



Problems of motor activity in cows with orthopaedic pathology

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Abstract. The relevance of the study is conditioned by the fact that diseases that manifest various degrees of lameness in cows are widespread (50-70%) among livestock. Milk productivity and body weight gain decrease in sick animals, which causes their culling. It is important to establish nosological forms of such pathologies and determine the effectiveness of their treatment. The purpose of the study is to analyse the problems of motor activity in cows with orthopaedic pathology. The study included an assessment of herd mobility before entering the milking parlour, which allowed comprehensively considering the rhythm and length of steps and the load on the cows' limbs. It was found that the development of purulent-necrotic processes is accompanied by severe lameness in 66.6% of animals. A smaller number of animals (16.6%) were diagnosed with mild lameness. It was found that in 100% of cases, pathological processes were localised in the pelvic extremities. In the vast majority of animals, more than 3/4 of the lateral hooves were affected. There were no differences in the development of pathological processes on the right or left pelvic limb. The results of the examination of cows proved that the surgical pathology was accompanied by the development of local purulent inflammation. The most common pathology of the distal limbs in cows was purulent pododermatitis, which accounted for 66.6% of surgical diseases. Phlegmon in the area of the corolla and interdigital ulcers were diagnosed less frequently, with their respective shares in the pathology structure being 16.6%. It is proved that for the treatment of lame cows

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with the use of Levomekol ointment, clinical recovery was established with the disappearance of symptoms of lameness for purulent pododermatitis up to 24 days, and for phlegmonic processes in the corolla area and lesions of the finger arch – up to 22 days. The proposed therapy regimens will help to reduce the duration of treatment of purulent pododermatitis, phlegmon in the corolla area and lesions of the finger arch compared to conventional methods

Keywords: hoof; limb damage; purulent pododermatitis; corolla phlegmon; interdigital ulcer; lameness

Introduction

Pathologies in the finger area in cows have a great impact on both animal productivity and health. As noted by A. Stotskiy *et al.* (2020) the number of cows with finger tissue lesions is 50-70% in dairy complexes. N.M. Khomyn *et al.* (2019) found that violation of the conditions of keeping animals and the lack of an appropriate level of veterinary and sanitary culture on farms does not allow achieving a balance between the body of livestock and its habitat. The uneven distribution of body weight on the sole surface caused by keeping animals on uneven floors contributes to the appearance of bruises, sprains and ligaments, slippery floors lead to falls and various injuries, including limb fractures, ligament tears, joint capsulitis, and excessively hard floors lead to excessive abrasion of the heel horn, etc. In such herds, it is difficult to maintain the health of animals at the proper level and prevent the occurrence, in particular, of aseptic pododermatitis. In the hoof of the thoracic and pelvic limbs of cows with aseptic pododermatitis, the amount of moisture decreases by 8.2 and 9.3%, respectively, and the concentration of SH-groups increases by 10.6 and 15.8% with a likely decrease in the content of calcium, sulphur, copper and zinc. The density of the hoof horn decreases and the resistance to abrasion of the hooves of the pelvic limbs decreases by 1.6 and 18.0%.

Lameness is a symptom of many diseases in the extremities (muscles, joints, tendons, ligaments, hooves) and one of the most common

causes of culling of cows from the herd. In dairy cows, lameness has serious negative consequences for the economy of production due to harmful effects on herd productivity. Violation of the function of movement of animals is manifested in a change in activity, which is associated with damage to the hooves, especially in the pelvic extremities. Hoof diseases are severe, which affects the well-being of dairy cows. Important factors that affect the health of the limbs are nutrition, animal hygiene, maintenance techniques, genetic and breeding predisposition. Nutrition is one of the main preventive factors that determine the quality and growth of the heel horn and the associated prevalence of diseases. The strength and structure of the heel horn are affected by the composition of the feed diet (amino acids, minerals, vitamins, toxic substances that pollute the feed or occur in them in the form of fungal metabolites) (Langova *et al.*, 2020). The main aetiological factors of hoof diseases are improper maintenance of animals, reduced feeding levels and unbalanced feed rations, lack of regular active exercise, sun exposure and regular orthopaedic cleaning (Khomyn *et al.*, 2017).

Observation and logistic regressions are used to obtain data and evaluate factors associated with lameness. As a result of research by M. Sadiq *et al.* (2020), hoof damage was reported in 470 cows out of 1,001 cows studied. Lameness was increased on farms with a high livestock density and in the presence of paths with

dirty concrete floors. There is also other data available, established by P. Kriz *et al.* (2021), on the prevalence of lameness and severe tarsal lesions and contamination of cows. Based on the results of collecting anamnesis and observations on 54 farms, cows were assessed for hock disease and the relationship with hygiene. Thus, it was found that the condition of the resting surface of cows is largely associated with the prevalence of lameness and the degree of lameness. The researchers found that on farms with loose keeping (17.4%), animals had a significantly lower prevalence of lameness (score ≥ 3 on a scale of 1 to 5, where 1 = normal movement) than on farms with loose keeping, installs and rubber bedding (30.5%).

