

NOTA BREVE

ULTRASOUND ASSESSMENT OF FETAL DEVELOPMENT IN NELORE COWS

ESTUDO ULTRA-SONOGRÁFICO DO DESENVOLVIMENTO FETAL EM VACAS NELORE

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ADDITIONAL KEYWORDS

Fetal growth. Genotype.

PALAVRAS CHAVE ADICIONAIS

Crescimento fetal. Genótipo.

SUMMARY

Real time B-mode ultrasound technology was applied to monitor gestation of Nelore cows which had been sired with semen from Nelore (G1), Canchim (G2), Angus (G3) and Simental (G4). Ultrasonographic examinations were taken to monitor the fetal growth. Ultrasonography allowed for a comprehensive study of gestation in Nelore cows until 122 days. Length, diameter and circumference of the head did not show differences ($p>0.05$) in fetal development, amongst genetic groups up to 122 days, even though represented reliable parameters for the estimation of age.

RESUMO

A ultra-sonografia, em tempo real, em modo-B foi utilizada para monitorar a gestação de vacas nelore, inseminadas com sêmen de touros das raças Nelore (G1), Canchim (G2), Angus (G3) e Simental (G4). Os exames ultra-sonográficos foram feitos para monitorar o crescimento fetal. A

ultra-sonografia permitiu o estudo da gestação das vacas Nelore até 122 dias da gestação. O comprimento, o diâmetro e a circunferência da cabeça fetal não diferiram entre os grupos genéticos até os 122 dias, embora representassem parâmetros confiáveis para a predição da idade gestacional.

INTRODUCTION

Genetic make up of the conceptus and its relationship and interactions with environmental factors play an important role on fetal development and gestation in the cow (Gluckman, 1986). Per rectum palpation and other traditional methods are not suitable to monitor early stages of embryonic development and gestation. On the other hand, ultrasonography can be used to obtain fetal measurements

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allowing for effective and accurate diagnostic of early pregnancy (Kähn, 1990), sex of the conceptus, gestational stage, embryonic mortality and fetal development (Hansen & Delsaux, 1987). Kähn (1989) established the correlation coefficients between days of pregnancy and several measures of fetal size. The present trial aimed to study the fetal development and its effects on the uterus of *Bos taurus indicus* cows carrying conceptuses of four different genetic composition.

MATERIAL AND METHODS

Cattle was handled under intensive rotational management of pastures. A commercial TAI protocol was applied to 100 Nelore cows aged 3-5 years and were inseminated with semen of bulls of four different breeds: (G1) 12 animals gestating Nelore pure-breds (F1); (G2), 13 animals gestating crossbred fetuses (50 percent Canchim/ 50 percent Nelore - F2); (G3), 14 animals gestating crossbred fetuses (50 percent Angus/ 50 percent Nelore - F3); (G4), 14 animals gestating crossbred fetuses (50 percent Simental/ 50 percent Nelore - F4). Ultrasonographies were performed according to standard procedures. B-mode real time ultrasound was used coupled to a 5.0 MHz transducer and the examinations were done on the 31st, 45th, 59th, 94th, 122nd, 150th, 192nd, 220th and 255th days of pregnancy. Fetal measurements were taken (cm) throughout all examinations. The statistical analysis was performed by using either the GLM or the REG procedures in SAS (SAS, 1993).

RESULTS AND DISCUSSION

The ultrasound examination at 31 days of gestation allowed to visualize the conceptus and its heartbeats, in agreement with the literature (Pierson & Ginther, 1984; Hansen & Delsaux, 1987). The ultrasonography performed on the 45th day of gestation permitted to visualize the fetus, allantois and amnion. The initial differentiation of the head and fetal limbs was observed, as reported previously (Pierson & Ginther, 1984).

In the examination at 59 days of gestation, the fetus was totally differentiated, which allowed to observe the head, thorax, abdomen, thoracic and hind limbs, organs of the digestive system, urachus, umbilical cord and placentomes, similar to that observed previously (Curran *et al.*, 1986).

The mean fetal length observed was 1.07 ± 0.07 , 2.35 ± 0.08 and 5.55 ± 0.08 cm, at 31, 45 and 59 days of gestation, respectively. Intermediate results were confirmed, taking into account the difference of one day, since fetuses of Holstein cows were observed to be 6.61 ± 0.17 cm at 60 days of pregnancy (Curran *et al.*, 1986) and 5.25 ± 0.7 cm for the same gestational stage in *Bos indicus* fetuses (Totey *et al.*, 1991). The fetuses exhibited a mean growth rate of 0.92 ± 0.08 and 2.3 ± 0.07 mm/day for the periods between the first and second and between the second and third determinations, respectively. The first interval was shown to be less than that reported for undefined cross breed cows, demonstrating fetal development of 1.10 mm/day (Ferrell *et al.*, 1976).

ULTRASOUND ASSESSMENT OF FETAL DEVELOPMENT IN NELORE COWS

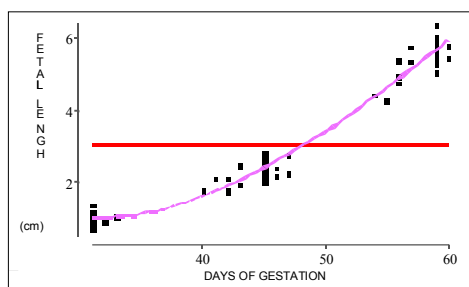


Figure 1. Cubic regression for fetal length during early gestation (y), of experimental groups, as a function of day of gestation ($y=12.4 - 0.818DAY + 0.0174DAY^2 - 9.3 * 10^{-5} * DAY^3$, $R^2 = 0.98$). São Carlos, SP. (Regressão cúbica do comprimento fetal, dos grupos experimentais, em função do dia de gestação ($y=12,4 - 0,818DIA + 0,0174DIA^2 - 9,3 * 10^{-5} * DIA^3$, $R^2 = 0,98$). São Carlos, SP.).

