

Determination of Gestational Age and Observation of Kacang Goat Fetal Development during 60 Days of Pregnancy by Using Transcutaneous Ultrasonography

(PENENTUAN UMUR KEBUNTINGAN DAN OBSERVASI PERKEMBANGAN JANIN KAMBING KACANG SELAMA 60 HARI KEBUNTINGAN MENGGUNAKAN TRANSCUTANEOUS ULTRASONOGRAPHY)

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ABSTRACT

This study was aimed to observe correlation between gestational age and fetal growth of Kacang goat for 60 days after mating with transcutaneous ultrasonography visualization. Three female goats of productive age with normal estrus cycle and one male goat were used in this study. The female goats were synchronized with double injection of prostaglandin F₂α (PGF₂α) intramuscularly with dosage of 1 mL for each female goat with 11 days' time interval. Observation of oestrus was conducted using male goat after being synchronized. When the sign of estrus were prominent, the female goats were naturally mated. The result was pregnant positive for one female goat. Detection of early pregnancy was observed on the 24th days after mating, with the result of 6.77 mm length embryo by isoechogenic visualization. On 35th days of pregnancy, fetal could be seen clearly in isoechogenic to hyperechogenic visualization with head diameter and fetal length were 17.4 mm and 36.2 mm, consecutively. The observation also found the placentom. On day 45 of pregnancy, head diameter and fetal length were 21.8 mm and 40.6 mm. Later on day 49 of pregnancy, the size of gestational saccus was 44.1 mm, with head diameter of 25 mm, and average placentom diameter size of 12.4 mm. On day 53 of pregnancy, head diameter was 25.2 mm with fetal length of 63.6 mm and placentom diameter of 15 mm. On day 56 of pregnancy, vertebrae of fetal were observed using hyperechogenic visualization and placentom was measured 17.9 mm in diameter. On day 60 of pregnancy, we observed that the fetal length was 79.8 mm and the organs such as eyes, heart, liver, os costae, and fetal extremities, could be observed clearly. The size of developing fetal and organs would grow along with the addition of gestational age.

Keywords: Kacang goat; pregnancy; fetal; transcutaneous ultrasonography

ABSTRAK

Tujuan penelitian ini adalah untuk mengamati hubungan antara umur kebuntingan dan pertumbuhan fetus kambing kacang selama 60 hari pascakawin dengan menggunakan visualisasi *transcutaneous ultrasonography*. Sebanyak tiga ekor kambing kacang betina usia produktif dengan siklus berahi normal dan satu kambing kacang jantan digunakan dalam penelitian ini. Kambing kacang betina diserentakkan berahinya dengan cara menyuntikkan injeksi ganda sediaan prostaglandin F₂ alfa secara intramuskuler

dengan pemberian sebanyak 1 mL pada masing-masing kambing betina dengan selang pemberian 11 hari. Pengamatan terhadap berahi dilakukan dengan memanfaatkan kambing jantan, setelah kambing betina serentak berahi. Pada saat gejala-gejala berahi menonjol, kambing-kambing kacang betina secara alami dikawinkan. Hasilnya adalah satu betina kambing kacang positif bunting. Pelacakan akan adanya kambing bunting secara dini diamati pada hari ke-24 pascakawin, dan berhasil melacak embrio yang memiliki panjang 6,77 mm dengan visualisasi *isoechogenic*. Pada hari ke-35 kebuntingan, fetus dapat teramati secara jelas dengan visualisasi *isoechogenic* hingga *hyperechogenic*, dan terukur garis tengah kepala 17,4 mm dan panjang fetus 36,2 mm. Pengamatan juga menemukan adanya *placentom*. Pada hari ke-45 kebuntingan, garis tengah kepala fetus 21,8 mm, sedangkan panjang fetus 40,6 mm. Selanjutnya pada hari ke-49 kebuntingan, ukuran *gestational saccus* adalah 44,1 mm, dengan garis tengah kepala 25 mm, dan rata-rata ukuran garis tengah *placentom* 12,4 mm. Pada hari ke-53 kebuntingan, ukuran garis tengah kepala 25,2 mm, panjang fetus 63,3 mm, dan garis tengah *placentom* 15 mm. Pada hari ke-56 kebuntingan, tulang vertebrae fetus teramati dengan menggunakan visualisasi *hyperechogenic* dan *placentom* diukur memiliki garis tengah 17,9 mm. Pada hari ke-60 kebuntingan, teramati panjang fetus 79,8 mm dan organ seperti mata, jantung, hati, tulang iga, dan tulang-tulang kaki dapat teramati dengan jelas. Ukuran fetus dan organ-organ yang berkembang terus tumbuh dengan bertambahnya umur kebuntingan.