Lameness is causing more and more problems for the dairy industry around the world. However, little is known about lameness and its causes in grazing cattle, especially in tropical climates. Researchers have established the prevalence of hoof lesions and lameness in dairy herds of cattle grazing year-round in tropical conditions, and also identified the main lesions associated with lameness. In particular, 48 farms located in the state of Minas Gerais, Brazil, were studied. It was found that among the 2,267 cows evaluated during lactation, 16.0% were rated as lame and 7.0% as severely lame. The researchers noted that cows had at least one type of hoof lesion, of which heel horn erosion (90.0%), white line fissure (50.0%), and finger dermatitis (33.0%) were the most common. Heel horn erosion was present on all farms, and finger dermatitis was diagnosed in 96.0% of farms. A sole ulcer was observed in one animal. The results of the study show that finger dermatitis and white line cracking are the main problem and the main cause of lameness in cows (Moreira *et al.*, 2018).

Cattle lameness is an important welfare issue that also has an economic impact on the dairy industry. Factors associated with

lameness were found to be poor assessment of body condition, long time spent in pens, confinement in pens during periods of drought, and poor hygiene. For hoof lesions, floor features were the most significant factor in determining the probability of heel horn erosion, white line cracks, and sole haemorrhage – more than 3 times. Results of the study by M. Kibar & T. Caglayan (2016) show that improving the hygiene conditions and floor conditions of rooms where animals are kept is the first step to planning measures aimed at reducing lameness. Lameness, according to M. Huyssteen *et al.* (2020), is a major concern for the health and productivity of dairy cattle, which is extremely common in North American herds. The researchers provided information on the prevalence of lameness and hoof damage in loose herds in the province of Alberta. It remains high, which indicates a low level of adoption by manufacturers of mitigation strategies.

The purpose of the study was to investigate the motor activity of cattle in pathologies of the motor system and test a new treatment regimen for purulent pododermatitis and phlegmon in the finger area in animals.

Literature Review

B.E. Griffiths *et al.* (2018) found that the mean prevalence of lameness on a farm was 31.6% with a standard deviation of 13.9% and a range of 5.8-65.4%. A total of 14,700 cows were evaluated for mobility, of which 4,145 cows were found to be lame (28.19%); 536 cows received a score of 3 (which is 3.65% of the cows evaluated). The repeatability of mobility assessment was investigated by evaluating one herd (189 dairy cows) twice on the same day. In particular, it was found that the prevalence of lameness in the herd was 27.5 and 28.0% (morning and afternoon milking, respectively). Researchers cite summary data estimates of the frequency of lameness that indicate a high level of the

disease. It is estimated that approximately 30% of British dairy cattle suffer from this disease during the year. This statement is reinforced in the paper by O. Atkinson (2022), who investigated the prevalence of lameness in dairy herds in the UK. The latter is estimated at about 30-32%. The researcher notes that most farmers constantly underestimate this indicator (Afonso *et al.*, 2020).

J. Somers *et al.* (2019) note that herd-level risk factors are associated with the cow's environment and lameness. The uncomfortable surface of the stall, insufficient depth of the litter, and the abrasive surface of the floor are factors that contribute to an increase in the level of lameness. It was found that dairy cattle that are grazed are exposed to a different set of lameness risk factors, mainly related to the animal's motor activity. Researchers have established the risk of lameness in the first 150 days of lactation. Lameness data were collected from 10 dairy herds in pastures. A total of 1,715 cows were examined, of which 1,675 cows were available for analysis. The association between lameness status and potential risk factors at the cow level was determined using multivariate logistic regression. The researchers note that data collected as part of herd health monitoring can be used in conjunction with lameness records to identify deficiencies in controlling it. J. Tunstall *et al.* (2021) suggest that animal lameness in beef production is not given enough attention in the UK, despite the fact that it is a generally recognised problem in the dairy industry. The researchers found that British beef farmers underestimated the prevalence of lameness on their farms. It is considered that its indicator is 7% with a range from 5 to 9%. L. Randall *et al.* (2019) note that obtaining accurate estimates of lameness levels in a dairy herd is challenging due to the difficulty of selecting truly random samples. Accurately quantifying the incidence of lameness in herds

is problematic because most of the available information is based on non-random and potentially biased data sets.

