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# Fetal Ultrasonographic Parameters for Gestational Age detection in Maraz Goats

**Salah Noori Mohammed, *Salman Hammadi Ghareeb,* Abdulmumem Sabea khamees,**

**Alaa Hasan Wafur, Ali Hassan Ali, Mina Jaafar Sadeq**

Faculty of veterinary medicine, University of Diyala

**ORCID: https://orcid.org/ 0000-0002-0509-1234**

**Email: salah.n@uodiyala.edu.iq**

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**Abstract**:

**Background:** Ultrasound considers one of most common tools that used and depended in pregnancy diagnosis in farm animals and also to assess many parameters of reproductive performance

**Aims:** The goal of this study was to conduct relationship between Crown-rump length (CRL), Biparietal diameter (BPD) and age of gestation in Maraz goat. Thirty Maraz does non-pregnant were synchronized to inducing estrus by utilizing vaginal sponges for about 12 days and followed by injection of 600 IU of PMSG hormones withdrawing the sponges and naturally served to obtain pregnancy. 73.3% (22/30) of the synchronized goats became pregnant, all synchronized goats were scanned every five to ten days beginning from day 30 to 95 of gestation transrectally (TR) with linear-probe (4-9 MHz).

R**esults**: This study conducts a significant relationship of each CRL and BPD with advance age of gestation period. The CRL and BPD increased significantly (P≤0.05) with the progress of pregnancy

**Conclusions**: The CRL and BPD are crucial parameters that could be useful and depended for follow the advance of gestation period by ultrasonic technique in goats.

**Keyword:** Ultrasonic scanning, Meraz goat, CRL, BPD, Gestation period



## Introduction:

Goat is one of the ancient domesticated animals, due to archeological confirmation about 10.000 years ago. The (Capra hiricus) doe was the first domesticated in the Zagros mountains( Daly,*et al.*, 2021).

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On the high-altitude highland of Kurdistan area, in Iraq, a particular breed of Cashmere does are boost, define as Maraz. The major using of this breed is for their outer coat fibers, that is the candid substance for the national costumes of the Kurds. Meantime, the undercoat fibers stay unused according to the insufficiency of processing ( Aziz, 2009).

The natural mating dates of does and ewes usually are unrecorded and imprecise and this may impact indirectly on breeding conduct. Also, accurate knowledge about gestation phases of does will be helpful to avoid any defect closer birth (Doize et al, 1997). Early demonstrated of fetus in does are crucial for economic view, also to classify the herd to pregnant and non-pregnant goats (Yotov *et al.*, 2005).

There are numerous clinical and laboratory procures to reveal pregnancy in small ruminants but depending ultrasound scanning is the most common dependable technique for early find of embryo and to set a worthy strategy for ruminant farm (Martinez *et al.*, 1998). B-mode ultrasonic style considers accurate, rapid and safe way for detection of the pregnancy in does. Transabdominal or transrectal technique could be depended 100% precise rate (Abdelghafar *et al.*, 2007, Peixoto *et al.*, 2010). Using real-time ultrasonic way considers so benefit for development and following growth many portions of embryo-like head, heartbeat, CRL (crown-rump length) and trunk, without harmful impact on pregnancy condition (Noia *et al.*, 2002, Rasheed, 2017). Ultrasonic scanning technique used with huge precise as a well way for pregnancy demonstration and marking of embryo growth in goats (Buckrell, 1988). Many previous studies demonstrated relationship of BPD, trunk diameter, CRL and the diameter of uterus with pregnancy phases in cows (González *et al.*, 2004, Kumar *et al.*, 2015). Also, another study for (Metodiev *et al.*, 2012) mentioned the change of the BPD during gestation period in does. There is a paucity of researches about depending ultrasonic scanning to detect early fetus in Maraz does in Sulmani province by detecting CRL and BPD to set the age of embryo, also to find any the relation between pregnancy age and CRL, BPD in maraz does

**Materials and Methods:**

A total of 30 maraz does were got from two private farms existing in Sulmani city, Iraq from September 2023 to May 2024. The does were aged between 2–3 years, and weighed 25–30 kg, and managed under open grazing. The does were also supplied with concentrated feed due to herd management that consisted of barley, corn, and soybean, these goats kept outdoor close to resource of water.