Kata-kata kunci: kambing kacang; bunting; fetus; *transcutaneous ultrasonography*

INTRODUCTION

Productivity of livestock mammals depends on the success of reproduction. The ability to reproduce is determined by the parent's success to produce offspring that is healthy and strong on weaning process, so its next life period would be better. The weight of the offspring is determined by prenatal growth (during pregnancy), which is the accumulation of growth since the zygote developed into embryo and fetus until it was born (Dziuk, 1992; Manalu *et al.* 1999).

The increase in livestock productivity has recently become the main demand concomitant with the plan to declare self-sufficiency in meats. The detection of gestation is an important factor in enhancing livestock productivity. However, gestational detection still has weaknesses. The current methods of detecting gestation have some weaknesses, such as low accuracy, high risk of gestational failure, less applicable for communities, and high cost. The traditional method of diagnosing ruminants' early pregnancy is to palpate the external abdomen and to record the growth of the udder. However, this method is only valid for late pregnancy. The trans-abdominal ultrasonography technique has been used with high accuracy to diagnose pregnancy and estimate fetal numbers in lambs (Buckrell, 1988), goats (Gonzalez *et al.*, 2004; Martinez *et al.*, 1998), and deer (Revol and Wilson, 1991).

The sonographic appearance of fetal organs could be used to estimate gestational age, e.g., the fetal bladder appears on day 20 towards the

end of pregnancy on cows (Goddard, 1995). Barr (1990) notes that from day 38 to day 45 of pregnancy, the development of organs could be studied by ultrasonography. The fetal heart is easier to visualize and have an anechoic structure with echogenic walls as chamber division and heart valves. On day 45 of pregnancy, the fetal stomach (anechoic structure) can be identified in 90% of fetuses on the caudal of the liver. Fetal numbers can be determined from day 28 to day 35 of pregnancy, when the fetus is still small. If the fetus is big enough, determining its age is harder because only some parts of the fetus can be seen, double estimation of the same fetus could occur, or other fetus are missed entirely. Early information of gestational status is very useful for business management and breeding of goats. Haibel and Perkins (1989) stated that estimation of pregnancy detection and gestational ages were paramount to achieve maximal reproduction efficiency. Research on goat reproduction is still limited, particularly regarding pregnancy examination using ultrasonography. Therefore, this study play an important role in determining gestational age of kacang goat (*Capra sp.*) based on fetal growth imaging during 60 days of pregnancy with transcutaneous ultrasonography.

RESEARCH METHODS

Animals

We used three female local Kacang goats (*Capra sp.*) of reproductive age with normal estrus cycle and one male goat. We kept female

goats in separate cage from the male goat. Grass feeds were given three times a day while additional feeds were given on morning and afternoon and drink were given *ad libitum*.

Estrus Synchronization and Breeding

The female goats achieved estrus synchronization by injecting 1 mL of prostaglandin F2/PGF2á (Estron®) intramuscularly for each goats followed by another injection after 11 days. We observed the estrus daily using male goat after PGF2á injection, and then studying the estrus behavior of the goat. Estrus was characterized by female goats being quiet and ready to mate when approached by the male goat. When signs of estrus were observed, the female goat was naturally mated. Treatment protocol for goats was described on Figure 1.

Pregnancy Observation Using Transcutaneous Ultrasonography

We examined the pregnancy with transcutaneous ultrasonography (Mindray DP3300 VET, Shenzhen Mindray Bio-Medical Electronic Co.Ltd, China) complete with 3.5 MHz abdominal probe (35C50EB, Shenzhen Mindray Bio-Medical Electronic Co. Ltd., China). This goat examined when it is in lying position. Transcutaneous ultrasonography (USG) evaluation would be easier if the operator bow in the left side of the goat while pulling the goat’s hind feet. On the initial steps, operator should prepared the USG equipment and place it on the left side of operator’s hand while the operator was in the left side of the goat. Some of the goat’s hairs should be shaved to obtain best visualization on that site. The next step was to apply KY jelly around the abdomen in front of the *mammae*, move to cranial of *mammae* until

sebum filling the *inguinal* gland, and then apply to dorsal and a little bit on caudal-medial. The probe should be given slight pressure on the abdomen toward *vesica urinariae*.