The researchers determined the prevalence of lameness and examined potential risk factors in cows in Canada's Maritime provinces. Cows were also evaluated in 46 free-range herds and 33 tethered herds in Nova Scotia, New Brunswick, and Prince Edward Island. Thus, the prevalence of lameness was 21.0% for cattle that were kept loose, and 15% for cattle in premises. Of the 1,488 cows kept in stalls, 68.0% showed no behavioural changes, while 15, 15, 2, and <1% showed 1, 2, 3, or 4 changes, respectively. With the loose method of keeping, the chances of lameness were higher when cows spent ≥ 3 hours/day in the milking area compared to cows in this area <3 hours/day. In animal herds, a higher probability of lameness was observed when the litter was wet than when it was dry. For both types of rooms for lactating cows, keeping dead cows and heifers in deep bedding compared to a tethered or loose method was associated with a reduced chance of lameness (Zhao *et al.*, 2015).

D. Beggs *et al.* (2019) note that on Australian pasture farms, where cows can often walk several kilometres and stand for several hours a day in a crowded concrete yard while they wait to be milked, the potential for the negative impact of lameness on animal welfare is a constant concern. Several studies have shown that farmers tend to underestimate cases of lameness. The researchers evaluated 19,154 cows on 50 farms for lameness in herd groups of about 100 to 1,000 cows after milking. The researchers compared these results with farmers' data on lameness of the same day. The following rating system was used: 0 – moves normally; 1 – moves unevenly; 2 – limps; 3 – severely limps. All very lame cows were identified by the farmer, but overall they identified only 24% of the cows identified by the lameness assessment. Analysis

of the position of lame cows in the milking order showed that an assessment of the lameness of the entire herd was necessary to identify all lame cows. However, the lameness score in only the last 200 cows that were milked can be used as a screening test to determine the prevalence of lameness below a given threshold.

J. Kofler *et al.* (2021) note that the effect of lameness on milk yield in dairy cows has already been investigated in many countries by many, but most often mobility indicators ≥ 3 were considered almost exclusively. Overall, data from 4,005 cows from 144 dairy farms across Austria were evaluated using two statistical models. The farm, year and time of calving were considered, and the number of lactation days were included in the analysis of milk, fat, and protein yield indicators. The researchers found that the average cumulative prevalence of lameness during the follow-up period was 51.0%, and 8.1% of cows had adverse motor activity indicators. During the first 100 days of lactation, 34.7% of all cows were lame.

M. Garvey (2022) noted that lameness is one of the three main problems of dairy cattle worldwide after mastitis and infertility, leading to reduced productivity, economic losses, and animal welfare problems. Lameness is associated with reduced milk yield, insufficient weight gain, low fertility, and frequent culling of animals. Environmental risk factors (temperature, humidity) and surrounding animals contribute to the severity of the disease, making this multi-faceted disease difficult to eradicate and control. Thus, worldwide, the prevalence of lameness in dairy herds ranges from 17 to 35%.

D. Kucevic *et al.* (2022) investigated the effect of the system of keeping (tethered and free-stall cows) on the prevalence of hoof diseases, and also established the percentage of culling in 6,348 dairy cows of Holstein breed from 5 farms. Over three months of hoof examination, it was found that both retention

systems were equally affected by the same diseases. In this regard, pathology in the area of the white line was diagnosed in both systems with a prevalence of 0.5-1%, finger ulcer 5% and necrosis in 3-6% of animals, Rusterholz ulcer in 20-23%, finger dermatitis in 18-20%, interdigital thyloma in 10-12%, interdigital phlegmon in 0.7-0.77%, while the prevalence of mechanical damage was insignificant and in similar quantities – 0.2-0.5%. According to the researchers, cows with untethered keeping were more likely to suffer from interdigital dermatitis (39.11%) compared to cows in the tethered keeping system (20.40%). In contrast, diagnosed acute, chronic, and haemorrhagic laminitis was more pronounced in cowsheds with a tethered stall (18.61%) than in cowsheds with a free stall (0.88%). In the statistical analysis performed, statistically significantly more diseases were registered in the tethered keeping system than in the untethered one ($P < 0.01$). For three months of the study, the average percentage of culling with untethered keeping was 5.4%, and with tethered keeping – 4.9%. This difference was not statistically significant ($P < 0.05$).

