Accuracy of Repeated Pregnancy Diagnoses with a Battery-Operated Portable Ultrasonic Scanner in Dairy Cattle

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Introduction

One of the most suitable techniques for early pregnancy diagnosis on the farm is the B-mode ultrasonography. There are only a limited number of reports dealing with the examination of the same animals at different intervals after breeding[14]. Except for two studies[2,3], the accuracy of their pregnancy diagnoses was not reported.

The present study was designed to determine the accuracy of repeated transrectal ultrasound scanning of the uterus, under field conditions, with a battery-operated, portable ultrasonic scanner.

Materials and Methods

Two to twelve year old dairy cattle (n=112) were used in the study. Individual animals were examined in traditional stalls where, during the winter period between November and April, all cattle were constantly restrained. Cows were also milked here. Ambient lighting was dim.

A battery-operated, portable, real-time, B-mode diagnostic ultrasound scanner, equipped with a 5 MHz rectal sector transducer and with a built-in video recorder (Ultra-Scan V8, Alliance Medical Inc, Montreal, Canada) was used. The total weight of the scanner is approximately 6 kg including battery, video recorder and transducer. Its dimensions are width: 24 cm, height: 27 cm and depth: 14 cm.

The battery operated Ultra-Scan permits a minimum of 4 hours continuous operation without recharging the battery.

Ultrasound examinations were conducted at 3 or 4-day intervals between 17 and 47 days after A.I. The first examinations were made between 17 and 20 days after insemination so that the 3 or 4-day visits provided a range of viewing days. The entire uterus was imaged in transverse planes. A cow was considered to be pregnant when, on the monitor an irregularly shaped, non-echogenic black spot (or spots) appeared within the uterine lumen, representing the fluid filled conceptus. The demonstration of an embryo or fetus, which was not systematically and specifically investigated in this study, provided additional confirmation of pregancy. Where no such signs were found, the possibility of pregnancy was ruled out, giving a nonpregnancy diagnosis. Cases in which the signs were not totally clear were regarded as doubtful diagnosis.

The reproductive status was designated as pregnant if an embryo proper was detected at the final ultrasound examination on Days 45 and 47. Cattle which were diagnosed nonpregnant between Days 45 and 47 were defined as nonpregnant between Days 17 and 43. Rectal palpation of the uterus between 8 to 10 weeks after A.I. was also used to determine whether cattle were still pregnant. Chi-square analysis was used to compare the result of the ultrasound examinations with the age of cattle.

Results

Quantitative results of the ultrasound examinations are given in Table 1. The percentage accuracy of our pregnanacy and nonpregnancy ultrasound diagnoses made by transrectal sector scanning of the uterus became highly accurate from 27 days after A.I. From 34 days after breeding onwards no mistakes were made in pregnant and nonpregnant animals. The percentage of animals found to be pregnant during the last ultrasound examinations but not sustaining their pregnancy until the day of rectal palpation was 3.9 % (3 of 76).

Discussion

Despite several studies, there are only a limited number of field studies regarding the accuracy of conceptus detection with a 5 MHz transducer. Kastelic and others[3] reached 100 % accuracy on nulliparous pregnant (n=20) and nonpregnant (n=11) Holstein heifers on Days 20 and 22. In contrast, under field conditions, accurate results (89.6 % and 97,2 %, respectively) could be reached only between Days 26 and 33 after A.I.[5].

The results of our study show that transrectal ultrasound scanning of cattle with a 5 MHz sector transducer from Days 27 after A.I. onwards was apparently more reliable for pregnant animals (97.4 %) than that (89.6 %) reported by others[5]. At the same time, the number of incorrect pregnancy diagnoses was similar (n=2 and n=1[5], respectively) in both study.

The accuracy of detection of pregnancy[2] is inversely proportional to the age of the cow (r=-0.967), which could not be confirmed in our study. From 34 days onwards 100 % reliable results could be detected both for pregnant and nonpregnant cattle. Late embryonic mortality may occur in up to 23 per cent[1]; in our case it was only 3.9 %.

It can be confirmed with this study, that ultrasound imaging of the uterine horn in transverse planes is more useful for the initial detection of conceptus than those in longitudinal or in oblique planes. Since the equipment used in our study operates with rechargeable batteries and could be recharged from a car battery, it makes ultrasonographic examinations in field conditions considerably easier, than with scanner which needs connection to the electricity network.

Summary

A battery-operated portable scanner with a 5 MHz sector transducer was used to perform early pregnancy diagnoses under field conditions in 112 dairy cattle. Ultrasound examinations were conducted at 3 or 4 day intervals between 17 and 47 days after AI. Pregnancy and nonpregnancy were diagnosed with a high degree of accuracy from 27 days after AI onwards. The accuracy of the detection of pregnancy was not influenced by the age of the cattle. Late embryonic mortality in this study

was 3.9%. The advantage of ultrasound imaging in transverse planes and the advantage of the operation of the scanner with rechargeable batteries are discussed.

Zusammenfassung

Ein tragbares batteriebetriebenes Ultraschallgerät mit einem Sektoruntersuchungskopf von 5 MHz wurde unter praktischen Bedingungen für die Diagnostizierung der Frühtrachtigkeit von 112 Milchkühen verwendet. Die Ultraschalluntersuchung wurde in Abständen von 3-4 Tagen zwischen dem 17. und 47. Tag nach der Insemination durchgeführt. Die Diagnosen über die Trächtigkeit und Nichtträgtigkeit wurden ab dem 27. Tag nach der Insemination mit grosser Sicherheit gestellt. Das Lebensalter der Tiere beeinflusste die Genauigkeit der Ultraschalluntersuchung nicht. Die späte embryonale Mortalität betrug 3.9 % in unserem Fall. Die Vorteile der Anfertigung von Ultraschallaufnahmen in transversaler Ebene und das mit wiederaufladbarer Batterie betriebenen Gerätes werden diskutiert.

Resumen

Se utilisó un equipo de scanner con un transductor de 5 MHz para el diagnostico precoz de prenez en condiciones naturales en 112 vacas lecheras. Los examenes por ultrasonido se realizaron con intervalos de 3 a 4 dias entre los dias 17 a 47 posteriores a la inseminacion artificial (IA). Los diagnosticos de prenez y no prenez con un alto grado de seguridad se obtienen a partir de los 27 dias en adelante despues de la IA. La determinacion de prenez no esta influciada por la edad de animales. En el estudio de la mortalidad embrionaine tardia fue de 3.9 %. La ventaja del uso de imagines de ultrasonido en planos transversales y del uso de scanner con batterias recargales son discutidos.

Table 1. Percentage accuracy of pregnancy and nonpregnancy ultrasound diagnoses in cattle

Days after AI	Pregnancy diagnosis		
	Correct %	Doubtful %	Incorrect %
17 to 19	32.9	10.5	56.6
20 to 22	44.7	26.3	29.0
24 to 26	82.9	9.2	7.9
27 to 29	97.4	-	2.6
31 to 33	97.4	-	2.6
34 to 47	100.0	-	-
	Nonpregnancy diagnosis		
17 to 19	95.8	-	4.2
20 to 22	83.3	16.7	-
24 to 26	66.7	25.0	8.4
27 to 29	91.6	4.2	4.2
31 to 33	95.8	4.2	-
34 to 47	100.0	-	-

References

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