On the ultrasonography monitor, the embryo, embryonic vesicle, and pelvis appeared white or greyish (hyper-echogenic/iso-echogenic), while embryonic fluid and uteri lumen appeared dark (hypo-echogenic). Sonography image consists of three parts, that is; white (hyper-echogenic), grey (iso-echogenic) and black (hypo-echogenic).

Data Analysis

Observation of gestational sac diameter, head diameter, and fetal length, was analyzed descriptively and was shown as pictures.

RESULTS AND DISCUSSIONS

This study confirmed one pregnant female. Pregnancy was detected on day 24 after mating. Our study observed gestational sac, embryo 6.77 mm in length, and umbilical. The first observed sign of pregnancy was the appearance of *hypoechoic* fluid from gestational sac, which indicates that female goat, was on early pregnancy. This condition differed from the other goats, which were not pregnant after mating. Based on the observation, fetus started to be discovered on day 22 of pregnancy in Garut lamb by using trans-rectal method. While Ali and Hayder (2007) showed that fetal and amnion of Ossimi lambs was first detected in day 25 of pregnancy. Martinez *et al.* (1998) stated that embryo could be detected in day 24 until 26 of pregnancy using 5 MHz transducer. Using trans-abdominal USG method, pregnancy was

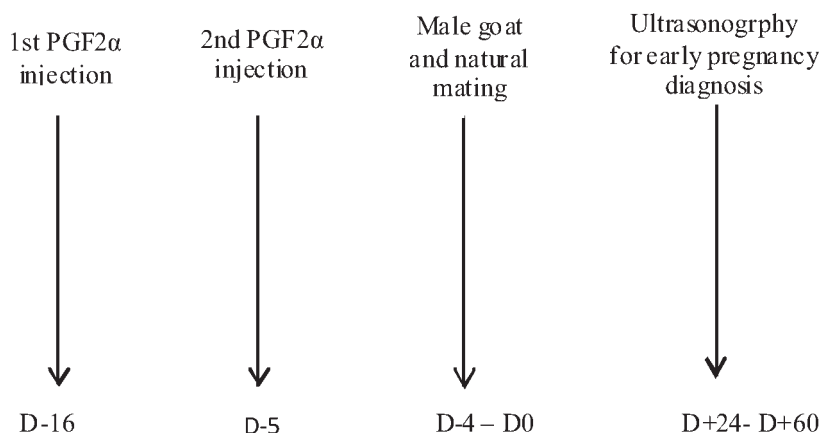


Figure 1. Treatment protocol for the Kacang goats

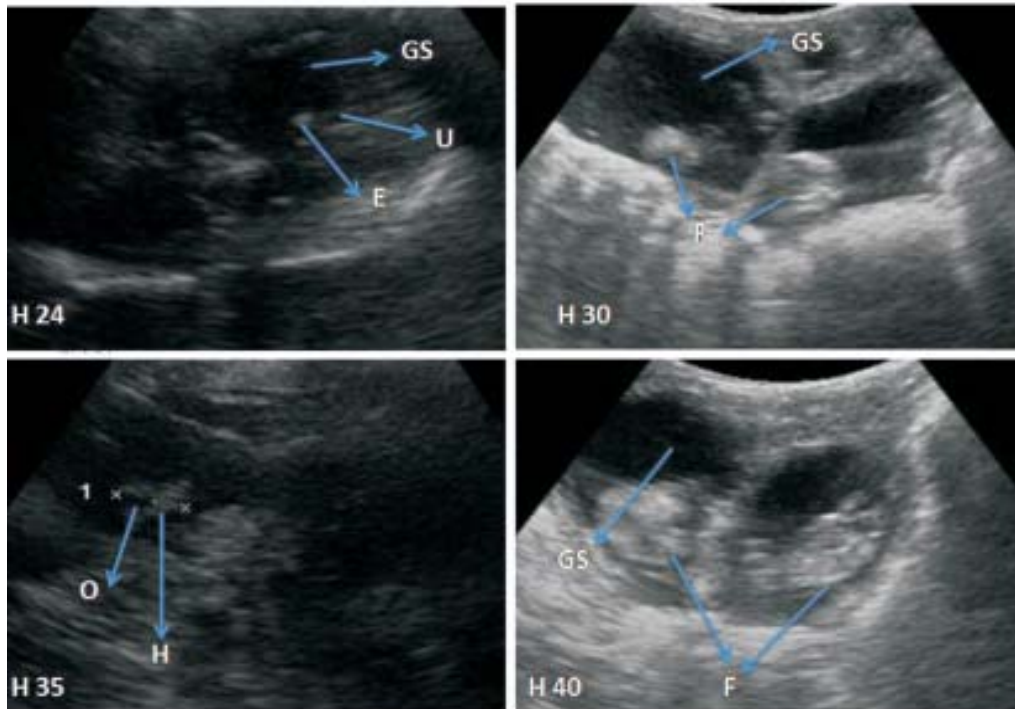


Figure 2. Ultrasonography (USG) pictures of gestational growth of Kacang goat in day 24 until 40 of pregnancy (H= day of pregnancy, E= embryo, F= fetal, GS= gestational saccus, U= umbilical, O= orbita, H= Head)

