Rocz. Nauk. Zoot., 44, 1 (2017) 3–12

RISK FACTORS FOR LAMENESS IN A DAIRY HERD*

Waldemar Teter, Piotr Stanek, Witold Chabuz, Paweł Żółkiewski, Wioletta Sawicka

University of Life Sciences in Lublin, Department of Cattle Breeding and Conservation of Genetic Resources, Akademicka 13, 20-950 Lublin, Poland
e-mail: waldemar.teter@up.lublin.pl

Kulawizna jest zewnętrznym objawem problemów zdrowotnych w obrębie nóg, a u bydła szczególnie w okolicy skóry palców i racic. Właściwa identyfikacja czynników ryzyka w stadzie bydła mlecznego oraz ich eliminacja są jednym z kluczowych działań poprawiających długość użytkowania krów oraz poprawę wyników produkcyjnych i ekonomicznych w gospodarstwie. Celem pracy jest wskazanie źródeł czynników ryzyka pojawiających się w intensywnej produkcji mleka oraz działań zmierzających do ich eliminacji. W pracy wykazano genetyczne i środowiskowe przyczyny występowania schorzeń w obrębie racic. Za kluczowe w rozwiązaniu problemu kulawizn w stadzie uznano kontrolę warunków środowiskowych, w tym żywienie jako głównego czynnika ryzyka w stadach o intensywnej produkcji mleka.

Słowa kluczowe: kulawizny, bydło mleczne, choroby racic, choroby kończyn

Lameness in dairy cattle is a key problem affecting production and animal welfare, especially in modern dairy industry. Lameness belongs to the most important welfare issues essential for ethical quality of dairy production. Many articles have addressed the problem of cow comfort during laying and locomotion as factors able to limit lameness prevalence (Cook et al., 2005; Hristov et al., 2008; Cook & Nordlund, 2009; Dippel et al., 2009).

According to Greenough (2007) and Porter et al. (2010), lameness is defined as an improper cow gait while its etiologic factors include many diseases and metabolic disturbances. Lameness should not be called a disease entity because a disease is a change in the structure and function of the body while lameness is only a consequence of these deficiencies.

Pathological changes in hoofs and legs cause pain and discomfort of animals during staying and moving.

Hoof diseases in dairy cattle are as frequent as mastitis, reproductive system diseases and metabolic disturbance (Nałęcz-Tarwacka & Jędrzejek, 2012).

* This work was financially supported from statutory activity No. DS ZKD-1.

Lameness also belongs to the costliest ailments in dairy cows together with mastitis and reproductive disorders. It reduces milk yield (Juarez et al., 2003; Hultgren et al., 2004; Hernandez et al., 2005; Bicalho et al., 2008), impairs fertility (Sogstad et al., 2007), and, consequently, increases culling risk (Booth et al., 2004) thus contributing to significant economic losses.

The aim of the present work was to identify lameness risk factors in high-producing dairy herds and to suggest suitable countermeasures.

In the last twenty years, lameness prevalence has been constantly on the rise and now it is observed in more than a half of animals at least once a year (Tadich et al., 2010).

Webster et al. (2005) distinguished 4 categories of causes which lead to lameness in cattle. The first one is related to claw horn disruption (CHD) causing hemorrhages in the sole or white line and then formation of ulcers and abscesses. The second category comprises cases underlain by inflammation, like digital dermatitis and inflammation of sole interior. The third class encompasses classic laminitis and the fourth group includes lameness produced by sporadic conditions causing necrotic changes in the skin.

Lameness has multifactorial etiology with genetic, nutritional, and most of all technological components, related to technical aspects of facilities, housing and management systems. It is accompanied by response of the body aimed to minimize pain. Each incorrect leg positioning to reduce pain is called a relief posture. Knowledge of these postures can be helpful in initial diagnosis of the type and severity of claw disease (Mordak, 2008).

