

## **EFFECT OF SOME FACTORS ON TYPE OF CALVING AND PERIPARTURIENT DISORDERS IN DAIRY COWS**

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**Abstract.** The study was performed with Polish Holstein-Friesian cows (Black-and-White variety) in five farms located in the Kujawsko-Pomorskie province (364 cows in two free-stall barns, average milk yield of 7844 kg; 158 cows in three tie-stall barns, average milk yield of 7596 kg). The number of calves born, the housing system and the age of cows had a highly significant effect ( $P \leq 0.01$ ) on the type of calving, and a significant effect ( $P \leq 0.05$ ) on their production level. Single birth calvings were easier than twin birth calvings. Compared to single pregnancies, twin pregnancies were associated with a greater proportion of difficult and very difficult calvings (almost 3 and 16 times, respectively). In the free-stall system more calvings were assisted by one or more persons, while in the tie-stall system there were more normal but also very difficult parturitions that required veterinary assistance. Difficult and very difficult calvings accounted for 15.16% in heifers and 4.50% in cows. Compared to lower producing cows, parturitions of cows yielding > 7000 kg of milk were slightly more often classified as normal, but 3 times as often as difficult. Housing system had an effect on the incidence of periparturient disorders, which were more frequent in the free-stall system. Dairy cow breeders should give particular attention to the calvings of heifers and multiple pregnancies, because in such cases parturition is more often classified as difficult or very difficult. Inflammation of the udder was the greatest health concern postpartum, regardless of the housing system.

**Key words:** dairy cows, type of calving, periparturient disorders

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## INTRODUCTION

One aspect of breeding is successful herd reproduction and the associated course of parturition, which determines the delivery of live and healthy offspring. The incidence of birthing difficulties is influenced by factors such as age of cow [Tyczka 1998], breed and proper selection of animals for reproduction [Przybylska and Reklewski 1990], sex of calf [Skrzypek et al. 1993, Sawa et al. 2014], twin pregnancy [Kuźma and Kuźma 1994, Sawa et al. 2012, 2014], condition [Adamski and Kupczyński 2005]; environmental factors such as diet, housing system and microclimate; and human factors. Przysucha and Grodzki [2009] consider that the course of parturition is a complex process determined by different groups of factors and the predisposition of cows to calving ease is related to their body weight, anatomy of the genital tract, and hormonal mechanisms. Most fertility disorders arise from various periparturient abnormalities. Difficult parturitions were found to considerably increase the incidence of endometritis [Brzozowski 1990] or increase the frequency of endometritis and ovarian cysts by a factor of 2–3 [Małecki-Tepicht et al. 2000]. Gnyp [1993] showed that first calvers with a larger proportion of difficult parturitions are 1.5–2 times more susceptible to postpartum complications than easy calvers. Periparturient metabolic disorders and diseases in cows are among the most common diseases, affecting as much as one-third of the population [Erb and Gröhn 1988, Małecki-Tepicht et al. 2000]. Imbalanced diets during the dry period and in early lactation lead to diseases such as acidosis, ketosis, fat metabolism disorders, displacement and torsion of the abomasum, downer cow syndrome, and milk fever. All of them have a negative effect on uterine and ovarian activity, thus reducing the production and reproduction parameters [Kinal et al. 2003]. One of the most common complications during the postpartum period is placental retention [Skrzypek et al. 1994, Małecki-Tepicht et al. 2000], which largely contributes to acute or chronic inflammation of the endometrium. Abnormal mineral metabolism in cows may lead to milk fever, which favours the occurrence of mastitis, placental retention, ketosis and abomasal displacement [Erb and Gröhn 1988]. Udder inflammation often occurs postpartum. It is most often triggered by another disease such as downer cow syndrome, ketosis, placental retention. An animal's compromised immunity postpartum leaves the udder open to infection by microorganisms. Another risk factor for damage to the udder defence mechanism is relaxation of the teat sphincter due to subclinical hypocalcemia and high milk production postpartum [Empel et al. 1987]. Periparturient disorders cause breeders much concern. Because these diseases are interrelated, the occurrence of one disease contributes to the emergence of another.

The aim of the study was to analyse the effect of selected factors on the type of calving and incidence of periparturient disorders.

## **MATERIAL AND METHODS**

The study was performed with 522 Polish Holstein-Friesian cows (Black-and-White variety) in five farms located in the Kujawsko-Pomorskie province. In two herds, 364 cows were kept in the free-stall system, milked twice daily in a 2×7 herringbone milking parlour, and fed TMR diets based on maize silage and lucerne haylage. The cows yielded an average of 7844 kg milk. In three farms, 158 cows were maintained in the tie-tall system and fed traditionally on maize silage, forage, and grass and legume haylage. Average milk yield was 7596 kg. The cows were milked twice daily with a pipeline milking machine.

