

# Selection of Parameters in the Development of a Welfare Assessing System on Dairy Farms in Ukraine

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**Abstract.** *The livestock sector is of great importance in the agriculture of Ukraine, but it still does not have a system for assessing animal welfare. It is important for Ukraine to create such a system, considering legislative requirements, climatic and cultural factors, peculiarities of animal husbandry. Our goal was to select basic, practical and scientifically based parameters for the system of assessing the cow's welfare on dairy farms in Ukraine. After the first phase of our research, namely the analysis of modern global protocols, codes and evaluation systems, we determined 57 parameters. In turn, after the second phase, which consisted of expert discussions, 4 parameters were excluded due to their impracticality in Ukraine, difficulty of assessment, and assessment time. Also, as a result of expert discussions, 3 more parameters were added to the system. During the third phase, namely testing on two farms, we removed 8 more parameters. So, in the final phase of testing on the third farm, the expediency of using 48 parameters to assess the cows' welfare on dairy farms in Ukraine was verified and substantiated. It is appropriate to note the universality of this system in relation to different numbers of livestock and systems of keeping animals. We consider it necessary to conduct further testing of parameters on a larger number of dairy farms in Ukraine.*

## Introduction

Nowadays, the welfare of farm animals is an integral part of the sustainable development of animal husbandry. A high level of animal welfare is increasingly recognized as an important component of trade in animal products (Dunston-Clarke et al., 2020). Current research (Clark et al., 2017; Wolf et al., 2017; McKendree et al., 2014; Bejaei et al., 2011; Spooner et al., 2014; Estévez-Moreno et al., 2022; Miranda-de la Lama et al., 2017; Malek et al., 2017) proves the growing level of concern of consumers in different countries regarding the welfare of animals on farms. Modern society is increasingly interested in the conditions of keeping, feeding and treating animals whose products they consume. Therefore, worldwide social demand for quality animal products from farms with a high level of animal welfare has led to the development of various animal welfare schemes (Sapkota et al., 2020).

An important aspect of establishing welfare on farms is the development, implementation and timely updating of the legal framework for the welfare of farm animals. In this aspect, Ukraine has signed an agreement with the EU, which provides for the maximum approximation of the legislative norms of Ukraine to the EU legislation in the field of animal welfare (Petkun and Nedosekov, 2022). Despite this, there is no standardized animal welfare assessment scheme and regular assessment of dairy farms in Ukraine.

Most modern animal welfare assessment programs on dairy farms are based on the Five Freedoms

model (Mellor, 2017). Grounded on this, building an evaluation system is based on direct parameters (based on animals) and indirect parameters (based on resources). Today, the vast majority of systems pay the greatest attention to direct parameters, because they reflect the direct impact of the environment on the animal and demonstrate its response to the provided resources. However, indirect parameters are also important as they are useful as predictors of potential welfare problems (Sapkota et al., 2020).

Based on the Five Freedoms model, Mellor (2017) identified four key building blocks of animal welfare management: feeding, environment, health and behaviour. Each of them needs a sufficient depth of assessment, if the welfare assessment system is aimed at a comprehensive study of both the physical and emotional states of the animal.

In turn, it is important that the assessment is appropriate for the management system in which the animal is kept (Winckler et al., 2003). Protocols suitable for one system may not be suitable for another. A similar rule can be applied to different countries, climatic zones, etc.

The purpose of our study was to select parameters for further development of a basic, practical, feasible and scientifically grounded system for assessing the cows' welfare on dairy farms in Ukraine.

## Materials and Methods

### *Collection and analysis of potential parameters*

During the search and selection of parameters, the following world protocols and systems for assessing the welfare of cattle on dairy farms were taken as a basis: Welfare Quality (2009) Red Tractor, The Code of Welfare (2019) FARM (2022), Cow Comfort (Van Eerdenburg et al., 2013).

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All systems were analysed by the authors and discussed with experts in order to exclude the following: 1) parameters related exclusively to meat cattle breeding; 2) parameters related to the pasture; 3) parameters that required significantly more time than it was available to assess the farm in one day; 4) parameters that are not typical for farming in Ukraine.

