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Original article

Late embryonic and foetal losses in eight dairy herds in north-east Poland

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Abstract

The information about the occurrence of embryonic and fetal losses in dairy herds in Poland is limited. Thus, the objective of this study was to assess the pregnancy loss between days 30 and 45 (late embryonic mortality) and between days 45 and 260 after artificial insemination (AI) (foetal loss). The study was carried out in 8 dairy herds in north-east Poland. In total 954 cows were examined for pregnancy on day 30 after AI using an ultrasound scanner. Cows diagnosed pregnant were re-examined on day 45 and 260 after AI using transrectal palpation. The pregnancy rate on day 30 after AI was 62.0%, after re-examination on day 45 after AI the pregnancy rate was 56.4%. The late embryonic loss rate was on an average 9.1%. The occurrence of late embryonic mortality differed not significantly ($p > 0.05$) among herds and ranged from 13.1% to 19.3%. The pregnancy rate on day 260 after AI was 53.5%. The average foetal loss after day 45 of pregnancy was 5.0%, ranged between herds from 0 to 9.2% ($p > 0.05$) and was significantly lower than embryonic loss rate ($p < 0.05$). The study revealed that in 8 dairy herds in north-east Poland the overall pregnancy loss between days 30 and 260 averaged 13.7% and therefore it is an important factor affecting economic efficiency of dairy production. The foetal loss was less prevalent than the late embryonic loss. Future strategies to minimizing late embryonic loss are needed.

Key words: dairy cows, late embryonic loss, foetal loss

Introduction

In past decades milk yield of cows has significantly increased. However, this increase in milk production has been accompanied by a decline in cow fertility (Lucy 2001, Diskin et al. 2006, Walsh et al. 2011). Embryonic and foetal losses are one of the major causes of reproductive failure (Peters 1996, Vasconcelos et al. 1997, Humblot 2002, Silke et al. 2002, Diskin and Morris 2008). Sreenan and Diskin (1986) calculated an embryonic and foetal mortality rate for high producing dairy cows of about 50%. Santos et al. (2004) suggested that pregnancy losses in dairy cattle from fertilization to term might represent up to 60%. The major component of embryo loss occurs before day 25 after fertilization (early embryonic mortality). Embryonic losses are classified as late embryonic mortality when occur between day 25 and 45 of gestation (Humblot 2002). Foetal losses are defined as pregnancy losses between days 45 and 260 of gestation (Forar et al. 1996).

The extent and pattern of late embryo loss can be established using repeated ultrasound scanning. In the recent years, there has been significant interest in the problem of late embryonic mortality (Silke et al. 2002, Horan et al. 2004, Santos et al. 2004) and foetal losses

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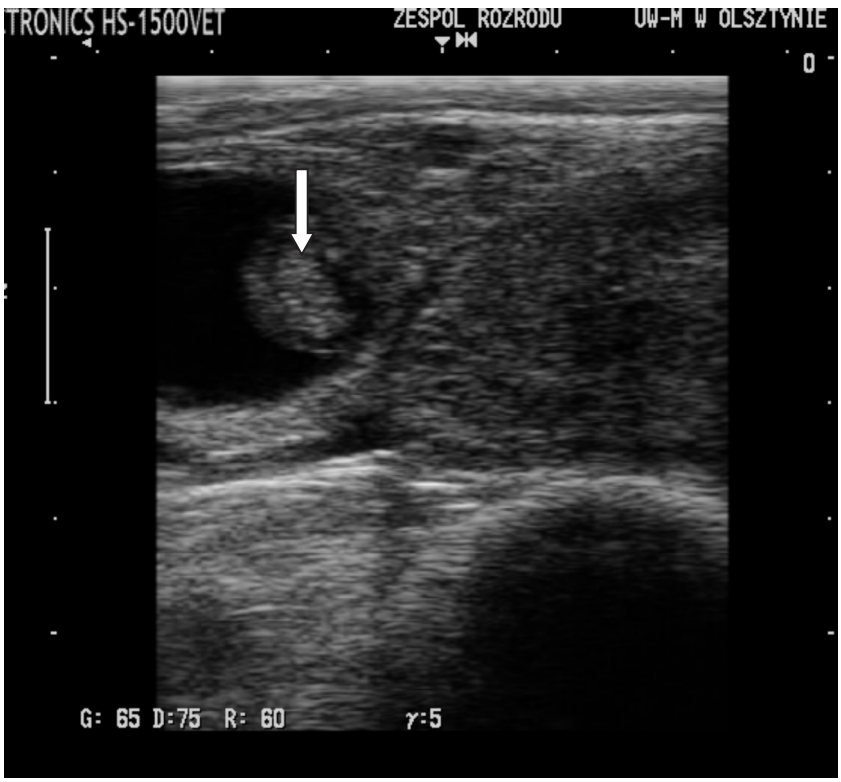

Fig. 1. Ultrasonogram of the uterus at day 30 after AI. The presence of an intact embryo (arrow) in the uterine lumen.