Diseases

In Poland, interdigital phlegmon and sole ulcers are relatively common problems (Mordak, 2008) whereas as reported by Amory et al. (2006), studies in the UK demonstrated that the most, which is ca. 25%, of all lameness cases were related to infection with bacterial flora, including anaerobic bacteria. Of them ulcers (27%), white line lesions (20%) and digital dermatitis (16%) were found to be most common. In Swedish studies (Manske, 2002), as much as 60% of 5000 cows showed only hoof hemorrhages (an initial step of ulcers and while line disease), 10% presented ulcers while only 5.1% cows expressed signs of lameness.

According to Swiss studies (Bielfeldt et al., 2004) white line lesions and heel erosions were the most common causes of increased lameness frequency. A majority of lameness cases were noted in animals housed in tie stalls while cows living in free-stall systems were characterized by the best locomotion. Studies of many authors (Winkler & Margerison, 2012; DeFrain et al., 2013; Navarro et al., 2013; Green et al., 2014) indicated that sole ulcer, hemorrhages, digital dermatitis and white line disease were the most common hoof diseases in dairy cattle.

According to Manske et al. (2002), most of pathological hoof changes did not produce express signs of lameness thus they could be difficult to identify if cows

are examined only for gait and posture abnormalities. Lameness was confirmed in 70% of the studied cows only during hoof correction as reported by Green et al. (2002).

Hoof diseases can be also caused by non-infectious factors, like sole ulcers, hemorrhages, hoof wall separation. It can result from the lack of hygiene in farm facilities, improper flooring material, irregular feces removal, inappropriate supervision and hoof care and small amount and low quality of bedding material (Laven, 2007). On the other hand, infectious hoof diseases include digital dermatitis or inflammation of sole interior (Scaife et al., 2006).

Lameness risk factors in dairy cattle can be categorized into an intrinsic and extrinsic component.

Intrinsic risk factors are those that cannot be changed. They include mostly season (MacCallum et al., 2002), lactation period (pregnancy and its stage) (Hirst et al., 2002), former diseases, especially connected with metabolic disturbances (Sanders et al., 2009), hoof condition (Grove-White, 2004) and genetic factors, which separately or in combination with other factors can cause complex and severe lameness (Baird et al., 2009).

Housing conditions

Extrinsic (environmental) lameness risk factors are closely related to herd management (Chesterton et al., 2008), type of bedding material and its depth (Dippel et al., 2009), structure of buildings, housing system (Regula et al., 2004), feeding of animals and access to a pasture (Haskell et al., 2006). On the other hand, Phillips & Morris (2002) listed space availability in the barn (stocking density), flooring quality and availability of light as the most important environmental factors for cattle locomotion.

Mülling et al. (2006) and Hristov et al. (2007) identified six areas of extrinsic factors which may be manipulated to reduce lameness in dairy cattle: (i) cow comfort (maximum laying time, comfortable laying surfaces, proper flooring for walking and staying), (ii) cow hygiene (dry and clean bedding, good herd biosecurity), (iii) social and physical integration of heifers and dry cows, (iv) cow flow (good paths around buildings, in the barn, on pasture), (v) proper diet (macronutrients and micronutrients), (vi) routine and professional hoof trimming.

Bedding type and quality play a significant role as lameness risk factors. Cattle transfer from more elastic floor (e.g. straw) to hard floors, e.g. concrete resulted in increased lameness rate and pathological leg changes.

Poor quality floorings include surfaces that are too smooth and may be slippery for animals or too abrasive causing excessive wear of the hoof sole. Smooth and slippery walking alleys contribute to reduced locomotor activity of animals which less walk and shorten step length (Faull et al., 1996).

Floors made of concrete-like materials, on the one hand, can stimulate hoof hypertrophy leading to unsymmetrical hoof weight, and on the other, can increase hoof wear out. Too high abrasion becomes the cause of excessive sole

wearing out which predisposes hoofs to more frequent changes on loaded hoof surfaces. Moreover, concrete floors in the first year of use are characterized by high friction and adhesiveness but as time passes, they become slippery which increases the number of leg injuries in cows and reduction of abrasiveness, and consequently hoof overgrowth (Telezhenko, 2007). Somers et al. (2005) noted a higher risk of digital dermatitis in cows placed on solid concrete floors compared with animals on floors without mechanical scrapers.

