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Accuracy rate of early pregnancy diagnosis in Holstein heifers by transrectal ultrasonography using 7.5MHz linear array transducer

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ABSTRACT

Pregnancy diagnosis and managements on it is one of the things that have always been a problem. Checking the accuracy of pregnancy diagnosis with ultrasound in cows can also be a useful step in this area. The pregnancy diagnosis in cows by ultrasound is used in two ways: one method is Transcutaneous ultrasound and the second method is Trans-rectal ultrasound using prop linear. Prop linear is a long rectangular bar that sends signals linearly. It is a solid-state transducer that contains a row of array supersonic crystals which are shot electronically in a row and form a rectangular image. The method is that the tail is raised and a prop is inserted in the rectum to animals. The researcher went to a cow keepery in Tabriz with 1000 cows to do pregnancy diagnosis by ultrasound in cows. The total number of cows under ultrasound was 150 vertexes which were placed in three groups of 50 vertexes. The first group 24 days after insemination, the second group 26 days after insemination and the third group 28 days after insemination performed pregnancy diagnosis by ultrasound 7.5 MHz. By analyzing the results, the best time for pregnancy diagnosis with the prop 7.5 MHz was reported 26 days after insemination.

Keywords: Cattle, Pregnancy diagnosis, Transrectal ultrasonography, linear-array transducer

INTRODUCTION

The use of ultrasound in the study of genital tract of cows is an advanced technology that changes our knowledge in the field of reproductive biology. In the applied aspect, ultrasound is used to assess pregnancy status, to identify cows that are pregnant with twins, to diagnose uterine and ovarian pathology, to determine fetal sex and to diagnose fetal death and these issues provide an opportunity to improve reproductive efficiency and productivity [4]. The wide use of ultrasound in the routine examination of the genital tract in dairy herds is the future goal of the technology [5]. In the past few decades portable ultrasound machines which provided high quality images have been used in veterinary rectal ultrasound in the dairy industry is available in both research and applied methods [10]. In research aspect, it is applicable to study Reproductive biology and to clarify the nature of the complicated reproductive process including ovarian follicles, corpus luteum function, and Embryo development and as a help in aspirating follicles and harvesting oocytes and embryo transferring [3]. In applied aspect, is applicable in Early assessment of pregnancy status in order to identify non-pregnant cows and identifying cows that are pregnant with

twins in order to implement various management practices to reduce or eliminate the negative effects of twin birth [8], accurate diagnosis of the pathology of the uterus and ovaries in order to treat them accurately and to determine Fetal sex with economic objectives [7]. So ultrasound should not be seen as a secondary management tool, but it should be used in the routine examinations of veterinary and in dairy herd [10]. So the use of rectal ultrasound for the assessment of reproductive structures in cows has improved diagnostic capabilities of veterinarians in comparison to rectal palpation.

MATERIALS AND METHODS

This study was conducted in an industrial cow keepery with 1000 cows in East Azerbaijan on 150 heifers inoculated during the nine months from April to December 2011. Practices in the dairy milking were done 3 times daily, at 6 in the morning and 14 and 22 at night. 150 inoculated heifers (inoculated at 12-10 h after estrus) were randomly divided into 3 groups of 50 vertexes. Heifers of the first group were identified 24 days after insemination, heifers of the second group 24 days after insemination and heifers of the third group 28 days after insemination by trans-rectal ultrasound using prop linear 7.5MHZ. In such a way that Heifers were bounded in a relatively dark place, the midwifery gloves and prop were stained to the gel. (To prevent damage to the rectal) then the animal's rectum was evacuated, then the animal's tail is raised by veterinarian or by another person. The prop approximately 20-40 cm was inserted into the rectum and bladder was observed. Upon seeing the bladder, prop was lead in a ventral manner. Then prop was rotated by an angle of 45 degrees in both directions to make the womb observable upon seeing the uterine, both uterine horns were checked and the presence of fetal fluids inside the horns and potential embryo in liquids were the indicators of pregnancy. After seeing the fetus the image was created. The ultrasound heifers were noted in terms of pregnancy and non- pregnancy. Heifers in three groups were examined by ultrasound on day 45 of pregnancy and finally the accuracy of pregnancy diagnosis was reported on days 24,26 and 28.