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All animals of the study were synchronized to induce estrus by using vaginal sponges for 12 days involved Medroxyprogesterone acetate/sponge 60 mg (Esponjavet, LABORATORIOS HIPRA, S.A., Spain). After 12 days, all vaginal sponges were removed from Maraz goats and injected with 600 IU PMSG I/M (serum gonadotrophin, OVISER 5000 IU, LABORATORIOS HIPRA, S.A. Avda. la Selva, Girona, Spain), the goats were checked for estrus during 48-72 hours. Two high fertile Maraz male depended for natural breeding for the animal of the study and considers day of mating as a day zero for pregnancy period.

All maraz does were ultrasonic scanned in standing position by depending transrectal portable ultrasound (draminski from Europe), frequency 4-9 MHZ every five interval days beginning from day 30 of gestation phase until day 100 to capture CRL and BPD images of fetus. A plastic bar 20 mm in diameter and 30 cm length was used to carry transducer to facilitate inserting the probe inside gently of rectum for the Maraz goats as done by Rasheed. (2017).

The measurement of crown-rump length was got by calculation the distance between higher part of fetus head until the lower point of the tail while BPD parameter was obtained by calculation the width of head of embryo, all these measurements were taken by millimeters after freezing the best images for the fetus (Rasheed, 2017)). All the statistical ways were achieved by using SPSS software program (version 18.0, IBM SPSS Inc., Chicago: USA), by depending T test and Tukey and Duncan post, the level of statistical significance was set at $P < 0.05$.

**Ethics approval:** The committee of animal care in faculty of veterinary medicine accepted all the procedures depended in the current study and all mice were maintained at Laboratory in accordance with all institutional protocols and the guide for the care and use of laboratory animals under the No. 3227 dated 1/1/2024.

**Results and Discussion:**

The results of the study indicated for the possibility measure of CRL of embryo between 30-70 days of gestation period while BPD parameter of fetus can detect between 35-95 days of pregnancy. This study demonstrated high significant relationship at $P < 0.05$ between advance weeks of pregnancy and both CRL and BPD fetal parameters (Table 1 and 2). The current study showed increasing the values of the measurements of CRL parameter between 30-70 days and 35-95 days of BPD of gestation period, this result agreed with previous studies (Rasheed, 2017, Abdullah *et al.*, 2018).

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Many fetal parameters were depended to predict the age of gestation period, CRL and BPD are the most common parameters that were used in many previous studies (Rasheed, 2017, Abdullah *et al.*, 2018, Kuru *et al.*, 2018, Devi *et al.*, 2019).

The first observation of CRL of the embryo in this study was during first month of gestation period while the last capture of CRL image was on day 70 of pregnancy (Fig 2-4). This finding is closed for another study in Abaza and Gurcu doe which detect CRL of fetus on day 30 of gestation period (Kuru *et al.*, 2018). A previous study detects CRL of embryo in local black goat between week five and week 7 of gestation period and this result closed for the finding of this study (Rasheed, 2017). Anyway, there were many previous studies got CRL of fetus early between 21-25 days of pregnancy (Devi et al, 2019, Khand et al, 2021). On other hand, other studies measured the CRL after day 40 of gestation period, a previous study for Amer (2008) got the first image for CRL between 40-49 days of pregnancy in Baladi goats in Egypt. Similar finding for study on Shami goat in Iraq recorded the CRL on 42-45 days of gestation period (Muhammad, 2021).

The first measurement of BPD was at day 35 of gestation period (Fig 5-6) while the last capture for this parameter was at 95 at pregnancy, this finding is close to previous studies (AL-Rawi, 2012, Kandiel *et al.*, 2015) that get BPD 27-106 and 36 -91 days of gestation, respectively. Another study for Rasheed (2017) in local black goats got BPD between 42-98 by depended trans-abdominal ultrasound examination with 5MHz sector transducer. Anyway, the finding of this study disagreed with many previous studies that measured this parameter late between 60-130, and 45-109 days of pregnancy (Suguna et al, 2008, Airina et al, 2011). The difference of value of measurements of CRL and BPD in various studies may be beyond to the type of ultrasound that depended in scanning, breed of goat, type of pregnancy single or twin may be the sex of fetus male or female and also could the experience of inspector that used ultrasound technique (Rasheed, 2017).