Apart from flooring quality, hygiene is an equally important factor. Contaminated floors are a habitat for different microorganisms, including pathogens, causing horn softening which makes it less susceptible to abrasion. Increased humidity of the environment raises humidity of hoof horn which contributes to reduction of its elasticity and diminishes its resistance to punctures (Winkler & Margerison, 2012). The use of automated cleaner systems (scrapers) in manure and feeding alleys to improve hygiene undoubtedly improves floor cleanliness, however, it contributes to increased frequency of injuries of lower limbs (Barker et al., 2010).

Overall, it is recommended to use floors that ensure an appropriate friction and thus a better adhesiveness to flooring, which improves locomotion. Having the possibility to choose hard and soft flooring, cows usually choose the soft one both for standing and walking. It is also suggested to maintain flooring cleanliness and to prevent cows from staying and walking on floors contaminated by manure (humid, slippery) (Telezhenko et al., 2008).

Care

Lameness frequency can also be reduced by proper hoof trimming (correction) which allows for detection of pathological changes in an early subclinical phase before clinical symptoms become apparent or severe damages occur. Moreover, hoof trimming fulfills a very important function, namely, it prevents hoof damage by early correction of hoof load. Many authors underline significance of this procedure. Grove-White (2004) highlighted crucial importance of frequency and professionalism of hoof correction as one of the main factors reducing the risk of disease, independently of techniques used. Hoof correction before calving reduced lameness frequency compared with cows with untrimmed hoofs. Moreover, Bergsten et al. (1998) demonstrated almost two-fold reduction of the number of sole ulcers in animals which had hoofs trimmed not less frequently than twice a year. It was also demonstrated that uneven weight and pressure distribution between hoofs increased risk of lameness in the overloaded limb. After proper correction, the weight of animal is optimally distributed between all limbs and also within hoofs. However, this is more difficult to achieve in barns with highly abrasive flooring, e.g. free-stall barns with concrete floor.

As already mentioned, lameness can contribute to fertility disturbances. Depending on physiological stage of a cow, they can have different etiology and consequences. During peripubrrtal period, cows are exceptionally vulnerable to

stress while stress factors in this period include hormonal changes, altered food rations, changes in housing, transfer to another group. All these factors influence lameness risk. Hormonal changes have a significant impact on development of lameness. Relaxin, a hormone relaxing birth canal before calving can also relax hoof tissues, which leads to sole injuries manifested as peripubertal lameness (Szymaniak, 2005).

Pregnant females exposed to stress related to painful limbs give birth to weak newborns with impaired immunity. It is consequent to constriction of uterine wall vessels resulting in anomalous fetus nutrition. This disables fetus development in the first period of pregnancy (Hapek & Tischner, 2009).

Lameness signs occurring within first 30 days postpartum result in ovulation disturbances, ovarian cysts and inflammatory changes in endometrium as purulent foci in hoofs are the infection source for endometrosis. Hoof sole inflammations cause a functional impairment of corpus luteum and compromise early pregnancy. Endotoxins disturb the follicular phase of the estrus cycle. This is manifested by the delayed release of LH or its blockade and depressed heat signs due to suppression of preovulatory estradiol surge (Urbaniak & Jaśkowski, 2004).

Nutrition

Quantitative and qualitative composition of feed rations plays an important role in health of dairy cow limbs, especially hoofs. Using the feed rations based on high-starch feeds in dairy cow feeding causes quick fermentation leading to ruminal acidosis. This reduces horn quality of hoofs that become softer and more vulnerable to wear (abrasion, cracks) thus increasing the risk of damage (Amory et al., 2006).

