IMPACT OF ULTRASONOGRAPHIC MONITORING IN REPRODUCTIVE EFFICIENCY OF MARES DURING MONTHS OF YEAR IN IRAQ

Yaseen Mahmood Rasheed[1,2] **Salman Hammadi Ghareeb[1]**

[1]Department of Surgery and Obstetrics, College of Veterinary Medicine-University of Diyala.

[2] Corresponding author: dr.yaseen73@gmail.com

ABSTRACT

The objectives of the present study were to illustrate the effect of seasons of year in the reproductive efficiency in mares and to investigate the optimal period for early pregnancy diagnosis using real-time ultrasonography. The present study was conducted on mares (n=70) which were from Iraqi equestrian club in Al-Ameria/ Baghdad. The mares were from different breeds (Arabian, cross breed and thoroughbred) and with age average from (4-14) year. These mares were examined for pregnancy diagnosis which was carried out by trans-rectal ultrasonography using a 5 MHz linear-array transducer from day 10 to day 40 post-breeding (last breeding day= Day zero). The current study showed higher ($P<0.01$) breeding rates in spring season. The results of ultrasonographic examination revealed higher accuracy of pregnancy diagnosis from (31-35) days post-breeding. Meanwhile, this study indicated that most of the conception rates were maximum in spring season, with a high significant differences ($P<0.01$) between pregnant, non-pregnant mares and the months of the year. Therefore, it can be concluded from this study that the season of the year have a significant effect in the incidence of heat in mares. Pregnancy diagnosis in mares can achieved accurately starting from day thirty-first of gestation onward.

Key words: mares, ultrasound, daylight, season.

INTRODUCTION

Most mares are seasonally polyestrous and many of them show behavioral estrus in February, March and April without accompanying ovulation (Hafez and Hafez, 2000). In the northern hemisphere, the natural breeding season occurs from April to September associated with increase in daylight, temperature and availability of food (Hughes *et al.*, 1975). Seasonal variation in the duration of daylight has a profound influence on mare reproductive performance (Blanchard *et al.*, 2003).

The diagnosis of pregnancy in mares by ultrasonography was first reported in 1980, this technology has increased veterinarian's ability to estimate gestational age and evaluate equine pregnancy considerably (Palmer and Drahncourt, 1980). In addition, the ability to accurately detect pregnancy during the early intra-uterine period has also been critical in the development of techniques to successfully manage twin pregnancy and for detecting abnormal conceptus development and pregnancy loss (Stout, 2009). Real-time ultrasonic imaging provides a noninvasive technique to image directly, in situation, the internal and external anatomy of reproductive organs and tissues, and to characterize reproductive events such as ovulation and transition of the uterus during the estrous cycle echotexture (Boyd and Omran, 1991 ; Panthan and Pampori, 2011). Ultrasonography has proved its worth in improving the efficiency of recent gynecological technique like artificial insemination and embryo transfer. There is still a great potential for the continued application of this technology to further improve our understanding of the reproductive processes, disease diagnosis and to maximize reproductive efficiency of the mare (Medan and Abd EI-Aty, 2010).

The area that has arguably benefited more from the development of ultrasound technology than any other area is equine reproduction. In many cases, rectal palpation has been replaced by trans-rectal ultrasonography for pregnancy determination, and diagnosis of associated with uterine and ovarian infections (Reef, 1991). More accurate measurements of the reproductive organs have opened doors to new areas of research and validated or refuted data from previous studies.

The objectives of the current study were to illustrate the effect of seasons of year in the reproductive efficiency in mares and to investigate the optimal period for early pregnancy diagnosis through using real time ultrsonographic (RTU) technique (5 MHz) during different post-breeding periods.