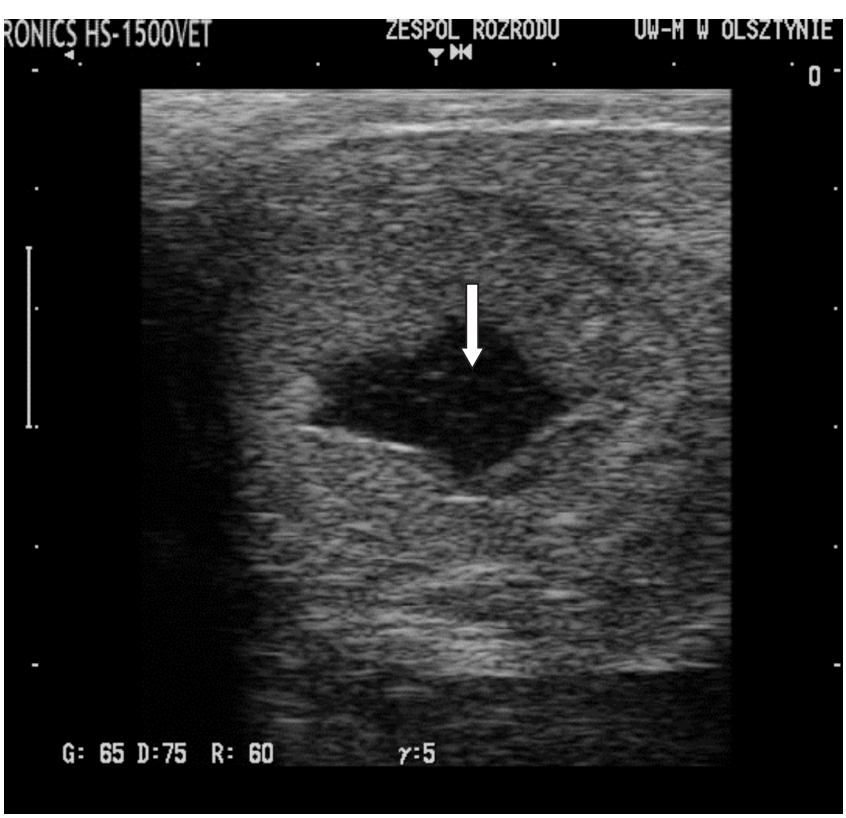

Fig. 2. Ultrasonogram of the uterus at day 30 after AI. Fluid (arrow) is present in the uterine lumen.

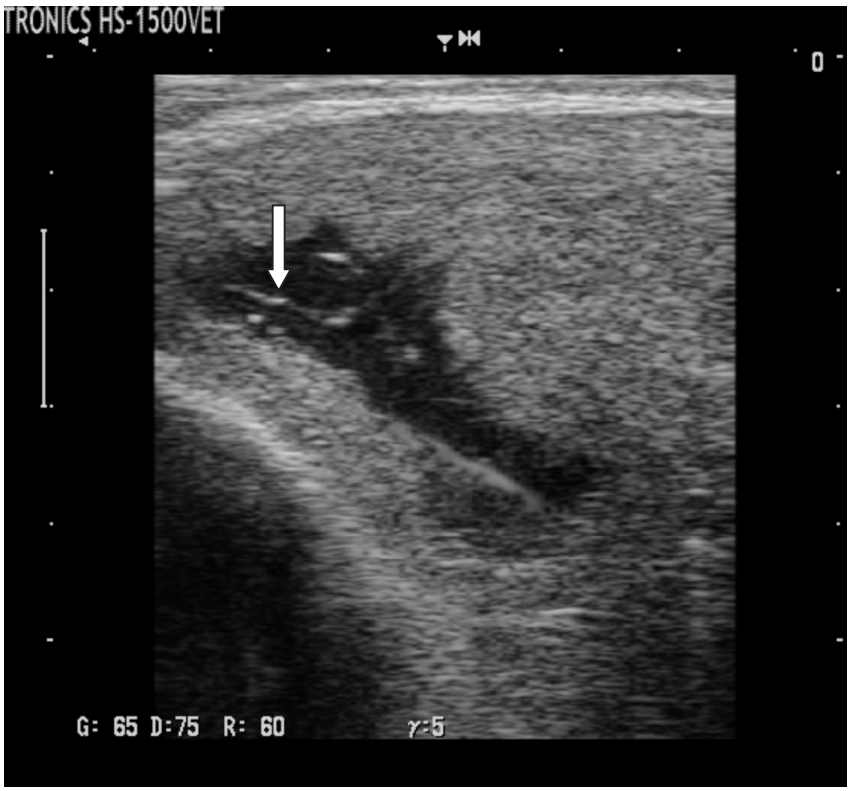

Fig. 3. Ultrasonogram of the uterus at day 30 after AI. The presence of allantochorion fragments (arrow) floating in a cloudy fluid.