The parameters that were suitable were used to create a system for assessing the dairy cows' welfare on farms in Ukraine and tested them for feasibility. The system was pre-tested for compliance with Ukrainian farm animal welfare legislation to confirm that no potentially important welfare areas covered by the legislation were missed.

#### *Feasibility testing of welfare assessment parameters*

The system was tested on three dairy farms of Ukraine in the period from July 2023 to October 2023. During the first stage, two farms were assessed, and after the analysis of the parameters, the final assessment took place on the third farm. All parameters were evaluated for practicality, time spent, ease of assessment, best place and period for assessment.

The first technical and economic testing was carried out in July 2023 on a farm with a tied method of keeping and a herd of 324 cows (290 milking cows). The second testing was carried out in August 2023 on a farm with a loose housed method of keeping and a herd of 1100 cows (681 milking cows).

Farms were selected specifically with different numbers of cows and husbandry methods to confirm or disprove the applicability of these welfare parameters to different dairy farms. Assessment based on farm records, as well as parameters that are difficult or impossible to investigate on the farm in a short time (mastitis records, dehorning methods, etc.), was carried out through a survey of the farmer or veterinarian (Appendix A).

All parameters (direct and indirect) were evaluated by one person at the time when the animals were

in stalls or pens. When estimating animal-based parameters, we did not aim to survey the entire herd, so we applied a similar concept to the Welfare Quality protocol (Welfare Quality, 2009). In herds with up to 300 cows, 20% of animals were examined; in herds with 300–500 cows, 15% of animals were examined; and in herds with more than 500 cows, 10% of animals were examined. Cows for observation were chosen arbitrarily. Parameters such as the presence of aggressive and stereotyped behaviour and the manifestation of social contacts were studied in the entire herd during the assessment on the farm.

#### *Final phase*

The analysed and edited parameters of the system were tested again on a third farm with a loose housed method of keeping and a herd of 4350 cows (3800 milking cows) in September 2023. During this testing, all previous comments were taken into account and changes were made.

## **Results**

During the first phase of the research, after analysing world protocols, we determined 57 parameters for assessing the dairy cows' welfare on farms in Ukraine.

During the second phase (expert discussions), four parameters were deleted due to the following reasons: 1) their irrelevance in the conditions of Ukraine; 2) limited practical application; 3) spending time to conduct research on the farm (Table 1). However, three parameters were added during expert discussions (Table 2). So, after the second phase, we received 56 parameters, which were subsequently tested for the feasibility of their application on the farm.

During the first stage of third phase (2-farm testing), 8 parameters were determined to be unsuitable for a one-day, time-limited on-farm dairy cow welfare assessment with a single observer. The excluded parameters and the reasons for their exclusion are shown in Table 3. Thus, a total of 48

*Table 1* Parameters that were excluded from the evaluation system after expert discussions and rationale for their exclusion

Rejected parameter	Reason for rejection	Rationale
Symptoms of heat stress	The parameter strongly depends on weather conditions.	It is impossible to evaluate this parameter objectively during one short-term visit to the farm. The assessment of this parameter was replaced by the measurement of the temperature in the barn at the moment and the presence of shelter from bad weather on the outdoor loafing area.
Quality behaviour assessment	Evaluation takes a lot of time.	Due to time and observer limitations, this parameter was replaced by an assessment of the presence of aggressive behaviour and stereotypical behaviour, social contacts and vocalizations.
Tail docking	Not typical for Ukraine	This practice is not typical for Ukraine and is carried out extremely rarely.
Record keeping and documentation on the farm	Difficulty of assessment	This parameter cannot be checked personally.

parameters remained after testing the evaluation system on two different farms.

The third, final, on-farm testing confirmed that all 48 parameters were acceptable and practical. The final system with all parameters is given in Table 4.

### Discussion

The purpose of this study was to select basic, scientifically based, practical and feasible parameters for the welfare assessment system on dairy farms in Ukraine. The parameters met the requirements of limited time spent on the farm (2–3 hours depending on herd size), one person for observation and compliance with four functional domains: feeding, environment, health, and behaviour (Mellor, 2007).

