

INFLUENCE OF THE SELECTED HOOF DISEASES ON REPRODUCTION PARAMETERS OF POLISH HF COWS

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Abstract. The aim of the paper was to show the most frequently occurring limb disorders and their effect on reproduction parameters of the cows. The studies were conducted on 220 cows with the mean yield equal to 10 500 kg of milk and showed that 16% of the herd suffered from digital dermatitis, 10% had interdigital dermatitis and 7% revealed sole ulcer (Rusterholz disease). The primiparas and the cows in the third lactation suffered most frequently from hoof lesions. The three mentioned above diseases affected significantly the decrease of milk production of the cows and deterioration of reproduction indices. Ovarian cysts occurred most frequently in the cows suffering from the Ruslerholz sole ulcer (13.33%). Endometritis was most frequently (47.06%) found in case of the cows with digital dermatitis. The cows with the hoof disorders became pregnant with greater difficulties and their inter-pregnancy period was considerably prolonged.

Key words: cows, hoof diseases, reproduction

INTRODUCTION

Lameness in cows is a very serious health problem, being encountered in most of dairy cattle farms in Poland as well as abroad. Different pathological disorders within the feet and legs are the reason for feeling pain and lack of welfare of the animals. Their occurrence leads to lowering of milk production [Warnick et al. 2001], decrease of effectiveness of reproduction and increase of cow culling. It causes considerable economic losses. Hoof disorders in dairy cattle occur as commonly as mastitis, diseases of reproduction system and metabolic disorders. In

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Great Britain, the discussed diseases are found on the second place after mastitis in respect of the level of losses. In the European Union, about 5 million of cows – from the whole population equal to 21.5 million animals – suffer from limb diseases what results in annual losses on the level of more than 1 billion EURO [Mordak 2008]. About 90% of lameness concerns hind limbs due to decisively higher charging of the mentioned part of body. In majority of cases the disorder concerns external digits. The level of culling, caused by incidence of lameness in the farms varies within the limits of a few – several percent. The problem of foot and leg disorders in annual scale concerns ca. one fourth of the cattle population and it reveals a growing tendency. Holstein-Friesian breed is the most common breed in Poland and it is especially susceptible to digital disorders [Urbaniak and Jaśkowski 2004].

Lying boxes for animals are a very environmental important factor. If the boxes are properly constructed, the cows stay in them easily and for a long time. The cows, which lie ca. 8 hours per day suffer considerably more frequently from hoof disorders as compared to those ones which lay down 12–14 hours. If the lying places are filled with sand, it should be regularly supplemented because the animals push it off from their lying site and discover the threshold which could become a successive reason for damage of the hooves during lying down or standing up. The sand improves comfort of the rest and prevents formation of bruises, enables keeping the sites clean and makes that they remain always dry. The appropriate length of boxes protects also from contamination with faeces and urine [Bogucki and Neja 2007].

The research concerning the influence of floor type on hoof diseases occurrence was also conducted by Telezhenko and Bergsten [2005]. The incidence of sole ulcers was 47.6–55.4% of the total number of claw lesion in cows with the locomotion problems [Olechnowicz et al. 2010]. Leg diseases detection in cows is also possible in a milking robot thanks to devices measuring load on each leg separately [Pastell et al. 2008]. In another experiment cows' activity was examined by the pedometer [Mazrier et al. 2006]. As much as 45.7% of cows showed the activity reduced by 5%, which indicated on leg problems.

The aim of the study was to show the most frequently occurring limb disorders and their effect on reproduction parameters of cows.

MATERIAL AND METHODS

The studies were conducted in the farm, situated in the Wielkopolska region on 220 Polish Holstein-Friesian cows (PHF) of Black-and-White variety with the mean milk performance of 10 500 kg of milk. The research was conducted du-

ring one year. The analysis included all cows in which lameness was found. The animals covered with the study were kept in the loose-standing barn. Milking was performed at milking parlor of fish bone type (8/8) three times a day. All cows were subjected to the same prophylactic treatment and they were fed in the same way within a given group. Cows were fed by use TMR system. TMR composition (for cows in a peak of lactation) was as follows: maize silage (24 kg), hay (1.5 kg), straw (2 kg), Lucerne silage (8 kg), barley concentrate (4 kg), brewer's grains (5 kg), siled maize corn (6 kg), soy extracted meal (2 kg), rape extracted meal (2 kg), protected fat (0.35 kg), yeast (0.06 kg). Mineral additions were: dolomite (0.2 kg), "Vitamin Biovet" (0.15 kg), "Herbenin" (0.1 kg), sodium carbonate (0.2 kg).