in cows (Lopez-Gatius et al. 2002, Ettema and Santos 2004, Carpenter et al. 2006). However, the information about the occurrence of embryonic and foetal losses in dairy cows in Poland is limited. Barański et al. (2008) showed that the incidence of abortion in dairy herds was on average 4.0%. Thus, the objective of this study was to assess the pregnancy losses in dairy cows between days 30 and 45 after artificial insemination (AI) (late embryonic mortality) and between days 45 and 260 after AI (foetal loss).

Materials and Methods

The study was carried out on 954 Polish Holstein-Friesian cows in 8 dairy herds in north-east Poland. The average number of cows in the herds ranged from 60 to 200. Cows were housed in lose-type barns with cubicles and fed total mixed ration based on grass silage, maize silage and concentrate. The average milk yield was about 7000 kg per year. All cows were inseminated artificially by an experienced AI-technician. The animals were inseminated at the first oestrus occurring after 60 days post partum. Cows were examined for pregnancy on day 30 after AI using a portable ultrasound scanner Honda 1500 equipped with a 5 MHz linear-array transducer. Positive diagnosis of pregnancy was based on criteria of Kastelic et al. (1988) and included the presence of an viable embryo and a normal amount of chorioallantoic fluid (Fig. 1). Cows without an visualized embryo but with the presence of amniotic fluid (Fig. 2) and the corpus luteum, and cows with nonviable embryo or with signs of embryo degeneration (Fig. 3) were re-examined by transrectal ultrasonography 7 days later. Cows diagnosed pregnant were re-examined on day 45 and 260 after AI using transrectal palpation. Late embryonic loss was defined when pregnancy was absent at day 45 after AI in a cow previously diagnosed by ultrasonography as pregnant. The foetal loss between days 45 and 260 after AI was considered to have occurred when the cows were observed in oestrus and then diagnosed as nonpregnant, an expelled foetus or foetal membranes were observed or cow was diagnosed nonpregnant on day 260 after AI.

Differences between the total late embryonic and foetal losses as well as among herds were statistically analyzed using chi-square test (GraphPad PRISM, GraphPad Software Inc., Sand Diego, Ca, USA).

Results

The pregnancy rate on day 30 after AI was 62.0%, after re-examination on day 45 after AI the pregnancy rate was 56.4%. The late embryonic loss rate was on

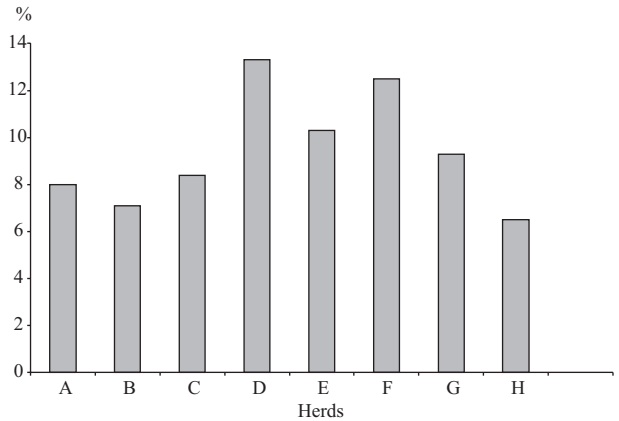

Fig. 4. Late embryonic loss between days 30 and 45 after AI in 8 dairy herds.

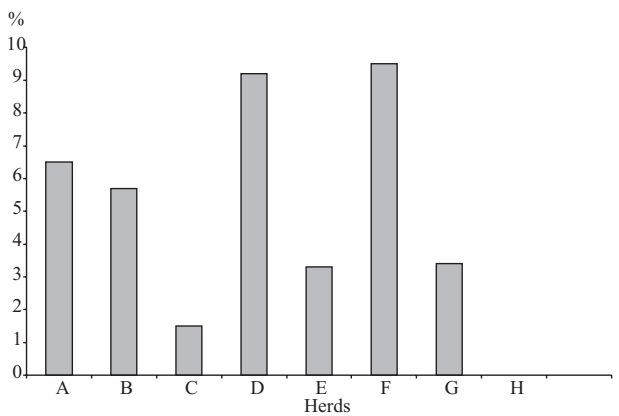

Fig. 5. Foetal loss between days 45 and 260 after AI in 8 dairy herds.

