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The Effects of Lactation and Body Condition Score Changes on Embryonic Death Rates in KWPN Mares

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Abstract
Embryonic deaths (ED) are one of the most important economic losses in breeding mares. Energy deficit and hormonal changes in the lactating mare is expected to increase the incidence of embryonic deaths. In this study, it was aimed to investigate the liability of ED from lactation and body condition score changes during breeding season in KWPN (Koninklijk Warmbloed Paard Nederland) mares, on which there are a limited number of studies about the reproductive properties in this breed. At the onset of reproductive activity inception in lactation, average body condition score (BCS) was 7.44 ± 0.24, until the second estrous cycle postpartum it was decreased (6.89 ± 0.20), and by the end of the breeding season upward tendency (6.96 ± 0.18) was observed. In the non-lactating mares the average BCS was 6.33 ± 0.21, continuously rising until the end of the breeding season (7.17 ± 0.31). The rate of embryonic deaths were 25.58% in lactating mares (11/43). In the non-lactating mares, total of 16 pregnancies were recorded in any of the embryonic mortality was observed. As a result, the decrease in embryonic death occurred in body weight and BCS, depending on the energy loss in lactating KWPN mares was concluded to be remarkable factors with increasing incidence. Therefore the reproductive status of the mares in the generative approach has been demonstrated that a strategy should be kept in mind strongly.

Keywords: Mare, embryonic death, lactation, fertility.

INTRODUCTION

Embryonic deaths (ED), which result from certain factors related to the first 40 days of pregnancy, are one of the most important causes of economic loss in the equine industry since they require re-insemination or reduce the foal production in mares (Pycock, 2001). The rate of ED's are ranged from 2.5 to 25 % in mares, (Samper et al., 2007), and they predominantly occurred before the 35th day of the pregnancy (Villahoz et al., 1985). The factors that lead to ED are classified into three groups as intrinsic (luteal insufficiency, age, endometrial diseases, lactation and insemination time), extrinsic (stress, nutrition, season, transrectal palpation and factors related to the stallion) and embryonic (chromosomal anomalies) (Samper et al., 2007; Yang & Cho, 2007). It is reported that the decrease in the progesterone level (Allen, 2001), age progression (Hemberg et al. 2004; Morel et al., 2005), and endometrial cysts (Stanton et al., 2004; Samper et al., 2007) increase the rates of ED in lactation period (Morris and Allen, 2002; Heidler et al., 2004; Newcombe and Wilson, 2005; Dirk, 2008). Van Niekerk and van Niekerk (1998) pointed out to low progesterone levels as the possible cause of EDs that occur in lactating mares in early pregnancy period. Researchers attributed this to the problems that arise in corpora lutea development or continuity as a result of low circulatory levels in lactating mares. Dirk (2008) maintains that the energy gap in the lactation period and hormonal and metabolic changes coexisting with lactation could raise the incidence of ED. However, there are a limited number of studies conducted in this subject.

This study aims to present some effects of lactation period and body condition score (BCS) changes on ED in KWPN (Koninklijk Warmbloed Paard Nederland) mares,to identify the differences between lactating and non-lactating mares and to provide a new insight putting emphasis on the reproductive status into the reproduction methods in equine industry.

MATERIALS AND METHODS

Animals and Study Groups

The present study was conducted in the Southern Marmara region of Turkey. This study was carried out during four breeding seasons on 20 KWPN mares which did not have any contagious diseases between the ages of 6-10, with mean body weight of 642.40±25.48 kg and with BCS ranging between 6 to 8 in Turkish Military Veterinary School. All mares were housed in the same building under identical environmental and nutritional conditions.

In this study, the mares were divided into two groups according to their reproductive status. Group I (n=20) consisted of lactating mares, which conceived one year ago and went through a normal pregnancy period (normal delivery, no postpartum gynaecological and metabolic disorders). Group II (n=14) was formed based on the data collected about non-lactating mares, which were either not bred or did not become pregnant previous year. No artificial lightening was performed and no hormonal application was conducted in order to activate the ovarian activity during the study.

