Assessment of the gestational age in Chall fetus by measuring the embryonic vesicle, biparietal diameter, and crown ramp length

Soroori, S.[1], Veshkini, A.[1], Tajik, P.[2]*

[1]Department of Surgery and Radiology, [2]Department of Theriogenology, Faculty of Veterinary Medicine, University of Tehran, Tehran-Iran.

Abstract: To give a standard in the Iranian Chall ewes, 24 of them were synchronized by two injections of $PGF_2\alpha$ (12.5 mg/ewe Lutalize, Upjohn) 8 day apart. Forty-eight h after the 2nd injection, 16 ewes showed signs of estrous and were randomly divided into 2 groups and each was introduced a fertile ram for 24 h (ram introducing day was counted as day 0). Embryonic vesicle (E.V.), biparietal diameter (B.P.D.) and crown ramp length (C.R.L.) were measured. Early pregnancy diagnosis was performed by transrectal (with or without abdominal pressure) ultrasonography in standing position. Ultrasonography was performed until day 144. Embryonic vesicle was 0.55 cm in diameter on the day 18. It was 0.79, 0.95, 1.41, 1.91, 2.42, 2.98 and 3.42 cm in days 20, 21, 24, 25, 30, 33 and 37 of pregnancy, respectively. The first assessment of BPD was in day 37, which was 1.04 cm. It was 1.19, 1.87, 4.12 and 6.27 for days 40, 61, 98 and 144 of pregnancy, respectively. CRL was 2.25, 2.78, 3.19, 4.33, 5.39, 6.94 and 8.03 in days 33, 37, 40, 44, 47, 54 and 58 of pregnancy. These data are the first report giving a standard measurement in Chall gestational age assessment. *J.Vet.Res. 62,2:1-5,2007.*

Key words: ultrsonography, sheep, pregnancy.

Introduction

The determination of the fetus age is of great importance in breeding programs. Barker and Cawley in 1967 used radiographic detection for assessing fetal numbers in goats. In 1976, Rizoli *et al.,* made use of radiography to diagnose pregnancy in sheep between 100 to 120 days. It seemed very difficult as they were needed two technicians and two assistants for the accomplishment of the process. The same year, Royal and Tainturier used ultrasonography, but could not challenge to radiography. In 1982, Raw suggested that measurement of tibia length after 70 days of pregnancy could be used to assess fetal age. Fukui *et al.,* in 1984 used Doppler ultrasonography to assess pregnancy between 140 to 160 days in 5 minutes. Owens and Armstrong in 1985 assessed the litter size with an accuracy of 95% in days 62-75 and 110-124 by using ultrasonography or radiology respectively. In 1987, Panter *et al.,* studied fetal hydrops and development of fetal membranes. Real-time B-mode ultrasonography was first introduced to veterinary practice for early pregnancy diagnosis by Taveme in 1984. In 1988 Buckrell and Gearhart *et al.,* separately used a B-mode ultrasonography to diagnose pregnant ewes from day 25. In 1990, Kahn *et al.,* compared transrectal and transabdominal ultrasonography and diagnosed pregnancies in days 25 and 35 of pregnancy using the above mentioned methods, respectively. Many other authors (Kahn *et al.,* 1992; Schrick and Inskeep 1993; Alan 1994) reported limited data belonging to a limited time during pregnancy. A lot of work on sheep ultrasonography was used as a tool for assessing pregnancy in novel works (Wilmut *et al.,* 1997) or management tools for farmers (for a detail refer to the New Zealand. Soc.

*Corresponding author's email: ptajik@chamran.ut.ac.ir, Tel: 021-66438322, Fax:021-66933222

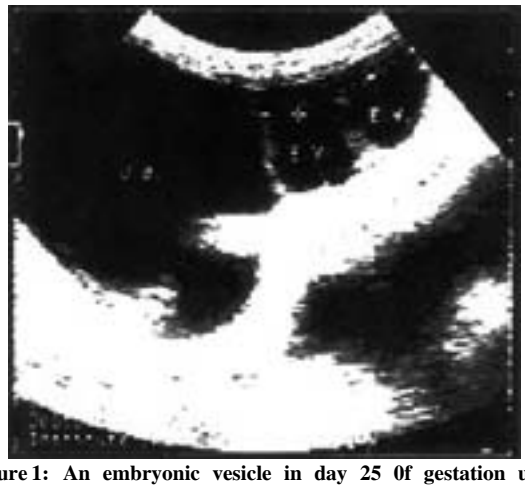

Figure 1: An embryonic vesicle in day 25 0f gestation using transabdominal ultrasonography.