Data on the type of calving were retrieved from breeding records. Depending on the course of parturition, calvings were identified as normal (assisted by one person); difficult (assisted by several people); and very difficult (with veterinary assistance). Periparturient disorders were diagnosed by a veterinarian and documented in breeding records. The diseases were classified as placental retention, downer cow syndrome, cysts, abomasal torsion, ketosis, mastitis, metritis and uterine tumour, inactive ovaries.

Chi-square test [SAS, 2013] was used to analyse the incidence of different types of calving and periparturient disorders depending on the housing system (free-stall, tie-stall), milk production per lactation ( $\leq 7000$  kg,  $>7000$  kg), parity (1,  $>1$ ), season of calving (March–August, September–February). Sex of calf ( $\sigma$ ,  $\varphi$ ) and number of calves born (single, twin) were selected as experimental factors in evaluating the incidence of different types of calving, and type of calving in the case of periparturient disorders.

## **RESULTS AND DISCUSSION**

The results of the chi-square test show that the incidence of calving type varied according to the housing system, the number of calves born, the age of cows ( $P \leq 0.01$ ) and their milk production level ( $P \leq 0.05$ ) (Table 1). The factor that differentiated calving type the most was the number of calves born. Birthing difficulties increased for twin births, with the proportion of difficult and very difficult calvings being almost 3 and 16 times higher, respectively, compared to single pregnancies. Also other authors [Kuźma et al. 1994, Gaafara et al. 2011, Sawa et al. 2012, 2014] identify multiple pregnancies as factors having direct effects on the course of parturition. According to Sawa et al. [2014], difficult calvings (requiring a hard pull) and very difficult calvings (requiring medical assistance) accounted for from 4.31% (single pregnancy) to 6.48% (twin pregnancy) in heifers, and from 1.67% (single pregnancy) to 4.30% (twin pregnancy) in cows. Kuźma et al. [1994] reported that pregnancy losses, premature and difficult births are found in twin-

producing cows twice as often as in cows with single pregnancy, attributing it to a poorly balanced diet during the dry period. As is evident from the study of Gregory et al. [1990], incidence of assistance was 35% for twin-producing cows and 23% for single-calving cows. Gregory et al. [1996] concluded that assistance during twin births is needed twice as often as for single births, whereas most complications result from abnormal position of one or both fetuses.

Table 1. Incidence (%) of type of calving depending on selected factors

Tabela 1. Frekwencja (%) występowania określonego rodzaju porodu w obrębie wybranych czynników

Factor Czynnik	n	Type of calving – Rodzaj porodu			
		normal normalny	assisted by 1 person pomoc 1 osoby	difficult, assisted by several people ciężki pomoc kilku osób	very difficult, with veterinary assistance bardzo ciężki pomoc lekarza weterynarii
Housing system System utrzymania		Chi <sup>2</sup> = 14.85**			
– free-stall – wolnostanowiskowy	364	24.18	67.03	7.42	1.37
– tie-stall – uwięziowy	158	38.61	52.53	5.70	3.16
Production level Poziom produkcji		Chi <sup>2</sup> = 7.56*			
≤ 7000 kg	163	25.15	69.33	3.07	2.45
> 7000 kg	234	29.91	58.97	8.97	2.14
Next lactation Kolejna laktacja		Chi <sup>2</sup> = 21.67**			
primiparous cows pierwiastki	211	22.27	62.56	11.37	3.79
multiparous cows wieloródki	311	32.80	62.70	3.86	0.64
Calving season Sezon wycielenia		Chi <sup>2</sup> = 4.24			
March – August Marzec – sierpień	269	29.00	60.59	8.92	1.49
September – February Wrzesień – luty	253	28.06	64.82	4.74	2.37
Sex of calf Płeć cielęcia		Chi <sup>2</sup> = 3.58			
♀	218	32.11	62.39	4.59	0.92
♂	223	25.56	66.82	7.17	0.45
No. of calves born Liczba urodzonych cieląt		Chi <sup>2</sup> = 42.50**			
– single – pojedyncze	441	28.80	64.63	5.90	0.68
– twin – bliźnięta	62	16.13	56.45	16.13	11.29

\*\* – significant differences at  $P \leq 0.01$ ; \* – significant differences at  $P \leq 0.05$ .

\*\* – różnice istotne dla  $P \leq 0,01$ ; \* – różnice istotne dla  $P \leq 0,05$ .

The proportion of calvings requiring the assistance of one or several people was greater in free-stall barns compared to the tie-stall system, where normal and very difficult calvings requiring veterinary assistance were more frequent. Sakowski et al. [1989] reported a significant effect of the housing system on the course of parturition, observing an increased number of difficult and very difficult calvings in large commercial farms using the free-stall system. Chociłowicz et al. [2010], for tethered cows, observed only easy spontaneous calvings and calvings assisted by one person. According to Czerniawska-Piątkowska [2008], cows kept in the free-stall system had easier calvings.