MATERIALS AND METHODS

The study conducted in Iraqi equestrian club/ Al-Ameria/ Iraq. Seventy mares were included in this study. These mares were from different breeds (Arabian, Thoroughbred and Cross breed), and their average from (4-14) years. Ultrasound Scanner (SIUI-CTV-200V- China). Ultrasound examinations were applied weekly, with a real time B-Mode scanner equipped with a 5 MHz linear array rectal transducer.

The examination was carried out in foaling mares and at various post foaling periods. The scanning was performed out of the direct sunlight, since this can hinder interpretation of images on the ultrasound screen. Thorough palpation of the genital tract must be performed before ultrasound scanning (Sertich, 2007). The Statistical Analysis System- SAS (2004) was used to analysis different factors in study parameters. The Qi-square (χ^2) test compare between percentages in this study on P<0.01 and P<0.05 level of probability.

RESULTS AND DISCUSION

The results of current study showed that there are higher significant differences (P<0.01) among pregnant mares, non-pregnant mares in four seasons. While higher conception rates bred mares were from March to June (spring season). The lower pregnancy rate was observed in the mares that bred during October, November and December, (Tab. 1).

Table 1. Effect of months of year on pregnancy rates

Month	No. of breeding	No. of +ve (%) (pregnant)	No. of - ve (%) (non-pregnant)
January	25	9, (36)	16,(64)
February	38	11 ,(29)	27,(71)
March	66	32 ,(48.5)	34,(51.5)
April	64	31 ,(48.4)	33,(51.6)
May	71	30 ,(42.3)	41,(57.7)
June	47	19 ,(40.4)	28,(59.6)
July	45	17 ,(37.8)	28,(62.2)
August	32	11 ,(34.4)	21,(65.6)
September	28	9 ,(32.2)	19,(67.8)
October	55	15 ,(27.3)	40,(72.7)
November	49	14 ,(28.6)	35,(71.4)
December	30	8 ,(26.7)	22,(73.3)
Qi-square- χ^2	---	11.281 **	11.281 **

(P<0.01) **.

These findings coincided with study of mentioned that maximal rate of pregnancy was occurred on March through June (Ju *et al*., 2002). Interestingly, the increasing in day light duration, elevated ambient temperature and availability of nutrition play a role in acceleration of folliculogenesis prior to ovulation (Nagy *et al.*, 2000 ; Al-Timimi, 2012).

Moreover, the results of present study showed the occurrence of ovulation followed by successfully pregnancy through the year. Findings of the current study disagree with the results of Abdul-Rahman (1986) and recently with Ginther *et al*., (2005) they reported that the ovulation is lower during Winter months. This discrepancy may be due to differences in the breeds, management system and environmental conditions (Gentry *et al*., 2002). Indeed, the conclusion of the current study agree with the findings of Abdul-Rahman (1986) ; Ju *et al*., (2002) ; and Al-Timimi (2012) that some mares have regular estrus cycle accompanied with ovulation throughout the year.

Meanwhile, the data of our study showed higher significant differences (P<0.01) in pregnancy rates diagnosed by using ultrasonographic technique during various post-breeding periods (Table 2).

Table 2. Effect of post-breeding interval on true and false pregnancy examinations

Post-breeding interval (day)	No. of exam.	No. of positive		No. of Negative	
		true +ve (pregnant)	false +ve (nonpregnant)	true –ve (nonpregnant)	false –ve (pregnant)
10------15	115	27		88	
		25	2	82	6
Qi-square- χ^2	---	14.75 **		24.09 **	
16------20	66	23		43	
		21	2	41	2
Qi-square- χ^2	---	10.41 **		13.28 **	
21-----25	70	28		42	
		26	2	40	2
Qi-square- χ^2	---	9.79 **		10.40 **	
26------30	30	14		16	
		13	1	15	1
Qi-square- χ^2	---	9.79 **		9.79 **	
31-----35	23	10		13	
		10	0	12	1
Qi-square- χ^2	---	15.00 **		12.35 **	
36-----40	16	10		6	
		9	1	5	1
Qi-square- χ^2	---	12.35 **		12.35 **	
10------40	320	---			

(P<0.01) **.

