

Evaluation of Ultrasound for Pregnancy Diagnosis Between 20 and 40 Days Post Insemination in Dairy Cows

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Abstract: A study to evaluate the accuracy of pregnancy diagnosis in dairy cows was conducted using animals between 20 and 40 days after service. The accuracy of the method was obtained calculating the sensitivity, specificity, positive and negative predictive values (PPV and NPV). The highest values in these indicators were obtained between 31-35 and 36-40 days post insemination, with a NPV of 97% for both ranges and a sensitivity of 98 and 97%, respectively. The PPV and the specificity for both ranges was 85.7 and 93.6% and 80 and 93%, respectively. The decrease of the PPV and specificity could be affected by early embryonic death increasing the number of false positives in days 31 to 35 post insemination. We conclude that a negative diagnosis of gestation by ultrasound practice after 30 days post insemination is considered to be accurate method to monitor empty cows which can be reprogram for a synchronization method for rapid insemination.

Key words: Dairy herd, bovine pregnancy, transrectal ultrasonography

INTRODUCTION

One of the main problems of economical impact for dairy producers is the reproductive performance of cattle in lactation. Important parameters such as intervals between calving, service per conception and open days are used in dairies as indicator or reproductive efficiency. The achievement of pregnancy after the postpartum period is essential between calving. Although the infertility problems are of multifactorial origins, one common reason for this pathology is the inappropriate detection of heat or cows not presenting heat at all. Frequently, cows in production are not inseminated none are programmed for synchronization of service until 50 days postpartum. Early detection of empty cows after service improve the reproductive efficiency because it lowers the interval time between services and increases the rate of artificial insemination in the herd^[1-3]. The use of ultrasound for the diagnosis of gestation in cattle was reported 22 years ago by^[4]. The aim of this study was to evaluate the use of ultrasound for the early diagnosis of gestation.

MATERIALS AND METHODS

Reference population: This study was carried out in the dairy basin located in Valle del Carrizo in Tijuana, Baja

California, Mexico. It is located at 32° 43' 19'' (latitude North) and 117° 04' 19'' (longitude west), average annual rainfall is 196.2 mm. The valley has approximately 3,800 milking cows in 10 commercial dairy farms located on 850 hectares. Each dairy has an average of 380 milking cows. The farms have the same general handling conditions, the cows are milked twice daily (average production is 28 liters/day), they have an average of 143 open days and 2.5 services per conception. Diet supplied to the cows is integral and contains a mixture of commercial dairy concentrate with a formula based on corn flakes and a complement of ground alfalfa hay at the rate of 50:50. During this study each cow consumed an average of 25 kg of feed per day. Feed is offered twice daily (at 03:00 and 14:00 h). Average productive life span of cows is 3-4 calvings and the culling rate is approximately 25%.

Pregnancy diagnosis: With the purpose to detect pregnant cows, a ultrasound study (ultrasound Aloka 500, transducer linear de 5.0 mHz, USA) of the reproductive tract via rectum was performed in a total of 323 Holstein Friesian cows, these animals had between 20 and 40 days from the last insemination. A positive gestation diagnosis was considered where the presence of amniotic fluid and/or an embryo surrounded by an amniotic sac was detected^[4-6]. All animals evaluated by ultrasound

and rectal palpation were confirmed by rectal palpation 50 and 60 days post insemination, an standard procedure used in that particular herd.

Data collection: Information of each of the observed cows was recorded in a format that included, amongst other variables cow number, date of parity and days of the last insemination. Generated information was captured and processed using the program Microsoft Excel 2000.

Information analysis: To compare the results of ultrasound and rectal palpation, we calculate the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) using a 2x2 contingency table. The sensitivity on this study is the probability that a pregnant cow is detected as positive by ultrasound^[7]. The specificity is the probability that ultrasound has to detect an empty cow^[6, 8]. PPV is the probability that a cow detected as pregnant is truthly pregnant, while the NPV is the probability that a non pregnant cow is detected as empty by the ultrasound method^[6, 8].

RESULTS

The indicators of accuracy of pregnancy comparing the method of ultrasound and rectal palpation at different time intervals are shown in Table 1. The sensitivity and specificity between ranges of 20, 25, 26 and 30 days post insemination were very low, which shows that ultrasound was not a reliable method to determine the pregnancy status in those days. The best results of ultrasound were obtained between days 31 to 40 post insemination. In the range between days 31 to 35 ultrasound was capable to detect 98% of pregnant cows later confirmed by rectal palpation. In this same range the specificity of ultrasound was 80% to detect empty cows later confirmed by rectal palpation. The best performance of the ultrasound method in sensitivity, specificity, PPV and NPV was between 36 and 40 days post insemination with values of 97, 93, 93 and 97%, respectively.