Heifers had a greater proportion of difficult and very difficult calvings (77.73% required calving assistance), whereas cows had a greater proportion of normal parturitions (by 10.53%). Many authors implicate the number of calvings as one of the causes of birthing difficulties [Tyczka 1998, Nogalski et al. 2001, Gaafar et al. 2011]. Nogalski et al. [2001] and Tyczka [1998] noted that over 50% of the heifers required birthing assistance.

As milk yield increased, so did the proportion of normal and difficult calvings, while the proportion of calvings assisted by one person decreased. According to Erb and Gröhn [1988], higher productivity in animals is associated with an increase in calving complications. Conversely, Skrzypek et al. [1994] demonstrated a negative correlation between milk yield and incidence of difficult calvings.

Season of the year in which calving occurred had no significant effect on the type of calving. However, spring and summer calvers, compared to autumn- and winter-calving cows, had higher proportions of difficult parturitions (8.92 vs. 4.74%), parturitions assisted by one person (by 4.23%) and very difficult parturitions (by 0.88%).

Sex of calf did not have a significant effect on the course of calving and there was only a tendency for increased proportion of difficult and very difficult calvings when bulls were born. In turn, Skrzypek et al. [1993] and Nogalski [2004] found sex of calf to have a significant effect on the course of parturition, with bull calves producing more calving complications than heifer calves.

The incidence of periparturient disorders was highly significantly affected by the housing system and the type of calving, and significantly by parity (Table 2). A greater proportion of the cows exhibited no periparturient disorders under the tie-stall system (65.93%) compared to the free-stall system (47.91%). Adamski and Kupczyński [2005], Saba et al. [1990] and Twardoń et al. [2002] conclude that 90% of periparturient diseases are determined by numerous environmental factors, namely the way animals are housed, fed and cared for.

The greatest health concern after parturition was udder inflammation, with more cases of mastitis being found for cows from free-stall compared to tie-stall barns. According to Sawa [2004] and Miciński et al. [2011], free-stall housing of

Table 2. Incidence (%) of periparturient disorders depending on selected factors

Tabela 2. Częstość (%) występowania zaburzeń okołoporodowych w zależności od wybranych czynników

Factor Czynnik	n	Periparturient disorders – Zaburzenia okresu okołoporodowego								
		None found Nie stwierdzono	Placental retention Zatrzymanie łożyska	Downer syndrome Zaleganie poporodowe	Cysts Cysty	Abomasal torsion Skręt trawieńca	Ketosis Ketoza	Mastitis Mastitis	Metritis, uterine tumour Zapalenie macicy i guz	Inactive ovaries Nieczynność jajników
Housing system System utrzymania		Chi <sup>2</sup> = 23.35**								
– free-stall – wolnostanowiskowy	311	47.91	5.47	1.93	6.43	0.64	3.22	29.26	4.18	0.96
– tie-stall – uwięziowy	135	65.93	4.44	4.44	5.19	0.74	4.44	12.59	0.74	1.48
Production level Poziom produkcji		Chi <sup>2</sup> = 13.34								
≤ 7000 kg	163	53.85	3.21	3.85	6.41	1.92	5.77	21.79	1.28	1.92
> 7000 kg	234	50.72	5.26	1.91	7.66	0	2.39	26.79	4.31	0.96
Next lactation Kolejna laktacja		Chi <sup>2</sup> = 13.92*								
– primiparous cows – pierwiastki	162	60.49	6.17	1.23	4.32	0.62	3.70	17.28	4.94	1.23
– multiparous cows – wieloródki	284	49.30	4.58	3.52	7.04	0.70	3.52	28.17	2.11	1.06
Calving season Sezon wycielenia		Chi <sup>2</sup> = 4.90								
March – August Marzec – sierpień	211	53.08	6.16	2.37	7.11	0.47	3.32	21.80	4.27	1.42
September – February Wrzesień – luty	235	53.62	4.26	2.98	5.11	0.85	3.83	26.38	2.13	0.85
Type of calving Rodzaj porodu		Chi <sup>2</sup> = 37.72**								
– normal – normalny	125	60.00	5.60	1.60	5.60	1.60	4.00	20.80	0.80	0.00
– assisted by 1 person – pomoc 1 osoby	282	50.35	4.26	2.13	6.03	0.35	3.90	27.66	3.55	1.77
– difficult, assisted by several people – ciężki, pomoc kilku osób	30	56.67	10.00	6.67	6.67	0.00	0.00	13.33	6.67	0.00
– very difficult, with veterinary assistance – bardzo ciężki, pomoc lekarza wet.	9	44.44	11.11	22.22	11.11	0.00	0.00	0.00	1.11	0.00

\*\* – significant differences at P ≤ 0.01; \* – significant differences at P ≤ 0.05.