RESULTS

The results of this study are as follows: 31 heifers in the first group (24 days after insemination) were pregnant and 19 of them were nonpregnant and all The 31 cases were real positive, but only 3 cases from 19 nonpregnants were false negative. In fact 34 heifers were pregnant by ultrasound on day 45. There were 3 cases of false negatives on day 24. So sensitivity was 93.05% and specificity was 100%. According to these figures, the positive predictive value was 100% and negative predictive value was 84.86%. In the second group 34 heifers were pregnant and 16 cases were non-pregnant and there were no false-negative or false-positive. According to the ultrasound conducted on day 45, sensitivity and specificity were obtained 100 %. With regard to these cases the positive predictive values was 100 % and negative predictive value was 100%. In the third group 34 heifers were pregnant and 16 cases were non-pregnant. This group has no false positives and no false negatives on day 28 which have been diagnosed with ultrasound 7.5MHZ. Sensitivity and specificity were 100 % in this group. And the positive predictive value of was 100% and the negative predictive value was 100%.

Table 1

	Days		
	24	26	28
No. of examination	50	50	50
No. of pregnant at TRUS	31	34	34
No. of non pregnant at TRUS	19	16	16
No. of correctly classified pregnant	31	34	34
No. of incorrectly classified pregnant	0	0	0
No. of correctly classified nonpregnant	16	33	33
No. of incorrectly classified nonpregnant	3	0	0
No. of pregnant on days 45post AI (diagnosis by TRUS)	34	34	34
No. of non-pregnant on days 45 post AI (diagnosis by TRUS)	16	16	16
Sensitivity (%)	93.05	100	100
Specificity (%)	100	100	100
Positive predictive value (PPV ;%)	100	100	100
Negative predictive value (NPV ;%)	86.84	100	100

DISCUSSION

There are many articles about the accuracy of pregnancy diagnosis using ultrasound in heifers [1]. However, very few studies, examined the sensitivity, specificity, positive predictive value and negative predictive value based on each day by trans-rectal ultrasound [4, 5, 10, 11]. Some researchers have reported that by using trans-rectal ultrasound the pregnant heifers can be detected 9 days after insemination [9]. But such research can be done only in special circumstances and requires a lot of time Also it has a very low accuracy and is not possible in practical terms [9]. Some researches advise using trans-rectal ultrasound on days 25 or 26 [6]. But this study is contrary to other reports because of high rates of false-negative diagnosis at this time. In a study conducted by a group of researchers at Texas A & M University (abc) 1079 cows and 321 heifers were examined by ultrasound using prop linear 5MHZ [5]. Cows were randomly examined once between days 24 and 30, heifers between days 21 and 27 by ultrasound and for the second time in three days after that, namely day 31 to 38 for cows (estrus = Day 0) and heifers approximately days 24 through 31. The sensitivity and specificity of cows and heifers were compared from days 24 and 27. The sensitivity gradually increased from 74.5% to 100% in 29 days.($p < 0.01$). This feature increased from 24 to 25 and it 96/6 % on day 26 ($p < 0.01$). Sensitivity in heifers was 50% on day 21 increased to 100% on day 26. ($p < 0.0$) it increased from 87.5% on day 21 to 94% on ay 23. ($p > 0.05$) Sensitivity for cows and heifers, were respectively, 89.2 and 96.8%, ($p < 0.05$) it was for cows and heifers, respectively, 93.0 and 93.4%. In this study, the diagnosis was made early pregnancy in heifers than in cows. And also the highest sensitivity and negative predictive value was 3 days earlier than the cows (Respectively, for heifers day 26 and day 29 for cows). Also curran *et al.*, (1986) and Totey *et al.* (1991), conducted different researches in the field of pregnancy diagnosis using trans-rectal ultrasound in 19 to 21 days after insemination [2, 4, 11]. But none of them reported sensitivity, specificity, and positive and negative predictive values. Most of these researches have been conducted under ideal conditions. Kastelic also reported in 1991 that trans-rectal ultrasound 5MHZ cannot be more than 50% 18 days after insemination and 16 days after insemination with 7.5MHZ [6]. Thus, the results of these studies and our study showed that maximum sensitivity and specificity using trans-rectal ultrasound with transducer prop 7.5MHZ in dairy heifers by an experienced operator, the best time is 26 days after insemination.

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