Boer does was significantly ($P<0.05$) higher in comparison to kids in primiparous with regard to gender. The birth weight of Boer male goat kids was significantly ($P<0.05$) higher than female Boer kids. Birth weight results are presented in the Table 1. Boer goat fertility in north-western Croatia over the three-year period was 93.44%. Prolificacy in this herd was 180% or 1.80 kids per doe. Seasonal distribution of kiddings in this investigation was as follows: 45% of Boer does delivered in winter, 31% in spring, 11% in summer and 13%

in autumn. Does with singles accounted for 22.53% (n = 98), does with twins, 49.20% (n = 107), does with triplets, 18.62% (n = 27), does with quadruplets 7.35% (n = 8) and does with quintuplets 2.29% (n = 2).

Table 1. Average birth weights of the Boer kids according to parity and gender of newborn

Parity of doe	Gender of kid	n	M ± SEM	Min	Max	SD
1.	male	68	3.21 ± 0.08^{a}	2.1	4.4	0.65
	female	54	3.01 ± 0.10^{b}	1.8	5.1	0.84
2.	male	64	3.69 ± 0.10^{c}	1.7	5.0	0.77
	female	54	3.43 ± 0.09^{d}	2.2	4.8	0.69
3.	male	38	3.81 ± 0.08^{c}	2.2	5.1	0.66
	female	33	3.56 ± 0.12^{d}	2.3	4.9	0.67
4.	male	59	3.81 ± 0.09^{c}	2.2	5.4	0.74
	female	28	3.75 ± 0.10^{c}	3.0	5.0	0.58
5.	male	14	3.77 ± 0.22^{c}	3.1	5.3	0.82
	female	23	3.29 ± 0.11^{a}	2.4	4.3	0.52
Total		435	3.47 ± 0.04	1.7	5.4	0.76

Values with different superscripts in the same column differ significantly ($P<0.05$)

Discussion

The improved Boer goat is thought of as highly fertile and well-known for its fecundity (MALAN, 2000). In this research, the fecundity rate was very high at 241.66% (2.42 kids/doe/year), in comparison with 209% (ERASMUS, 2000), 210% (MALAN, 2000), and 212-215% (AUCAMP and VENTER, 1981). In Croatia, kiddings occurred mostly in the winter and spring (about 76% of all kiddings). There was no equal distribution of mating and kidding through the seasons. The average value of the interkidding period of Boer goats in Croatia was 265.35 ± 4.42 days, or 1.38 kiddings/doe/year (ĐURIČIĆ et al., 2009a). After Boer kids were weaned in early spring or midsummer (the anoestrus period for European goat breeds begin in February and ends in May) (SHELTON, 1978; CORTEEL, 1977; ĐURIČIĆ et al., 2009a), Boer does waited for the breeding season (August to November) to mate. An average figure of 70 to 80% following natural mating (in the autumn breeding) is considered normal to good for most European goat breeds (SHELTON, 1978; CORTEEL, 1977), although the Boer goat had a better conception rate (MALAN, 2000). The Boer goat conception rate in north-western Croatia over the three-year period was very high at 93.44% (242 successful of 259 total matings in this study), similar to MALAN (2000) who recorded a conception rate of about 90% in South Africa. The average number of kids per doe depends on the goat breed (AMOAH et al., 1996).

