

Applying of B-mode ultrasound for determining pregnancy by means of measurement of Placentomes Diameter and Fetal Bi-parietal diameter in dairy cows

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Summary

The objective of the current study was to estimate whether fetal age could be accurately estimated using trans-rectal and trans-abdominal ultrasonographic measurements for placentomes diameter and Bi-parietal diameter. This experiment was carried out in the College of Veterinary Medicine in Diyala University. Twelve Multiparous cows (4-7 years old) were inseminated artificially, and Serial trans-rectal and trans-abdominal ultrasonic examinations were done during the 7 – 13 week and during 10 -26th week of gestation, respectively. Using 5-7.5 MHz linear array transducer and also 3.5-5MHz convex transducer. Possible discrimination of placentomes and Bi-parietal diameter for the first time at the fifth and ninth week of gestation, respectively. The mean values for placentomes diameter were 7.5mm and 69 mm during 7 and 26 weeks of pregnancy, respectively, as well the placentome increased in diameter an average of 3.0028 mm per week. Besides that, the mean Bi-parietal diameter was 17.5mm and 33mm during 9 and 13 week of pregnancy, respectively. The Bi-parietal diameter was increased linearly an average of 3.620mm per week. The obtained results revealed that using TRUS during 3rd month of gestation to observed pregnancy and fetal organs as well as fetal viability with fast and easy during mid-gestation onward .High correlations were found between different studied parameters and gestational age with high significant for both which were ($R=0.97^{**}$; $P<0.01$) and($R=0.95^{**}$; $P<0.01$) for placenttomes diameter and, Bi-parietal diameter respectively. In conclusion, the trans-abdominal ultrasonography it reliable technique for determining pregnancy and the best window for fetal viability during third month of gestation until term and a strong positive with a high significant correlation of coefficient between gestational periods and placentomes diameter, fetal bi-pareital diameter in cows and relatively the highest correlation was also evident in placenttomes diameter ,moreover, this study prove that widely restricted factors of ultrasound are that its efficient, is always depending on skill of the operator

Keywords: Ultrasound, pregnancy, Placentomes diameter, Bi-Parietal Diameter, Cows.

Introduction

Pregnancy diagnosis has two key roles in dairy cows. Firstly, the identification of non-pregnant cow, which can then be managed appropriately, and secondly, to identify the time of breeding and thus the expected approach of calving(1). Various methods have been used for pregnancy detection in bovine. Real-time ultrasound is considered as a versatile technique for detection of pregnancy and observes of the fetal development and has different advantages in comparison with conventional techniques (2). Trans-rectal ultrasonic (TRUS) examination is widely applied in bovine for early pregnancy detection

(3 and 4). Although, pregnancy diagnosis and monitoring of fetus at different stages of gestation are also significant. Determined the fetometry, Bi-parietal diameter (BPD) method previously used in cattle (5) and also in buffalo (6). The overall the B-mode ultrasound scanning indicated the feasibility and value of fetometry in bovine for evaluation of fetal development and estimation of gestation period. In the cow, the allantochorionic membrane and Endometrium become modied for exchange at special-ized points of contact, the placentomes. This structure· composed of maternal caruncle and foetal cotyledon, is the

organ through which respiratory gases, nutrients and wastes are transported. Normal placentome growth and development is essential for normal foetal growth and developme (6) .

The technique of trans-abdominal ultrasonic(TAUS) examination has been used with high accuracy as means of pregnancy diagnosis, estimation of stage of gestation and fetal viability in cattle (8). However, studies are lacking on the application of this technique in the estimation of these parameters in cows. The cows are difficult to diagnose as pregnant particularly that at the stage between fourth and sixth months of pregnancy(9) .

The objective of present study was undertaken to assess the relationship between placental development (PD) fetal bi-parietal diameter(BPD) and actual gestational age by ultrasonographic observations approach trans-rectal and trans-abdominal examinations during first and second trimester of pregnancy in cow.