Study design and clinical examinations

Electronic scale was used to determine body weight changes in mares. Body condition scores were determined as of February, the onset of breeding seasons (15th February), until the 60th day of the pregnancy in mares

whichconceived and until the end of breeding season (15th July) in those which did not conceived at every 15 days in line with the method by Henneke et al. (1984) through visual evaluation and grading the fatty tissue of the horse that can be palpated from 1 (excessively thin) to 9 (excessively fatty) subjectively by two different researchers.

Rectal palpation and B–Mode real-time, 5 MHz linear probe transrectal ultrasonography (AGROSCAN AL, FRANCE) and teasing method (Gorecka et al., 2005) were performed daily in lactating mares following foal heat and in non-lactating mares starting from the seven days after the preceding ovulation until the next ovulation for oestrous cycle follow-up. In the study, bred by natural cover was performed every two days upon detection of ≥ 35 mm follicles in the ovaries of the mares until ovulation occurs. In all bred by natural cover procedures, two fertile KWPN stallions which were regularly tested for andrological condition (sperm density was at least $150x10^6$, and motility was at least 70%) were used. The pregnancy examinations were performed with transrectal ultrasonography for the first time 14 days after ovulation in oestrous cycles. The mares which were found to be pregnant were examined again on days 24-27, 33-35, and 60 with the aim of monitoring pregnancy status, embryonic development, twin pregnancy, and embryonic death.

In the ultrasonography examination, pregnancies in which malformed embryonic pouch, echogenic illumination of liquid pouch, prolonged movement of the embryonic pouch and abnormal endometrial fluid collection by days were visualized and in which no heartbeat was heard after 30th day of the pregnancy were accepted as ED (Carnevale et al., 2000).

Ethics committee approval

The study was approved by Ondokuz Mayıs University Local Ethics Committee for Animal Experiments with approval number HADYEK/32.

Statistical Evaluation

The significance of the difference between the study groups was analysed with SPSS package programme (version 16.0) using basic statistical methods and appropriate test statistics (ANOVA, ChiSquare, Student T-Test, Wilcoxon Test, Mann Whitney U Test). The data were given as mean and standard error.

RESULTS

In Group I, it was identified that mean body weight (690.00±5.72 kg) was higher than Group II (605.17±12.90kg) (P<0.001). In the mares which foaled, post-partum mean body weight loss was found as 87.38±1.26 kg. Following delivery, no statistical difference was detected between Groups I (649.78±5.56 kg) and Group II (631.33±9.85 kg) mean body weights. Although it was seen that the rate was approximate to mean body weights of the groups at the end of the breeding season (662.83±4.83; 676.75±13.11 kg), the measurements indicated body weight loss in some lactating mares, no body weight loss was found in non-lactating mares in any measurement. In the study, it was observed in lactating mares that at the beginning of breeding activity follow-up, BCS (7.44±0.24) decreased until second post-partum oestrous cycle (6.89±0.20) and increased again until the end of the breeding season (6.96±0.18). In non-lactating mares, it was observed that at the beginning of breeding activity mean BCS was (6.33±0.21) continuously increased until the end of breeding season (7.17±0,31) (Table 1).

Table 1. Body Condition Score profiles and reproductive outcomes of lactating (Group 1) and non-lactating (Group2) mares in various breeding seasons. LM: Lactating mares, NLM: Non-lactating mares.

Results		Group I (LM)	Group II (NLM)
Body Condition Score profiles	Starting of Breeding Season	7.44±0.24	6.33±0.21
	2nd Estrus Cycle	6.89±0.20	6.83±0.16
	End of breeding season	6.96±0.18	7.17±0.31
Pregancy rates	Positive	50 (74.63 %)	21 (75.00 %)
	Negative	17 (25.37 %)	7 (25.00 %)
	Number of overall mating cycles	67	28
Embryonic death rates (*P* <0,05)		11 (25.58 %)	N/A
Localization of embryonic death (P>0.05)	Same uterine horn	6 of 19	N/A
	Opposite uterine horn	5 of 24	N/A
Distribution of embryonic deaths according to stallions used for mating	Stallion A	7 of 36	
	Stallion B	4 of 23	