### Feeding

Assessment of water quality and availability is an important aspect of any on-farm animal welfare assessment system. In our system, the number of water points, the serviceability and cleanliness of water points, their type and water purity were selected as measures. The latter corresponds to the Welfare Quality protocol (2009), in which water purity is an indicator of water quality.

The measurement of the water flow rate was excluded, because the evaluation of this parameter takes a lot of time. The parameter “Distance between drinking troughs” was rejected due to its feasibility for use in a pasture system of livestock keeping. For

animals kept in pens, the parameters of the size of drinking bowls and the number of drinking bowls relative to the number of animals were selected.

Availability of fodder on the feed table is an important parameter for satisfying the basic food needs of cows. In turn, the presence of foreign impurities in the feed and insufficient cleanliness of the feeding table significantly reduces the quality of the feed itself. The parameter “Measurement of the length of the feed table per animal” was selected as a determination of feed availability for each animal. According to the Welfare Quality protocol (2009), the length should be 65 cm per 1 animal.

Covering the feed table is important, because the animal can be injured during feed consumption if the cover is rough enough.

### Environment

All parameters are indirect and demonstrate the existing conditions for the animal's life.

*Noise level.* Excessive noise negatively affects the physiological and behavioral aspects of an animal's life and its productivity. Cows do not like noise in their environment (Grandin, 1997).

Farms with a noise level of up to 70 dB are considered to be good farms in terms of noise level, and farms with a noise level of more than 70 dB are considered problematic (Dimov et al., 2023). So given that a quiet conversation = 60dB, using a noise trade-off based on how easily you can hear your interlocutor

Table 2 Parameters that were added to the evaluation system after expert discussions

Added parameter	Rationale
Mortality of cows per year	This parameter must be fixed on all farms. Its assessment is carried out through a survey of the farmer/veterinarian specifying the cause of death/culling.
Ingrown horns	These parameters are easy to estimate. They are direct indicators of management problems regarding timely and effective dehorning on the farm.
Eye damage	

Table 3 Parameters that were excluded from the evaluation system after the test evaluation of welfare on dairy farms

Rejected parameter	Reason for rejection	Rationale
Width walkways	Difficulty of assessment	Due to the fact that different farms are built in different ways, this parameter loses its relevance and significance.
Nose discharge Eye discharge Vaginal discharge Diarrhoea	Difficulty of assessment	In a short time, without additional research and the collection of a complete history, it is difficult to determine the pathology of these secretions. Therefore, the results of the assessment of this parameter cannot be relevant.
The occupancy of the stalls in the cowshed	Difficulty of assessment	Due to the different practices constantly carried out on farms, it is difficult to estimate this parameter in a single visit to the farm.
Slope of the floor in the stall	Difficulty of assessment	Due to the different designs of stalls and bedding, this parameter cannot be universal and its measurement is difficult.
Cough	Difficulty of assessment	In a short time, it is difficult to determine the pathology of the cough, its nature and intensity, without additional research and the collection of a complete history.

Table 4 Final set of parameters, taking into account test scores on three farms

Welfare blocks	Parameters	Assessment type	Assessment method
Feeding	Availability of feed on the feed table Feed table covering The presence of foreign impurities in the feed The length of the feed table for 1 animal Cleanliness of the feed table Number of drinking points Cleanliness of drinking points Water temperature Water cleanliness Functioning of water points	Resource-based Resource-based Resource-based Resource-based Resource-based Resource-based Resource-based Resource-based Resource-based Resource-based	On the farm On the farm On the farm On the farm On the farm On the farm On the farm On the farm On the farm On the farm
Environmental	Technological grouping Lighting period Lighting quality Access to pastures Access to outdoor loafing area % of cows lying outside the “lying zone” Noise level Microclimate Ventilation Bedding (type, softness, dryness) Stall (cleanliness, design) Floor (cleanliness, slippery) The condition of the outdoor loafing area Presence of a motorized/conventional brush The presence of a maternity ward	Resource-based Resource-based Resource-based Resource-based Resource-based Animal-based Resource-based Resource-based Resource-based Resource-based Resource-based Resource-based Resource-based Resource-based Resource-based Resource-based	Through the survey On the farm On the farm Through the survey Through the survey On the farm On the farm On the farm On the farm On the farm On the farm On the farm On the farm On the farm Through the survey Through the survey
Health	% of mastitis per herd per year % of ketosis in the herd per year Availability of necessary vaccination Number of pathological births and % of birth assistance Dehorning methods Hoof cleaning Lameness BCS Coat condition Alopecia Tails damage Swelling Wounds Abscesses Franks and hips cleanliness Hind legs cleanliness Udder cleanliness Mortality per herd per year	Record-based Record-based Record-based Record-based Record-based Record-based Animal-based Animal-based Animal-based Animal-based Animal-based Animal-based Animal-based Animal-based Animal-based Animal-based Animal-based Record-based	Through the survey Through the survey Through the survey Through the survey Through the survey Through the survey On the farm On the farm On the farm On the farm On the farm On the farm On the farm On the farm On the farm On the farm On the farm Through the survey
Behaviour	Human-animal relationships Aggressive behaviour Stereotyped behaviour Social contacts Vocalization	Animal-based Animal-based Animal-based Animal-based Animal-based	On the farm On the farm On the farm On the farm On the farm