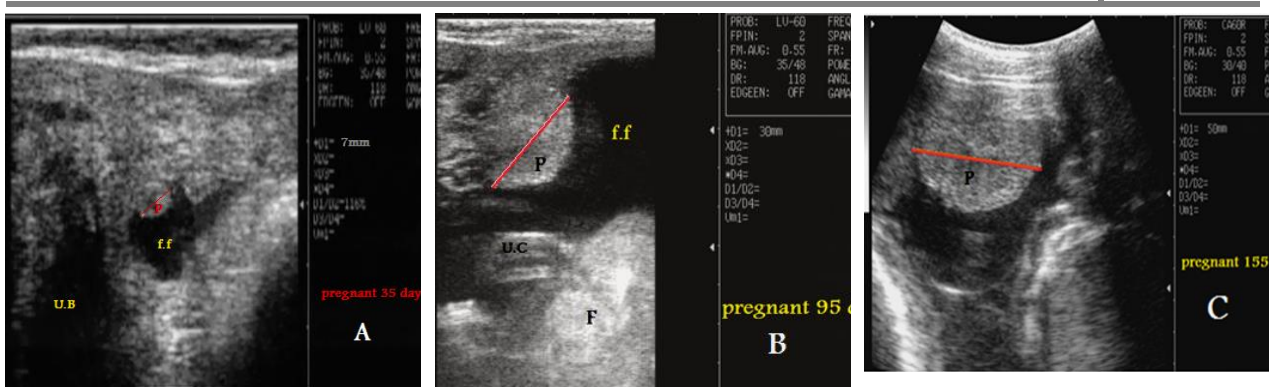
Materials and Methods

The experimental procedures involved twelve Multiparous cows (4-7 years old) were inseminated artificially. This experiment was carried out in the College of Veterinary Medicine in Diyala University from December/2016 to December /2017. Sequential Ultrasonographic (U.S) examinations were performed by trans-rectal approach (10), using a 5-7.5 MHz linear array transducer, and then performed trans-abdominal approach according to (11) with a 3.5-5MHz convex transducer. Serial trans-rectal and trans-abdominal ultrasonic scanning were carried out once weekly between the 7 – 13 week and during 10th -26th week of gestation, respectively. Using B-mode ultrasound (Welld ultrasound,

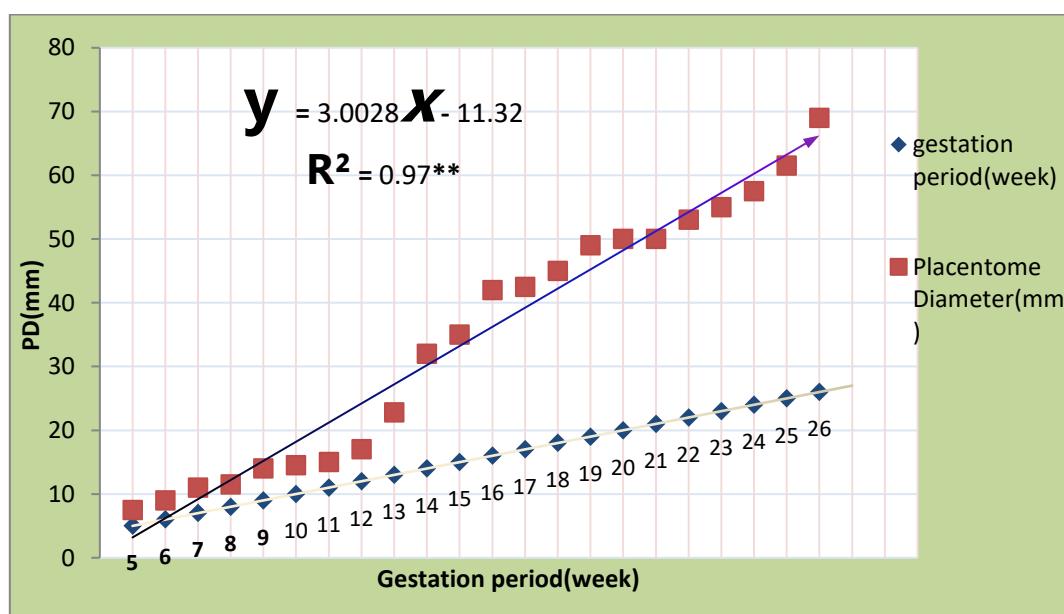
Shenzhen well. D. Medical Electronics Co. LTD. China). Light wave recording and play video, USB 2.0 TV BOX, ultrasound transmission Gel. Measurements of linear dimension were made utilize incorporated electronic caliper, applied to the frozen image displays on the screen of the scanner. Two measurements were used in this study; placent (PD and BPD)of the head. PD was obtained by measuring the distance between the farthest points of the horizontal axis of placentome. Also in the current study, at three to four big sizes of placentomes were measured and then mean diameters of those placentomes were calculated. BPD is the width of the skull directly behind the orbit and is perfectly measured as the widest points of the skull in a symmetrical sight. The Statistical Analysis System- SAS (2012) program was used to estimate of regression coefficient between PD,BPD and gestation period in cows(12).

