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Dairy cattle welfare assessment-importance and significance: A review

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Abstract
Animal welfare is growing importance from social, political, ethical and scientific viewpoints, but it is compulsory for the assessment of animal welfare that certain agreement on the meaning of animal welfare has been accepted. Thus, evaluation can be based on behavioral, physiological, psychopathological parameters or productive performances. The parameters should consider welfare assessment based on housing, environment, animal health, seasons, feed, management etc. Housing system is most critical indicators for welfare assessment where the floor type, type of bedding material, drainage and waste disposal system, level of the floor, space allocation, roof etc. effect on the health and production of the animals. BCS is a simple but useful procedure, which can help producers make management decisions regarding the quality and quantity of feed needed to optimize production and reproduction. The cattle cleanliness affects hygienic milk production, thermoregulation, health and production. Lameness is a much known problem in a production, reproduction and economic issues. Hock lesions are also closely correlated to lameness; they are associated with economic losses and impaired welfare. There should be precision welfare assessment protocol at the farm level. So by improving welfare of the farm animals we can increase productivity for better economic return and quality assured animal products to the consumers.

Keywords: Welfare, assessment, housing, BCS, lameness and hock lesions

Introduction
Animal welfare involves the subjective feelings of animals, such as pain, frustration, hunger and other unpleasant states (Duncan, 1996) [16] and the welfare of an animal regards its attempt to cope with its environment (Broom, 1996) [8]. The debate is still in progress, because in addition to science, ethical and political concerns regarding animal welfare are also essential. In the meanwhile, different methods of on farm monitoring of animal welfare have been developed (Johnsen *et al.*, 2001) [26] in Europe. Some of these methods are concerned with design criteria (Bartussek, 1999) [3], which comprise structural and technical elements (space, facilities etc.) and management-related factors such as hygienic and climatic conditions (Sundrum, 1996) [43]. Others use animal-based variables or parameters dealing with behavior, health and physiology of the animals. However a combination of design and performance criteria is generally recommended to obtain a valid and holistic assessment of animal welfare (Sandoe *et al.*, 1996 and Sundrum, 1996) [40, 44]. Though this recent interest and concerns about animal welfare are growing day by day, however, the assessment of animal well-being is a complex matter (Rushen *et al.*, 2011) [37]. A good welfare is such management where there is no stress and the stress plays an important part in welfare research (Broom, 2001) [8].

Economic importance of welfare assessment
The farm level welfare assessment can be used as an advisory tool by farmers, as source of information for management and as a component of quality assurance schemes for consumers. Now presently in western countries there is an increasing public concern about animal welfare. In such countries from west various numbers of consumers are influenced by ethical concerns rather than cost. People have high interests in farming and the associated animal welfare standards due to its impact on health and productions of animals and subsequent good impact upon public health. More and more consumers become aware of dairy welfare upon public health, food security and environmental protection. Because of this fact that dairy welfare became part and parcel of milk quality, its monitoring is an additional guarantee for the consumers that the products they buy derive from healthy animals, breed and kept according to standard of good practice in farms (Broom, 2004) [8].

They demand high quality livestock products obtained with methods where animal welfare is also taken under close consideration and for these products they are willing to pay premium prices (Sundrum and Rubelowski, 2001) [44]. From the economical point of view, the assessment of animal welfare is really important, because it allows in the first stage the detection of imperfections and their correction in the second stage. Thus, retrieval of shortcomings assures the integral development of genetic productive performances by the animal and by the other hand, perfecting the technologies. The farm animal welfare is provided especially by housing and breeding systems suitable for animal health and behavioral needs and by proper farming practices as well (Broom, 2004) [4].

Housing and welfare

Housing system is one of the most important indicators in case of the welfare assessment where the level of the floor, space, roof etc affect on the health and production of the animals.

Sandoe *et al*., (1997) [41] described that the interactions between production system and management can lead to large variations in herds with regard to animal welfare and also stated that the housing type constitutes an important element of influence. There are many different variations of cattle housing exist, but most of these can be included in two major types of housing systems, one is the loose another is the tie-stall housing system, based on the confinement degree of the cows. There are so many advantages and disadvantages of both of these and their effects on the health and behavior of the dairy cows, compared to the more traditional tie-stall systems (Regula *et al*., 2004) [35]. There is some evidence where loose housing and regular outdoor exercise have positive effects on the health and welfare of dairy cows. Yet, fewer studies were conducted on the overall welfare of the dairy cows in different housing conditions (Gustafson, 1993) [22]. Valde *et al*., (1997) [45] described in his study that loose housing comes with the advantage of better udder health, lower risk of ketosis and better fertility which is accepted by welfare scientists as having a superior potential for higher animal welfare. The number, design and placement of the feeding and drinking facilities may influence the activities of the cattle like food and water intake but also their social behavior and the occurrence of physical injuries (Rousing *et al*., 2000) [37].