The current study got a great significant correlation coefficient between fetal parameters and advance of gestation period (Table 3), this study recorded strong positive R2 = 0.98 between CRL and advancing of pregnancy in does. The finding of this study similar to another previous studies which recorded great rate R2 ≥ 0.98 between CRL and pregnancy period in Shiba does (Kandiel *et al.*, 2015), Teddy does (Khand *et al.*, 2021) and in black local does in Iraq (Rasheed, 2017).

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On the other hand, this finding of correlation coefficient in the current study was higher than many other studies which got R2 = 0.92 in Abaza and local Bulgarian does (Karadaev *et al.*, 2016, Kuru *et al.*, 2018) respectively and R2 = 0.90 in Saanen goat (Abdelghafar *et al.*, 2011). Anyway, relative strong correlation coefficient found in another studies R2 = 0.92 between CRL and gestation period Gurcu and Egyptian native does (Kuru *et al.*, 2018, Karen *et al.*, 2009) respectively.

Also, this study got a great significant correlation coefficient between BPD and pregnancy period, and R2 = 0.96 was indicated to strong relationship between this fetal parameter and advance of gestation in Maraz goat. The finding in this study was close to many other previous studies that got R2 = 0.95 in local Iraqi and Saanen does (Rasheed, 2017, Abdelghafar *et al.*, 2011). Also, many other studies recorded strong correlation coefficient R2 = 0.92 -90 in Gurcu and Bulgarian does (Kuru *et al.*, 2018, Karadaev *et al.*, 2016,) respectively. Conversely, lower values of correlation recorded in many previous studies, a moderate relationship R2 = 0.65 got in Korean does (Lee *et al.*, 2005), while good correlation coefficient R2 = 0.84 between BVD and gestation period in Shami does in Iraq (Muhammad, 2021), but still lower than our finding in the current study.


**Figure 1:** Open uterus (Linear probe, 7MHz).

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**Figure 2:** CRL of embryo in age 33 days of gestation period (Linear probe, 7MHz).