Pain accompanying locomotion decreases appetite and aggravates postpartum energy deficit. Hoof diseases manifested by lameness belong to principal health problems in dairy farming. Current practices of dairy cattle management, like litterless housing, hard uneven humid and contaminated floor in barns, inappropriate feeding, constant selection and striving for the highest milk yield (Urbaniak & Jaśkowski, 2004) contribute to a greater risk of lameness.

Manson & Leaver (1988) focus on the significance of protein and its level in feed to hoof health. High protein content increased hoof horn growth rate which could lead to its hypertrophy and incorrect pressure distribution, thus causing a risk of hoof damage and prolongation of lameness.

According to Bicalho et al. (2009) and Lean et al. (2013) high intake of easily digestible sugars (NFC) with low fiber (NDF) intake results in a drop in rumen pH and release of histamine and endotoxins, which, after entering the circulation, destroy capillary vessels in hoofs leading to production of low-quality horn.

In addition, quality of horn tissue significantly depends on dietary supply of micro- and macroelements and vitamins. Deficit of sulfur, copper, zinc, selenium, manganese, cobalt (as vitamin B_{12}), retinol and biotin, i.e. elements

and vitamins participating in creatinine metabolism, reduces hoof horn quality which has a detri-menttal effect on hoof health. Further, copper, zinc, selenium and manganese are components of antioxidant enzymes. Oxidative stress leads to destruction of hoof capillary vessels thus hindering oxygen and nutrient supply which results in synthesis of horn of poor quality (Lean & Rabiee, 2011; Al-Qudah & Ismail, 2012).

Genetic factors

Van der Waaij et al. (2005) discovered significant correlations between the hoof angle, limb posture, rump width, ankle angle and the susceptibility to lameness. According to McDaniel (1995), some hoof diseases are dependent on genetic factors and their heritability is from 0.13 to 0.15 for sole erosion, 0.39 for interdigital dermatitis, 0.39 for sole ulcer, and 0.17 for white line disease. Many authors link lameness also with environmental factors and estimate their heritability at 0.005–0.220 (McDaniel, 1995; Pryce et al., 1998; Van Dorp et al., 2004; Van der Waaij et al., 2005).

Conclusions

Lameness is characterized by multifactorial etiology encompassing genetic factors and technological aspects related to technical management of dairy farms, housing conditions, care and hygiene of animals and also, to a large extent, a proper nutrition.

Efficient elimination of lameness requires implementation of a number of procedures in a dairy farm including monitoring, identification of causes, risk assessment in a herd and treatment of existing cases. Detection of disorders in cows without signs of lameness but confirmed during hoof correction can cause some problems.

Elimination of risk factors should also involve prophylactic measures, like improvement of hoof care and housing conditions.

Another problem of increasing importance in current dairy production is related to intense feeding of cows at the limit of physiological tolerance of the feed ration. Metabolic disturbances resulting from such practice lead to ruminal acidosis, damage of capillary vessels in limbs and production of poor-quality horn tissue. Micro- and macroelement deficits aggravate this problem especially in high-yielding cows on high-producing dairy farms.

Attempts to identify risk factors and eliminate them are a challenge at present when the main aim of dairy industry is to maximize milk yield. While we are able to improve conditions ensuring the welfare of animals and to implement proper prophylaxis in terms of hygiene and hoof correction, preservation of physiological balance of high-yielding cows fed diets rich in highly fermentable sugars, remains the main problem.

Are we able to change the vision on high milk production taking into consideration physiological capabilities of animals so that to preserve their health? Where are the limits of increasing yield?

Lameness leads mostly to discomfort and pain in animals, reduction of milk yield, impairment of reproductive success and increase in culling rate, which generates considerable economic losses. Lameness prevalence and its economic impact are still undervalued by farmers, consultants and veterinary practitioners.

References

Al-Qudah K.M., Ismail Z.B. (2012). The relationship between serum biotic and oxidant/antioxidant activities in bovine lameness. Res. Vet. Sci., 92: 138–141.

