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POSITIVE WELFARE INDICATORS IN DAIRY ANIMALS

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Abstract. *The concept of "positive welfare" arose in response to the heavy focus on negative aspects when assessing the overall welfare of animals. Although one of the main components of welfare is the emotional status. The aim of this paper is to study and describe the existing, promising, reliable and feasible indicators of the positive welfare of dairy cows on farms. We conducted a search and critical analysis of scientific literature, articles, books and welfare assessment protocols in international databases (Web of Science, PubMed and ResearchGate) using the key words "positive «welfare», «indicator», «comfort», «relationship between human and animal», «emotions», «natural behaviour», «pleasure» combined with «cattle» and «cow». For structure, all indicators were divided into 4 groups: feeding, environment, behaviour and position of animal body parts.*

A number of the most relevant and feasible indicators for assessing positive welfare in dairy cows were identified, namely: access to pasture, lying comfort, synchronization and qualitative behaviour assessment (QBA). Studies of the positions of the ears, tail and vocalization in dairy animals are promising for the further development of tests. Also an important indicator is the level of relations between a human and animal, as this indicator has a significant impact on the animal welfare.

We consider it relevant to conduct a practical study of these parameters directly on the farm with subsequent inclusion in the protocol for assessing the welfare of the dairy herd. We believe that this review will create a platform for research and discussion about the positive welfare of cows in Ukraine.

Key words: positive welfare, animal emotions, animal behaviour, dairy cattle, cow comfort.

Today, animal welfare is recognized as a global goal of sustainable agricultural policy (Buller et al., 2019). The UN Committee on World Food Security has officially named animal welfare as a fundamental pillar of sustainable development in agriculture, food security and nutrition, along with other classical areas, i.e. economy, society and environment (United Nations Committee, 2016). At the same time, there is a significant modernization and development of the issue of animal welfare, which becomes evident thanks to the concepts of "One Health" or "One Welfare".

A key component of animal welfare is their emotional state (Ede et al., 2019) To date, most animal welfare research has focused on negative experiences and emotions (Reefmann et al., 2009), but there is a collective understanding that knowledge about positive emotions are essential for animals to have a good life full of positive experiences and emotions. Because of its subjective nature, we often believe that we cannot measure or understand the emotional lives of animals. However, understanding the experience of animals is critical to improving their welfare (Proctor, 2012) Several approaches are known to measure emotional states in animals, and they can be applied to both positive and negative emotional states, and they can assess one or more components of emotional experience (Mattiello et al., 2019)

Based on a collection of theoretical and experimental articles, we reviewed the scientific literature on emotion assessment in dairy cattle, highlighting the strengths and weaknesses of the scientific methods used to assess them. Therefore, the purpose of this study is to analyse positive indicators of well-being that can be applied directly on the farm and subsequently included in the general protocol for assessing the well-being of the dairy herd.

Materials and methods. We conducted a review of the scientific literature in the main databases (Web of Science, PubMed and Scopus) using keywords such as ‘positive welfare’, ‘indicator’, ‘comfort’, ‘human-animal relations’, ‘emotions’, ‘natural behaviour’, ‘pleasure’ combined with ‘cattle’ and ‘cow’. Then, based on the links provided in these entries, we expanded our search to obtain the final list included in this review. We examined only English-language articles published in international journals, as well as book chapters and protocols for assessing the welfare of dairy cows.

This review covers direct welfare indicators (animal-based indicators) that could be collected directly on the farm. Indicators of positive welfare that required further laboratory analysis were rejected due to their impracticality from an economic point of view. Resource-based and management-based measures were also excluded due to their poor objectivity in assessing actual animal welfare.

The results. It is believed that emotions are determined by two main elements: level of arousal and emotional valence. The valence of an emotion can be both positive and negative, depending on the nature of

the stimulus. While the level of arousal can vary from high to low and describes the degree of arousal caused by a given stimulus (Mendl et al., 2010)

If an animal is exposed to an unpleasant experience, it will lead to negative emotional states, such as fear. Regarding arousal, the emotion 'disappointment' means a negative emotional state of arousal, while the emotional state 'relaxed' refers to a positive low arousal (Mendl et al., 2010)

After analysing the indicators of positive welfare, we conditionally assigned them to 4 groups, namely: feeding, environment, behavior and position of body parts (table 1).