Table 1: Indicators of accuracy of pregnancy comparing ultrasound and rectal palpation at different period's intervals

Indicator	Post inseminación days			
	20-25	26-30	31-35	36-40
Sensitivity	50%	79%	98%	97%
Specificity	69%	89%	80%	93%
Positive predictive value	60.8%	86%	85.7%	93.6%
Negative predictive value	58.8%	83.6%	97%	97%

DISCUSSION

In our study the PPV (60.8%) and NPV (58.8%) in the range between days 20 and 25 post insemination were very low which indicates that the ultrasound was not reliable to determine the pregnant status in those days; similar results were obtained by^[6], they reported a poor PPV of 40% and a NPV of 66.7% in the range of 22 and 24 days pos insemination.

These results could be explained because the scan presence of amniotic fluid and embryonary growth make more difficult it's detection by ultrasound^[5, 6]. Respecting to the range of 30-35 days it is important to say that the ultrasound was capable to detect 98% of the cows later confirmed by rectal palpation. In the other hand, the specificity was 80%, indicating that there was a lost of capacity to detect empty cows of 20%. This can be attributed in part to the presence of cases of embryonary death which affected the specificity of the method, although this factor was not measure during this trial, several authors have cited that early embryonary deaths range between 9 and 10% on this period^[6, 9]. In a dairy herd, the detection of cows with open days after insemination represents great interest for the producer because of its economical impact. With the use of ultrasound it can be possible to detect those nonpregnant cows to be reprogrammed for service early on that those routinely monitored by rectal palpation. Therefore the relevance of using of ultrasound radicates in the possibility to detect con excellent precision (97%) nonpregnant cows by 30 after service. These animals can be rapidly be include in a reproductive program that includes estrus synchronization^[3], with the purpose of increasing the insemination rate and the probability that more cows achieve pregnancy and therefore impacting in open days.

CONCLUSION

In the present study, we conclude that the ultrasound method for diagnosis of gestation can be applied with accuracy 30 days post insemination with a positive predictive value of 97%. Therefore we can assure that 97% of the cows detected as empty are not really pregnant. The diagnosis of pregnancy in early stages is the more practical application of this technology in dairy cows^[1, 2, 10], for this reason any trained personal in rectal palpation can be train in ultrasound easily. Any of the procedures implemented to detect empty cows that will return them to service will be an advantage for the early detection by ultrasound.

ACKNOWLEDGEMENTS

Authors would like to thank MVZ Javier Jiménez Serrano president of the Local Dairy Cattlemen's Association of Tijuana for their interest in this study and their support.

REFERENCES

1. Stroud, B.K., 1994. Clinical applications of bovine reproductive ultrasonography. *Compend. Contin. Educ. Pract. Vet.*, 16: 1085-1097.
2. Pursley, J.R., M.R. Kosorok and M.C. Wiltbank, 1997. Reproductive management of lactating dairy cows using synchronization of ovulation. *J. Dairy Sci.*, 80: 301-306.
3. Fricke, P.M., 2002. Scanning the future- Ultrasonography as a reproductive management tool for dairy cattle. *J. Dairy Sci.*, 85: 1918-1926.
4. Pierson, R.A. and O.J. Ghinter, 1984. Ultrasonography for the detection of pregnancy and study of embryonic development in heifers. *Theriogenology*, 22: 225-233.
5. Curran, S., R.A. Pierson and O.J. Ghinter, 1986. Ultrasonographic appearance of the bovine conceptus from days 10 through 20. *J. Am. Vet. Med. Assoc.*, 189: 1289-1294.
6. Filteau, V. and L. Des Côteaux, 1998. Valeur prédictive de l'utilisation de l'appareil échographique pour le diagnostic précoce de la gestation chez la vache laitière. *Le Médecin Vétérinaire Du Québec*. 28: 81-85.
7. Martin, S.W., A.H. Meek and P. Willeberg, 1987. *Veterinary Epidemiology: principles and methods*, Iowa State University Press. USA.
8. De Vries, A., J. Bartolome and B. Broaddus, 2005. What is early pregnancy diagnosis worth? *Proceedings of 2nd Florida Dairy Road Show*. Florida, USA. pp: 31-40.
9. Nation, D.P., J. Malmo, G.M. Davis and K.L. Macmillan, 2003. Accuracy of bovine pregnancy detection using transrectal ultrasonography at 28 to 35 day after insemination. *Aust. Vet. J.*, 81: 63-65.
10. Wilson, J.M. and D.D. Zalesky, 1988. Early pregnancy determination in the bovine utilizing ultrasonography. *Theriogenology*, 29: 330.