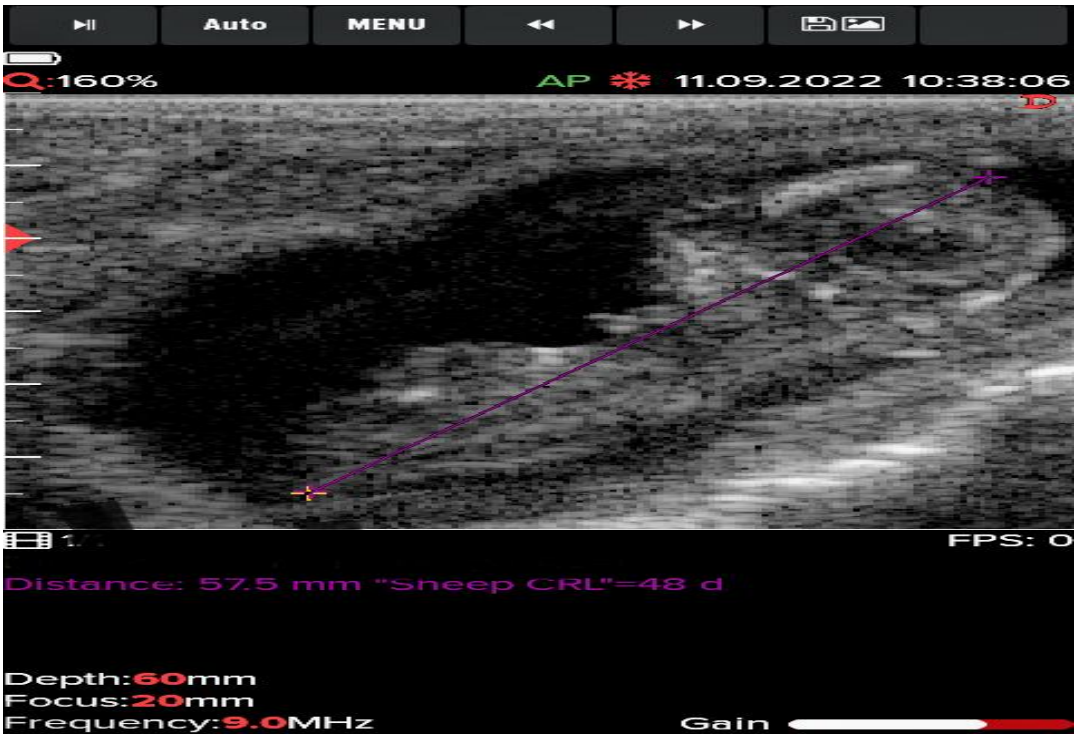


**Figure 3:** CRL of embryo in age 48 days of gestation period (Linear probe, 9MHz).

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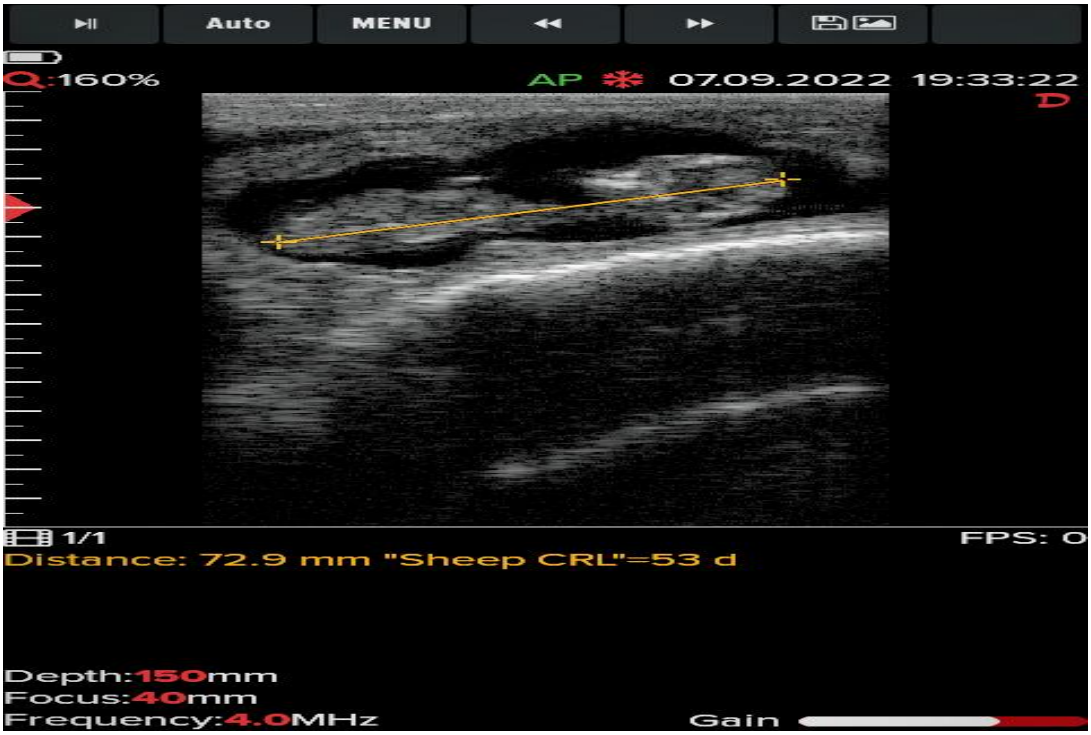