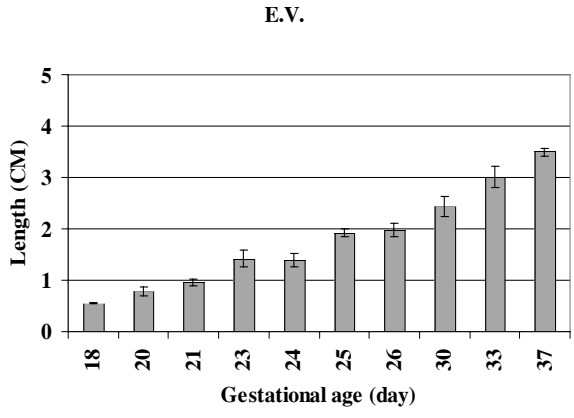

Figure 2: Mean values ±SD of the embryonic vesicle in the duration of measurement.

Anim. Prod. 1999 proceedings abstracts No, 27, 29, 30 31 and 32). In our previous study (Hojjati and Tajik 1999) we assessed the litter size of Arabian ewe in south Iran. In the present study we decided to standardize the fetal age according to the fetal body measurement. Among the sheep breeders in Iran, the Chall is famous for gaining weight as well as breeding 2-3 lambs a year. Our study was conducted to measure some parts of the Chall fetus such as; biparietal distance (BPD), radius and tibia to give a standard for future determination of the fetal age and/or teratology in this breed.

Materials and Methods

Twenty-four Iranian Chall ewes were synchronized by two injections of $PGF_2\alpha$ (12.5 mg/ewe Lutalize, Upjohn Co.) during 8 days. Forty-eight h after the 2nd injection, 16 ewes showed signs of estrous and were randomly divided into 2 groups for each, a fertile ram was introduced for 24 h (ram introducing day was counted day 0). Early pregnancy diagnosis was by transrectal ultrasonography (with or without abdominal pressure) in standing position. Transrectal ultrasonography was substituted by transabdominal ultra sonography after concluding that it could not be used anymore. Ultrasonography was performed until day 144.

Results

Embryonic vesicle (E.V.) was first diagnosed on day 18 of pregnancy carrying transrectal ultrasonography Fig. 1 shows an embryonic vesicle on day 25 of gestation using transabdominal ultrasonography. Fig. 2 shows the mean values and STD of the E.V. during this experiment. The smallest and the largest E.V. were 0.54 and 0.55 cm respectively. The largest number of pregnancies in which E.V. was diagnosed were days 30 and 33.

BPD was measured in the images in which *Falx cerebri* could be observed. Fig 3 shows a BPD measurement in 58 days of gestation by transrectal ultrasonography. The arrow points the *Falx cerebri*. For he first time, BPD was assessed in day 37 and it was 10.6 mm. The shortest measured BPD was 10 mm and the longest one was 62.9 in 144 days of pregnancy. The mean values of BPD were 10.6, 12.5, 13.6, 16.6 and 19 mm in days 37, 40, 47, 54 and 61 of pregnancy respectively(Fig 4). shows measured values upto day 117.

For the first time CRL was assessed in day 33 (Fig 5). The shortest measured CRL was 2.1 cm, and the longest one was 8.25 cm belonging to a 58 days pregnancy. The mean values for CRL were 2.25, 2.79, 3.19, 4.33, 5.4, 6.46, 6.95 and 8.03 mm for days 33, 37, 40, 44, 47, 51, 54 and 58 of pregnancy respectively. These values are given in fig 6.

Discussion

In this experiment pregnancy diagnosis could be started from 18th day of gestation in 2 fetuses in Chall breed by a 7.5 MHZ transducer. In previous studies Garcia *et al* in 1993 observed the EV of Suffolk,

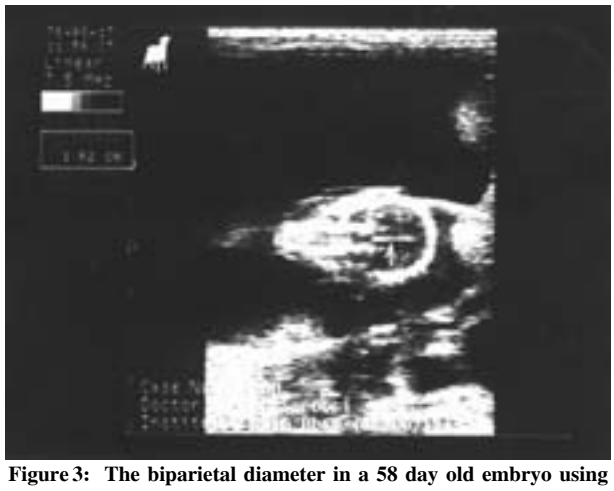

Figure 3: The biparietal diameter in a 58 day old embryo using transrectal ultrasonography. The arrow points the *falx cerebri*.