The studies were carried out by the method of early discovering of limb disorders – LSC [Locomotion Score Cows] [Wójcik 2005]. On the ground of visual evaluation of position and walking of the cows, lameness in the particular individuals was discovered and the stage of disease advancement was determined. The evaluation was conducted by the co-author. The diagnosis of the disorder and the confirmation of the results of visual monitoring were performed during the correction of hooves of the whole herd by the experienced animal rearing specialist, who was also a veterinary technician. Information on the run of lactation in the cows before and after professional trimming of hooves and on daily activity of the cows (discovery of heat) were obtained from the computer AFIfarm system, installed in the cow house. Information about the passed diseases, the frequency of incidence of endometritis and ovarian cysts, and the way of their treatment were found in the cow health cards. All the mentioned data were helpful in evaluation of the effect of the selected disorders on milk performance and reproduction parameters.

RESULTS AND DISCUSSION

Monitoring of a given herd, lasting for 6 months, has brought the following results: from among 220 animals, 16% (34 heads) suffered from digital dermatitis, 10% (22 animals) had interdigital dermatitis and 7% (15 individuals) had Rusterholz sole ulcer (Fig.1).

It results from Figure 1 that in own studies the incidence rate of interdigital dermatitis was by 3% higher than of Rusterholz ulcer. Somewhat different results were obtained in the studies of Jaśkowski, as described in literature [Szwaczkowski 2007]. In the mentioned studies, as much as 30% of the cows (with more than 75% of PHF genes) suffered from digital dermatitis, 4% – interdigital dermatitis and 35% from Rusterholz sole ulcer. It means that the incidence rate of the mentioned above diseases in own studies was considerably lower as compared to the herd, described by Jaśkowski [quotation in Szwaczkowski 2007]. Besides it,

4% of the cows in the studies of Jaśkowski suffered from interdigital dermatitis. It is by ca. 31% lower than the Rusterholz sole ulcer. Such high differentiation of the results might be affected by the number of the examined animals or another percent of HF gene participation. Different methods of prophylaxis, different environments, nutrition methods, different period of the studies are the successive reasons for the observed discrepancies. In spite of these differences, however, a high predisposition of HF breed to interdigital dermatitis is visible in the both experiments.

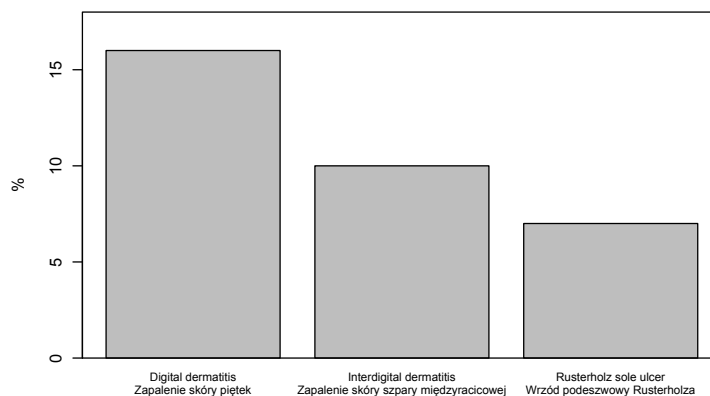


Fig.1. Frequency of incidence of the selected digital disorders in the examined herd

Rys. 1. Częstość występowania wybranych chorób palców w badaniu własnym

It results from own studies that the disease was situated in hind legs in ca. 94% of the lame cows. From Table 1, which represents the results of own studies, it is easy to notice that the differences in the frequency of incidence of the disorders in hind legs are small. Rusterholz sole ulcer and interdigital dermatitis concerned exclusively hind limbs. Only interdigital dermatitis occurred in front legs but they were only single cases.