Materials and Methods

The research was conducted in the period from October 2022 to March 2023 at the private enterprise “Agroecology” of the Myrhorod district, Poltava Oblast. At the beginning of the work, limb diseases in cows were monitored. Digital colour photographs available in the literature in accordance with the international classification system adopted during the 15th International Lameness Committee (2008) were used to identify each hoof lesion. Animal conditions and experimental research methods were conducted in compliance with the requirements of the “general ethical principles for conducting animal experiments” approved by the 1st National Congress on Bioethics (Law of Ukraine..., 2006) and the provisions of the “European Conven-

tion for the Protection of Vertebrate Animals used for Experimental and other Scientific Purposes” (1986). A total of 12 cows with lameness were examined and treated. All the animals had hoof lesions in the pelvic limbs. The cows of the dairy herd were evaluated for mobility when they left the parlour after morning, afternoon, or evening milking. The mobility of each herd was evaluated at the entrance to the milking parlour. The proportion of clinically lame cows was calculated for each farm. 0 points – the animals have a gait with uniform support and rhythm on all hooves with a flat back, long smooth steps; 1 point – steps are uneven (rhythm or length of steps is shortened, the affected limb or limbs do not immediately move to the stage of support on all four hooves with a flat back, long smooth steps during movement; 2 points – uneven load on the limb, the affected limb immediately after removal tries to return to a static position (accelerated rhythm of movement of the affected limb, shortened steps, the affected limb or limbs not immediately identified as diseased, clearly curved towards the centre of the back; 3 points – the animal is unable to move as fast as a healthy one, does not keep up with a healthy herd. The movement of the cow was observed when the animal walked at a normal pace and moved along a straight route through the pen.

Diagnosis of hoof lesions in the studies was carried out during trimming based on visual analysis, the presence of a specific smell in the pathological focus, and local pain reactions of cows based on the international standardised diagnosis described by J. Espinasse *et al.* (1982). Lesions were marked as absent or present on the pelvic extremities. Additionally, the cleanliness of the shin, flanks and udder was also assessed on a 4-point scale based on the amount and freshness of the manure present (Militaru *et al.*, 2019). The evaluated limb area was located between the corolla and the lower

half of the tarsal joint on the lateral surface of the right limb. The state of contamination on the right side of the animal was assessed. The surface was considered clean at 0 (fresh manure spatter on <50% of the area); 1 point (fresh manure spatter on ≥50% of the area). Dirty at 2 (dry manure on ≥50% of the area); 3 (dry manure on the entire area). Given that the accumulation of contamination occurs mainly due to the spatter of manure on the lower part of the limb during movement, it is advisable to have a balanced distribution for the cleanliness of the lower leg. It is well known that cows do not choose which side they lie on. Thus, it can be expected that manure contamination will be equally distributed on the right and left sides. Therefore, for consistency between cows and to reduce the amount of time spent on animal measurements, only the right side score was chosen. The obtained data on the spread of pathology and its types allowed planning further procedures aimed at recovering animals from lameness. It also made it possible to calculate the resources needed to overcome the disease. In addition, the survey data provided an opportunity to set priorities for initiatives in the treatment of animals, considering the time aspect. After performing orthopaedic hoof cleaning in sick animals and primary surgical treatment of the pathological area, a Chemi-spray aerosol drug was applied to the affected area. Levomekol ointment was applied to the affected surface of the tissues using cotton-gauze swabs on top of the “chemi-spray”. The therapeutic substance was fixed with a dressing material (bandage). Manipulations were performed once every 48 hours. At the end of the experiments, the material was processed statistically and presented in the form of tables. Statistical data processing was performed in Excel.

Results and Discussion

During the monitoring studies, the analysis of reporting data on the frequency of hoof lesions

was carried out. It was established that in 2022-2023, the diagnosis of pathology in the distal part of the limb was made 12 times. The findings are presented in Table. 1.

Table 1. Assessment of motor activity of sick cows using the AHDB system

Scores	Indicator	Animal units (%)
0	Gait with uniform support and rhythm on all hooves with a flat back. Long smooth steps are possible	-
1	The steps are uneven (the rhythm or length of the steps is shortened, the affected limb or limbs do not immediately go into the stage of support on all four hooves with a flat back, when moving long smooth steps	2 (16.7)
2	Uneven load on the limb, the affected limb immediately after removal tries to return to a static position (accelerated rhythm of movement of the affected limb, steps are shortened, the affected limb or limbs are not immediately identified as patients, clearly curved to the centre of the back)	8 (66.6)
3	The animal is not able to move as fast as a healthy one, does not keep up with a healthy herd	2 (16.7)
Total		12 (100)

Source: developed by the author based on research by AHDB (2020)

The established results prove that the vast majority of cows were diagnosed with severe lameness, the steps were different in size, significantly shortened compared to the norm. The animals held the limb in the air. In dynamics, the animal has long smooth steps. In the herd under study, both mild motor activity disorders and severe motor activity disorders were recorded in the same number of percentages. The results obtained are consistent with data by E. Flor & N. Tadich (2008), who noted that the prevalence of lameness was 33.12% in LDH and 28.7% in SDH ($P < 0.02$). Of all lame cows, 50.85% and 44.05% had a lameness score ≥ 2 for LDH and SDH, respectively. The three main lesions on large farms were white line lesions (54.9%), sole bleeding (52.7%), and heel erosion (48.4%), while on small farms they were white line lesions (82.5%), heel erosion (53.3%), and haemorrhages (24.6%). 92% of lesions were found in the pelvic limb area in both types of herds. The authors concluded that lameness is highly common on dairy farms.