Amory J.R., Barker Z.E., Wright J.L., Mason S.A., Blowey R.W., Green L.E. (2006). Lame cow at the University in Warwick: study of lameness in dairy cows. Cattle Pract., 14: 132–125. Baird L.G., O'Connell N.E., McCoy M.A., Keady T.W., Kilpatrick D.J. (2009). Effects of breed and production system on lameness parameters in dairy cattle. J. Dairy Sci., 92: 2174–2182.

Barker Z.E., Leach K.A., Whay H.R., Bell N.J., Main D.C.J. (2010). Assessment of lameness prevalence and associated risk factors in dairy herds in England and Wales. J. Dairy Sci., 93 (3): 932–941.

Bergsten C., Hultgren J., Manske T. (1998). Claw traits and foot lesions in Swedish dairy cows in relation to trimming interval and housing. A preliminary report. In: Ossent P., Lischer C. (Eds), 10th Int. Symp. Disorders Ruminant Digit. University of Zurich Dept. Vet. Surgery, Lucerne, pp. 46–48.

Bicalho R.C., Warnick L.D., Guard C.L. (2008). Strategies to analyze milk losses caused by diseases with potential incidence throughout the lactation: A lameness example. J. Dairy Sci., 91 (7): 2653–2661.

Bicalho R.C., Machado V.S., Caixeta L.S. (2009). Lameness in dairy cattle: A debilitating dis- ease or a disease of debilitated cattle? A cross-sectional study of lameness prevalence and thickness of the digital cushion, J. Dairy Sci., 92: 3175–3184.

Bielfeldt J., Tolle K-H., Badertscher R., Krieter J. (2004). Investigation of claw health of dairy cows in Switzerland, EAAP, Commission on Animal Management and Health.

Booth C.J., Warnick L.D., Grohn Y.T., Maizon D.O., Guard C.L., Janssen D. (2004). Effect of lameness on culling dairy cows. J. Dairy Sci., 87: 4115–4122.

Chesterton R.N., Lawrence K.E., Laven R.A. (2008). A descriptive analysis of the foot lesions identified during veterinary treatment for lameness on dairy farms in north Taranaki. N Z Vet. J., 56 (3): 130–138.

Cook N.B., Nordlund K.V. (2009). The influence of the environment on dairy cow behavior, claw health and herd lameness dynamics. Vet. J., 179: 360–369.

Cook N.B., Bennett T.B., Nordlund K.V. (2005). Monitoring indices of cow comfort in free- stall-housed dairy herds. J. Dairy Sci., 88: 3876–3885.

DeFrain J.M., Socha M.T., Tomlinson D.J. (2013). Analysis of foot health records from 17 confinements dairies. J. Dairy Sci., 96: 7329–7339.

Dippel S., Dolezal M., Brenninkmeyer C., Brinkmann J., March S., Knierim U., Winckler C. (2009). Risk factors for lameness in cubicle housed Austrian Simmental dairy cows. Prev. Vet. Med., 90: 102–112.

Faull W.B., Hughes J.W., Clarkson M.J., Downham D.Y., Manson F.J.,

Merritt J.B., Murray R.D., Russell W.B., Sutherst J.E., Ward W.R. (1996). Epidemiology of lameness in dairy cattle: The influence of cubicles and indoor and outdoor walking surfaces. Vet. Rec., 139: 130–136.

Green L.E., Hedges V.J., Schukken Y.H., Blowey R.W., Packington A.J. (2002). The impact of clinical lameness on the milk yield of dairy cows. J. Dairy Sci., 85: 2250–2256.

Green L.E., Huxley J.N., Banks C., Green M.J. (2014). Temporal associations between low body condition, lameness and milk yield in a UK dairy herd. Prev. Vet. Med., 113: 63–71.

Greenough P.R. (2007). Bovine Laminitis and Lameness – A Hands-on Approach. Saunders Elsevier, St. Louis, Missouri, 312 pp.

Grove-White D. (2004). Healthcare in the modern dairy herd. In Practice, 26: 368–376.