Similar results concerning the frequency of incidence of digital disorders in hind legs were obtained in the studies conducted in Great Britain [Corsar 2007] and in Poland [Olechnowicz et al. 2010]. It was recognized that the considerably greater charging of the hind part of the body was the reason for such state. This opinion is also expressed by other authors [Janeczek and Kupczyński 2002] who stated that it was caused not only by the improvement of nutrition of animals but

also by intensive selection, leading to the increase of performance and by this, size of the udder, additionally burdening the hind part of the body.

Table 1. Frequency of incidence of the selected hoof disorders in front and hind limbs

Tabela 1. Częstość występowania wybranych chorób racic w kończynach przednich i tylnych

Disease Choroba	Right hind leg Kończyna prawa tylna		Left hind leg Kończyna lewa tylna		Right front leg Kończyna prawa przednia		Left front leg Kończyna lewa przednia	
	no. of cows liczba krów	% of herd % stada	no. of cows liczba krów	% of herd % stada	no. of cows liczba krów	% of herd % stada	no. of cows liczba krów	% of herd % stada
Rusterholz sole ulcer Wrzód podeszwowy Rusterholza	9	4.10	10	4.55	–	–	–	–
Digital dermatitis Zapalenie skóry palca	22	10.00	20	9.09	–	–	–	–
Interdigital dermatitis Zapalenie skóry szpary międzyraccowej	9	4.09	12	5.45	3	1.36	2	0.91
Total Razem	40	18.18	42	19.09	3	1.36	2	0.91

In the examined herd, the sick animals which suffered from pain, consumed their feed more rarely, lost their weight, lost their strength and position in the hierarchy of the herd and decreased milk production. Energy deficits, generated in the discussed period had a big effect on fertility. The inter-calving period was prolonged and disturbances in the heat cycle occurred. The individuals who suffered from interdigital dermatitis, i.e. bacterial disease, had the greatest problems with reproduction. They had most frequently endometritis, causing the problems with pregnancy (Table 2).

Lameness is often accompanied by endometritis of different types and dysfunctions of ovaries. The mentioned relationship was indicated in the studies of other authors [Badura et al. 1992, Twardoń et al. 2001]. According to the mentioned authors, bacterial microflora which lives in a sick limb, is a source of infection of reproduction organs and generation of purulent processes.

From the data, given in Table 2 it may be resulted that ovarian cysts were most frequently met in the cows with Rusteholz sole ulcer. Twardoń et al. [2001] express the opinion that stress-causing, long-lasting pain infringes homeostasis of cow organism. It results in disturbance of neuro-hormonal regulation of gonad

function – secretion of ovarian hormones and release of gonadotropins, leading to generation of ovarian cysts and dysfunction of ovaries. Rusterholz sole ulcer is the most painful and bothersome disease for animal. Probably in the case of this disease, the highest number of individuals with ovarian cysts was recorded.

Table 2. Effect of digital disorders on the frequency of incidence of reproduction system diseases in own studies

Tabela 2. Wpływ chorób palców na częstość występowania schorzeń dróg rodnych w badaniach własnych

Selected digital disorders Wybrane choroby palców	Number of sick cows (100%) Liczba chorych krów (100%)	Reproduction system disorders Schorzenia dróg rodnych			
		endometritis zapalenie błony śluzowej macicy		ovarian cysts cysty jajnikowe	
		number of sick cows liczba chorych sztuk	%	number of sick cows liczba chorych sztuk	%
Digital dermatitis Zapalenie skóry palca	34	16	47.06	3	8.82
Interdigital dermatitis Zapalenie skóry szpary międzyrąbicowej	22	5	22.73	–	–
Rusterholz sole ulcer Wrzód podeszwowy Rusterholza	15	4	26,67	2	13.33

There is no doubt that the limb diseases have a negative influence on reproduction parameters in ruminants. Szymaniak [2005] states that the greatest effect is exerted by lameness, occurring during the first 30 days of lactation because the most hormonal changes in cow body leading to incidence of heat, have place just in the discussed period. Twardoń et al. [2001] adds that if the disease of the legs occurs in the discussed period, it disturbs involution of uterus and brings about the irregularity of ovarian cycle.