4 behavioural changes were evaluated in animals at rest: standing on the edge of the stall,

supporting one pelvic limb, moving weight between the pelvic limbs, and uneven load when moving from side to side. Before starting the assessment, the cows had to stand for at least 3 minutes, the cow was observed from behind for 30 seconds, and behavioural changes were evaluated from different angles. The cow was then urged to step from side to side 2-4 times to assess the condition of the pelvic limbs. The cow was monitored after moving for another 30 seconds for behavioural changes. A cow with 2 or more behavioural changes was considered lame. A cow that rested on one limb and held its weight unevenly while moving from side to side was more likely to suffer damage to the hooves of the pelvic limbs than a cow that did not exhibit this behaviour. When considering specific hoof lesions in a cow whose one limb was at rest and carried uneven weight, it had a higher chance of developing pathology compared to those that did not exhibit this behaviour. Behavioural indicators of weight resistance and limb position helped identify cows with pelvic limb hoof damage.

The expediency of conducting such an assessment is reflected in the papers by

P.T. Thomsen *et al.* (2012), who evaluated the motor activity of cows, recorded the behaviour of animals in a supine position and collected data on hoof damage seen during trimming. The results were analysed using logistic regression with hoof damage as a result and motor activity assessment (1-5), which found that the probability of all hoof and skin lesions increased with increasing locomotion assessment and an increase in the average duration of supine seizures. It was concluded that motor activity assessment can be used as a tool for managing healthy hoof health in dairy herds.

The researchers evaluated the state of animals in static dynamics and local changes. During a clinical examination, it was found that animals in which motor activity was estimated at 1 point showed uneven gait when moving, they limped, but not constantly, and lameness increased with intense movements. In a static position, the animals transferred their body weight as much as possible to the opposite healthy limb, the diseased limb was periodically removed from the support and supported only on the hooked part of the hoof. In animals that were given 2 points for lameness, a load transfer to the cervical part was noted clinically during movements. When the animal took a step, it raised its head up as much as possible and quickly carried the diseased limb out and returned it to a static position after carrying it out. That is, the animal took quick shortened steps with a sick limb. Cows that were rated limp at 3 points did not move much and often lay down. In the state of movement, they practically did not lean on the affected limb, jumping on three limbs. In a static position, the affected limb was in a suspended state and, only occasionally, the animal rested on the hooked hooves of the affected hooves for a short time. The obtained data matches the data of R.C. Ebling *et al.* (2019), who note that hoof damage is one of the main causes of reduced productivity in the

dairy industry and is conditioned by the degree of motor activity of cows and the frequency of horn trimming in the area of the animal's finger.

N. Browne *et al.* (2022) identified lesions associated with a higher lameness score, established a relationship between the lesions, and identified risk factors. On 98 farms during the grazing period and on 74 of the same farms during the housing period, each cow was assessed for lameness (0-3 lameness score), including examination of the pelvic hooves of lame cows (scores 2 and 3) (maximum 20 cows per visit), and the prevalence of each type of lesion was recorded. The most common types of lesions during both grazing and keeping were white lines, sole haemorrhages, and pointed hooves; all other lesions had a prevalence of less than 15%. The prevalence of lesions at the cow level was 19% during the grazing period and 25% during the housing period; the most common lesion was sole ulcers in both periods. The researchers found significantly more foreign bodies in the sole of the hoof (pasture = 14%, indoor = 7%) and sharp-angled hooves (pasture = 71%, indoor = 55%) during the grazing period compared to the housing period. Cows with hoof damage, sole ulceration, pododermatitis, finger necrosis on the limb, or amputated hoof were more likely to develop severe lameness compared to mild lameness. According to the researchers, the results of such assessment will help understand the causes of lameness in partially pasture-raised dairy cows and can be used to develop prevention and treatment protocols.

Evaluating the localisation of pathological processes, the authors found that they were 100% localised on the pelvic extremities. In the vast majority of cows, more than 3/4 of the lateral hooves were affected. There was no difference in the development of pathological processes on the right or left pelvic limb. M. Rodriguez *et al.* (2021) indicate that to some extent, this effect on the pelvic limbs is equally conditioned by the

distribution of weight between paired pelvic limbs and the presence of hoof horn destruction. This apparently affected differences in local blood circulation in the affected and unaffected contralateral pelvic limbs in lame cows. According to the results of clinical studies, it can be concluded that the surgical pathology of cows

was accompanied by the development of local purulent inflammation, according to the pathology of the finger, the development of lameness was recorded in the vast majority of moderate degrees (2 points). Nosological forms of lesions in the distal part of the limbs of cows were also established (Table 2).