The ultrasonic scanning of pregnancy at (10-15) day and (16-20) day, revealed higher accuracy in pregnancy diagnosis in both positive (pregnant mare) and

negative (non-pregnant mare) with some errors results as false positive (non-pregnant mare) which could be due to confusion with uterine cysts, and false negative (pregnant mare) may referred to the early examination. This is in accordance with study showed Paccamonti and Pycock (2009) that the pregnancy diagnosis is highly accurate even at this stage, and the important consideration that the endometrial cyst can be very difficult to distinguish from early pregnancy and this could give a chance of false-positive pregnancy diagnosis. Meanwhile, Badtram *et al*., (1991) mentioned that the false negative pregnancy diagnosis ascribe to the examination performed early and possible to miss the conceptus if scanning conditions are not ideal and the ovulation date is not accurately known. These observations are coincided with the results of the present study.

The ultrasonic examination showed the possibility of false positive pregnancy diagnosis during (21-25) day, (26-30) day, respectively, due to misinterpretation of uterine cyst with early conceptus. These findings coincided with Van Ittersum (1999) and Stanton *et al*., (2004) that the irregular shape of embryonic vesicle at early stage of pregnancy can be confused with endometrial cysts and collection of intraluminal uterine fluid, particularly because no embryo can be visible during these stages. While the false negative pregnancy diagnosis in our study was attributed to the operator experience and scanning quickly (Badtram *et al*., 1991). At around (31-35) day of gestation there was a high accurate pregnancy diagnosis without false positive results. This finding agree with Pycock (2007) mentioned that the embryo is highly echogenic and was clearly visible on the line separating the allantoic and yolk sac (Fig. 1).

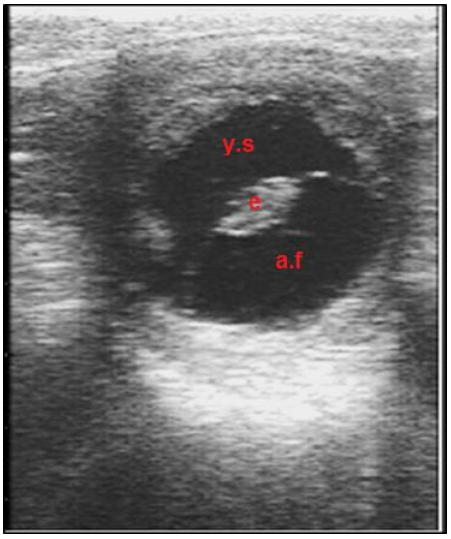


Fig. 1. Ultrasonic image of conceptus at 32 day. yolk sac (y.s), allantoic sac (a.s), embryo (e)