In the study, it was found that the pregnancy rates were similar in Group I and II (74.63% and 75%). From these pregnancy rates that were recorded throughout four seasons, 2 abortions and 5 twin pregnancies seen in Group I and 1 abortion and 4 twin pregnancies seen in Group II were not included in the mean score in order for the data on ED not to change the normal distribution. In the study, while 25.58 % (11/43) ED was observed in the cycles following foal heat in Group I, no ED was observed in any of the 16 pregnancies in Group II. It was observed that of a total of 11 ED, 2 of them (18%) occurred on days 14-23, 4 of them (36%) occurred on days 24-27, 5 of them (46%) occurred on day 28-35.

The ED was seen with a higher rate in case that a pregnancy occurs in the uterine horn where the preceding pregnancy developed a year ago in the lactating KWPN mares. In the study, from the factors that could influence the ED in lactating KWPN mares, the age of the mare, the stallion used in insemination, the months of breeding seasons and breeding season were found statistically insignificant.

DISCUSSION

It is reported that the rate of ED increase as the bodyweight decreases in the early periods of the pregnancy in mares (Ashworth, 1994; Newcombe, 2000). A continuous body weight loss was reported in the first two weeks of the lactation period and then increase after pregnancy and in mares (Heidler et al., 2004, Deichsel and Aurich, 2005). In the study, it was seen that the mean body weight in the lactating group was 14% higher compared with the non-lactating mares (P<0.001). It was reported that this difference resulted from the weight of mares and the amniotic fluid, which are the physiological outcomes of the

pregnancy (Brinsko et al., 2010). In the study, no statistical difference was detected between the mean body weight at the beginning and end of the breeding season in both groups while post-partum mean body weight loss was found as 87.38±1.26 kg. It was seen that these findings are similar to the findings by the researchers who state that lactation does not result in a significant body weight loss in the mares (Doreau et al 1988; Heidler et al., 2004). In the study by Newcombe and Wilson (2005) who reported the contrary, it was found that the ED rate in parallel with body weight loss in the lactating mares was higher (31.4% vs 15.4%) and this was attributed to the body weight changes that occurred. It was reported that this difference in the body weight gain in the lactating mares might be resulting from the energy gap due to lactation (Doreau et al., 1990).

In this study, it was concluded that the body weight loss detected in some lactating mares in line with the findings by Heidler et al. (2004) despite the diet prepared taking the reproductive status into the consideration and the lower rates of body weight increase in the lactating mares at the early pregnancy period, consistent with the findings by Newcombe and Wilson (2005), are the potential factors that could trigger ED.

Number of studies reported that the ED are increase rates in the mares during lactation (England, 1996; Van Niekerk and van Niekerk, 1998; Morris & Allen, 2002; Heidler et al., 2004; Newcombe and Wilson, 2005; Dirk, 2008), some studies reported the contrary are available as well (Hemberg et al., 2004 and Yang & Cho, 2007). In this study, while ED was seen 11 out of 43 pregnancy (25.58%) which conceived following the cycles after foal heat, no ED was seen in any of 16 non-lactating mares. This finding is in parallel with the studies revealing that ED rates are affected from lactation. A previous study (England, 1996) suggested that the ED rate in the mares in which the preceding pregnancy developed in the same horn a year ago is two folds of the pregnancies developed in a different uterine horns. Also, England (1996) attributes the high rate of ED in lactating mares to the adverse effect of a new pregnancy in the uterine horns where another pregnancy developed a year ago on the embryonic development. Newcombe (2000) also obtained similar findings. In this study, consistent with England (1996) and Newcombe (2000), it was observed that the rate of ED in the pregnancies developed in same uterine horn with the preceding pregnancy is 1.5 folds of the pregnancies that developed in a different uterus horn in lactating KWPN mares.