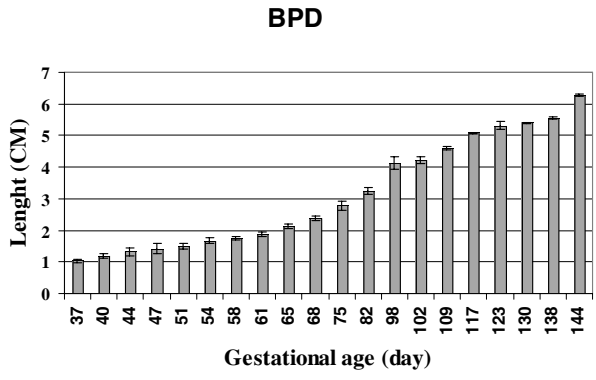

Figure 4: Mean values ±SD of the biparietal diameter in the duration of measurement.

Polled Dorset and Rambouillet by a 5 MHZ transducer and transrectal ultrasonography. Schrick and Inskeep observed EV on days 18 or 19. Slosarz *et al* in 1999 also reported that 78% of the pregnant cases could be diagnosed by using 3.5 and 5 MHZ transducers and by transrectal ultrasonography. They reported that in day 26 the pregnancy accuracy rate would be 100%. The small difference between the present study and the Khan's study (1994) shows that the longest EVs in transrectal ultrasonography were 10 mm in day 20 and 15 and 20 mm in days 25 and 30 of pregnancy, respectively. It may be due to the reason of measuring EV values in sheep and goats together. He also did not mention the bred of the fetuses studied. Schrick and Inskeep also reported that in day 25 of gestation, all fetuses were observed by transrectal ultrasonography. In our study also, all fetuses were observed from day 23 till day 26 of gestation by the same technique. In the Schrick and Inskeep`s study, transrectal ultrasonography by a 7.5 MHZ transducer was carried out in crossbred ewes, in dorsal recumbency in a tilting squeeze chute. However, in our study, diagnosis was carried out in standing position, which was easier and faster than the previous one. In the present work the entire procedure took approximately 5 minutes to complete.

The measurement of BPD in the present study showed that this is a proper indicator for diagnosing gestational age from day 37 of pregnancy. In our study, the clear observation of BPD is also possible between days 40 and 100 of pregnancy. However, the BPD can be measured before and after this time. It seems that Kelly and Newnhom (1989) are first people who measured the BPD in Merino lambs and suggested that there is a correlation between BPD and fetal age. Sergeeve *et al.,* (1990) measured the BPD in 28 Merino ewes from days 49 to 91 by weekly measurement. They used a 5 MHZ transducer for transabdominal ultrasonography in dorsal recumbency. The BPD which they measured was about 0.2 to 1.87 mm longer than that of Chall (our measurement) in days 51-68 of gestation, but the same as our measurement on days 75-119. Aiumiamai *et al.,* (1992) measured the BPD in seven Swedish peltsheep that is a little more than that of Chall. They also claimed that there is a relationship between fetal age and BPD. Neither the former nor the latter studies showed the relationship they had claimed. Surprisingly the BPD in 6 and 8 weeks before parturition are more than that BPDs which measured in 5 and 3 weeks before parturition respectively. However in the present study there is a moderate increase in BPD of Chall fetus according to the progress of the gestation. The difference in the results of the former and latter studies may be due to the measuring procedure of BPD. For the measurement of BPD, at first *falx cerebri* should be observed in ultrasonographic scans. The scan in fig. 4, shows the skull of a fetus with *falx cerebri*, which indicates it is scanned in a right angle. Haibel and Perkins (1989) also measured the BPD in 4 Suffolk and 9 Finn fetuses and introduced one equation for