Table 1

Potential indicators for assessing the positive welfare of dairy cows on the farm

Feeding	Natural feeding behaviour
	Synchronization of feeding behaviour
	Access to pastures
Environment	Comfort around resting
	Lying synchronization level
	Using automatic brushes
Behaviour	Allogrooming
	Self-grooming
	Play behaviour
	Synchtonization behaviour
	Maternal care
	Vocalization
	Quality behaviour assessment (QBA)
	Human- animal relationships
Position of body parts	Ears position
	Tail position

Feeding. The positive aspects of nutritional well-being go beyond simply meeting physiological metabolic needs. They involve aspects of choice and variety of feed-stuff with a pleasant smell, taste and texture, pleasure related to the activity and exploration of the environment during foraging, pleasure from chewing, which ultimately lead to a positive mental state (Mellor, 2017). Positive indicators of feeding would include measures indicating satisfaction associated with consuming the desired feed, satiety, and anticipation of pleasure in finding and consuming the feed-stuff. Being able to choose feed-stuff gives animals the freedom to express their normal behaviour, meet specific individual needs, and reduce the incidence of disease by better dealing with toxins (Manteca et al., 2008).

Ruminants can be further benefited by allowing them to exhibit their *natural feeding behaviour* on pasture as also provided for in the Welfare Quality Dairy Cow Welfare Assessment Protocol (Welfare Quality, 2009). After all, the search for plants, grazing areas, selection and natural consumption of food-stuff is an important element in ensuring positive emotions in animals. It is worth noting that access to pastures significantly improves the general emotional state and level of animal welfare. Pasture ensures synchronicity of feeding cows. Synchronization of feeding behaviour in social animals is an adaptive behaviour that has evolved to provide several advantages, such as the ability to obtain information about the location of food and allow more time to forage through reduced risk of predation (Dávid-Barrett and Dunbar, 2012). In addition, feeding synchronization helps to reduce the level of competition in the herd. Assessment of feeding synchronization is possible directly on the farm by scanning the sample (Napolitano et al., 2010) given that synchronization is maximal in the morning and evening (Stoye, 2012).

The environment has a significant impact on the animal welfare. The positive aspects of this parameter involve providing the animal with space and requirements for comfort and satisfaction related to rest and ease of movement, as well as providing choice and the opportunity to exercise freedom in using this environment (Mattiello et al., 2019).

Comfort around resting is an important component of positive environment-based welfare. Cows spend about nine hours a day lying down on pasture and about ten to twelve hours a day when stalled (Tucker et al., 2021).

Longer lying times are associated with higher comfort scores and the possibility of positive emotional states (Beaver et al., 2021). One of the methods for evaluating lying comfort is the method proposed in the Cow Comfort evaluation protocol. This method estimates the percentage of cows standing in pens without consuming feed, as well as the percentage of cows lying outside their stall (Van Eerdenburg, 2013). This parameter is reliable when the level of lying comfort is testing.

An important aspect of lying behaviour is the *level of synchronization*, which can be considered as an indicator of positive welfare. Lying synchronization can be assessed using a snapshot scan sample: this measure can be collected more fast than lying time and is less likely to be affected by diurnal changes in behaviour (Richmond et al., 2017). Further study of synchronization and the development of rapid methods for its evaluations at the herd level. For example, Holstein heifers with a larger resting area showed higher lying synchronization, which was interpreted as a higher level of welfare, thus confirming the predictive validity of this indicator (Nielsen et al., 1997).

The using of automatic brushes has been intensively studied during the last decade because they improve the welfare of cattle and promote a positive emotional state of the animals. Providing brushes can be seen as environmental enrichment (Ninomiya, 2019) that stimulates natural animal behaviour. Cows are highly motivated to access the mechanical brush. Studies have shown that cows choose access to brush over fresh feed (McConnachie et al., 2018). The indicator is still not fully validated, but the available studies allow this indicator to be reliable and feasible directly on the farm.

Behaviour. Positive welfare is characterized by the ability of an animal to show active and positive interaction with its environment and in its interaction with other animals, which leads to the exploration of the environment in which the animal is, the search for food, social contacts (such as play, social care, interaction with its offspring) (Mellor et al., 2015) Social and affiliative interactions are characteristic of dairy animals. Together with aggressive behaviour, they create balance and structure in the group, strengthen the bond between individual animals and create overall group cohesion (Tucker, 2017).

Cows perform social *allogrooming* behaviour, also called social licking (Tucker, 2017). This is a type of prosocial behaviour with positive effects for both parties (Rault, 2019). Social licking has been included in the Cattle Welfare Quality Protocol (Welfare Quality, 2009) as an indicator of positive social behaviour. It has also been observed that cows prefer to groom certain individuals in a group, with the frequency of social licking positively increasing with cohabitation between animals (Sato et al., 1991). Allogrooming is also a highly motivated cow-calf behaviour that strengthens the mother-calf bond.

