



ORIGINAL ARTICLE

Evaluation of Relationship between Serum Progesterone levels and Size of Normal and Vacuolated Corpus Luteum and Comparison of Fertility in Holstein dairy cows

Amirali Kaveh¹, Mostafa Vosough Khelejani², Farzad Noei², Amir Shahryari², Mohammad Javad Sadighi Kordelar², Pedram Isaloo², Vahid Ghadiri², Alireza Vosoughy Irany²

1- Department of Clinical Sciences, Faculty of Veterinary Medicine, Tabriz Branch, Islamic Azad University, Tabriz, Iran

2- Department of Veterinary Medicine, Tabriz Branch, Islamic Azad University, Tabriz, Iran

*Corresponding author's email: Dr.a.kaveh@gmail.com

ABSTRACT

The corpus luteum is a temporary endocrine structure in female mammals that is involved in the production of relatively high levels of progesterone and moderate levels of estradiol and inhibin A. In present study we aimed to determine the range of these two kinds of CLs and progesterone secreted from them and the fertility rate. On days 7 to 9 of estrus cycle, ovaries were examined using rectal and ultrasonic methods. The used apparatus was Hitachi v900 frequency 7.5 MHz linear. Then, the type of CL was diagnosed. 10CC blood samples were obtained. Plasma was isolated at the laboratory using centrifuge at 3000RPS for 10 minutes and was kept at -20°C till using. Ultrasonographic evaluation showed of 100 examined diestrus cows, 33 cases had vacuolated CL and 67 of them had non vacuolated CL. By dimensioning the CLs using ultrasonographic method and calculating the area it revealed that the size of vacuolated CLs is 357.391mm² and the mean square is 348.53 mm² (table 1). Statistical analysis showed no significant difference among the size and area. As shown in the diagram 2, the mean value of serum progesterone CL is 9.34 ng/ml and 8.36 ng/ml in vacuolated and non-vacuolated, respectively. Statistical analysis showed no significant difference among the groups in term of serum progesterone (P=0.64). Also, subsequence administration of PG and induction of estrus and AI, of 33 cases with vacuolated CL on day 30 after AI, 18 of them were pregnant and 13 of them were non pregnant. Also, of 67 cases with non- vacuolated CL, 41 of them were pregnant and 26 of them were non pregnant. Statistical analysis showed no significant difference among the groups in term of serum progesterone (P=0.369).

Keywords: Progesterone, CL, fertility, Dairy cows.

Received 02/10/2013 Accepted 27/11/2013

©2013 AEELS, INDIA

INTRODUCTION

The corpus luteum is a temporary endocrine structure in female mammals that is involved in the production of relatively high levels of progesterone and moderate levels of estradiol and inhibin A. It is colored as a result of concentrating carotenoids (including lutein) from the diet and secretes a moderate amount of estrogen to inhibit further release of gonadotropin-releasing hormone and thus secretion of luteinizing hormone and follicle-stimulating hormone. A new corpus luteum develops with each menstrual cycle. Follicle before changing to Corpus Luteum forms a bloody corpus. At the time of the transmission of ovum started into the uterus, this corpus remains on the surface of the ovaries. Corpus luteum is bigger than ovary in size. The cells of Corpus luteum are consist of cells the cells of surrounding the ovary [3,4]. The follicular theca cells luteinize into small luteal cells (thecal-lutein cells) and follicular granulosa cells luteinize into large luteal cells (granulosa-lutein cells) forming the corpus luteum. Progesterone is synthesized from cholesterol by both the large and small luteal cells upon luteal maturation. Cholesterol-LDL complexes bind to receptors on the plasma membrane of luteal cells and are internalized. Cholesterol is released and stored within the cell as cholesterol ester [2,1]. There are two forms of Corpus luteum of vacuolated and non-vacuolated. It has been reported that in pregnant cows the range of vacuolated CL is lesser than in non-pregnant cyclic cows [4]. Vacuolated CLs are called cystic CLs

in that cases the construction is differ from CL [3,4].In present study we aimed to determine the range of these two kinds of CLs and progesterone secreted from them and the fertility rate.

MATERIALS AND METHOD

This study was carried out in 3rd and 5th stations of Moghan livestock and husbandry complex on 100 non pregnant cases which were in diestrus. On days 7 to 9 of estrus cycle, ovaries were examined using rectal and ultrasonic methods. The used apparatus was Hitachi v900 frequency 7.5 MHz linear. Then, the type of CL was diagnosed. 10CC blood samples were obtained. Plasma was isolated at the laboratory using centrifuge at 3000RPS for 10 minutes and was kept at -20°C till using. The progesterone was measured using chemoluminescens method. In continue, by injection of PGF2 α and observing the estrus signs artificial insemination was exerted and 30days later AI diagnosis of pregnancy was made. Data were analyzed using SPSS and MCNemar protocol.