allowed us to determine the level of noise and various extraneous sounds on the farm and assess their risks to the welfare of the animals inside.

**Lighting.** The presence of high-quality lighting and a period of “darkness” is very important for the active life and rest of cows. Thus, 16 hours of light and 8 hours of darkness is ideal for animal health and welfare (Van Eerdenburg et al., 2013). We took this time ratio as the basis for our system.

**Lighting quality.** Light intensity should be at least 100 Lux (Chastain, 2000). Therefore, this parameter was measured by the ease of reading the printed text anywhere indoors (Van Eerdenburg et al., 2013).

**Temperature in stalls.** Heat stress can cause not only reduced performance, but also reproductive problems, affective states, aggressive behaviour and lameness (Polsky and von Keyserlingk, 2017). The most comfortable temperature for dairy cows is +5–

15 degrees of Celsius (Van Eerdenburg et al., 2013). Therefore, we used these temperature norms as a basis for measuring the parameter.

**Ventilation.** This parameter was measured by assessing the presence of cobwebs, condensation and fungus in the premises of the farm. High humidity causes difficulties in thermoregulation and increases the risk of spread of airborne infections (Kadreze et al., 2002).

**Bedding** provides a soft area for animals to lie down, which promotes rest, supports health and productivity (Carroll and Underwood, 2023). An ideal bedding should be dry and soft, provide thermal insulation, be easy to replace, and not be too abrasive (Anderson, 2016).

No system or code for evaluating the cows' welfare on dairy farms has specific requirements for the amount of bedding (Mc Pherson and Vasseur, 2020). In our evaluation system, we focused on such parameters as the softness and dryness of the bedding, because the main purpose is to provide a comfortable lying area for the animal.

**Stall.** Stall indicators such as cleanliness and design of the stall affect cows' welfare in stall housing systems through general indicators: lying time and comfort, the prevalence of injuries and damage to the animals' bodies, cleanliness of cows, and lameness. The cleanliness of the stall is inextricably linked to the cleanliness of the animal kept in it. This is especially noticeable in the case of tethered confinement, where the animal is unable to choose a place to lie down. In turn, longer postures reduce the risk of injuries and increase lying time (Bouffard et al., 2017; Mc Pherson and Vasseur, 2020). In order to evaluate the comfort of the stall and its conformity to the breed, we chose the parameter "Number of cows lying outside the lying area in the stall", the cleanliness of the stall and its design, namely the presence of alopecia in the withers area of the animal.

**Floor.** A floor that is too slippery or not abrasive enough increases the risk of injury. A moderate level of friction between the cow's hooves and the floor is essential for the cow's comfort and to prevent limb disease (Sharma et al., 2019). That is why floor assessment for slipperiness and cleanliness is relevant.

**Outdoor loafing areas opportunities for natural behaviour and social interactions** (Yemelienko et al., 2022). In general, in Ukraine, the practice of organizing loafing areas is quite common, in contrast to the use of pastures. However, it is not so much the presence of a loafing area as its quality and provision that is important. Therefore, we investigated the availability of clean water, a feed table, a shelter from bad weather, and a dry elevation for rest.

