Predição do consumo de matéria seca de cabras leiteiras durante a gestação[1]

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Resumo: O período da gestação é caracterizado por importantes mudanças fisiológicas no corpo materno tais como a diminuição da ingestão de alimento no último terço de gestação em fêmeas com gestação de múltiplos fetos. O objetivo desse estudo foi desenvolver modelos para predizer a ingestão de matéria seca (IMS) em cabras durante gestação simples e gemelar. Parar este estudo, foram usadas 1820 observações de IMS, obtidos diariamente a partir de sete cabras com gestação gemelar e seis cabras com gestação simples a partir do primeiro dia até os 140 dias de gestação. A IMS diária foi ajustada em três modelos não lineares, os quais foram avaliados através do critério de informação Bayesiana (BIC) como um indicador de melhor ajuste do modelo aos dados. O modelo que melhor se ajustou aos dados foi o modelo quadrático, com valor de BIC de 11549. Os interceptos e coeficientes de regressões do modelo quadrático utilizado para predição do IMS diário foram diferentes entre gestação simples e gemelar ($P< 0.01$). Comparado as cabras com gestação simples, as cabras com gestação gemelar tiveram maior decréscimo na IMS durante a gestação. Esse decréscimo na IMS em fêmeas com gestação gemelar se deve principalmente a mudanças hormonais e a maior compressão ruminal causada pelo maior tamanho de seus úteros grávidos. Os modelos desenvolvidos nesse estudo devem de ser considerados no manejo nutricional de cabras leiteiras durante a gestação.

Palavras–chave: peso corporal, cabras leiteiras, ingestão de alimento, prenhez.

Prediction of dry matter intake of dairy goats during pregnancy

Abstract: The pregnancy is characterized by important physiological changes in maternal body such as a decrease on feed intake in the last third of pregnancy mainly in pregnancy of multiples fetuses. The objective of this study was to develop a model to predict the dry matter intake (DMI) of dairy goats carrying single and twin fetuses throughout pregnancy. For this study it was used a total of 1820 individual records of DMI from seven goats carrying twins and six goats carrying single fetuses. The DMI was daily recorded from the first up to 140 days of pregnancy. The daily DMI as a proportion of the average BW was fitted to tree non-linear models which were evaluated considering the Bayesian information criterion (BIC) value as an indicator how well the model fit the data. The best model fitting the data was the quadratic model with had BIC value of 11549. The intercepts and the slopes of the quadratic models used to predict the daily DMI were different between litter sizes ($P < 0.01$). Goats carrying twin fetuses showed a greater decrease in the DMI during pregnancy compared to goats carrying single fetus. The decrease of feed intake in females carrying twins may be mainly related to hormonal changes and a greatest rumen compression due to the biggest size of the gravid uterus. The models developed in this study may be relevant in the adoption of nutritional management of dairy goats during the pregnancy.

Keywords: body weight, dairy goats, feed intake, gestation.

Introduction

The pregnancy is characterized by important physiological changes in maternal body and it imposes an approximate 75% increase on nutrient requirements, due to growth of the fetus, fetal membranes, gravid uterus, and mammary gland (Bauman and Currie, 1980).

The decrease of feed intake is one of many changes observed in the maternal body during pregnancy. A decrease on feed intake in the least third of pregnancy has been observed in pregnant ewes, mainly in pregnancy of multiples fetuses (Forbes, 2007).

The dry matter intake (DMI) is an important step for the diet formulation. However, little is known about the DMI of goats during pregnancy. Therefore the objective of this study was to evaluate a model to predict the DMI of goats carrying single and twin fetuses throughout pregnancy.