Results and Discussion

In the current study, the placentomes were the available structures of pregnant uterus for ultrasonographic examination starting from the 7th week of gestation. Figures (1. A-C) shows different measurements of PD that are scanned by ultrasound, The placentomes measures were easily observed using TRUS scanning with 5-7.5MHz linear transducer ,as an echogenic density, semi-circular elevations distributed on the surface of uterine lumen(7). As shown in the (Fig.2),the mean diameter of placentome were 7.5mm and 69mm during 7th and 26th weeks of pregnancy, respectively,the placentome increased in diameter an average of 3.0028mm per week.



Figure,1-Trans-rectal (A, B) and trans-abdominal(C) ultrasonographic images in different stages of pregnancy. UB: urinary bladder; f. f: fetal fluids; P: placentome(delineated by a red lines) ;U.C: umbilical cord ;F: fetus



Figure, 2:Relationships between the Placentomes Diameters (PD), and the gestational age (GA); y = PD (mm); x = gestational age;R2 = squares of correlation coefficient.

These results were agreed with (13 and 14) whose reported that PD can be ultrasonography identified onset on day 35 of gestation and the PD was 0.5-0.8cm on days 35-50, respectively. Meanwhile, according to the result of (6), which disagreed with this study, whom observed firstly placentome during 10th week of gestation as small hyperechoic nodules. This variation in two studies is consequent from the employed of difference species of animals in previous study as well as there is no doubt that reliability of technique in identifying placentome is quite highly if the operator was adequately experienced (14). Since the placentomes lay very close to surface of uterine lumen, it may be evidence difficult to find it

especially before 35day of gestation (15). The results of present study showed that PD was increased slightly during gestation period between 5 and 8 week, after that, developing of placentomes was increased clearly, these observations are similar to (16) who found there was a significant increase in the placental growing between 60 and 190 day of pregnancy in cattle (7). Furthermore, our study showed there was a high significant correlation of the PD on the gestational age ($P < 0.01$) as well as a strong positive correlation coefficient (R^2) between ultrasonic measurements of placentomes and gestational period was 0.97 and prediction equation are displayed in the (Fig.2). Similar result was reported in an

anatomical study that found a significant correlation between placental developing and age of pregnancy in cows and significant increase in diameter of placentomes from day 70 until 190 of gestation (7), and the high positive correlation between gestation age and PD in goats observed in the study of (18) was similar to the our findings which was $r^2=0.90$.

On the other hand, the results of (6 and 19) revealed that a lower coefficient correlation (R^2) between placentomes diameter and gestational age which were 0.68 and 0.77, respectively, than the data of present study. The divergence between the results of present and previous study, might be attributed to use a trans-rectal ultrasonic scanning with 6.5-7.5MHz probe combined with improvement in resolution of the real-time ultrasonic technology which is used in the current study, whereas, in other studies was used trans-abdominal ultrasound approach with 3.5MHz transducer as well as the animals species

differences (6). So the present study was undertaking to record the changes in individual placentome during pregnancy, normal placentome growth and development is essential for fetal growth and development (7). Additionally, in the present study, it was able to measuring the fetal BPD by TRUS examinations were conducted between 9th and 13th week of gestation(Fig.3-A and B).

In according to our results, the mean BPD were 17.5mm; 33mm during ninth; thirteenth week of pregnancy, respectively. The BPD was increased linearly an average of 3.620mm per week, as well as there was a highly significant correlation ($P<0.01$) as well a strong positive coefficient of determination between gestational period and BPD ($R^2=0.95$). The regression of fetal BPD on gestation age estimated via (TRUS) approach with the prediction equation is presented in (Fig.4).