Self - grooming is related to a broad behavioural category that includes tongue licking, interaction with environmental objects (trees, fences, pens, etc.) and brush use by dairy cows (Jensen, 2015). Self-grooming can be both a positive and a negative indicator cattle welfare. This is a positive indicator because it is a direct manifestation of the cow's natural behaviour (Tucker, 2017), but it can also be a response to stress or certain negative factors. In their study, Herskin et al. (2004) observed that self-grooming increased when dairy cows were offered a new feed or during contact with a stranger. In another study, Lv et al. (2018) dairy calves subjected to feed restriction showed more active self-licking behaviour compared to a positively stimulated group of calves receiving feed reward. Westerath et al. (2014) also observed that vocalization and self-licking increased in calves after positive human interactions. Therefore, the study of self-licking as an indicator of positive welfare is relevant.

The positive impact on the animal welfare from play behaviour can be both immediate (direct to the emotional impact that the animal feels now) and long-term, since the play behaviour helps the animal to develop and improve skills that will support it cope with stressful situations in the future (Held and Špinka, 2011) The game allows you to reflect positive experiences, as well as to shape such experiences.

Play behaviour is considered a promising indicator of positive welfare. However, some parameters should be taken into account. This behaviour is highly flexible not only between different species, but also among animals of the same species. This behaviour is mainly observed in young animals and decreases with growing (Keeling, 2019). All studies of play behaviour as a positive indicator of welfare have been conducted in young animals. It is also known that play behaviour in calves decreases at weaning (Bertelsen and Jensen, 2019). Calves are motivated to play only when their basic needs are met (Lawrence, 1987). Yes, it has been proven that calves play more if their need for food is fully satisfied. Manifestation of such play in calves is expressed as locomotor and social activities, as well as activities directed towards the environment (Jongman et al., 2020). Although assessing play behaviour on a farm can be difficult and time-consuming, research confirms that play behaviour itself is a consistent indicator of positive welfare.

Behavioural synchronization is high in dairy cows because they are all social species kept in groups. This is a promising positive indicator of welfare because it is rewarding and animals experience group cohesion, just as in social affiliation behaviour (Keeling, 2019).

A disadvantage of synchronization as a potential positive indicator of welfare is that it is a group phenomenon, whereas welfare is an individual characteristic (Keeling, 2019). Nevertheless, it can be studied together with other indicators in the approach to the animal as a whole.

Maternal care has been proposed as a positive indicator of welfare because it requires a strong bond between mother and child, which creates positive states for both parties. In general, the relationship between a cow and a calf is considered one of the most important social interactions in animals. If calves are kept with their mothers for long periods of time, affiliative social contact (licking, sniffing, actively seeking each other, and lying in contact) is frequent (Winckler, 2007) and associated with increased maternal oxytocin (Muir et al., 2019) Extending the contact period between cow and calf can reduce the calf's oral stereotyped behaviours, reduce

stress levels and improve their social development (Meagher, 2019). Calves with partial cow-calf contact show low response to separation compared to calves with no cow-calf contact (Wenker, 2022) Maternal care can be assessed by measuring care, contact and closeness between cow and calf. This is currently time consuming and impractical in a farm setting, but with technological advances such as proximity sensors, this may become a more feasible endeavour in the future.

Dairy cows kept in intensive systems have quite a lot of contact with people. The quantity and quality of human-animal relationships can have a marked effect on the behaviour, welfare and performance of farm animals (Hemsworth, 2003) Various studies of positive indicators of welfare in cattle (Lange et al., 2021) have used animal petting to induce positive states low arousal. Behavioural and physiological measures in all these studies suggest that the animals are relaxed and in a positive state.

The most common indicator of a positive human-animal relationship is the animal approaching and interacting with the human, while avoidance distance usually assesses fear of the human (Rault et al., 2020). Despite this, the Welfare Quality protocol assesses the criterion of a good human-animal relationship using the avoidance test (Welfare Quality, 2009)

Vocalization can be a promising tool for assessing positive emotions on the farm. One of the biggest pluses is the ease of application on the farm by the appraiser. However, previously vocalization was mainly studied as an indicator of negative emotions. Studies confirm that cows produce more vocalizations when experiencing emotional states of negative valence compared to positive valence (Laurijs et al., 2021). Cows have been observed to vocalize after being weaned from their calves (Schnaider et al., 2022). Depending on the breed, they performed high-pitched and longer vocal sounds. Another study reported that cows vocalized more when they maintained visual and vocal contact with their calves (Stehulová et al., 2008). In addition, both studies showed that calves vocalized maximally after separation from the mother, as well as in if they could still hear and see their mothers after separation.