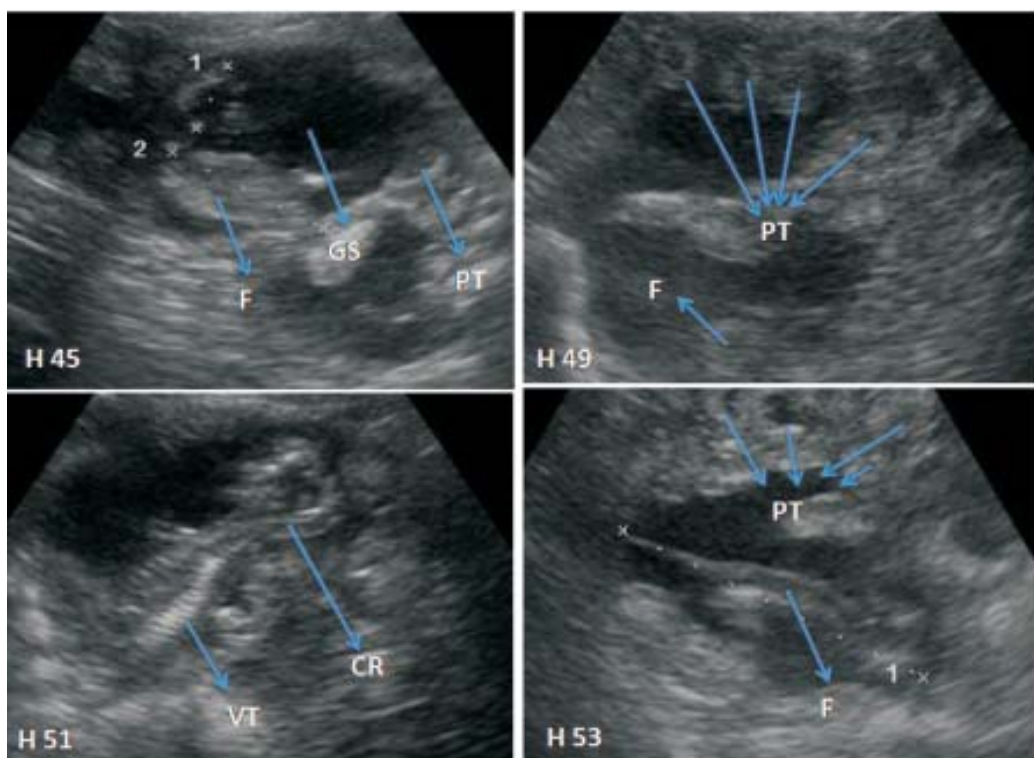


Figure 3. Pictures of gestational kacang goat growth on day 45 to 53 of pregnancy (H= day of pregnancy, F= fetal, GS= gestational saccus, PT= placentom, VT= vertebrae, CR= cranium)