Table 1. Average pregnancy rates at day 30, 45, 260 after artificial insemination (AI) and pregnancy losses in 8 dairy herds.

Item	% (n/n)
Pregnancy rate at day 30 after AI	62.0 (592/954)
Pregnancy rate at day 45 after AI	56.4 (538/954)
Late embryo loss between day 30 and 45 after AI	9.1[a] (54/592)
Pregnancy rate at day 260 after AI	53.5 (511/954)
Foetal loss between days 45 and 260 after AI	5.0[b] (27/538)
Overall pregnancy loss between days 30 and 260 after AI	13.7 (81/592)

a, b – differences statistically significant at $p < 0.05$

an average 9.1% (Table 1). The occurrence of late embryonic mortality differed not significantly ($p > 0.05$) among herds and ranged from 13.1% to 19.3% (Fig. 4). The pregnancy rate on day 260 after AI was 53.5%. The foetal loss rate between days 45 and 260 of pregnancy was 5.0% and was significantly lower than late embryonic loss rate ($p < 0.05$; Table 1). The average foetal loss rate ranged between herds from 0 to 9.2% ($p > 0.05$; Fig. 5). Of the 27 foetal losses, 6 (22.2%) were abortions observed by the stockman, other 19 (77.8%) were detected on a follow-up examination on day 260 after AI.

The cumulative frequency of pregnancy loss between days 30 and 260 after AI was 13.7% (Table 1).

Discussion

The occurrence of late embryonic loss in 8 dairy herds from day 30 to 45 after AI was relatively high (9.1%). In cows managed on pasture based systems in Ireland, the late embryonic loss rate between days 28 and 42 was 3.2% (Silke et al. 2002). Using milk progesterone profile Horan et al. (2004) recorded a late embryonic loss rate of 7.5%. Based on six studies, estimates for late embryonic loss ranged between 8.0 and 17.5% (Humblot 2002). The rate of late embryonic loss is higher in high yielding cows than in moderate yielding cows. In intensively managed dairy herds yielding 11,000-12,000 kg of milk per lactation, the late embryonic loss rate was 20.2% (Vasconcelos et al. 1997).

In contrary, the foetal loss rate between days 45 and 260 was low at 5.0%, and agrees with previous report from Poland (Barański et al. 2008). In other countries the incidence of foetal losses after day 45 of pregnancy was reported to be about 10% (Szenci et al. 1998, Lopez-Gatius et al. 2002, Ettema and Santos 2004). However, in some studies foetal losses were higher, and they reached 15-20% (Markusfeld 1997, Carpenter et al. 2006). Only 22.2% of the foetal losses were detected by the stockman as expelled foetus or foetal membranes, which is consistent with the report of Forar et al. (1996). Forar et al. (1996) and Vasconcelos et al. (1997) found that the most of foetal losses occurred at the end of the first trimester of pregnancy. Due to small size of the foetuses at this time it is difficult for the stockman to note them.

The late embryonic loss rate was higher than foetal loss rate (9.1% versus 5.0% respectively) and this is in agreement with previous reports (Vasconcelos et al. 1997, Silke et al. 2002, Santos et al. 2004). It seems that the embryos are more susceptible to negative influence of nutritional, hormonal and environmental factors in comparison to foetuses after placentation.

In the present study the cumulative frequency of pregnancy loss between days 30 and 260 of 13.7% was higher than in previous reports. In the study of Paisley et al. (1978) the pregnancy loss rate between days 30 and 260 of gestation was 3.62%. Szenci et al. (1998) reported a pregnancy loss rate of 8.6% between day 27 of gestation and parturition and Forar et al. (1996) found a cumulative incidence of foetal loss of 10.8% between days 30 and 260 of gestation.

Several factors can affect pregnancy losses in cattle. They are categorized as genetic, physiological, endocrinological and environmental (for review, see Diskin and Morris 2008, Walsh et al. 2011). Environmental stressors, pathogenic agents, occurrence of diseases and some dietary ingredients are associated with the late embryonic and foetal losses. The causes of pregnancy losses are usually undetermined (Santos et al. 2004). The variation among herds can be attributed to differences in the factors affecting late embryonic and foetal loss. A herd effect on pregnancy losses due to managerial factors was previously reported (Thurmond and Picanso 1990, Thompson et al. 1994, Forar et al. 1996). In the present study nutrition and housing conditions in the herds were similar and there were no statistically significant differences in late embryonic loss and foetal loss rates between them.

The present study revealed that in 8 dairy herds in north-east Poland the overall pregnancy loss between days 30 and 260 averaged 13.7% and therefore it is an important factor affecting economic efficiency of dairy production. The foetal loss was less prevalent than late embryonic loss. Future strategies to minimizing late embryonic loss are needed.

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