Hapek E.I., Tischner M. (2009). Pielęgnacja racic a wskaźniki rozrodu. Hoduj z Głową, 3: 18–27.

Haskell M.J., Rennie L.J., Bowell V.A., Bell M.J., Lawrence A.B. (2006). Housing system, milk production, and zero-grazing effects on lameness and leg injury in dairy cows. J. Dairy Sci., 89: 4259–4266.

Hernandez J.A., Garbarino E.J., Shearer J.K., Risco C.A., Thatcher W.W. (2005). Comparison of milk yield in dairy cows with different degrees of lameness, J. Amer. Vet. Med. Assoc., 227 (8): 1292–1296.

Hirst W.M., Murray R.D., Ward W.R., French N.P. (2002). A mixed-effects time-to-event analy- sis of the relationship between first-lactation lameness and subsequent lameness in dairy cows in the UK. Prev. Vet Med., 54 (3): 191–201.

Hristov S., Stanković B., Joksimović-Todorović M., Bojkowski J., Davidović V. (2007). Uticaj toplotnog stresa na proizvodnju mlečnih krava. Zbornik Naučnih Radova, 13 (3–4): 47–54.

Hristov S., Stankovic B., Zlatanovic Z., Todorovic-Joksimovic M., Davidovic V. (2008). Rearing conditions, health and welfare of dairy cows. Biotech. Anim. Husb., 24 (1–2): 25–35.

Hultgren J., Manske T., Bergsten C. (2004). Associations of sole ulcer at claw trimming with reproductive performance, udder health, milk yield and culling in Swedish dairy cattle. Prev. Vet. Med., 62 (4): 233–251.

Juarez S.T., Robinson P.H., DePeters E.J., Price E.O. (2003). Impact of lameness on behavior and productivity of lactating Holstein cows. Appl. Anim. Behav. Sci., 83: 1–14.

Laven R.A. (2007). The relationship between hoof conformation and digital dermatitis in dairy cattle. Cattle Pract., 15: 93–95.

Lean I.J., Rabiee A.R. (2011). Effect of feeding biotin on milk production and hoof health in lactating dairy cows: a quantitative assessment, J. Dairy Sci., 94: 1465–1476.

Lean I.J., Westwood C.T., Golder H.M., Vermunt J.J. (2013). Impact of nutrition on lameness and claw health in cattle, Livest. Sci., 156: 71–87.

MacCallum A.J., Knight C.H. i in. (2002). Effects of time of year and reproductive state on the proliferation and keratinisation of bovine hoof cells. Vet. Rec., 151: 285–289.

Manske T. (2002). Hoof lesions and lameness in Swedish dairy cattle: Prevalence, risk factors, effects of claw trimming and consequences for productivity. (Ph.D.