Newcombe and Wilson (2005) associated the high level of ED in lactating mares with the negative impact of energy gap that arose out of lactation on body weight. Similarly, in this study, consistent with findings by Newcombe and Wilson (2005), while no body weight loss was observed in non-lactating KWPN mares, body weight was decreased in some lactating KWPN mares by the measurements performed during the breeding seasons. Additionally in this study, It was found that the rate of body weight increase between 0-60 days of pregnancy was lower in lactating KWPN mares compared to non-lactating mares.

Also, another significant finding in our study was ED occurred in 2 out of 4 mares (50%) which were bred and became pregnant at the end of lactational anoestrus period. This finding is in parallel with the study by Nagy et al. (1998) who reported that ED rates are high in the mares which were bred and became pregnant in the cycles in which luteal activity lasted longer than normal. Although the findings of the studies by Hemberg et al. (2004) and Yang & Cho (2007) suggested that ED rates are lower in lactating mares compared with the non-lactating mares and revealed a large majority of the non-lactating mares experienced chronic infertility problems. Similarly, the study by Yang & Cho (2007) associated the higher rate of ED in non-lactating mares than the lactating mares with this reason. Besides, the studies which investigated the effect of lactation on the ED presented that embryonic deaths were not related to the age of the mares and any specific month of breeding season (Morris and Allen, 2002; Hemberg et al., 2004; Yang and Cho, 2007). Consistent with these findings, no statistically significant correlation was found between the age of mares, stallions used for mating, breeding season months and years in this study.

Although prostaglandin secretion varied according to the oestrous cycle stages in mares, the sensitivity of endometrial response to oxytocin and prostaglandin secretion capacity can be estimated. Oxytocin receptor concentration of mare endometrium reaches 25-30 % maximally during luteolysis (Starbuck et al., 1998; Sharp et al. 1997). Additionally, when bonded to the membrane receptors in combination with G proteins, oxytocin activates the prostaglandin synthesis (Gimpl and Fahrenholz, 2001).In this study, it can be concluded that uterus status, which is required for implantation due to impact of pulsatile oxytocin secretion of in lactating mares, is not sufficient under the negative influence of the prostaglandins secreted.

Consequently, it has been concluded that the decrease in the body weight and BCS in lactating KWPN and lower rates of body weight gains in the early period of pregnancy as a result of energy loss, conception at the end of lactational anoestrus and development of pregnancy in the same uterus horn where the preceding pregnancy developed previous year are the factors that contribute to the incidence of ED rates in lactating mares. Therefore, reproductive status should definitely be taken into consideration in the reproduction strategy approaches in KWPN mares

References

Allen WR. Luteal deficiency and embryo mortality in the mare. Reprod Dom Anim. 2001; 36: 121–131.

Ashworth CJ. Embryonic mortality in Domestic Species. First Edition, Boca Raton, CRC Press. 1994; 182–183.

Brinsko SP, Blanchard TL, Varner DD, Schumacher J, Love CC, Hinrichs K, Hartman D. 2010; Manual of equine reproduction. Third edition, Mosby Elsevier. 124–128.

Carnevale EM, Ramirez RJ, Squires EL, Alvarenga MA, Vanderwall DK, Mc Cue PM. 2000. Factors affecting pregnancy rates and early embryonic death after equine embryo transfer. Theriogenology, 54: 965–979.

Deichsel K, Aurich J. 2005. Lactation and lactational effects on metabolism and reproduction in the horse mare. Livestock Production Science. ; 98: 25–30.

Dirk KV. 2008. Early Embryonic Loss in the Mare. Journal of Equine Veterinary Science. 28: 691–702.

Doreau M, Martin–Rosset W, Boulot S. 1988. Energy requirements and the feeding of mares during lactation: a review. Livestock Prod Sci. 20: 53–68.

Doreau M, Boulot S, Barlet JP, Patureau–Mirand P. 1990. Yield and composition of milk from lactating mares: effect of lactation stage and individual differences. J Dairy Res. 57: 449–454.

England GCW. 1996. Allen's Fertility and Obsterics in the Horse. First Edition, Oxford, Blackwell Publishing Company.; 48–56.

Gastal MO, Gastal EL, Spinelli V, Ginther OJ. 2000. Body condition influences diameter of the ovulatory follicle in mares. Biol Reprod.; 62: 222.