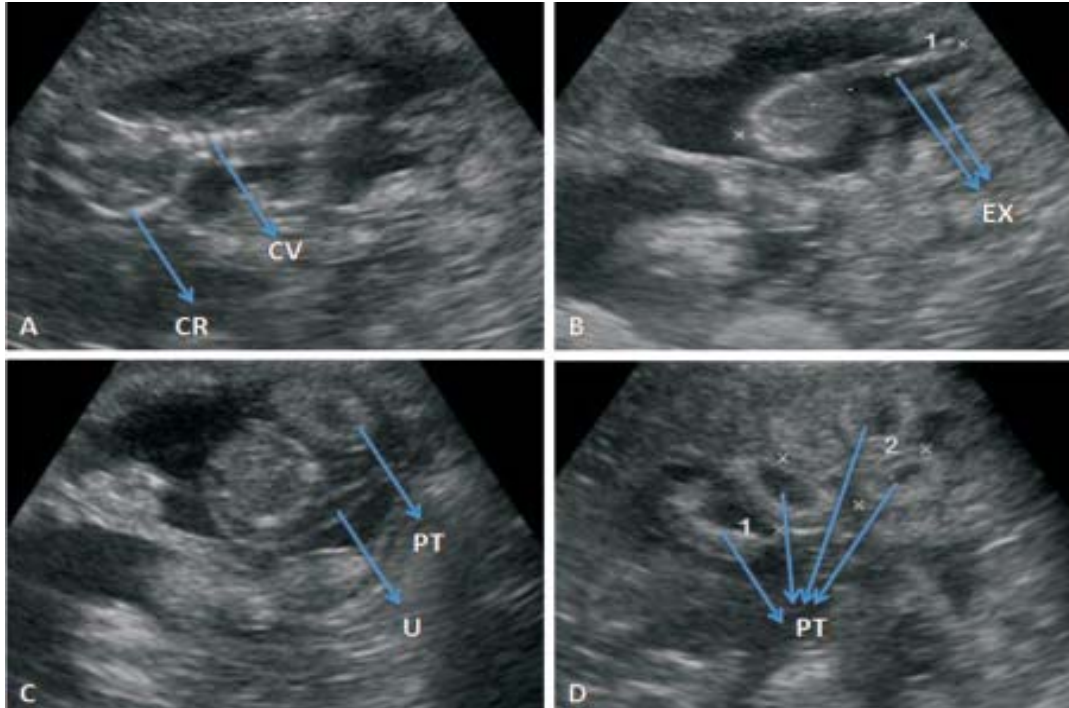
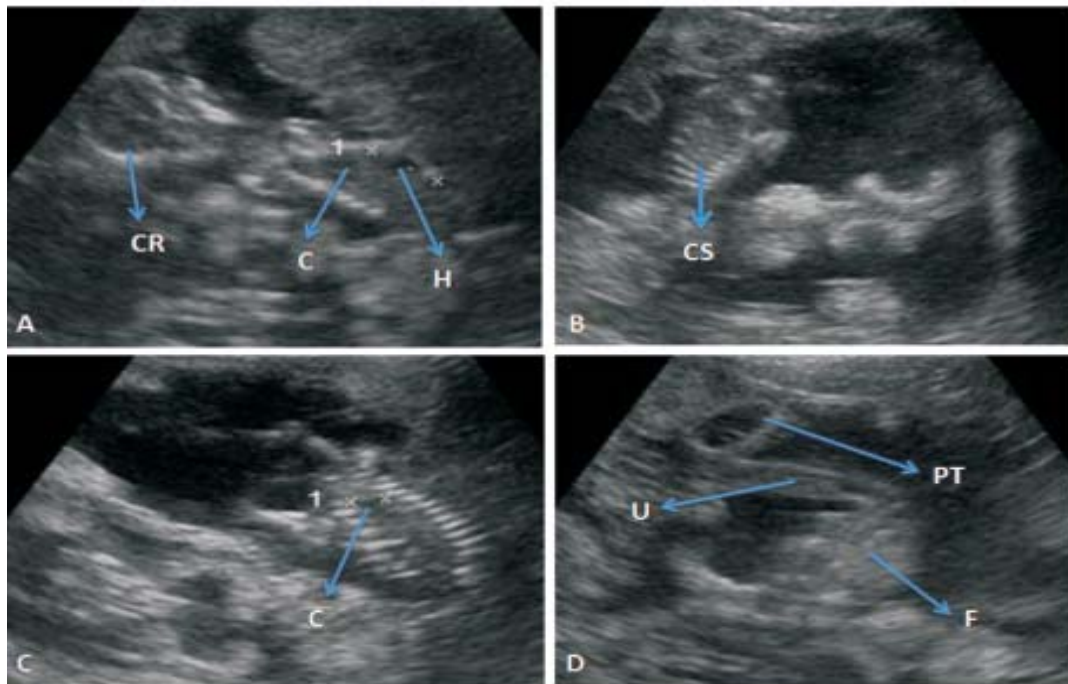


Figure 4. Pictures of kacang goat gestational growth on day 56 of prgnancy (A= fetal bones appearance; CR= cranium bones; CV= cervicalis bones; B= fetal bones appearance; EX= extremities bones; C= fetal *umbilical*; PT= placentom appearance U; D= placentom appearance dominating uterus lumen)