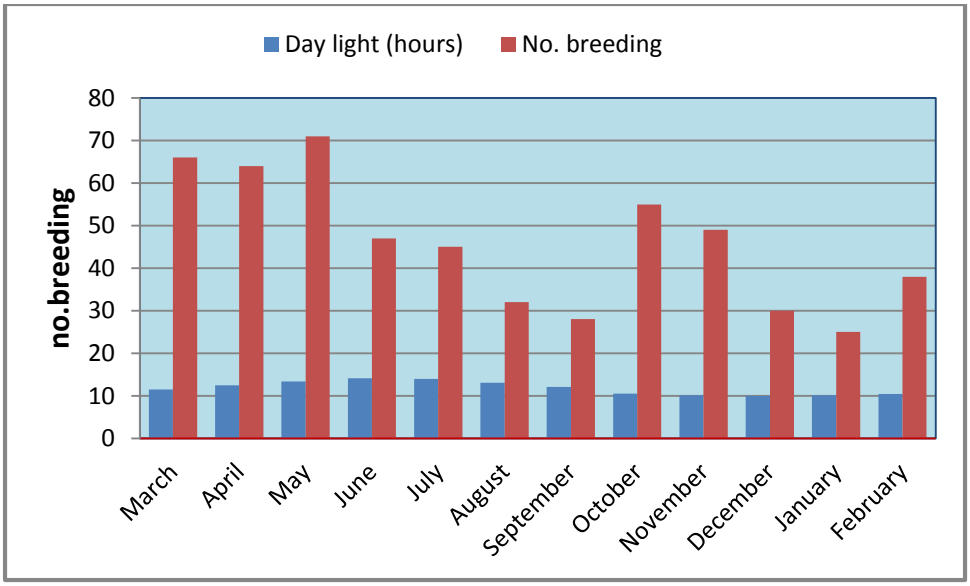
In this study, there were two errors (false positive and false negative) in pregnancy diagnosis through (36-40) day. These results may be attributed to equipment quality, transducer frequency, mare restraint, examination environment and operator experience. This finding agree with Badtram *et al*., (1991) observed that the most factors considered responsible for variation in rate of early diagnosis by ultrasonic as behavior, errors in annotation reproductive history, working conditions, frequency transducer and opportunity to re-examination the animal (Barros and Visitn, 2001). In the current study, there were a high significant differences (P <0.01) in breeding rates and season of the year, while there was no significant differences in the daylight period (Tab. 3 and Fig. 2).

Table 3. The relationship between daylight duration and Number of breedings throughout the year

Season	Month	Day light (hours)	Rate of breeding (%)	Rate of breedings (%)
Spring	March	11.5	12	36.5
	April	12.5	11.6	
	May	13.4	12.9	
Summer	June	14.1	8.5	22.5
	July	14	8.2	
	August	13.1	5.8	
Autumn	September	12.1	5.1	24
	October	10.5	10	
	November	10.15	8.9	
Winter	December	10	5.5	17
	January	10.1	4.6	
	February	10.45	6.9	
-----	Total Rate of breeding	-----	100	100
------	Qi-square - χ^2	1.482 NS	17.482 **	-----

In our study, the increasing breeding rates of mares bred were during Spring season and lower through Winter season were 36.4%, 17%, respectively, These results coincided with Abdul-Rahman, (1986) who found that the Spring season was the highest incidence of breeding, while, Winter was lower of breeding rates. This refer to managemental reasons, mares are programmed to start being reproductively active in the Spring and Autumn when moderate temperatures and abundance of forage, this strategy ensures birth of offspring at a time of year that is optimal for their survival and thereafter will make supporting a foal easier and less

stressful for the mare and foal. However, this may be due to the differences in management technique and environmental factors (Salazar-Ortiz *et al*., 2011). The stimulatory effect of daylight oscillation and nutrition on the onset of the breeding season was constant with previous studies (Al-Diwan *et al*., 1990 ; van Niekerk and van Niekerk , 1997), this agree with the results of the current study. The findings of our study disagree with Ju *et al*., (2002) found that the breeding season was in March through October. This discrepancy may be related to a managemental factor and breeds of animals.



(P<0.01) **. NS: non-significant

Fig. 2. The relation between daylight duration and Number of breedings throughout the year

Therefore, it can be concluded that season of the year together with duration of daylight showed a significant effect on incidence of heat in mares and the use of trans-rectal ultrasound for pregnancy diagnosis in mares can be assessed quickly and reliably under field conditions from thirty-first day of gestation onward.

REFERENCES

Abdul-Rahman, L. Y. 1986. Study of estrous cycle in Arabian Mares in Iraq. M. Sc. Thesis, Dept. of Vet. Obstetrics, Coll. of Vet. Med., Baghdad University.

Al-Diwan, M., A. Yheia and A. F. Hassan. 1990. Some aspect of reproductive performance of Arabian horses. *Basrah J. Agric. Sci.,* 3(1): 13-22.