Gentry LR, Thompson DL, Gentry GT, Del Vecchio RP, Davis KA, Del Vecchio PM. 2004. The relationship between body condition score and ultrasonic fat measurements in mares of high versus low body condition. J Equine Vet Sci, 24:198–203.

Gimpl, G, Fahrenholz, F. 2001 The oxytocin receptor system: structure,function, and regulation. Physiol. Rev. 81, 629–683.

Godoi DB, Gastal EL, Gastal MO. 2002. A comparative study of folliculer dynamics between lactating and non-lactating mares: effect of the body condition. Theriogenology, 58: 553–556.

Gorecka A, Jezierski TA, Słoniewski K. 2005. Relationships between sexual behaviour, dominant follicle area, uterus ultrasonic image and pregnancy rate in mares of two breeds differing in reproductive efficiency. Animal Reproduction Science , 87: 283–329.

Heidler B, Aurich JE, Pohl W, Aurich C.2004. Body weight of mares and foals, estrous cycles and plasma glucose concentration in lactating and non-lactating Lipizzaner mares. Theriogenology, 61: 883–893.

Hemberg E, Lundeheim N, Einarsson S. 2004. Reproductive performance of the thoroughbred mares in Sweden. Reprod Dom Anim, 39: 81–85.

Henneke DR, Potter GD, Kreider JL.1984. Body condition during pregnancy and lactation and reproductive efficiency of mares. Theriogenology, 21: 897–909.

Morel MCDG, Newcombe JR, Swindlehurst JC. 2005. The effect of age on multiple ovulation rates, multiple pregnancy rates and embrionic vesicle diameter in the mare.Theriogenology,63:2482–2493.

Morris LHA, Allen WR. 2002. Reproductive efficiency of intensively managed Thoroughbred mares in Newmarket. Equi Vet J, 34: 51–60.

Nagy P, Huszenicza GY, Juhhsz J, Kulcsfir M, Solti L, Reiczigel J, Abavhry K. 1998. Factors influencing ovarian activitiy and sexual behavior of postpartum mares under farm conditions. Theriogenology, 50: 1109–1119.

Newcombe JR. 2000. Embryonic loss and abnormalities of early pregnancy. Equine Veterinary Educatio, 12 (2): 88–101.

Newcombe JR, Wilson MC. Age, bodyweight, and pregnancy loss. J Equine Vet Sci. 2005; 25: 188–194.

Pycock J.2001. Infertility in the mare. In: Veterinary Reproduction and Obstetrics. First Edition, Philadelpia, WB Saunders ; 577–670.

Samper JC, Pycock CF, McKinnon AO.2007. Current Therapy in Equine Reproduction. First Edition, Missouri, WB Saunders; 335–342.

Sharp, D.C. Thatcher, M.J., Salute, M.E., Fuchs, A.R. 1997. Relationship between endometrial oxytocin receptors and oxytocininduced prostaglandin F2 alpha release during the oestrous cycle and early pregnancy in pony mares. J. Reprod. Fertil, 109, 137–144.

Stanton MB, Steiner JV, Pugh DG. 2004. Endometrial cysts in the mare. J Equine Vet Sci; 24: 14–19.

Starbuck GR, Stout TAE, Lamming GE, Allen WR, Flint, AP, 1998. Endometrial oxytocin receptor and uterine prostaglandin secretion in mares during the oestrous cycle and early pregnancy. J. Reprod. Fertil.;113, 173–179.

Van Niekerk CH, Van Niekerk FE. 1998. The effect of dietary protein on reproduction in the mare. VII. Embryonic development, early embryonic death, foetal losses and their relationship with serum progestagen. J S Afr Vet Assoc 69: 150–155.

Villahoz MD, 1985. Squires EL, Voss JL. Some observations on early embryonic death in mares. Theriogenology. 1985; 23: 915–924.

Yang GJ, Cho GJ. 2007. Factors concerning early embryonic death in Thotoughbred mares in South Korea. J Vet Med Sci, 69: 787–792.