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 (fetal 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.
which conceived and until the end of breeding season (15th July) in those which did not conceive 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 (AGROSSCAN 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 150x10⁶, 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 Mayis 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.**

<table>
<thead>
<tr>
<th>Body Condition Score profiles</th>
<th>Group I (LM)</th>
<th>Group II (NLM)</th>
</tr>
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<tbody>
<tr>
<td>Starting of Breeding Season</td>
<td>7.44±0.24</td>
<td>6.33±0.21</td>
</tr>
<tr>
<td>2nd Estrus Cycle</td>
<td>6.89±0.20</td>
<td>6.83±0.16</td>
</tr>
<tr>
<td>End of breeding season</td>
<td>6.96±0.18</td>
<td>7.17±0.31</td>
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<tr>
<th>Pregnancy rates</th>
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<tr>
<td>Positive</td>
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<tr>
<td>Negative</td>
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<th>Embryonic death rates (P&lt;0.05)</th>
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<tr>
<td>Same uterine horn</td>
</tr>
<tr>
<td>Opposite uterine horn</td>
</tr>
<tr>
<td>Stallion A</td>
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<tr>
<td>Stallion B</td>
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</table>

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
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