Thesis) Skara, Swedish University of Agricultural Sciences.
Manson F.J., Leaver J.D. (1988). The influence of dietary protein intake and of hoof trimming on lameness in dairy cattle. Anim. Prod., 47: 191–199.
Mc Daniel B.T. (1995). Genetics and importance of feet and legs in dairy cattle. Proceedings, 46th EAAP Meeting.
Mordak R. (2008). Kulawizny u krów – wieloprzyczynowy problem zdrowotny. Życie Weter., 83 (4): 288–291.
Mülling W.K.C., Green L., Barker Z., Scaife J., Amory J., Speijers M. (2006). Risk factors associated with foot lameness in dairy cattle and a suggested approach for lameness reduction. World Buiatrics Congress, Nice, France.
Nałęcz-Tarwacka T., Jędrzejek D. (2012). Influence of the selected hoof diseases on reproduction parameters of Polish HF cows. Acta Sci. Pol., Zootechnica, 11 (4): 79–90.
Navarro G., Green L.E., Tadich N. (2013). Effect of lameness and lesion specific causes of lame- ness on time budgets of dairy cows at pasture and when housed, Vet. J., 197: 788–793.
Phillips C.J.C., Morris I.D. (2002). The ability of cattle to distinguish between, and their preference for, floors with different levels of friction and their avoidance of floors contaminated with excreta. Anim. Welf., 11: 21–29.
Porter R.S., Kaplan J.L., Homeier B.P. (2010). The Merck Manual. Objawy kliniczne. Praktyczny przewodnik diagnostyki i terapii. Wydanie I. Wydawnictwo Elsevier Urban&Partner, Wrocław.
Pryce J.E., Esslemont R.J., Thompson R., Veerkamp R.F., Kossaibati M.A., Simm G. (1998). Estimation of genetic parameters using health, fertility and production data from a management recording system for dairy cattle. Anim. Sci., 66: 577–584.
Regula G., Danuser J., Spycher B., Wechsler B. (2004). Health and welfare of dairy cows in different husbandry systems in Switzerland. Prev. Vet. Med., 66: 247–264.
Sanders H.A., Shearer K.J., de Vries A. (2009). Seasonal incidence of lameness and risk factors associated with thin soles, white line disease, ulcers, and sole punctures in dairy cattle. Vet. J., 179: 360–369.
Scaife J.R., Galbraith H., Green L.E., Mulling C.M., Stanek C., Bergsten C., Urbanek K., Pijl R. (2006). Lamecow: multidisciplinary approach to the reduction in lameness and improvement in dairy cows welfare in the European Community. Cattle Pract., 14: 101–113.
Sogstad A.M., Osteras O., Fjeldaas T., Refsdal A.O. (2007). Bovine claw and limb disorders at claw trimming related to milk yield. J. Dairy Sci., 90: 749–759.
Somers J.G., Frankena K., Noordhuizen-Stassen E.N., Metz J.H. (2005). Risk factors for digital dermatitis in dairy cows kept in cubicle houses in The Netherlands. Prev. Vet. Med., 71, 11–21.
Szymaniak I. (2005). Kulawizna a rozród. Hod. Bydła, 6–7: 28–31.
Tadich N., Flor E., Green L. (2010). Associations between hoof lesions and locomotion score in 1098 unsound dairy cows. Vet. J., 184 (1): 60–65.
Telezhenko E., Bergsten C., Magnusson M., Ventorp M., Nilsson C. (2008). Effect of different flooring systems on weight and pressure distribution on claws of dairy cows. J. Dairy Sci., 91: 1874–1884.
Urbaniak K., Jaśkowski J. (2004). Kulawizny a płodność. Życie Weter., 79 (5):

263–265.
Van der Waaij E.H., Holzhauer M., Ellen E., Kamphuis C., Jong G. de (2005). Genetic parameters for claw disorders in Dutch dairy cattle and correlations with conformation traits, J. Dairy Sci., 88: 3672–3678.
Van Dorp T.E., Boettcher P., Schaeffer L.R. (2004). Genetics of locomotion. Livest. Sci., 90: 247–253.
Webster A.J.T., Knott L., Tarlton J.F. (2005). Understanding lameness in the dairy cow. Cattle Pract., 13: 93–98.
Winkler B., Margerison J.K. (2012). Mechanical properties of the bovine claw horn during lactation. J. Dairy Sci., 95: 1714–1728.

WALDEMAR TETER, PIOTR STANEK, WITOLD CHABUZ,
PAWEŁ ŻÓŁKIEWSKI, WIOLETTA SAWICKA

Risk factors for lameness in a dairy herd

SUMMARY

Lameness is an outward sign of leg problems, which affect cattle near the skin of toes and claws. Proper identification of the risk in a dairy herd and their elimination are one of the essential measures to increase the length of productive life and to improve the production and economic results of a farm. The aim of the study was to show the sources of risk factors in intensive milk production as well as the steps aimed at eliminating them. The study showed genetic and environmental causes of claw diseases. Super-vision of environmental factors, including nutrition as the main risk factor in herds with intensive milk production, was considered key for solving the lameness problem in the herd.

Key words: lameness, dairy cattle, leg diseases, claw diseases