In own studies, in case of the animals with interdigital dermatitis, the highest number of artificial insemination procedures, indispensable for making cow pregnant (the highest insemination index) has been observed (Table 3). Low effectiveness of insemination means prolongation of inter-pregnancy period (IPP) i.e. time between the calving and the successive pregnancy of the cow. The first AI procedure should be performed between the 50th and 75th day of after parturition [Grodzki 2005]. The mentioned time is necessary for involution of uterus and regeneration of cow organism after gestation. The desirable IPP value in high-yield dairy cows is ≤ 95 days and index of insemination repeatability should not exceed

1.7 [Hapek and Tischner 2009]. From the data, shown in Table 3, it results that 28 cows from 71 sick animals were inseminated more than twice, i.e. exceeded optimum insemination index. Besides it, 21 cows with the exceeded insemination index suffered from digital dermatitis.

Table 3. Effectiveness of insemination

Tabela 3. Skuteczność inseminacji

	Rusterholz sole ulcer Wrzód podeszwy Rusterholza		Digital dermatitis Zapalenie skóry palca		Interdigital dermatitis Zapalenie skóry szpary międzyzracicowej		Total Razem	
	no. of cows liczba krów	% of herd % stada	no. of cows liczba krów	% of herd % stada	no. of cows liczba krów	% of herd % stada	no. of cows liczba krów	% of herd % stada
Heat 1 Ruja 1	7	3.18	8	3.64	11	5.00	26	11.82
Heat 2 Ruja 2	6	2.73	5	2.27	6	2.73	17	7.73
Heat 3 Ruja 3	1	0.45	10	4.55	4	1.82	15	6.82
Heat 4 Ruja 4	–	–	6	2.73	–	–	6	2.73
Heat 5 Ruja 5	1	0.45	3	1.36	–	–	4	1.82
Heat 6 Ruja 6	–	–	2	0.91	1	0.45	3	1.36

In the examined herd, IPP is intentionally prolonged. The aim of the prolongation of the inter-pregnancy period is to obtain better regeneration of animal organism and the lower yields at the end of lactation. The first insemination is conducted on ca. 90th day after parturition. We may, therefore, assume that IPP in the examined herd should amount to ≤ 110 days. In case of Rusterholz sole ulcer, the mentioned period was exceeded by 4 animals from 15 sick cows. In case of interdigital dermatitis, 5 cows from 22 sick animals became pregnant after 110th day and the longest IPP, amounting to 180 days was reached by one animal. The longest inter-pregnancy period occurred in the animals with digital dermatitis. Only 13 individuals from 34 sick cows became pregnant in the appropriate time. In the remaining ones, IPP was considerably prolonged and in case of 5 animals, it reached even more than 300 days.

Lameness causes also problems in detection of heat [Gawryluk 2009]. In the examined herd, the heat is discovered with the help of computer system and da-

ily observations of the breeder and servicemen. Owing to pedometers, installed on the hind legs of the cows, AFIfarm system measures the daily activity, performance and conductivity of milk of each animal. The increase in activity of the cow and milk conductivity and decrease of milk performance mean most frequently the approaching heat period. The mentioned three parameters were a signal for a breeder to pay more attention to the animal, indicated by the computer. In spite of this fact, discovery of heat in sick animals caused difficulties. Lameness lowered cow activity. During the heat, the sick animals did not reveal any increased activity and anxiety. Due to painful limb, they did not jump on other cows. It was also difficult to observe a characteristic bending of the back, occurring during heat as in case of lame animals the line of the back is always bent. Lowering of appetite and performance could be caused by disease as well as by heat. In case of the cows with foot and leg disorders, the heat was discovered, first of all, when paying the attention to milk conductivity. At the moment when it occurred, the reaction of tolerance to leaping on by other cows and state of vulva were checked. The sick cows searched the contact and sniffed other cows.

In own studies, the highest rate of incidence of diseases was observed in the cows being in the first lactation. The third lactation was found on the second place and the second lactation was recorded on the third place. The fourth and fifth lactation was characterized by the lowest number of disease cases. The obtained results differ from those ones, described by Lesiakowski [2004] from which it is resulted that inclination to leg diseases is increased together with the age of the cow. In the opinion of the cited author, ca. 51% of animals are sick during the first lactation and in the successive ones, the frequency of diseases increases to 60%.