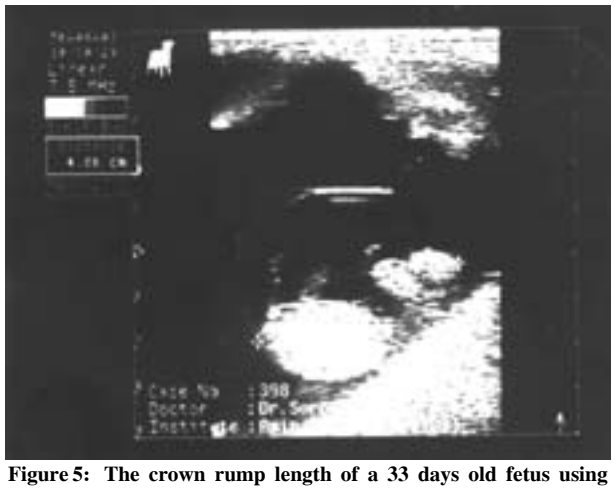

Figure 5: The crown rump length of a 33 days old fetus using transrectal ultrasonography.

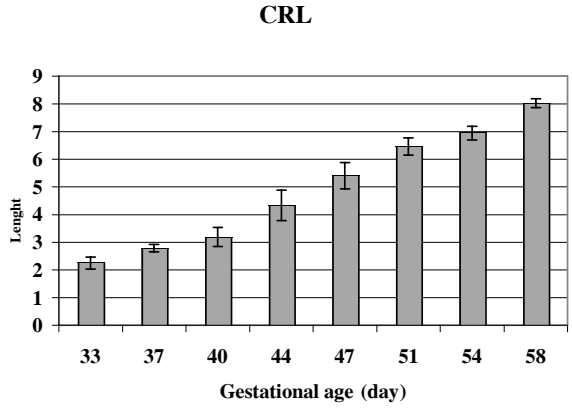

Figure 6: Mean values ±SD of the crown rump length in the duration of measurement.

each. They used transabdominal ultrasonography by a 5 MHZ linear transducer. The ewes were in standing position. The mean value of their finding on days 58, 61, 65, and 68 of pregnancy in the mentioned breeds were 0/19 - 1.38 mm more than those of Chall in the same days. However, same as that of Chall in the other days. Kahn (1994) also postulated that the mean value of BPD was 10 mm in day 40, 26 mm in day 70 and 45 mm in day 100 of gestation, which is similar to our finding in Chall fetuses.

Schrick and Inskeep (1993) measured the Crown ramp length (CRL) in 41 Crossbred fetuses on days 20, 25, 30, 35 and 40 of gestation. Their values were similar to our values calculated for Chall fetuses. However, in our study CRL was measured in Chall fetuses until day 58 of gestation. In the study of Kahn (1994), the values on day 40 were similar to our values and on day 58 were a littlemore than our values. However, Kahn measured sheep and goat fetuses and did not clearly separate the values he had measured.

In conclusion, it is considered first report standardizing the fetal measures in Chall breed. These measures may help veterinarians, sheep breeders, etc. to assess the health status of the fetus during gestation period.

References

1. Aiumlamai, S., Fredriksson, G. and Nilsfors, L. (1992) Real-time ultrasonography by determining the gestational age of ewes. Vet. Rec. 12: 560-562.
2. Alan, M., Timurkan, H. and Gulyuz, F. (1994) Pregnancy diagnosis by real-time ultrasonography in ewes. Turk-Veterinerlik-ve-Hayvanclinik-Dergizi, 18: 161-163.
3. Barker, C.A.V. and Cawley, A.J. (1967) Radiographic detection of fetal numbers in goats. Can. Vet. J. 8:59-61.
4. Buckrell, B. C. (1988) Application of ultrasonography in reproduction in sheep and goats. Theriogenol. 29: 71-84.
5. Farmer, R.J. and Davis, G.H. (1999) Experiences of a pioneer in commercial sheep pregnancy scanning business. New Zeal. Soc. Anim. Prod. Proceedings: Abst.No. 27.
6. Fukui, Y., Kimura, T. and Oneo, H. (1984) Multiple pregnancy diagnosis in sheep using an ultrasonic Doppler method. Vet. Rec. 114: 145.
7. Garcia, A., Neary, M.K., Delly, G.R. and Pierson, R.A. (1993) Accuracy of ultrasonography in early pregnancy diagnosis in the ewe. Theriogenol. 39: 847-861.
8. Gearhart, M.A., Wingfield, W. E., Knight, A. P., Smith, A., Dargatz, D. A. Boon, J. A. and Stocks, C. A. (1988) Real-time ultrasonography for determining pregnancy status and viable fetal numbers in ewes. Theriogenol. 30: 323-337.
9. Geenty, K.G. (1999) Use of ultrasonic pregnancy scanning information for farmer extension. New Zeal. Soc. Anim. Prod. Proceedings: Abst No. 32.
10. Haibel, G.K. and Perkins, N.R. (1989) Real time ultrasonic biparietal diameter of second trimester

Suffolk and Finn sheep fetuses and prediction of gestational age. Theriogenol. 32:863-869.

