

EVALUATION OF ULTRASONOGRAPHY ON EARLY GESTATION DIAGNOSIS IN SOWS

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INTRODUCTION

Gestation diagnosis in swine herds is very important due to the necessity of identifying reproductive failure and, consequently, decreasing non-productive days and piglet production cost. The ideal method to diagnose gestation should allow a quick confirmation of pregnancy (as soon as 18 days after mating) and should also be highly specific and sensitive (2). Some experiments have shown that the accuracy of gestation diagnosis by transcutaneous ultrasonography varies from 70 to 90% on day 21 of gestation, reaching 95% on day 26 (4, 5), the most satisfactory results being achieved on day 22. The aims of this experiment were to verify the performance and the execution time of the transcutaneous ultrasonography technique, using a 5 MHz frequency transducer, between days 17 and 21 (Experiment 1) and to evaluate the utilization of this technique in the field on day 21 after onset of estrus (Experiment 2).

MATERIAL AND METHOD

The experiments were performed in a swine herd located in southern Brazil, from August 8th to December 1st of 2000. Sows were moved from nursery to gestation crates, where they stayed till day 28 of gestation. In experiment 1, a total of 121 sows between parity 1 and 11 were scanned. The examinations were performed from day 17 to 21 after onset of estrus, every 24 h, by Tringa 50STM (Pie Medical[®]), equipped with a sector transducer (3.5/5.0 MHz) at 5 MHz. Sows were kept in individual crates and scanned placing the probe at the right flank, between the knee and the last rib, 10 cm above the udder. A gel preparation (Carboxymethylcellulosis) was used to permit sound transmission. Positive diagnosis was determined by presence of embryonic vesicles, represented by anechoic structures (dark) in circular or irregular shape, with or without embryos (echoic structures) inside the vesicles. Negative diagnosis was determined by absence of the structures above (2). A further examination around day 28, observation of abortion, and parturition were considered controls for the results. Another technician performed time counting during the scanning. When the result was negative the maximum time of scanning was 3 minutes. True positives (a), false positives (b), true negatives (c) and false negatives (d) were the basis to determine sensitivity, specificity and accuracy. So, sensitivity was determined by $a/a+d$, specificity by $c/c+b$ and accuracy by $a+c/a+b+c+d$ (5). Experiment design was completely random and the treatments were structured in levels for time measurements and submitted to linear regression analysis (SAS, 6). Time measurements were considered like time T (total time needed to perform the scanning, regardless the result) and time + (time needed to diagnose a gestation). Sensitivity and accuracy were analyzed by QUI-Square test. In experiment 2, a total of 510 sows between parturition 1 and 11 were scanned on day 21 after onset of estrus, using the same ultrasonography method described in experiment 1. Sensibility, specificity and accuracy were evaluated by QUI-Square test.

RESULTS AND DISCUSSION

Sensitivity showed a gradual increase, reaching 100% on day 21 after onset of estrus in experiment 1 (Tab. 1), agreeing with data from literature (4, 5). Determination of specificity was not possible in this experiment because there was only one empty sow of 121 scanned, resulting in 100% of specificity. Day of scanning related negatively to time T ($T = 12.88 - 0.578 \times \text{dia}$; $R^2 = 0.5093$, $P < 0.0001$) and to the square root of time + (SQR t+ = $4.497 - 0.178 \times \text{dia}$; $R^2 = 0.2181$, $P < 0.0001$), being the quickest scanning on day 21 (Tab. 2). Based on data in experiment 1, it's possible to say that day 21 after onset of estrus is the safest and quickest to perform gestation diagnosis (Fig. 1), however, it could be done on day 20 with relative caution. These results supported the choice of day 21 to scan sows in experiment 2. Sensitivity obtained from experiment 2 (Tab. 3) was slightly higher than in the literature, even though it was performed earlier, when compared to some experiments, which obtained 95.2% between days 21 and 22 (5), 85.0% between days 21 and 28 (4) and 98.9% between days 24 and 37 (2). These authors used the frequency of 3.5 MHz compared to 5 MHz in the present study, which shows a better image definition, important to perform early diagnosis. As in experiment 1, there was a small number of empty sows to determine specificity in experiment 2, resulting in 100%. However, specificity results as high as 97% between days 20 and 28 were also described in literature (3).

CONCLUSIONS

Gestation diagnosis in sows by ultrasonography can be done as early as 21 days after onset of estrus, rapidly and safely.

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Table 1 - Results of sensitivity, specificity e accuracy according the day of scanning.

| Day of scanning | Sensitivity (%) | Specificity (%) | Accuracy (%) |
|-----------------|-----------------------------|-----------------|-----------------------------|
| 17 d | 11.7 (14/120) ^e | 100 (1/1) | 12.4 (15/121) ^e |
| 18 d | 29.2 (35/120) ^d | 100 (1/1) | 29.8 (36/121) ^d |
| 19 d | 64.2 (77/120) ^c | 100 (1/1) | 64.5 (78/121) ^c |
| 20 d | 90.1 (109/120) ^b | 100 (1/1) | 90.9 (110/121) ^b |
| 21 d | 100 (120/120) ^a | 100 (1/1) | 100 (121/121) ^a |

Values followed by different letters in the same column differ between each other by QUI-Square test (P<0.01)

Table 2 – Average scanning time for positive pregnancy (Time +), average scanning time for negative pregnancy (Time -) and average scanning time (Time T) according to the days of scanning after onset of estrus.

| Day of scanning | Time + (min) | Time - (min) | Time T (min) |
|-----------------|--------------|--------------|--------------|
| 17 d | 1.85 | 3 | 2.87 |
| 18 d | 1.75 | 3 | 2.64 |
| 19 d | 1.57 | 3 | 2.08 |
| 20 d | 0.98 | 3 | 1.18 |
| 21 d | 0.68 | 3 | 0.7 |

Table 3 - Results of sensitivity, specificity and accuracy according to the day of scanning.

| Day of scanning | Sensitivity (%) | Specificity (%) | Accuracy (%) |
|-----------------|-----------------|-----------------|-----------------|
| 21 d | 97.81 (493/504) | 100% (6/6) | 97.84 (499/510) |

Figure 1 – Relationship between the time and the accuracy of scanning.