Table 2. Nosological forms of hoof lesions in cows

Type of pathology	Animal units (%)
Purulent pododermatitis	8 (66.6)
Corolla phlegmon	2 (16.7)
Interdigital ulcer	2 (16.7)
Total	12 (100)

Source: compiled by the authors

The results obtained indicate that purulent pododermatitis was the most common pathology of the hoof area, and phlegmon in the corolla area and interdigital ulcers were less diagnosed. Investigating the causes of the development of purulent pododermatitis, it was found that its appearance was provoked by mechanical damage that animals received when moving on a concrete floor. A contributing factor was that the concrete floor was rough and significantly eroded the sole when the animal moved. Thus, the sole was thin and did not fulfil its protective properties. This fact was confirmed by the fact that when trimming, the soles of some cows had dark blue spots, which is evidence of the development of pododermatitis. The reason for the development of phlegmonous processes in the corolla area is also seen in the constant injury of the corolla area. Thus, the simultaneous influence of mechanical force and constant microtrauma caused the development of a pathological process in this area.

Symptomatics for corolla phlegmon in cows had a classic manifestation. Thus, with the corolla phlegmon, clinically the process was accompanied by swelling of the inflamed area, soreness when pressing on the hoof, pulsation

of the digital arteries, an increase in local temperature, the release of purulent exudate from the fistula and a slight increase in the total body temperature in the range of 0.2-0.4°C, a decrease in milk yield in the range of 10-15%. Sick animals were lying down for a long time and lost their appetite. When the animal moved, lameness of the operated limb of a moderate degree was noted. In cases of diagnosis of purulent pododermatitis, the symptoms had some differences. Thus, with superficial purulent pododermatitis, similar symptoms were noted in sick cows as with a phlegmonous process in the corolla area and fistulas were detected, from which purulent exudate was secreted. When diagnosing deep purulent pododermatitis in sick animals, there were signs of a more pronounced effect on the animal body. The increase in the total body temperature in such cows has already reached 0.4-0.5°C.

A. Stotskiy *et al.* (2020) indicate that while in the superficial course of the process, the lameness was of a moderate degree, in the deeply severe course, the animals held the limb in a bent position and stood only on the hooked part of the hoof. In a clinical study of animals, pathological processes in the finger

area were characterised by the following symptoms. In purulent pododermatitis, swelling in the sole area was noted, and pressing it with fingers could cause a strong painful reaction in the animal. The cow tried to free the limb from fixation. When palpating the digital arteries, their strumming (an increase in the amplitude of vibrations) was observed. When performing a funnel-shaped autopsy in the sole area, purulent exudate leakage was observed. Evaluating the exudate, it was found that it was of a liquid consistency, the colour ranged from pink to dirty grey. In more than half of the animals under study, purulent exudate had a sharp, unpleasant, sweet smell. In phlegmon, local formation of a crescentic painful swelling of a doughy consistency in the corolla area was noted. The fingers were slightly apart. When performing oblique autopsies, the release of thick white purulent exudate without foreign impurities and smell was observed (Fig. 1).



Figure 1. Corolla phlegmon of cattle

Source: developed by the author

Symptoms of an interdigital ulcer were the presence of a skin defect in the area between the fingers, in which signs of connective tissue development and weakly expressed skin epithelialisation processes were noted. The processes were localised in the middle third of the interdigital arch. High humidity in the premises in

winter causes softening and maceration of the skin in the area of the interdigital gap. In addition, given that cattle were cloven-hoofed animals, foreign objects often got between the fingers in addition to manure, which injured the area, and the bacteria complicated the pathological process (Fig.2)



Figure 2. Ulceration of tissues in the area of the interdigital arch

Source: developed by the author

After conducting studies, it was found that the predominant cause of finger pathology in cows was injuries, a low percentage of lameness reflects a high level of farm management. As noted by J. Kofler (2017), three theories for the development of finger lesions of the limb are currently proposed: traumatic hoof injury; disruption of blood vessels in the finger area due to both external and internal factors; and, as a result, the development of laminitis. To understand the influence of the environment on the pathological process, the contamination of the skin surface was assessed in the area of the limb, flanks, and udder on a 4-point scale based on the amount and freshness of the manure present (Table 3).

The results prove that the body surface of sick cows, despite the pathological process, remained clean (Fig. 3).

