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Factors affecting the reproductive performance of goats under intensive conditions in a hot arid environment

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Abstract

Data collected from a large goat farm in northern Mexico (4584 services), were use to investigate if early growth rate, season of mating, parity and breed of doe influenced reproductive performance of goats in a hot environment. Data were analyzed using stepwise, forward univariate logistic regression analyses. Goats whose birth weight was less than 2.7 kg were 1.2 times less likely ($P < 0.05$) to become pregnant than goats with heavier birth weights. The parity groups 2–5 were 1.8 times more likely ($P < 0.05$) to become pregnant, compared to primiparous goats and animals with more than five parturitions. Season of mating was a significant risk factor for pregnancy rate; goats mated in summer had greater chances of getting pregnant than goats mated in fall. Traditional dairy breeds (Saanen, Toggenburg and French Alpine) were nine times less likely ($P < 0.05$) to become pregnant compared with Nubian and Granadina goats. The parity groups 2–5 were half as likely ($P < 0.05$) to abort as were primiparous or older goats. Goats with the lowest pre-weaning daily gains (<136 g d^{-1}) were at increased risk ($P < 0.05$) for abortion. Granadina goats had 30% lower ($P < 0.05$) odds of aborting compared with all other breeds of goats. The oldest goats were 90% more likely ($P < 0.05$) of having stillbirths than the younger does. The risk of stillbirth was lower ($P < 0.05$) in goats with less than six parturitions. The risk of stillbirth was also lower in those goats bred in the fall, as compared with goats mated in summer. Goats with the highest body weights at 25 d of age had higher odds of multiple births than goats with moderate or low weights at 25 d of age. Goats bred in the fall had lower ($P < 0.05$) odds of multiple births than goats mated in summer. Nubian goats were twice more likely ($P < 0.05$) to have multiple births than the other breeds of goats. Our findings indicate that reproductive success in goats in a hot arid environment increased with birth weight of doe >2.7 kg, body weight at 25 d of age >8 kg, growth rate higher than 200 g d^{-1} from birth to 25 d of age, parity <6, breeding in summer and the utilization of Nubian or Granadina does instead of traditional dairy breeds.

Keywords: Abortion; Stillbirth; Pregnancy rate; Litter size; Birth weight

1. Introduction

Reproductive performance of goats is a major determinant of productivity and economic viability of com-

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mercial goat farms. The reproductive process is regulated by genetic and environmental factors, and the net effect of all these influences determine the level and efficiency of reproduction. Fertility in healthy goat herds is influenced by prepuberal nutrition (Bocquier et al., 1996), postpartum nutrition (Sachdeva et al., 1973), body condition (Absy et al., 2001) and age (Erasmus and Fourie, 1985). Although goats can tolerate moderate weight losses at mating and still get pregnant (Goonewardene et al., 1997), more severe changes in energy intake during pregnancy markedly affect fetal survival, thus abortions and stillbirths are major causes of economic loss for the goat industry under intensive (Engeland et al., 1998) and extensive (Mellado et al., 2001) conditions in northern latitudes. Limited data exist on factors affecting reproductive performance of dairy goats under intensive conditions in hot-arid environments. The objective of this study was to identify those genetic and non-genetic factors associated with the likelihood of pregnancy, gestation failure, stillbirths and litter size for dairy and non-dairy goats in an arid environment.

2. Materials and methods

2.1. Study site

The data for this study were obtained from a large commercial goat operation in northeast Mexico (26°06′15″N, 103°26′15″W). Mean annual precipitation at the study site is 242 mm (range during the study period was 162.6–358.8) and in general, November–April is dry and May–October is a rainy season. Annual mean daily temperature is 21.1 °C (S.D. = 0.7).

2.2. Animal and management

The breeds of goats in the study were Saanen, Toggenburg, French Alpine, Granadina and Nubian. Milk production varied from 353 to 513 kg per lactation of 250 d. Goats were confined in a large barn, with a roof of metal sheets. The barn was partitioned into small pens. Each pen was provided with a forage rack, concentrate bowl and water troughs. Goats were fed twice a day (morning and evening) on alfalfa hay, cottonseed meal, sorghum grain and molasses. These diets were formulated to achieve consistency of supply of energy and protein, according to the physiological state of the animals. Trace-mineral mixture, common salt and clean water were always available. The animals were not vaccinated against brucellosis, but were routinely screened (agglutination test) to detect infected animals. Immediate veterinary assistance was given to goats when necessary.

Kids were reared artificially. Does were allowed to breed for the first time at 14 months of age. Breeding was mostly done by hand-mating, exposing goats to fertile mature bucks of their same breed from May to December in the case of Granadinas (this breed is the only one to breed year-round in this zone), and from June to December for the rest of the breeds as full reproductive activity is displayed by goats (males and females) during this period in this latitude (Mellado and Meza-Herera, 2002). Does were checked daily, thus estrus and natural-service dates were recorded for each individual doe during the breeding season. Abortions, stillbirths, kiddings and litter size were recorded. Kids were identified and weighed within 24 h of birth and at 25 d of age.

2.3. Data analysis

Reproductive data were obtained from records routinely kept on the farm. The records covered a period of 7 years (1989–1996). The reproductive traits of primiparous and multiparous goats recorded consisted of: (1) kidding rate (kidding goats divided by the number of services performed, regardless of whether or not pregnancy was established; 4584 services); (2) abortion rate (number of aborting does divided by total pregnant goats); (3) the percentage of stillbirths (birth of a dead kid or a kid dead within 24 h after parturition); (4) birth litter size (including still-born kids). Additional variables were doe type of birth (single or multiple), average daily gain of doe from birth to 25 d of age, body weight of does at birth and at 25 d of age, season of mating (summer or fall), parity (1, 2–5 and >5), birth litter weight and litter weight at 25 d of age of goats. Not all data on all variables included in the models were available, so, for some variables some records were omitted.

Mating months were categorized into two seasons: summer (May–September) and fall (October–December). Birth weight of goats was grouped into