Al-Timimi, R. I. 2012. Study of various aspects of estrous cycles in Mares during winter in Iraq. M.Sc. Thesis, Dept. of Vet. Obstetrics, Coll. of Vet. Med., Baghdad University.

Badtram, G. A., J. D. Gaines, C. B. Thomas and W. T. K. Bosu. 1991. Factors influencing the accuracy of early pregnancy detection in cattle by real-time ultrasound scanning of the uterus. *Theriogenology,* 35(6): 1153-1167.

Barros, B. P. and J. A. Visintin. 2001. Control ultrasound pregnancies, embryonic and fetal mortality of sex of fetuses and zebu cattle. *Braz. J. Vet. Res. Anim. Sci.,* 38(2).

Blanchard, T. L., D. D. Varner, J. Schumacher, C. C. Love, S. P. Brinsko and S. L. Rigby. 2003. Reproductive Physiology of the Non-pregnant Mare. In: Manual of Equine Reproduction. Mosby. 2nd ed. 9-15.

Boyd, J. S. and S. N. Omran. 1991. Diagnostic ultrasonography of the bovine female reproductive tract. *Practice,* 13(3): 109-118.

Gentry, L. R., D. L. Thompson, G. T. Gentry, K. A. Davis, R. A. Godke and J. A. Cartmill. 2002. The relationship between body condition, leptin, and reproductive and hormonal characteristics of mares during the seasonal anovulatory period. *J. Anim. Sci.,* 80: 2695-2703.

Ginther, O. J., E. L. Gastal, M. O. Gastal and M. A. Beg. 2005. Regulation of circulating gonadotropins by the negative effects of ovarian hormones in mares. *Biology of Reproduction,* 73: 315-323.

Hafez, E. S. E. and B. Hafez. 2000. Horses. *In*: Hafez, E. S. E. and B. Hafez. "Reproduction in farm animals", Lippincott William and Wilkins. 7th ed. Pp: 192-217.

Hughes, J. P., G. H. Stabenfeldt and J. W. Evans. 1975. The estrous cycle of the mare. *J. Reprod. Fertil. Suppl.,* 23: 161-166.

Ju, J. C., H. C. Peh, J. C. Hsu, S. P. Cheng, S. C. Chiu and Y. K. Fan. 2002. The reproductive characteristics of the Mare in subtropical Taiwan. Asian-Aust. *J. Anim. Sci.,* 15(4): 494-499.

Medan, M. S. and A. M. Abd El-Aty. 2010. Advances in ultrasonography and its applications in domestic ruminants and other farm animals reproduction. *J. Advanced Res.,* 1(2): 123-128.

Nagy, P., D. Guillaume and P. Daels. 2000. Seasonality in mares. *Anim. Reprod. Sci.,* 60-61: 245-262.

Paccamonti, D. and J. Pycock. 2009. Infertility and subfertility in the mare. *In*: Noakes, D. E., Parkinson, T. J. and England, G. C. W. (Ed.). Veterinary Reproduction and Obstetrics. Saunders Co.9th ed. pp: 582-631.

Palmer, E. and M. A. Driancourt. 1980. Use of ultrasonic echography in equine gynecology. *Theriogenology*, 13(3): 203-216.

Panthan, M. M. and Z. A. Pampori. 2011. Real-Time ultrasonography as a diagnostic tool in Bovine Reproduction. *Vet. Scan veterinary journal*, 6(2): 88.

Pycock, J. F. 2007. Pregnant Diagnosis in the Mare. *In*: Samper, J. C., Pycock, J. F. and McKinnon, A. O. (Edit.). Current Therapy in Equine Reproduction. Saunders Elsevier, Pp: 335-342.

Reef, V. B. 1991. The use of diagnostic ultrasound in the horse. Ultrasound Quarterly, 9(1): 1-34.