Table 3. Assessment of skin surface contamination of lame cows

Scores	Indicator	Animal units (%)
0	Fresh manure spatter on <50% of the area	2 (16.6)
1	Fresh manure spatter on ≥50% of the area	10 (83.4)
2	Dry manure on ≥50% of the area	-
3	Dry manure on the entire area	-
Total		12 (100)

Source: compiled by the authors

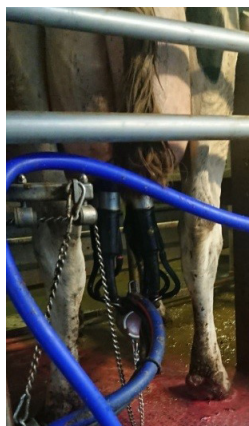


Figure 3. Assessment of skin surface contamination of cows with lameness

Source: developed by the author

Thus, B.E. Griffiths *et al.* (2018) note that improving the sanitary and hygienic conditions of keeping animals and the quality of the stable floor condition is the first step towards

planning measures aimed at reducing lameness and hoof damage. The effectiveness of Levomekol ointment was established for the pathology diagnosed above in cows (Table 4).

Table 4. Effectiveness of the treatment performed

Type of pathology	Recovery period, days
Purulent pododermatitis, n=8	24.0
Corolla phlegmon, n=2	22.0
Skin ulcer of the interdigital arch, n=2	22.0

When using Levomekol ointment in animals with phlegmonous and ulcerative processes of the skin of the interdigital arch, the wound surface was released from necrotic detritus. However, a small amount of thick purulent exudate was simultaneously observed in the wound. After the first treatment, improvements in the general condition were recorded in the animals.

They were less depressed, tried to lean on the affected limb, and their lameness decreased. After the 10th day of drug use, most animals showed no lameness and only some animals showed it during movement. In the lesion, the wound surface was released from the purulent exudate and the defect was filled with granulation tissue. In addition, in animals with phlegmonous and

ulcerative processes, the absence of inflammatory oedema and pus leaks was noted.

The use of Levomekol ointment helped accelerate the recovery of animals with pathologies in the finger area. Signs of lameness disappeared with purulent pododermatitis in 24 days. With phlegmonic processes in the corolla area and lesions in the finger arch area – in 22 days. The results obtained are consistent with the results of I. Bondarenko & S. Rublenko (2020), who note that Levomekol ointment in the treatment of pododermatitis promotes faster recovery compared to the use of other drugs of similar action. Thus, it was found that Levomekol ointment and Chemi-spray helped accelerate the elimination of clinical symptoms such as lameness, swelling, soreness of the sole and in comparison with conventional treatment with Chemi-spray and iodoform powder provided a reduction in the duration of treatment by 1.4 times.

Research of research by M. Ninkovic *et al.* (2021) confirm the findings, indicating that regular hoof trimming (twice a year) and adequate conditions of maintenance are crucial for improving hoof health. J. Afonso *et al.* (2020) note that monthly hoof examinations significantly reduce the prevalence of finger pododermatitis in the herd. After hoof trimming, removal of destroyed tissues and first treatment, animals with purulent pododermatitis showed a decrease in exudative phenomena and the release of the wound surface from avitalised tissues (Fig. 4).



Figure 4. Trimming of the hoof horn in the area of the hoof sole in a cow with purulent pododermatitis

Confirmation of the effectiveness of maximum removal of necrotic tissues is found in the paper by R. Rinnovati *et al.* (2019), where a clinical study found out the effectiveness of various methods of treating pathologies in the finger area. The effectiveness of thorough and aggressive surgical removal of lesions of destroyed tissues for pathology in the white line area was established by treating 236 cows with lameness in combination with a therapeutic dressing. This contributed to rapid clinical healing (a marker of which was the growth of new tissue), followed by improved milk production. M. Alvergnas *et al.* (2019) note that the most effective strategy is early detection (regular checking of hooves with mirrors, pressure plates or infrared thermometers) and diagnosis (by veterinarians or trained farmers), regular trimming of hooves (no more than twice a year), bedding with sand and a clean and dry floor, a balanced diet to avoid any scarring acidosis.

Hoof baths are important for the prevention of infectious diseases of cattle hooves. Their use on farms, according to N.B. Cook (2017), helps maintain high milk yields by reducing the occurrence of musculoskeletal diseases. These treatments help reduce the risk of these disorders, especially finger dermatitis. According to M. Alvergnas *et al.* (2019), weekly use of 5% CuSO₄ solution for hoof baths has a therapeutic effect on bovine toe dermatitis, as this solution has antibacterial properties. However, according to N.B. Cook (2017), since 2006 in the European Union due to the toxicity of this compound and its insufficient biodegradability, the use of CuSO₄ was forbidden.