**Figure 4:** CRL of embryo in age 53 days of gestation period (Linear probe, 4MHz).

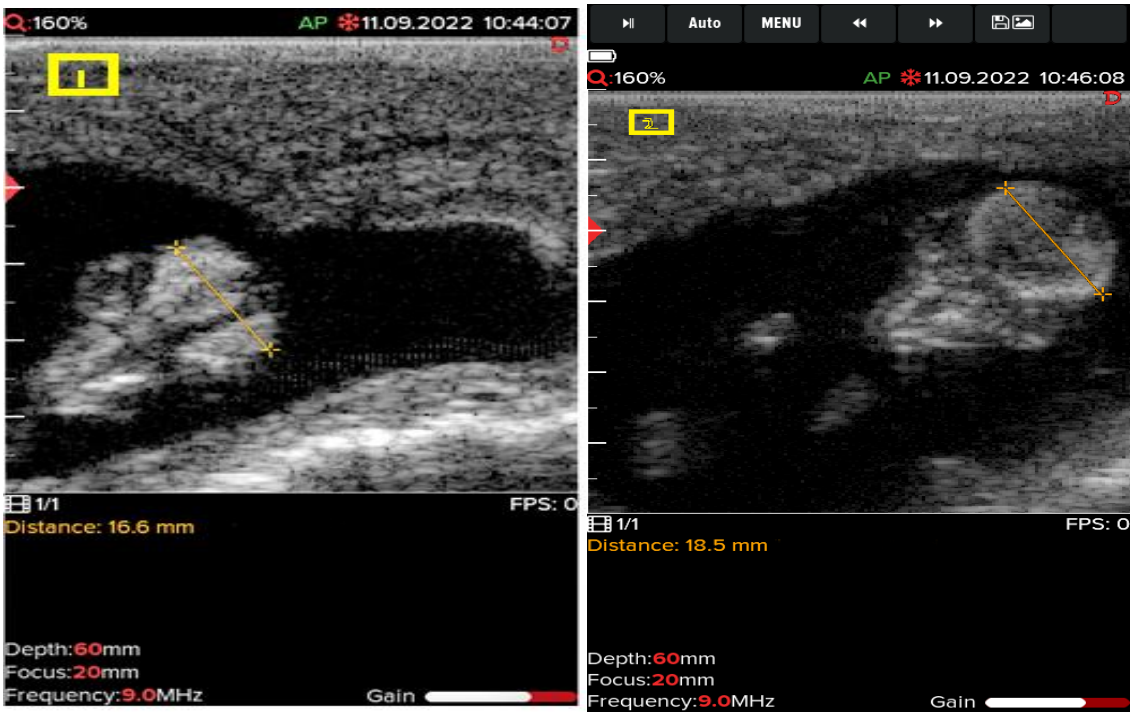


**Figure 5:** BPD of embryo in age 50(1) and 55 (2) days of gestation period (Linear probe, 9MHz).

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**Figure 6:** BPD of embryo in age 60-65 days of gestation period (Linear probe, 5MHz).

Table 1: Relationship between pregnancy period and CRL.

| Duration of pregnancy/ days | Crown-Rump Length/ mm |
|---|---|
| 30 | 17.3 ± 1. 2 |
| 35 | 21.7 ± 1.2 |
| 40 | 30. 8 ± 1.4 |
| 45 | 40. 6 ± 1.2 |
| 50 | 54. 8 ± 0.3 |
| 55 | 63. 7 ± 1.1 |
| 60 | 69. 3 ± 1.3 |
| 65 | 77.1 ± 1.4 |
| 70 | 104.9 ± 1.3 |
| | (P≤0.05) |

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Table 2: Relationship between pregnancy period and BPD.

| Duration of pregnancy/ days | Bi-parietal Diameter/ mm |
|---|---|
| *35* | *6.4* ± 0.2 |
| *45* | *10.2* ± *0.2* |
| *55* | *14.6* ± *0.1* |
| *65* | *21.1* ± 0.3 |
| *75* | *30.1* ± *0.2* |
| *85* | *34.5* ± 0.2 |
| *95* | *40.1* ± *0.3* |
| | |
| | (P≤0.05) |

Table 3: Correlation coefficient between gestation age with CRL and BPD.

| Independent Variable | Correlation coefficient | |
|---|---|---|
| Crown Rump Length (CRL) | *0.98* | (P≤0.05) |
| Biparietal Diameter (BPD) | *0.96* | (P≤0.05) |

**Conclusions:** The CRL and BPD are crucial parameters that could be useful and depended for follow the advance of gestation period by ultrasonic technique in goats.

**Recommendations:** This study recommend using doppler ultrasound technique to check another parameter of fetus during advancing gestation period.

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**Conflict of Interest:** No conflict of interest is disclosed by the authors.

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**Authors Contributions:** All authors had significant contribution in achievement an design, analysis and writing this work

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