Figure, 3:Trans-rectal ultrasonographic images in different stages of pregnancy .FL: fore limbs; N: nose; ;E: eyes; P :placentome(delineated by a white line); BPD: delineated by a red line

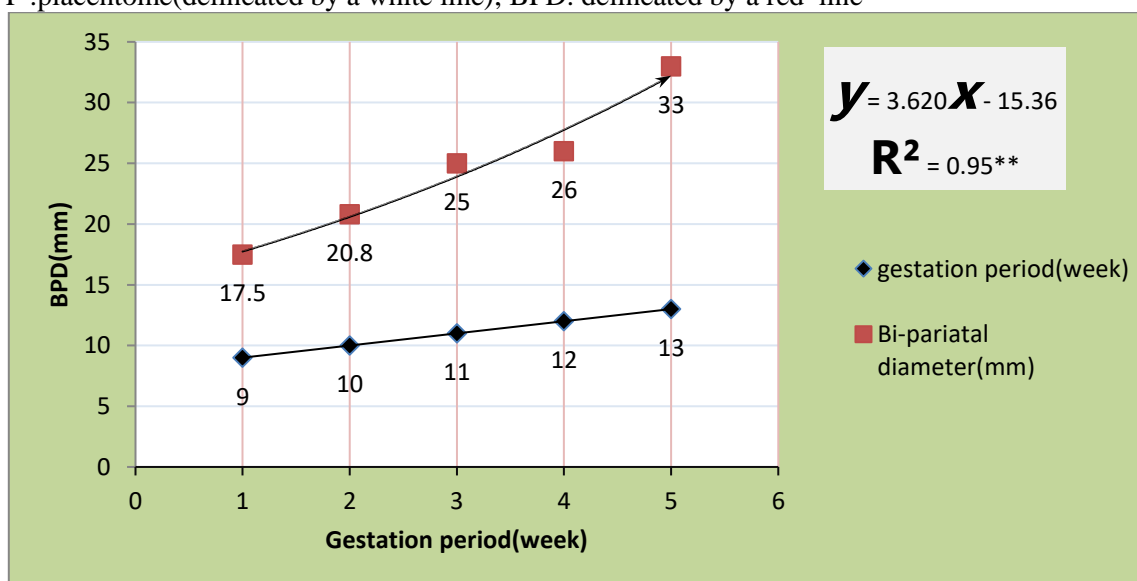


Fig.4-Relationships between the biparietal diameter (BPD), and the gestational age (GA), $y = \text{BPD}(\text{mm})$, $x = \text{gestational age}$, $R^2 = \text{squares of correlation coefficient}$

Similar results were reported according (6 and 20) who observed that the precisions of the ultrasonographic measurement was judged by coefficient correlation between pregnancy period and fetal BPD growth, where the high correlation were ($R^2=0.90$ and $R^2=0.97$), respectively, at mid-gestation. The result of current observations as well as in previous studies(6 and 21) explain that fetal head was readily accessible using TRUS during eight-nine week of pregnancy, and that due to ossification was observed by the eight week of fetal age(6). Based on data of (20), The fetal head visualization and its measures in Camel were visualized a few weeks later during 10th week of gestation than reported by TRUS examinations compared to present as well as previous studies (6). These discrepancy is attributed to the use of low frequency probe during (TAUS) scanning (3.5MHz) compared to that used in (TRUS) approach with high frequency (6.5MHz-7.5MHz), moreover, the differences in two studies may be due to employed different animals species in previous research. Essentially, higher frequencies have a correspondingly shorter wavelength and can be used to create sonographs with accurate details (22). According to the current data, the detection of pregnancy could be estimated accurately via the (TRUS) method. The TRUS which performed during 3rd month of gestation to observed pregnancy, fetal organs as well as fetal viability with fast and easy during mid-gestation until term(Fig.5).



Figure,5: Trans-abdominal ultrasonographic image of fetal organs during third month of pregnancy. H: heart; rb: Ribs; ru :rumen ;L: liver

Meanwhile, (9 and 23) were reported that the technique of TRUS which is performed during end of the first trimester for diagnosis of pregnancy although fetal viability is practical, rapid than (TRUS), these results are agreement

with present observations. Moreover, this procedure does not need the sonographer to kneel behind the animal (11). Additionally, some of fetal parameters could not be diagnose by TRUS along mid and late gestation periods as the gravid uterus had moved below during progressive of gestational age (24).