### **Health**

**Lameness** interferes with the ability to express natural behaviour, change lying time, social interactions and feeding behaviour (Whay and Shearer,

2017).

To determine the level of lameness in the tied method of keeping, we studied the posture of the cow, the position of the body, how the animal carries the weight and to what position the animal returns. In order to determine the level of lameness in loose housed cows, we assess their gait and posture.

Body condition score (BCS) is an effective indicator of energy balance in the medium term (Roche et al., 2009). As a rule, extremely high or low BCS is associated with the deterioration of animal welfare, because BCS provides a general, but fairly accurate indicator of the cow's energy reserves.

The scale by which BCS is measured varies from country to country, but low values will always reflect emaciation, and high values equate to obesity. The optimal BCS for dairy cows is from 3.0 to 3.25 (on a 5-point scale). A lower BCS at calving can lead to reduced performance and reproductive performance, while a BCS greater than 3.5 is associated with reduced dry matter intake in early lactation and an increased risk of metabolic disorders. Also, weight loss or gain at calving can affect the risk of lameness (Lim et al., 2015). To determine the BCS level, we chose a scale from 1 to 5.

**Integument alterations.** Pathological changes occur as a result of contact of the animal's body with a hard floor, pressure on the stall or even blows (against elements of the stall or caused by a person). The main areas of the body affected are the hock joint, hips, neck, withers, and shoulder blade. Similarly, infections with ectoparasites lead to discomfort, itching, and pain (Winckler, 2008). During the assessment of this parameter, we paid attention to the condition of the cows' hair, alopecia, damage to the tails, the presence of swelling, wounds, and abscesses, the presence of which reflects the direct impact of the environment on the animal.

**Cleanliness.** Maintaining herd cleanliness is a key approach to ensuring good animal health, but this practice remains a challenge for intensive farms (Ramanoon et al., 2018). Dirt and faeces can compromise product quality and mammary health (Munoz et al., 2008; Lundmark Hedman et al., 2021). Wet and dirty coat loses part of its insulating ability. Urine and faeces are also known to cause burns and dermatitis (Authority EFS, 2009). Cows housed in dirty stalls are more likely to suffer from hock injuries, which can cause lameness (Kester et al., 2014).

We evaluated the parameter according to the "Cow cleanliness Assessment" by evaluating the cleanliness of the hind limbs, flanks and mammary gland using a scale from 1 to 4, where 1 is clean, and 4 is very dirty.

**Mastitis.** Despite the widespread implementation of mastitis control programs, it still remains the most common and one of the most damaging diseases in the dairy industry, with a wide range of impacts and consequences (Pettersson-Wolfe et al., 2018).

During on-farm welfare assessment, it is difficult to

determine the herd's incidence of mastitis, especially with subclinical mastitis, so we chose the percentage of cows with mastitis per year as the measure of assessment. We get this parameter directly from the farmer/veterinarian during a short survey.

**Vaccination.** Timely vaccination helps to reduce the level of antibiotic use. Protecting animal health through vaccination improves animal welfare and, in turn, maintaining an appropriate level of welfare ensures the animal's successful response to vaccination. Poor welfare can lead to immunosuppression, which can affect the animal's response to vaccination (Morton, 2007). We assessed the availability of the necessary vaccination according to the recommendations.

**Dehorning** is a common practice in animal husbandry, including in Ukraine. The scientific community agrees that dehorning is a painful procedure regardless of the age of the animal and recommends the use of local anaesthetics in combination with analgesics as a means of pain relief (Marquette et al., 2023). Evaluating this parameter, we paid attention to the age of the animal when dehorning is performed, the use of anaesthetics before the procedure and analgesics after.

**Hoof cleaning.** Most cases of lameness are associated with pathological changes in the hooves (Moreira et al., 2019). Therefore, timely hoof cleaning is important for maintaining their welfare. Our assessment was based on a farmer/veterinarian survey regarding the frequency and regularity of hoof cleaning on the farm.