Salazar-Ortiz, J., S. Camous, C. Briant, L. Lardic, D. Chesneau and D. Guillaume. 2011. Effects of nutritional cues on the duration of the winter anovulatory phase and on associated hormone levels in adult female Welsh pony horses (Equus caballus). *Reprod. Bio. and Endocrinology*, 9: 130.

SAS. 2004. SAS/STAT User's Guide for personal computers. Release 7th ed. O. SAS. Institute Inc., Cary. NC., USA. (SAS: Statistical Analysis System).

Sertich, P. L. 2007. Pregnancy evaluation in the mare. In: R. S. Youngquist and W. R. Threlfall (Ed.). Current therapy in large animal Theriogenology. Saunders Elsevier. 2nd ed.: 99-106.

Stanton, M. B., J. V. Steiner and D. G. Pugh. 2004. Endometrial cysts in the mare. *J. of Equine Vet. Sci.*, 24(1): 14-19.

Stout, T. A. E. 2009. The early pregnancy. In: "Equine breeding management and artificial insemination". Samper, J. C. (Ed.). Saunders Elsevier. 2nd (ed). Pp: 223-239.

Van Ittersum, A. R. 1999. The electrosurgical treatment of endometrial cysts in the mare. Tijdschr Dierqeneeskd, 124(21): 630-633.

Van Niekerk, F. E. and C. H. van Niekerk. 1997. The effect of dietary protein on reproduction in the mare. III. Ovarian and uterine changes during the anovulatory, transitional and ovulatory periods in the non-pregnant mare. *J. S. Afr. Vet. Assoc.*, 68(3): 86-92.

استخدام الموجات فوق الصوتية للكشف عن الكفاءة التناسلية للافراس خلال أشهر السنة في العراق

ياسين محمود رشيد[1،2] **سلمان حمادي غريب[1]**

[1] فرع الجراحة والتوليد- كلية الطب البيطري- جامعة ديالى، العراق

[2] المسؤول عن النشر: dr.yaseen73@gmail.com

المستخلص

هدفت الدراسة الحالية الى تحديد تأثير مواسم السنة في بعض اوجة التكاثر في الافراس في العراق. شملت الدراسة سبعين فرسا من سلالات مختلفة (العربية والهجينة والثوروبريد) تراوحت اعمارها بين (4-14) سنة. أجريت الدراسة في نادي الفروسية في العامرية- بغداد. تم تشخيص الحمل في الافراس باستخدام تقنية الموجات فوق الصوتية عبر المستقيم مع مجس مستقيمي ذو تردد 5 ميغاهيرتز (MHz) خلال الفترة (10-40) يوما بعد التسفيد واعتبر أخر تسفيد هو يوم الصفر. أشارت الدراسه الى ارتفاع عدد الأفراس المسفدة خلال موسم الربيع مقارنه بالمواسم الاخرى مع وجود فارق معنوي عالٍ ($P<0.01$) بين أشهر السنة وعدد الأفراس المسفدة. اظهرت نتائج الفحص بالموجات فوت الصوتيه للحويصلة الجنينية أن مدة 31-35 يوما من الحمل هي الاعلى دقة مقارنة بمدد الحمل الاخرى. وأخيرا، كانت نسبة الحمل في اعلى قيمها خلال فصل الربيع مع وجود فارق معنوي عال ($P< 0.01$) بين الأفراس الحوامل وغير الحوامل وأشهر السنة.

نستنتج من الدراسة الحالية أن هناك تاثيراً واضحاً لمواسم السنة مع فترة الاضاءة خلال اليوم في حدوث الشبق في الافراس فضلا عن امكانية أستخدام تقنية الموجات فوق الصوتية عبر المستقيم لتشخيص الحمل في الأفراس والتي تعد طريقة سريعة التقدير وموثوقة في الظروف الحقلية ومن الفترة الحادي والثلاثون يوما من الحمل فصاعدا.

الكلمات المفتاحية: الافراس، الموجات فوق الصوتية، فترة الاضاءة، الموسم.