In conclusion, this study it was founded a strong positive with a high significant correlation of coefficient between gestational periods and PD, fetal BPD in cows and relatively the highest correlation was also evident in PD.TAUS was reliable technique for determining pregnancy and the best window for fetal viability during third month of gestation onward. Moreover, this study prove that widely restricted factors of ultrasound are that its efficient, is always depending on proficiency of the operator.

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تشخيص الحمل في ابقار الحليب عن طريق قياس قطر الفلقات الرحمية وقطر العظم الجداري المزدوج للجنين

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الخلاصة

هدفت الدراسة الحالية الى تقدير عمر الجنين في الابقار عن طريق قياس قطر الفلقات الرحمية اضافة الى قطر العظم الجداري المزدوج للجنين بأستخدام الفحص بالموجات فوت الصوتية عبر المستقيم وعبر البطن، أجريت الدراسة في كلية الطب البيطري -جامعة ديالى، حيث استعملت في الدراسة اثنا عشر بقرة متعددة الولادات تراوحت اعمارها ما بين 4-7 سنوات وقد تلقح جميع حوانات التجربة اصطناعياً لتثبيت بدء الحمل. أجري الفحص بالموجات فوت الصوتية عبر المستقيم خلال المدة 7-13 اسبوع من الحمل، وأجري الفحص عبر البطن خلال المدة 10-26 أسبوع من الحمل مع مجس خطي (مستقيمي) ذو تردد 5-7.5 ميغاهرتز ومجس منحنى ذو تردد 3.5-5 ميغاهرتز وبفاصل اسبوع واحد بين فحصين متتابعين. أظهرت نتائج الدراسة أمكانية قياس الفلقات الرحمية وقطر الراس للجنين عند الاسبوع الخامس والتاسع من الحمل، وعلى التوالي. كما بينت نتائج الدراسة أن اقيام قطر الفلقات الرحمية كانت 7.5 ملم و69 ملم خلال الاسبوع السابع والاسبوع السادس والعشرين من الحمل، وعلى التوالي. في حين كان قطر راس الجنين 17.5 ملم و33 ملم خلال الاسبوع التاسع والاسبوع الثالث عشر من الحمل، وعلى التوالي. لقد اظهر كل من قطر الفلقات الرحمية وقطر العظم الجداري المزدوج زيادة بمقدار 3.0028 ملم و 3.620 ملم عند زيادة عمر الحمل اسبوعاً واحداً، وعلى التوالي. كما كشفت نتائج الدراسة الحالية ان تشخيص الحمل ممكن مع امكانية تقدير عمر الجنين وبيان حيويته عند استخدام الفحص بالموجات فوت الصوتية عبر البطن خلال الشهر الثالث من الحمل فصاعداً. كما تبين من الدراسة أن هنالك أنحدار موجب ومعنوي عند ($P < 0.01$) ولكلاً من قطر الفلقات الرحمية وقطر العظم الجداري المزدوج على فترة الحمل مع معامل تحديد مرتفع ولكلا المعيارين حيث بلغ 0.97 و 0.95، على التوالي. الاستنتاجات: تعد طريقة الفحص بالموجات فوت الصوتية عبر البطن تقنية موثوقة لتحديد فترة الحمل مع امكانية معرفة حيوية الجنين وخلال نهاية الثلث الاول من الحمل فصاعداً. كما استنتج من الدراسة أن معامل التحديد ما بين فترة الحمل وكلا من قطر الفلقات الرحمية وقطر راس الجنين كانت مرتفعة علماً أن اعلى قيمة لمعامل التحديد كانت في صالح الفلقات الرحمية. كما بينت الدراسة ان من اهم العوامل المؤثرة في تقنية التصوير بالموجات فوت الصوتية هو كفاءة الشخص الفاحص.

الكلمات المفتاحية: الموجات فوت الصوتية، الحمل ، الفلقات الرحمية ، قطر العظم الجداري المزدوج، الابقار