### **Behaviour**

Assessment of animal behaviour usually involves observation of the animal in its habitat, an artificially created environment or a created situation, for example to assess the animal's reaction to a person. In terms of time, behavioural assessment can be short, if it is aimed at capturing a specific response, or long-term, if it is necessary to observe the natural behaviour of a specific animal or group of animals (Haskell and Langford, 2023).

Behavioural tests are useful because they can contribute to a better understanding of the motivational, cognitive, and emotional aspects underlying behaviour. In the evaluation system, we investigated the frequency of manifestations of complete behavioural parameters, their intensity and prevalence in the herd.

**Vocalization** is an important criterion for specific behaviour, as it is considered an "honest indicator" and a direct indicator of both positive and negative emotional states (Watts and Stookey, 2000). For example, separating a cow from a calf is a stressful stimulus for both animals, causing increased vocalization tones (Orihuela and Galina, 2019).

In our evaluation system, we paid attention to both high vocalization tones (indicators of stressful states) and low tones (indicators of positive emotional states). These parameters were recorded during the entire stay on the farm, and then their number, intensity,

frequency and conditions under which vocalization was manifested were analysed.

**Human-animal relationship.** Fear of human is an important area of research for both economic and welfare issues. During the on-farm evaluation, we used an "avoidance distance" test. This test consists in the fact that the evaluator slowly moves towards the tested animal. The point at which the animal moves away, thereby avoiding contact, is the point of avoidance. This test is performed under experimental conditions to assess the quality of the relationship between animals and farm workers. The highest level of trust is the point when the animal is allowed to touch its nose (Andreasen et al., 2019).

**Aggressive behaviour.** Cattle can exhibit aggressive behaviour in the event of competition for resources such as feed, shade or comfortable places to lie down. An animal on which aggression is directed will experience fear, limited access to these resources and an increased risk of injury. As a rule, the frequency of manifestations of aggressive behaviour is greater in pen systems than in pastures.

**Stereotyped behaviour** has a fixed form and is performed repeatedly without any obvious purpose or function. Such behaviour is not as dangerous as conventionally aggressive behaviour, but its presence gives us clear signals of management problems and dissatisfaction of the animal's basic needs. In cattle, common stereotypes are tongue twisting, object licking, biting, manipulation of different body parts of same-sex individuals (Schneider et al., 2019).

**Social behaviour.** Cattle are highly social animals and have many social interactions within the herd. Also, they perceive isolation from other animals of their species very negatively. For example, allogrooming (licking) is a critically important component of forming and maintaining social relationships between animals. Social relations are an indicator of the presence of positive emotions and satisfaction of the animal's basic needs (Bouissou et al., 2001).

### **Conclusions**

The purpose of this research was the selection of basic and scientifically based parameters for the further development of the first Ukrainian system for assessing the cows' welfare on dairy farms. We believe that we succeeded in covering four important domains of welfare: feeding, environment, health, and behaviour.

So, the final system after 3 test evaluations had 48 parameters. Of them, 17 are direct, based on animals and, accordingly, 31 indirect, based on the resources provided to the animal. Most parameters, namely 36, are assessed directly on the farm, while the remaining 12 are assessed through a survey of the farmer/farm veterinarian.

These parameters are simple and logical in selection, easy to use, meet the requirements of a limited time spent on the farm, the number of observers conducting the assessment, and fully

meet the contemporary requirements of Ukrainian legislation in the field of veterinary medicine and animal welfare. Also, after testing these parameters, its versatility was noted for use on farms with different

numbers of livestock and methods of keeping.

We consider it necessary and relevant to carry out further assessments of welfare on dairy farms of Ukraine using these parameters.

#### Appendix A. Questionnaire for owner farmers/veterinarian

<b>1. General questions</b>	
Date	Name of the farm
Livestock	
Method of keeping	
Average yield of milk	
Breed	
<b>2. Environment</b>	
Availability of technological grouping	
Lighting period	
Availability of motorized/conventional brush on the farm	
Access to pasture/walking area	
The presence of a maternity ward	
<b>3. Health</b>	
% of mastitis in the herd per year	
% of ketosis in the herd per year	
Vaccination	
Number of pathological births and % of birth assistance	
Dehorning (animal age, use of anaesthesia)	
Hoof cleaning	

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