Thus, diseases such as purulent pododermatitis and interdigital ulcers are pathologies that were most often registered in cows during the study. When monitoring the cleanliness of the skin surface in the area of the affected limb, it was noted that cows with lameness remained clean. The treatment regimen using Levomekol

ointment and Chemi-spray aerosol has proven its effectiveness and can be proposed for use by practitioners in the treatment of cows with pathologies in the finger area accompanied by lameness.

Conclusions

Using a systematic review of prevalence and morbidity as a methodology in the field of evidence synthesis, it was proved that the vast majority of cows (66.6%) were diagnosed with severe lameness. The dominant pathology in the hoof area was purulent pododermatitis, the share of which in the structure of pathology was 66.6%. The spatter of fresh manure on $\geq 50\%$ of the area was observed in 83.4% of the animals under study. There was no difference whether inflammation occurred on the right or left limb. The reason for the development of purulent pododermatitis was the mechanical damage that animals received when walking on a concrete floor. The main aetiological factor was that the concrete floor had a rough surface, and therefore, cows significantly eroded the sole during movement on it. This was confirmed by trimming the horn in the sole area. In some cows, the base of the skin had dark blue spots, which was evidence of the development of pododermatitis. The reason for the appearance of phlegmonous processes in the corolla area is a constant injury to its area. According to the clinical examination of cows, pathological processes in the hoof area were characterised by the development of local purulent inflammation. When palpating

the digital arteries, their strumming (an increase in the amplitude of vibrations) was observed. When performing a funnel-shaped autopsy in the sole area, purulent exudate leakage was observed. As a result of its evaluation, it was found that the purulent exudate had a liquid consistency, and the colour ranged from pink to dirty grey. In more than half of the animals, exudate had a sharp, unpleasant, sweet smell. Topical application of Levomekol ointment for the treatment of sick animals already on the 10th day contributed to the removal of purulent exudate from the wound surface and filling the defect with granulation tissue. The use of Levomekol ointment provided clinical recovery with the disappearance of symptoms of lameness for purulent pododermatitis in 24 days, for phlegmonous processes in the corolla and lesions of the finger arch in 22 days, and in the treatment of wounds and abscesses, respectively, on 27 and 29 days.

In the future, it is planned to continue studying the nature of lameness in cows on farms and the effectiveness of using various therapeutic schemes for sick animals, considering the features of the influence of numerous environmental factors on the development of the pathological process.

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Conflict of Interest

None.

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Проблеми рухової активності в корів з ортопедичною патологією

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Анотація. Актуальність дослідження зумовлена тим, що хвороби, які проявляються різним ступенем кульгавості в корів, мають значне розповсюдження (50-70 %) серед поголів'я. У хворих тварин знижується молочна продуктивність і прирости маси тіла, що стає причиною їх вибракування. Важливим є встановлення нозологічних форм таких патологій та визначення ефективності їх лікування. Мета проведеного дослідження – проведення аналізу проблем рухової активності в корів з ортопедичною патологією. Наукове дослідження включало проведення оцінки мобільності стада перед входом у доїльну залу, що дозволяло комплексно розглянути ритм і довжину кроків та навантаження на кінцівки корів. Встановлено, що розвиток гнійно-некротичних процесів супроводжується у 66,6 % тварин вираженою кульгавістю. У меншій кількості тварин (16,6 %) діагностовано кульгавість легкого ступеня. З'ясовано, що в 100 % випадків патологічні процеси локалізувалися на тазових кінцівках.

У переважної більшості тварин, більш ніж $\frac{3}{4}$, вражалися латеральні ратиці. При цьому, не відмічали різниці щодо розвитку патологічних процесів на правій чи лівій тазовій кінцівці. Результатами обстеження корів доведено, що хірургічна патологія супроводжувалася формуванням локального гнійного запалення. Із патології в дистальному відділі кінцівок у корів найпоширенішою патологією ділянки пальця були гнійні пододерматити, частка яких в структурі хірургічних хвороб становила 66,6 %. Менше діагностовано флегмон в ділянці вінчика та міжпальцевої виразки, їх частки відповідно в структурі патології становили по 16,6 %. Обґрунтовано, що за лікування кульгаючих корів із застосуванням мазі Левомеколь встановлено клінічне одужання із зникненням симптомів кульгавості за гнійних пододерматитів до 24 доби, а за флемонозних процесів у ділянці вінчика та ураження пальцевого склепіння – до 22 доби. Запропоновані схеми терапії сприятимуть скороченню термінів лікування гнійних пододерматитів, флегмон у ділянці вінчика та ураження пальцевого склепіння порівняно з традиційними методами

Ключові слова: ратиця; ураження кінцівок; гнійний пододерматит; флегмона вінчика; міжпальцева виразка; кульгавість