From the data shown in Table 4 it may be followed that Rusterholz sole ulcer appeared most frequently in the cows being in the third lactation. It might be caused by the fact that in the third lactation, the cow reaches its highest performance. Milk production consumes a lot of energy and the tremendously big and heavy udder charges additionally the limbs of animal. In consequence, inflammation and ulcer appear. Table 4 show also that interdigital dermatitis and digital dermatitis occurred most frequently in case of the cows in the first lactation. The both mentioned disorders have bacterial background. The intensity of their incidence could be caused by the change of the environment of living conditions of the animals. The cows in the first lactation – as high-pregnant heifers before parturition – were transferred from young stock shed to cow barn. Calving pen is a clean place with the limited number of bacteria. After delivery, the cow is however placed in the environment which is rich in pathogenic bacteria. Together with the time elapse, its organism becomes used to the new conditions and becomes resistant. At the beginning, however, the post-parturient weakening, hormonal changes and a big

number of stress-generating factors, i.e. change of nutritional rate, group and living environment have the effect on development of pathogenic states of hooves. The mentioned factors may be the reason, not only in primiparas, for generation of lameness during the first months of lactation.

Table 4. Sequence of lactations and the frequency of incidence of limb disorders

Tabela 4. Kolejność laktacji a częstość występowania schorzeń kończyn

Disease Lactation Choroba Laktacja	Rusterholz sole ulcer Wrzód podeszwowy Rusterholza		Digital dermatitis Zapalenie skóry palca		Interdigital dermatitis Zapalenie skóry szpary międzyzracicowej		Total Razem	
	no. of cows liczba krów	% of herd % stada	no. of cows liczba krów	% of herd % stada	no. of cows liczba krów	% of herd % stada	no. of cows liczba krów	% of herd % stada
Lactation 1 Laktacja 1	3	1.36	12	5.45	10	4.55	25	11.36
Lactation 2 Laktacja 2	2	0.91	9	4.09	6	2.73	17	7.73
Lactation 3 Laktacja 3	5	2.27	10	4.55	6	2.73	21	9.55
Lactation 4 Laktacja 4	3	1.36	1	0.45	–	–	4	1.82
Lactation 5 Laktacja 5	2	0.91	2	0.91	–	–	4	1.82

CONCLUSIONS

It results from the conducted studies that in the herd of high-productive cows of PHF breed, 33% of the animals had the problems with hooves. They included the following diseases: 16% of the cows suffered from digital dermatitis, 10% – on interdigital dermatitis and 7% had Rusterholz sole ulcer. The cows with digital disorders had also problems with reproduction. Ovarian cysts occurred most frequently in the cows with Rusterholz sole ulcer (13%). On the other hand, endometritis occurred most frequently (47%) in the cows with digital dermatitis. The cows with the hoof disorders became pregnant with more problems and their interpregnancy period was considerably prolonged. Digital disorders affected also a considerable influence on milk production. Analysis of the effect of sequence of lactations on the frequency of incidence of limb disorders revealed that primiparas and the cows in the third lactation suffered from the discussed diseases most frequently.