Material e Methods

We used 13 dairy goats (Oberhasli and Saanen breed) with an average body weight of 52.0 ± 8.4 kg and with two litter sizes: seven goats carrying twins and six goats carrying single fetuses. Goats were fed for ad libitum intake with 15% leftover feed daily. The feed intake was recorded daily and samples of leftovers were taken daily to determine the DMI. The body weight (BW) of the goats was measured every 15 days. Feed and leftovers DM was determined by oven drying at 105ºC for 12 hours. DMI was determined by the difference between the offered DM and the DM in the leftovers. Daily DMI was recorded from the first day of pregnancy up to140 days, in total of 1820 individual records. The daily BW was predicted by average daily BW gain between the weighing performed every 15 days. To find a prediction of DMI, the daily DMI as a proportion of the daily BW was fitted to non-linear models which were evaluated considering the Bayesian information criterion (BIC) value as an indicator how well the model fit the data. We tested two quadratic models (1. $y = ax^2 + b$; 2. $y = a + bx + cx^2$), and the model from Dijkstra et al. (1997; $y = M_0 \exp\{m [1 – \exp (– kx)] / k – lx\}$), where x is days of pregnancy, M_0, m and k are parameters of the equation. Data on DMI were fit to the models using the %NLINMIX macro of SAS (v 9.4; SAS Inst. Inc., Cary, NC) and litter size and days of pregnancy was considered as fixed effects in the model. The random effects in the model were the effect of the animals and errors. The between-animal variability was modeled by introducing a parameter μ to the intercepts of the models. The data was analyzed as a repeated measure in time using the repeated statement and using the Autoregressive (ar (1)) as the covariance structure (Littell et al., 2006). The residual variance was modeled using the power-of-the-mean variance function to obtain a homogeneous variance of the residuals (Littell et al., 2006). The parameters for each treatment (single × twin fetuses) were compared using the CONTRAST statement. Differences between parameters were declared at $P<0.05$.

Results and Discussion

The best model to fit the data was the quadratic model with had BIC value of 11549. The multiple regression and the Dijkstra et al. (1997) models resulted in BIC values of 11565 and 11578, respectively. Although the resulted BIC values are very close, the quadratic model is also better because this model have only two parameters to be estimated, which makes the non-linear analysis easier to perform. The intercepts and the slopes of the quadratic models used to predict the daily DMI were different between litter sizes ($P<0.01$). The resulting quadratic equations are presented in the Figure 1. As expected, it was observed differences on DMI between goats carrying single and twin fetuses. It was possible to observe that DMI of goats carrying twins started decreasing DMI around 50 days of pregnancy (Figure 1).

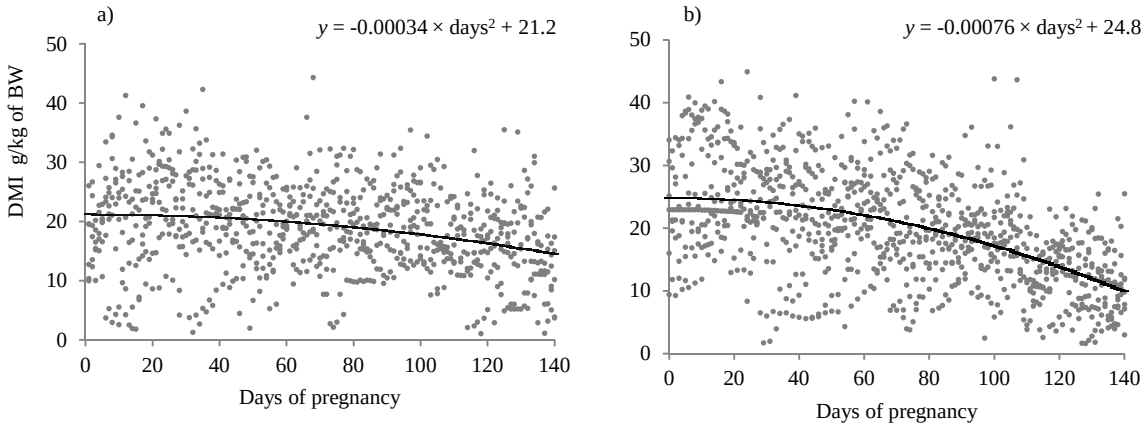

Figure 1. Observed (∘) and predicted (--) values od dry matter intake (DMI, g/kg BW) of pregnant goats carrying single (a) and twin (b) fetuses throughout pregnancy.

As the DMI is expressed as a proportion of BW, there is a dilutive factor caused by the increase of the female BW during pregnancy. However, the decrease of feed intake in females carrying twins may be mainly

related to hormonal changes and a greater rumen compression due to the bigger size of the gravid uterus compared to females carrying single (Forbes, 2007). Although females have the greatest nutrient requirements at the last third of pregnancy (Bauman and Currie, 1980), our results suggest that the concerns about feed intake should start since the second third of pregnancy (after 50 days), mainly for those goats carrying twins. As dairy goats are highly prolific, these results may be relevant in the adoption of nutritional management in dairy goats

Conclusions

The quadratic model should be used to predict daily DMI of pregnant goats during pregnancy.

Goats carrying twin fetuses showed a greater decrease in the DMI during pregnancy compared to goats carrying single fetus and the models developed in this study may be relevant for diet formulation for dairy goats during pregnancy.

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