In Nubian goats in Mexico, the average number of kids per doe was 1.77 (MELLADO et al., 1991), as opposed to 2.3 to 2.9 kids in Egypt (MARAI et al., 2002), 1.94 ± 0.07 for Spanish goat in the US, 1.89 ± 0.07 in Kiko (BROWNING et al., 2006), and 1.7 kids at first to 2.4 kids at the sixth kidding in Creole goats of Guadeloupe (ALEXANDER et al., 1999). In this herd, the prolificacy rate was 180%, lower than in Boer goats in Botswana at 193.42% (SEABO et al., 1994), and about 189% in South Africa (MALAN, 2000) and 185% in the US (BROWNING et al., 2006). 435 newborn goat kids were born dead or alive in the present three-year study period. Only 22.53% Boer does had singles (n = 98), similar to the report by SEABO et al. (1994) of 27.7% singles of Boer goats in Botswana. AUCAMP and VENTER (1981) recorded 65% twins in Boer goats, 54.57% (SEABO et al., 1994) in Botswana and 50% (SKINNER, 1972). In this study, 49.20% (n = 107) of does had twins. All authors concluded that more than half of Boer does had twins. This study recorded 18.62% triplets (n = 27). Similar results were obtained by SEABO et al. (1994) of 16.04%. However, both these results are lower than the records of 33% triplets (ERASMUS, 2000) or 27% triplets (AUCAMP and VENTER, 1981) and higher than 6.6% triplets (SKINNER, 1972). Litter size reduces the birth weight and survival rate of indigenous South African goat kids (LEHLOENYA et al., 2005). The most important influences on birth weight in small ruminants are the number of newborns, followed by number of parturitions, body weight and condition of female around the time of parturition, nutrition and gender of newborns (GARDNER et al., 2007). The average birth weight of Boer kids was 3.48 ± 0.04 kg (from 1.70 to 5.4 kg) in this study, similar to 3.21 ± 0.09 kg in the southeastern US (BROWNING et al., 2004). However, LEHLOENYA et al. (2005) recorded a lower birth weight by approximately 0.90 kg in South Africa. Due to improved management in this study, as opposed to the semiarid and arid areas of South Africa, better results were obtained. The performance of meat goats in intensive production in the European moderate climate zone is not well known (DJURICIC et al., 2010; SAMARDŽIJA et al., 2011). Average birth weights differ according to the gender of Boer kids and the number of newborn (BROWNING et al., 2004; LEHLOENYA et al., 2005). It was also concluded that the average birth weight of Boer male goat kids was higher than in female Boer kids (except in the fourth parturition). The birth weight of goat kids in multiparous Boer does was higher than for goat kids in primiparous does within the same gender. There was no equal seasonal distribution of parturitions through the year. It is supposed that after transferring from the southern to northern hemisphere, Boer goats gradually acclimated to a new seasonality. A higher percentage of multiple births were expected during the optimal breeding season and more goat kids during kidding season, as in most European goat breeds.

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Received: 4 July 2011
Accepted: 24 January 2012

ĐURIČIĆ, Đ., J. GRIZELJ, T. DOBRANIĆ, I. HARAPIN, S. VINCE, P. KOČILA, I. FOLNOŽIĆ, M. LIPAR, G. GREGURIĆ GRAČNER, M. SAMARDŽIJA: Rasplodni pokazatelji burskih koza u umjerenoj klimatskoj zoni. Vet. arhiv 82, 351-358, 2012.

SAŽETAK

Cilj je istraživanja bio utvrditi rasplodne pokazatelje burskih koza u sjeverozapadnoj Hrvatskoj u poluintenzivnom uzgoju kroz tri uzastopne godine. Šezdeset burskih koza u dobi od dvije do šest godina, podijeljenih u tri skupine upotrijebljeno je u ovom istraživanju. Dobilo se 1,80 jareta po jarenju, to jest 2,41 jare po kozi godišnje (435 jaradi u 242 jarenja). Fertilitet u burske koze iznosio je 93,44%. Koza s jednim jaretom bilo je 22,53% (n = 98), s dvojkima 49,20% (n = 107), trojkima 18,62% (n = 27), četvorkima 7,35% (n = 8) i 2,29% s petorkima (n = 2). Prosječna porođajna masa jaradi iznosila je 3,48 ± 0,04 kg (od 1,70 kg do 5,4 kg). Prosječna porođajna masa jaradi kod primiparnih koza (n = 68) iznosila je 3,21 ± 0,08 u muške i 3,01 ± 0,11 kg u ženske jaradi (n = 54). Kod pluriparnih burskih koza porođajna masa jaradi bila je značajno veća (P<0,05) u odnosu na jarad primiparnih koza neovisno o spolu. Porođajna masa muške jaradi burske rase bila je značajno veća (P<0,05) u odnosu na žensku jarad. Nije postojala korelacija između starosti koze, rednog broja jarenja i porođajne težine. Više od 76% burskih koza ojarilo se zimi (45%), a 31% u proljeće. Pretpostavlja se da se burska koza nakon preseljenja iz Južne u Sjevernu hemisferu postupno prilagodila na novu sezonost. Burska koza sa svojim genetskim potencijalom može poslužiti za križanje s domaćim kozama europskog podrijetla u cilju poboljšavanja njihove reprodukcijske sposobnosti.

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