REFERENCES

- Badura R., Buczek A., Samborski Z., Szymonis-Szymanowski W., Twardoń J., 1992. Einfluss technopathiebedingter Stressfaktoren auf die Fruchtbarkeit des Rindes. Dtsch. Tierärztl. Wochenschr. 99, 193–194.
- Bogucki M., Neja W., 2007. Warunki zoohigieniczne w oborze a stan racic [Zoohygienic conditions and the condition of the feet]. Hod. Bydła 2, 44–47 [in Polish].
- Corsar M., 2007. Investigation of hind limb lameness in cattle not involving the foot. Cattle Practice 15, 262.
- Gawryluk M., 2009. By krowy zdrowo stały [To have healthy cows]. Podl. Agro 3, 48 [in Polish].
- Grodzki H., 2005. Hodowla i użytkowanie zwierząt gospodarskich [Farming and livestock]. Wydaw. SGGW, Warszawa [in Polish].
- Hapek E. I., Tischner M., 2009. Pielęgnacja racic, a wskaźniki rozrodu [Hoof care, and reproductive rates]. Hoduj z Głową 3, 18–27 [in Polish].
- Janeczek W., Kupczyński R., 2002. Dbajmy o kończyny naszych krów [Let's take care of our cows limbs]. Porad. Hod. 1, 10–14 [in Polish].
- Lesiakowski R., 2004. Zadbaj o zdrowe racice! [Take care of healthy hooves!]. Top bydło 10, 34 [in Polish].
- Mazier H., Tal S., Alzinbud E., Bargai U., 2006. A field investigation of the use of the pedometer for the early detection of lameness in cattle. Ca. Vet. J. 47 (9), 883–886.
- Mordak R., 2008. Kulawizny u krów – wieloprzyczynowy problem zdrowotny [Lameness in dairy cows – multiple causes of health]. Życie Weter. 4, 288–291 [in Polish].
- Olechnowicz J., Jaśkowski J.M., Antosik P., Bukowska D., Urbaniak K., 2010. Claw diseases and lameness in polish Holstein-Friesian dairy cows. Bull. Vet. Inst. Pulawy 54, 93–99.
- Pastell M., Hautala M., Poikalainen V., Praks J., Veermäe I., Kujala M., Ahokas J., 2008. Automatic observation of cow leg health using load sensors. Comp. Electron. Agric. 62, 48–53.
- Szymaniak I., 2005. Kulawizna a rozród [Lameness and reproduction]. Hod. Bydła 6–7, 28–31 [in Polish].
- Szwaczkowski T., 2007. Nogi naszych krów [The legs of our cows]. Hoduj z Głową 5–6, 78–80 [in Polish].
- Telezhenko E., Bergsten C., 2005. Influence of floor type on the locomotion of dairy cows. Appl. Anim. Behav. Sci. 93, 183–197.
- Twardoń J., Samborski Z., Dejneka G.J., Dzięcioł M., 2001. Wpływ schorzeń palców na zdrowotność układu rozrodczego i gruczołu mlekowego u krów [The impact of diseases on the health of fingers reproductive system and mammary gland in cows]. Med. Weter. 9, 653–657 [in Polish].
- Urbaniak K., Jaśkowski J., 2004. Kulawizny a płodność [Lameness and fertility]. Życie Weter. 79 (5), 263–265 [in Polish].
- Warnick L.D., Jansen D., Guard C.L., Gröhn Y.T., 2001. The effect of lameness on milk production in dairy cows. J. Dairy Sci. 84, 1988–1997.

Wójcik P., 2005. Wczesne wykrywanie kulawizny u bydła w oparciu o metodę LSC [Early detection of lameness in cattle based on the LSC method]. *Hod. Bydła* 8, 26–29 [in Polish].

WPLYW WYBRANYCH CHOROÓB RACIC NA WSKAŹNIKI ROZRODU KRÓW RASY PHF

Streszczenie. Celem pracy było przedstawienie najczęściej występujących chorób kończyn oraz ich wpływu na wskaźniki rozrodu krów. Badania przeprowadzono na 220 krowach o średniej wydajności 10 500 kg mleka wykazały, że 16% stada cierpiało na zapalenie skóry palca, 10% krów chorowała na zapalenie skóry szpary międzyracicowej, a 7% na wrzód podeszwowy Rusterholza. Najczęściej na choroby racic zapadają krowy pierwiastki i będące w laktacji trzeciej. Trzy powyższe choroby istotnie wpłynęły na pogorszenie wskaźników rozrodu. Cysty jajnikowe występowały najczęściej u krów z wrzodem podeszwowym Rusterholza (13,33%). Zapalenie błony śluzowej macicy najczęściej występowało (47,06%) u krów z zapaleniem skóry piętek. Krowy z chorobami racic trudniej się zacięły, a ich okres międzyciążowy znacznie się wydłużył.

Słowa kluczowe: choroby racic, krowy, rozród

Accepted for print – Zaakceptowano do druku: 26.11.2012