RESULTS

Ultrasonographic evaluation showed of 100 examined diestrus cows, 33 cases had vacuolated CL and 67 of them had non vacuolated CL. By dimensioning the CLs using ultrasonographic method and calculating the area it revealed that the size of vacuolated CLs is 357.391mm² and the mean square is 348.53 mm² (table 1). Statistical analysis showed no significant difference among the size and area (P=0.91).

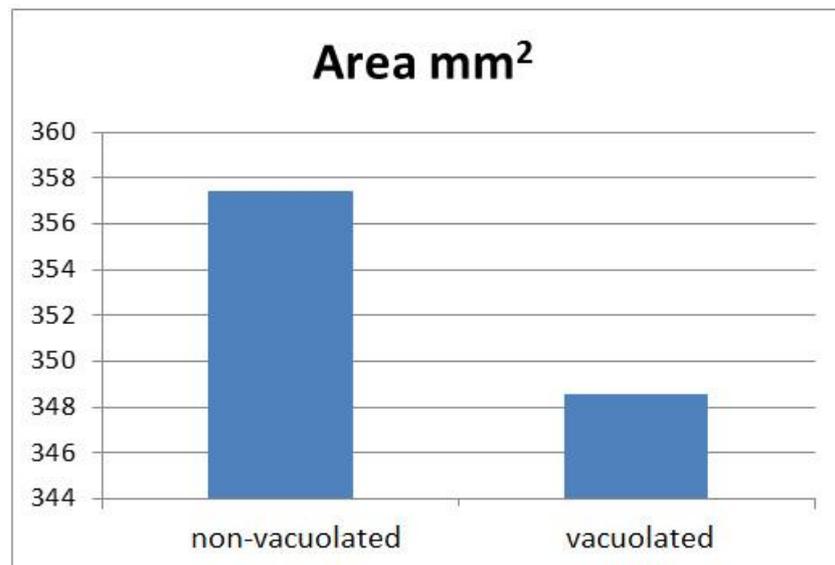


Diagram 1: comparison of Mean area of CL in two groups

As shown in the diagram 2, the mean value of serum progesterone CL is 9.34 ng/ml and 8.36 ng/ml in in vacuolated and non-vacuolated, respectively. Statistical analysis showed no significant difference among the groups in term of serum progesterone (P=0.64).

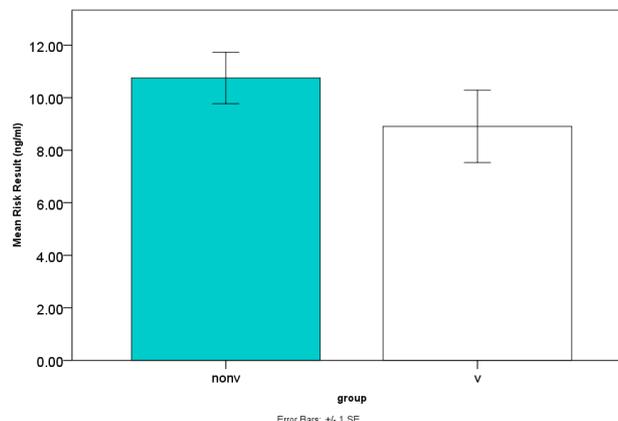


Diagram 2: mean value of serum progesterone in understudying groups.

Also, subsequent administration of PG and induction of estrus and AI, of 33 cases with vacuolated CL on day 30 after AI, 18 of them were pregnant and 13 of them were non pregnant.

Also, of 67 cases with non- vacuolated CL, 41 of them were pregnant and 26 of them were non pregnant. Statistical analysis showed no significant difference among the groups in term of serum progesterone ($P=0.369$).