11. Hojjati, P. and Tajik, P. (1999) Ultrasonographic diagnosis of pregnancy and litter size in Arabian ewe. The 26th World Veterinary Congress. September 23-26 Lyon-France.
12. Kahn, W. (1994) Veterinary Reproduction Ultrasonography, 11thEd. London, Mosby - Wolf, pp. 187-212.
13. Kahn, W., Kahn, B., Richter, A., Schulz, J. and wolf, M. (1992) Ultrasonic examination of pregnant ewes. I. Fetal measurement to estimate the stage of gestation and the propable date of lambing. Deutsche-Tierarztliche Wochenschrift. 99: 449-452.
14. Kahn, W., Fraunholz, J., Kasper, B. and Pyczac, Y. (1990) Ultrasonic early pregnancy diagnosis in horse, cattle, sheep, goats, pigs, dogs, and cats. Recommendations and limits. Berliner-und-Munchener-Tierarzitiche Wochenschrift. 103: 206-211.
15. Kelly, R. W. and Newnhorn, J. P. (1989) Estimation of gestational age in merino ewes by ultrasound measurement of fetal head size. Aust. J. Res. 40: 1293-1299.
16. McAtamney, T.J. and McAtamney, S. (1999) Farmer use and experience of ultrasonic pregnancy scanning. New Zeal. Soc. Anim. Prod. Proceedings: Abst No. 30: 1999.
17. McCorkindate, A.B. (1999) Ultrasonic pregnancy scanning - a tool for change. New Zeal. Soc. Anim. Prod. Proceedings: Abst No. 29: 1999.
18. Nicoll, G.B., Dodds, K.G. and Alderton, M.J. (1999) Field data analysis of lamb survival and mortality rates occurring between pregnancy scanning and weaning. New Zeal. Soc. Anim. Prod. 1999 Proceedings: Abstract No. 31.
19. Owens, J.L. and Armstrong, J.R. (1985) Diagnosis of foetal number in prolific sheep. Proc. New Zeal. Soc. Anim. Prod. 45: 155-157.
20. Panter, K.E., Bunch, T.D., James, L.F. and Sisson, D.V. (1987) Ultrasonographic imaging to monitor fetal and placental developments in ewes fed locoweed (Astragalus lentiginosus) Am. J. Vet. Res. 48: 686-690.
21. Raw, M. E. (1982) Radiographic assessment of gestational stage in the ewe. Vet. Rec. 111: 483-485.
22. Rizzoli, D.J., Winfield, C.G., Howard, T.J., Englund, I.K.J. and Goding J.R. J. (1976) Diagnosis of multiple pregnancy in ewes on a field scale. Agr. Sc. 3: 671-677.
23. Royal, L. and Tainturier, D. (1976) Review of modern methods of pregnancy diagnosis in the ewe. Revue-de-Medecine-Veterinaire. 127: 1009-1034.
24. Schrick, F.N. and Inskeep, E.K. (1993) Determination of early pregnancy in ewes utilizing transrectal ultrasonography, Theriogenol. 40: 295-306.
25. Segreev, L., Kleeman, D.O., Walker, S.K., Smith, D.H., Grosse, T.I., Mann, T. and Seamark, R.F. (1990) Real-time ultrasound imaging for predicting ovine fetal age. Theriogenol. 34: 593-601.
26. Slosarz, P., Steppa, R., and Gadek, A. (1999) The application of ultrasond for early pregnancy in sheep. Medycyna- Weterynaryja. 55: 686-688.
27. Taveme, M.A.M. (1984) The use of linear-array real-time echography in veterinary obstetrics and gynaecology. Tijdschr Diergeneeskd. 109: 494-506.
28. Wilmut, I., Schnieke, A.E., McWhir, J., Kind, A.J. and Campbell, K.S.H. (1997) Viable offspring derived from fetal and adult mammalian cells. Nature. 385: 810-813.