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STUDIES ON EARLY PREGNANCY DIAGNOSIS AND FETAL PHYSIOLOGY  
BY REAL-TIME ULTRASONOGRAPHY IN DAIRY CATTLE

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An electronic linear scanner of ultrasonotomography was used to visualize the gravid uterus as gestation progressed in dairy cattle. The results are summarized as follows :

1) Both sides of the non-gravid uterine horns demonstrated a symmetrical image 1 to 4 cm from the rectum by scanning with a rectal probe (3.5 MHz). The image showed a circular echogenic pattern. It was very difficult to visualize the cavity of the uterus.

2) The fetal sac (FS) was observed as early as 19 days post-AI (artificial insemination) in the gravid uterus. The black portion of the ultrasound image represented the fetal fluid. It was evident that the diameter of the FS increased until day 35 of pregnancy. A highly significant positive correlation was obtained between the diameter of the FS and the day of pregnancy. The correlation coefficient was 0.99 or 0.86 ( $P < 0.001$ ).

3) In the central part of the FS, the fetus could be clearly detected from day 30. It was seen as a small floating dot composed of a midrange echogenic image, but no details of the fetal body could be demonstrated besides the beating heart. After day 45 in all cases, fetal movement could be observed and details such as the fetal head and the umbilical cord could also be gradually seen. In this stage, most fetuses were located on the back at the ventral base of the FS.

4) The fetal heart rate (F-HR) increased from a level of 170 beats/minute at day 30 to a peak of 200 beats/minute at day 60, and then gradually decreased to a value of 140 beats/minute at day 130. Before day 60, a highly significant positive correlation ( $r = 0.94$  or  $0.86$  ( $P < 0.001$ )) was observed between the F-HR and the fetal age, but after day 60, a highly significant negative correlation ( $r = -0.96$  ( $P < 0.001$ )) was obtained. The crown-rump length (CRL) of each fetus was measured until day 80. A highly significant positive correlation was observed between the CRL and the fetal age. The correlation coefficient was 0.98 or 0.95 ( $P < 0.001$ ).

5) Early pregnancy diagnosis in 120 trials for 112 cases were performed between day 14 and day 140 post-AI in several dairy farms. Before day 24 post-AI, the accuracy of pregnancy diagnosis was not satisfactory (37.5%). However, the accuracy became considerably higher from day 25 to day 34 (60.0% to 77.8%), reaching 100% after day 35 post-AI. The accuracy was 96.5% for the positive diagnosis of pregnancy and 58.8% for negative cases. The overall accuracy of 120 diagnoses was 85.8%.

6) In a recipient to which two embryos were transferred, twins were also detected at day 56 after transfer.