Figure 1 shows fetal growth at the beginning of gestation. The length was not affected ($p>0.05$) by genotype and sex of the fetus.

At 122 days of pregnancy, the volume of the uterus, and its projection into the abdominal cavity, making the ultrasonographic examination difficult and impossible to perform in some animals, concurring with other studies (Kähn, 1989; Rajamahendran *et al.*, 1994).

There was no difference ($p>0.05$) for bi-parietal diameters (**figure 2**) and circumference of the head during fetal life and at birth within the principal effects of genetic group and sex of the fetus.

Figure 2 shows patterns of growth less pronounced than that observed for the fetal length. The genotypes behaved similarly for the development of the diameter and circumference of the head.

Length, bi-parietal diameters and circumference of the head of the fetus did not appear to be significantly distinct among the groups. However, the correlation coefficients (R^2) of the regression equations that related these variables with fetal age, indicated that these parameters are good predictors of fetal age, corroborating the results of other workers (Ferrell *et al.*, 1976; Hansen & Delsaux, 1987; Kähn, 1989).

The gestations examined were localized in the abdominal cavity at 150 and 192 days of pregnancy, in which none of the parameters were evaluated, since the fetuses exhibited a posterior longitudinal presentation, thereby not having access to the head. These results disagreed with others (Kähn, 1989; Rajamahendran *et al.*, 1994), who accomplished measurements during this gestational stage. At the end of this period, fetuses became

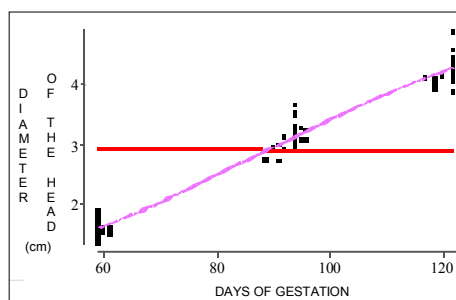


Figure 2. Cubic regression for fetal head diameter, of the experimental groups, as a function of day of gestation ($y = 1.47 + 0.0123DAY + 0.0013DAY^2 - 5.2 * 10^{-6}DAY^3$, $R^2=0.95$). São Carlos, SP. (Regressão cúbica do diâmetro da cabeça fetal, dos grupos experimentais, em função do dia de gestação ($y = 1,47 + 0,0123DIA + 0,0013DIA^2 - 5,2 * 10^{-6}DIA^3$, $R^2=0,95$). São Carlos, SP.).

more accessible, due the initiation of the ascent process.

No difference ($p>0.05$) among genotypes of conceptuses have been found in the circumference of the ocular orbit of the conceptuses (220th and 255th day of gestation).

CONCLUSION

The ultra-sonographic evaluation of the fetus was shown to be an efficient method up to 122 days of gestation, allowing for the prediction of the period of pregnancy. Length, diameter and circumference of the head of the fetus did not appear to be significantly distinct among the groups and showed

REFERENCES

- Curran, S., R.A. Pierson and O.J. Ginther. 1986. Ultrasonographic appearance of the bovine conceptus from days 20 through 60. *Journal of the American Veterinary Medical Association*, 189: 1295-1302.
- Ferrell, C.L., W.N. Garrett and N. Hinman. 1976. Growth, development and composition of the udder and gravid uterus of beef heifers during pregnancy. *Journal of Animal Science*, 42: 1477-1489.
- Gluckman, P.D. 1986. The regulation of fetal growth. In: Buttery, P.J., Lindsay, D.B., Haynes, N.B. (Eds.). Control and manipulation of animal growth. Butterworths, London, pp. 85-104.
- Hansen, C. and B. Delsaux. 1987. Use of transrectal b-mode ultrasound imaging in bovine pregnancy diagnosis. *The Veterinary Record*, 121: 200-202.
- Kahn, W. 1989. Sonographic fetometry in the bovine. *Theriogenology*, 31: 1105-1121.
- Kahn, W. 1990. Sonographic imaging of the bovine fetus. *Theriogenology*, 33: 385-396.
- Pierson, R.A. and O.J. Ginther. 1984. Ultrasonography for detection on pregnancy and study of embryonic development in heifers. *Theriogenology*, 22: 225-233.
- Rajamahendran, R., D.J. Ambrose and B. Burton. 1994. Clinical and research applications of real-time ultrasonography in bovine reproduction: a review. *The Canadian Veterinary Journal*, 35: 563-572.
- Sas Institute. 1993. SAS/STAT: user's guide, Version 6. 4.ed. Cary 2, 1891-1686.
- Totey, S.M., G. Singh, M. Taneja and G.P. Talwar. 1991. Ultrasonography for detection of early pregnancy following embryo transfer in unknown breed of *Bos indicus* cows. *Theriogenology*, 35: 487-497.

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to be effective in the determination of fetal age. There is a lack of highly accurate methods for the evaluation of bovine fetal growth in the last trimester of gestation, for the correct determination of eventual differences in these evaluated parameters.

The data gathered in this study with Zebu Cattle as subject have shown that pregnancy events and fetal development occurred in a similar fashion as compared to european breeds of Cattle.

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