Regarding vocalizations that clearly indicate a positive emotional state, research has shown that adult dairy cows, when lying down and chewing, produce vocalizations with a low mean peak frequency, indicating low arousal and positive valence emotions (Meen et al., 2015).

Quality behaviour assessment (QBA) is widely used to describe how animals interact with their environment. This methodology is based on the use of behavioral descriptors ranging from low (e.g., calm, relaxed) to high arousal (e.g., active, restless) and from positive (e.g., interested, excited) to negative valence/mood (e.g., indifferent, weariful). The Welfare Quality Cattle Welfare Assessment Protocol calculates a positive welfare measure that reflects emotional state using QBA. The evaluator observes how the animals interact with each other and the environment through spontaneous behaviour and pattern scanning.

Position of body parts. Ruminants have highly developed musculature around the ears, which allows them to move to express internal states (Reefmann, 2005). Relaxed ears in dairy cows are associated with positive emotional states of low arousal (e.g., petting or grooming). However, whether relaxed ears would be associated with a negative state of low arousal (such as boredom) has not yet been investigated. Frequent changes in ear position are positive stimuli in cows (Proctor, Carder 2014). Further research is needed to clarify the significance of changes in ear position for each species and to test the reliability of this measure.

The position of the tail and the frequency of its movement were also studied, but not as much as the position of the ears and the frequency of their changes. In cattle, scientists have observed that the tail mostly hangs motionless during feeding (De Oliveira, Keeling, 2018). Further research is needed on tail position as an indicator of emotional state.

Conclusions

This review gave an opportunity to determine a list of promising indicators that can be included in the protocols for assessing the welfare of the dairy herd.

Access to pasture, behaviour and comfort around lying and resting, synchronization and qualitative behaviour assessment (QBA) are the most promising positive indicators of dairy animal welfare.

In summary, it can be noted that several indicators are potentially already available for assessment directly on the farm. However, for such indicators as the position of the ears or tail, vocalization, further testing, research and improvement are needed.

Further study of welfare indicators is extremely useful for creating new and improving existing welfare assessment protocols. This will help focus on positive welfare indicators to provide consumers with higher quality animal products, with the assurance that farmed animals are truly living a life worth living.

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ІНДИКАТОРИ ПОЗИТИВНОГО БЛАГОПОЛУЧЧЯ МОЛОЧНОГО СТАДА

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Резюме. Поняття «позитивне благополуччя» виникло у відповідь на велику увагу до негативних аспектів під час оцінки загального благополуччя тварин. Хоча одним із основних компонентів благополуччя є саме емоційний стан в якому перебуває тварина. Метою даної статті є опис та вивчення існуючих, перспективних, надійних та здійсненних індикаторів позитивного благополуччя молочних корів на фермах. Нами був проведений пошук та критичний аналіз наукової літератури, статей, книг та протоколів оцінки благополуччя в міжнародних базах даних (Web of Science, PubMed і ResearchGate) за ключовими словами «позитивне благополуччя», «індикатор», «комфорт», «відносини між людиною та твариною», «емоції», «природна поведінка», «задоволення» в поєднанні з «велика рогата худоба» та «корова». Для структурованості всі індикатори були поділені на 4 групи: годівля, навколишнє середовище, поведінка та положення частин тіла тварини.

Було визначено ряд найбільш актуальних та здійсненних індикаторів для оцінки позитивного благополуччя у молочних корів, а саме: доступ до пасовищ, комфорт лежання, синхронізація та якісна оцінка поведінки (QBA). Перспективними щодо подальшої розробки тестів є дослідження положень вух, хвоста і вокалізації у молочних тварин. Також важливим індикатором є рівень стосунків між людиною і твариною, так як даний індикатор має значний вплив на благополуччя тварин.

Вважаємо актуальним практичне дослідження даних параметрів безпосередньо на фермі з подальшим внесенням їх в протокол оцінки благополуччя молочного стада. Ми віримо, що даний огляд створить майданчик для досліджень та дискусій про позитивне благополуччя корів в Україні.

Ключові слова: позитивне благополуччя, емоції тварин, поведінка тварин, молочна худоба, комфорт корів.

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