\*\* – różnice istotne dla P ≤ 0,01; \* – różnice istotne dla P ≤ 0,05.

cows has a beneficial effect on producing higher quality milk. In both housing systems, the incidence of placental retention was similar. Metritis and uterine tumour were more frequent in free-stall barns (by 3.44%), while downer syndrome and ketosis were more often diagnosed in tie-stall barns (by 2.51 and 1.22%, respectively). The incidence of the recorded diseases was much lower than that reported by Kuźma and Kuźma [1994] and Małeck-Tepicht et al. [2000]. In turn, Skrzypek et al. [1994] observed fewer cases of mastitis and downer cow syndrome than in our study.

When analysing the effect of type of calving on the incidence of periparturient disorders, we found that reproductive diseases such as retained placenta, downer cow syndrome and cysts were more frequent when calvings were difficult or very difficult. Likewise, Mordak [2011] mentions difficult and prolonged parturition as one of the functional reasons for retained fetal membranes. Małeck-Tepicht et al. [2000] noted that dystocia increased the incidence of ovarian cysts by a factor of 2–3. Gnyp [1993] showed that primiparous cows with a greater proportion of difficult calvings had a 1.5–2-fold greater number of postpartum complications compared to easy calvers.

Lower incidence of periparturient diseases was observed in primiparous cows than in multiparous cows, which were more often affected by downer syndrome and mastitis. That the incidence of these diseases increased with age of the cows was also observed by Bednarek et al. [2000].

Analysis of the effect of calving season on the incidence of periparturient diseases revealed that cows calving in the spring-summer period were comparably healthy to autumn and winter calvers.

The present study found a statistically significant effect of housing system, age of cows, number of calves born and production level on the type of calving. Dairy cow breeders should give particular attention to the calvings of heifers and multiple pregnancies, because in such cases parturition is more often classified as difficult or very difficult. Because difficult calvings cause financial losses, attention should be focused on selection for calving ease. Housing system and the type of calving contributed the most to the incidence of periparturient disorders. Inflammation of the udder was the greatest health concern after calving, regardless of the housing system.

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## **WPŁYW WYBRANYCH CZYNNIKÓW NA RODZAJ PORODU I ZABURZENIA OKRESU OKOŁOPORODOWEGO U KRÓW MLECZNYCH**

**Streszczenie.** Badania przeprowadzono na krowach rasy polskiej holsztyńsko-fryzyskiej odmiany czarno-białej, w pięciu gospodarstwach na terenie woj. kujawsko-pomorskiego (364 krowy w dwóch oborach wolnostanowiskowych, średnia wydajność 7844 kg mleka i 158 krów w trzech oborach uwięziowych, średnia wydajność 7596 kg mleka). Stwierdzono, że liczba urodzonych cieląt, system utrzymania, wiek krów miały wysoko istotny wpływ ( $P \leq 0,01$ ) na rodzaj porodu a poziom ich wydajności istotny ( $P \leq 0,05$ ) Łatwiejsze porody miały miejsce przy urodzeniu się cieląt pojedynczych niż bliźniąt. W przypadku ciąży bliźniaczych w porównaniu do pojedynczych udział porodów ciężkich był blisko 3-krotnie, a bardzo ciężkich przeszło 16-krotnie wyższy. W systemie wolnostanowiskowym więcej krów cielęło się przy pomocy jednej lub kilku osób niż w systemie uwięziowym, gdzie z kolei więcej było porodów normalnych, ale także bardzo ciężkich, wymagających pomocy lekarza weterynarii. Porody ciężkie i bardzo ciężkie stanowiły u jałówek 15,16%, natomiast u krów 4,50%. Porody krów o wydajności  $> 7000$  kg mleka, w porównaniu do mniej wydajnych, nieznacznie częściej klasyfikowano jako normalne ale też 3 razy częściej jako ciężkie. System utrzymania wpływał na częstotliwość występowania schorzeń okołoporodowych, większy ich udział odnotowano w systemie wolnostanowiskowym. Hodowcy krów mlecznych powinni zwracać szczególną uwagę na wycielenia jałówek oraz ciąży mnogie, bowiem w takich przypadkach poród częściej jest klasyfikowany jako ciężki lub bardzo ciężki. Największym problemem zdrowotnym po wycieleniu, niezależnie od systemu utrzymania, było zapalenie wymienia.

**Słowa kluczowe:** krowy mleczne, rodzaj porodu, schorzenia okołoporodowe

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