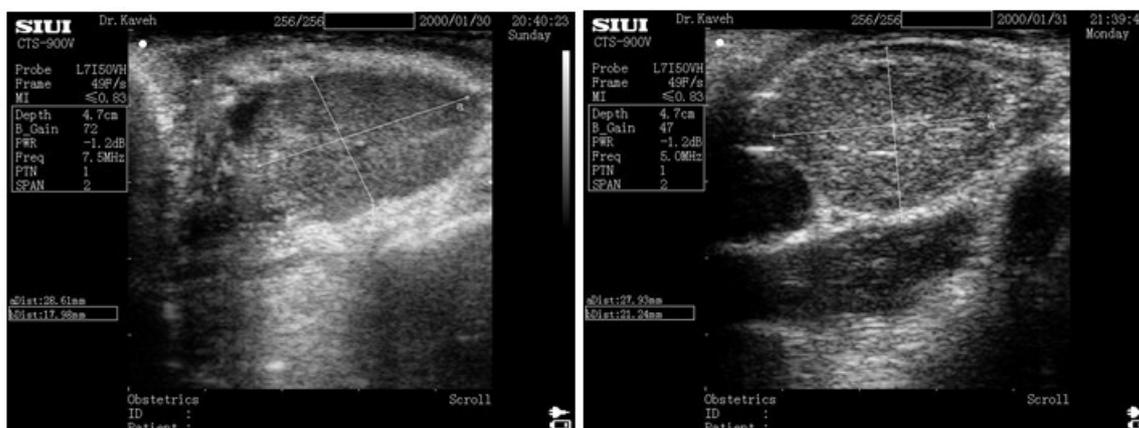


Figure 1:ultrasonographic view from ovaries with non-vacuolated CL

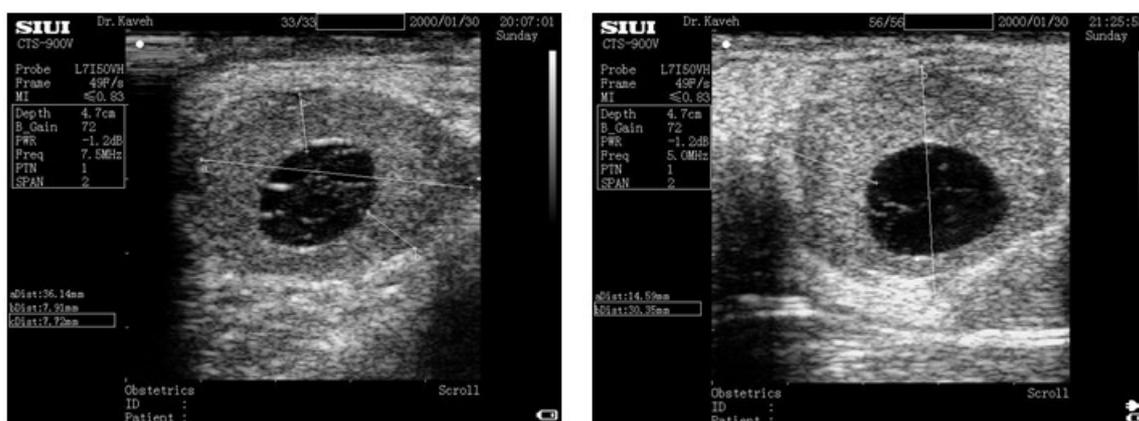


Figure 2:ultrasonographic view from ovaries with vacuolated CL

DISCUSSION AND CONCLUSION

Decrease in corpus luteum function in dairy cows is one of the factors that reduce fertility [9]. Many studies have shown that ovarian cycles in dairy cows after calving are often irregular [7]. Increase milk production in cows, increases metabolic demand and pulsatile secretion of LH [13]. Decrease in LH levels decreases follicular growth and luteal tissue. Researchers showed that LH pulsation and concentrations of E2 and FSH during the luteal phase in cows is lesser than cattle because cattle don't produce milk [5]. In theory, it seems that the creation of CL may be associated with increased milk production in cattle because by increasing of the animal metabolic demands in high producers, luteinization process is delayed. Maybe this is one of the causes of vacuolated CL but should be investigated in future studies. Although, some studies indicate no relation between luteal gland and cycle duration [6]. The results of this study also indicate that plasma progesterone levels in cows non-vacuolated is more than in cows with vacuolated CL but it is non-significant which is compatible with other studies [12]. The cows of both group has the same levels of progesterone and in some cases in non-vacuolated is higher than vacuolated. It has been shown that when the CL is detected for the first time on day 3 of cycle, it is a 17mm in diameter. After that, their size gets to be differ so that, the vacuolated is bigger than non-vacuolated. Vacuolated and non-vacuolated forms have the maximum size of 28 and 24.5 on days 8 and 10 respectively. Then, to gets smaller. The length of vacuolated form starts to decrease rapidly. From days 6 to 17 of cycle, vacuolated forms are bigger 2 to 4 mm than their pairs [10]. Data obtained from present study showed also there is no significant among two types of CLs on days 7-9 but, non- vacuolated is a little bigger. In another study, incidence and size of the luteal gland was assayed during the cycle and early 3 weeks of pregnancy. They showed that vacuolated CL has a maximum diameter on days 8 and 10 [10]. After that they start to decrease. By day 10, a third or a half of a normal cycle vacuolated corpus