Picture 5. Pictures of Kacang goat gestational growth on day 60 of pregnancy
 A= fetal bones and organs appearance (CR= *cranium* bones, C= *cor*, H= *hepar*)
 B= fetal bones appearance (CS= *costae* bones)
 C= fetal heart appearance (C= *cor*)
 D= fetal appearance (F), fetal umbilicus (U), and fetal placentoms (PT)

first confirmed in day 25 (Gearhart *et al.*, 1988) or day 30 after mating (Bretzlaff *et al.*, 1993). The sensitivity and specificity of this technique are high after day 29 (Taverne *et al.*, 1985) reaching 100% from day 46 to 106 of pregnancy (Fowler *et al.*, 1984; White *et al.*, 1984; Davey, 1986; Gearhart *et al.* 1988). The position and location of the probe affects the possibility to visualize gestational sac, so it has to be located in the exact location of the examined site. A very small diameter of the gestational sac could make its visualization and detection difficult. Sonographic images of fetal growth on day 24 until day 53 of pregnancy are shown in Figure 2 and Figure 3.

On day 35 of pregnancy, fetus of Kacang goat was 36.2 mm in size, its head diameter was 17.4 mm, and it also had *placentom*, eyes, and heart beats. The heart appearance couldn't be visualized clearly by the probe due to its very small size. First appearance leading the sign of heart was the difference movement compared to maternal abdominal movement and condition around gestational sac. Based on observation of rhythmic movement related to embryo was first detected on day 18 or 19 after mating using 7.5 MHz trans-rectal ultrasonography (Karen *et al.*, 2001). Whereas using 5 MHz trans-rectal ultrasonography, it is first sighted on day 21-23 after mating (Garcia *et al.*, 1993). Aiumlamai *et al.* (1992) measured fetal heart beats of lambs during second half of pregnancy using trans-abdominal ultrasonography and reported that fetal heart beat was high during seven weeks before *partus* ($167,0 \pm 1,5$ bpm) then it decreased three weeks before *partum* ($139,0 \pm 15,7$ bpm) reaching $117,0 \pm 9,2$ bpm on delivery. Martinez *et al.* (1998) stated that for goats, heart beat was detected on day 19 after mating. Heart beat must be detected to accurately identify the embryo. However, difficulties arise when the embryo attached to uterine wall. It was impossible to measure heart beat on day 19-20 after mating because of heart's small size (closed for transducer resolution limit) or the movement of uterus away from transducer coverage, making it impossible to visualize the heart of the embryo.

On day 45 of pregnancy, fetal head diameter and fetal length measured 21.8 mm and 40.6 mm, respectively. *Placentom* was well developed and appeared as an iso-echogenic to hyper-echogenic surrounding a hypo-echogenic area with an average size of 12.4 mm on day 49 and

grows to a constant size of 19.8 mm on day 60. On day 49 of pregnancy, the image of *placentom* almost filled the entire gestational sac and the fetus was vaguely visualized because of active fetal movement and growing fetus body part. Anwar *et al.* (2008) stated that *placentom* and extremities was 100% visualized between days 45 to 50 of pregnancy. Russel (1989) reported that *placentom* could be identified from day 40 with a hyper-echogenic circular structure on lambs. *Placentom* could be identified by trans-rectal ultrasonography (5 MHz) on day 30 of pregnancy (Buckrell *et al.*, 1986) and day 32 of pregnancy (Doize *et al.*, 1997). Karen *et al.* (2001) showed that *placentom* initially appeared as hyper-echogenic area on the endometrial surface. On day 42, *placentom* of lambs was described as cup-like appearance and reached maximal size on day 74 (Doize *et al.*, 1997).

Observation of Kacang goat pregnancy using USG on day 51 showed hyper-echogenic area of the fetus vertebrae. On day 53, fetal length could still be measured, not complete with other organs but only appeared as long iso-echogenic appearance. On day 56 of pregnancy, cranium bones, cervical bones, extremities bones, umbilical, and *placentom* dominating the gestational sac can be visualized. Whereas on day 60, fetal organs such as heart and liver appeared more clearly, showing a hypo-echogenic body. Pictures of transcutaneous USG of Kacang goat pregnancy on day 56 and 60 were shown in Figure 4 and Figure 5. Accordingly, it was concluded that the size of developing fetal and organs would grow along with the addition of gestational age.

CONCLUSION

This study concluded that fetal growth appearance of Kacang goat (*Capra sp.*) by using transcutaneous ultrasonography could provide information on determining gestational age of Kacang goat (*Capra sp.*).

ACKNOWLEDGEMENT

The author thanks to the persons and any inatitutions who can not be mentioned, which allows this research to be completed as expected.

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