luteum are detected with an ultrasound exam. After that, the outbreak of vacuolated CL decreases 3 to 4% per day which is in line with our research results. In another study it was reported that after 30 days of gestation in cattle, detecting the vacuolated CL is very rare. Disappearing the cavity is justified with wall thickness [8]. In another study it was reported that pregnant cows vacuolated CL is seen the same ratio in estrus cycle. This suggests that pregnancy rates are the same in cows with luteal glands of both [3, 6] but in the present study the presence of vacuolated CLs is low in pregnant cows. It seems that this decrease is due to presence of CL and its diminishing. Kastelic *et al.*, [8] have studied the CLs of cows and CLs cysts using ultrasonography and compared the secreted progesterone. Hanzen *et al.*, [6] also assayed the structure of CL in cows by ultrasonography method. Carroll *et al.*, [3] also studied the structure of ovaries and serum levels of progesterone and compared them each other. Ribadu *et al.*, [11] also achieved the same results. Pieterse, [10] also reported the structure of ovaries using ultrasonography.

REFERENCES

1. Assey, R.J., Purwantara, B., Greve, T., Hyttel, P., Schmidt, M.H.: (1993). Corpus luteum size and plasma progesterone levels in cattle after cloprostenol-induced luteolysis. *Theriogenology*; 39: 1321-1330.
2. Battocchio, M., Gabai, G., Mollo, A., Veronesi, M.C., Soldano, F., Bono, G., Cairoli, F.: (1999). Agreement between ultrasonographic classification of the corpus luteum and plasma progesterone concentration in dairy cows. *Theriogenology*; 51: 1059-1069.
3. Carroll DJ, Pierson RA, Hauser ER, Grummer RR, Combs DK. (2009). Variability of ovarian structures and plasma progesterone profiles in dairy cows with ovarian cysts. *Theriogenology*. ;34: 349-370.
4. "Corpus Luteum Cyst of Pregnancy". DrSpock.com. Retrieved 2009-05-26.
5. Desaulniers D, Lussier J, Goff A, Bousquet D, Guilbault L, (1995). Follicular development and reproductive endocrinology during and after superovulation in heifers and mature cows displaying contrasting superovulatory responses. *Theriogenology* 479-497.
6. Hanzen CH, Pieterse M, Scenczi O, Drost M. (2004). Relative accuracy of the identification of ovarian structures in the cow by ultrasonography and palpation per rectum. *The Vet J.* ;159: 161-170
7. Kafi M, McGowan M, (1997). Factors associated with variation in the superovulatory response of cattle. *Animal reproduction science* 137-157.
8. Kastelic, J.P., Bergfelt, D.R., Ginther, O.J.: (1990). Relationship between ultrasonographic assessment of the corpus luteum and plasma progesterone concentration in heifers. *Theriogenology*, 1990; 33: 1269-1278.
9. McNeill R, Diskin M, Sreenan J, Morris D, (2006). Associations between milk progesterone on different days and with embryo survival during the early luteal phase in dairy cows. *Theriogenology* 1435-1441.
10. Pieterse MC. (2008). Ultrasonic characteristics of physiological structures on bovine ovaries. In: Taverne MM,5 Willems AH, editors. *Diagnostic ultrasound and animal reproduction*. Kluwer Academic Publisher; .p.53-65.
11. Ribadu AY, Ward WR, Dobson H. (2003). Comparative evaluation of ovarian structures in cattle by palpation per rectum, ultrasonography and plasma progesterone concentration. *Vet Rec.*;135: 452-457.
12. Taylor, C., Rajamahendran, R.: (1991). Follicular dynamics, corpus luteum growth and regression in lactating dairy cattle. *Can. J. Anim. Sci.* 71: 61-68.
13. Wathes D, Taylor V, Cheng Z, Mann G, (2003). Follicle growth, corpus luteum function and their effects on embryo development in postpartum dairy cows. *Reproduction supplement* 61: 216-237.

Citation of this article

Amirali K., Mostafa V. K., Farzad N., Amir S., Mohammad J. Sadighi K. Pedram I., Vahid G., Alireza V. I. Evaluation of Relationship between Serum Progesterone levels and Size of Normal and Vacuolated Corpus Luteum and Comparison of Fertility in Holstein dairy cows. *Bull. Env. Pharmacol. Life Sci.*, Vol 3 (1) December 2013: 33-36