Body condition scoring is an indicator in welfare assessment

Body condition scoring is known as the management tool which is designed to assess body reserves of fat accumulation of an animal. The excessive body condition has been recognized as a risk factor for health problems in dairy cows and as a factor influencing feed intake and milk production (Morrow, 1976) [30]. When an animal passes through different stages of production cycle, their nutrient requirement varies particularly during early lactation it becomes so high that animal fails to get this energy from feed and utilizes body energy reserves. The excessive loss of body condition has been associated with lowered reproductive performance and reduced milk production. Thus, BCS has received considerable attention as a tool to aid in the management of nutritional programs in dairy herds (Garnsworthy and Topps, 1982) [21].

The BCS is assigned to a cow based on the appearance of tissue cover over the bony prominences in the back and pelvic regions. Specific regions include the spinous and transverse processes of the lumbar vertebrae, the ileal (hook bone) and ischeal (pin bone) tuberosities, the ileo-sacral and ischeal-coccygeal ligaments, the tail head, and the thurl region (rump) bounded anteriorally by the ileal tuberosity and ileo-sacral ligament, caudally by the ischeal tuberosity and the ischeal-coccygeal ligament, and ventrally by the greater trochanter of the femur. Tissue cover may be estimated via palpation, visual inspection, or both (Wildman *et al*., 1982) [49]. The correlation coefficient of 0.59-0.62 between body weight and condition score (Dun *et al.,* 1983, Nicholson and Sayers 1987) [17, 34]. The most BCS systems in dairy cattle use the 5 point scoring system with quarter point increments. The actual score of the animal depends on the visibility or palpability of the anatomical parts and the flesh and fat cover over these points. A high level of repeatability and reproducibility can be expected for BCS observations between workers (Croxton and stollard, 1976; Nicholson and Sayers 1987) [13, 34].

The scoring system should be simple, repeatable, and easy to convey to producers and industry personnel. Because changes in body fat occur in a coordinated fashion throughout the body, change in appearance of body regions is not independent (Ferguson *et al*., 1994) [20]. The BCS has received considerable attention as a means to estimate tissue mobilization. Body condition score is assigned to a cow based on the appearance of tissue cover over the bony prominences in the back and pelvic regions (Lean *et al.,* 1989) [28]. The scale used to measure BCS differs between countries, but low values always reflect emaciation and high values equals to obesity. So BCS also considered as one of the most important indicators of welfare (Sprecher *et al*., 1997) [42]. The BCS of 1.5 in case of one or two months after calving is not desirable because it indicates severe lack of adequate nutrition (negative energy balance). A BCS of about 3.0 should be typical of a cow recovering body reserves in mid lactation. In late lactation and during the dry period, a body condition score of 3.5 may be the most desirable. This body condition score gives the cow sufficient body reserves to minimize the risk of complications at calving while maximizing milk production in early lactation (Sprecher *et al*., 1997) [42].

Lameness is a health indicator in welfare assessment

Lameness is a much known problem in a production, economic issues and continues to be a common problem across many types of housing system. The lameness in cattle is a debilitating condition in which the affected animal attempts to reduce the weight borne by a particular limb. Foot lesions are associated with approximately 90% of cattle lameness. Pain, a serious component of lameness, is often masked by the stoical nature of cattle, this leads to delayed detection of lameness by farmers and often results in treatment (Murray *et al.,* 1996) [31]. It is ranked third in losses from diseases on dairy farms, following mastitis and fertility problems (Baggott, 1982) [2]. The production losses in milk due to Lameness and hence in fat and protein productions and lost future income appeared to be the two main sources of economic losses in dairy cattle. It is also found decreased milk production and costs associated with premature culling to be the main sources of losses (Whitaker *et al*., 1983) [48] and prolonged calving intervals, higher costs of veterinary treatment and additional labour by the farmer (Dijkhuizen *et al*., 1985) [15]. The United Kingdom's Farm Animal Welfare Council recently stated that lameness was the most important

animal welfare problem for the dairy cow. Lameness reduces milk production directly between 1.5 kg per day, up to 5 kg per day for 2 to 7 weeks (Esslemont and Kossaibati, 1996) [19]. The lame cows entered the milking parlour later, lifted and kicked their feet more frequently and shifted weight from one foot to another more often during milking compared to non lame cows (Hassall *et al*., 1993) [23]. The reduced walking activity which leads to minimize the chance of lameness. The animals use to frequent shifting of their weight from one leg to the other to overcome the painful situation during lameness (Neveux *et al.*, 2006) [33]. The intervals for calving to first service, calving to conception and re-calving, as well as the number of days open, was extended in lame animals compared with healthy herd mates. Lame cows show a lower frequency of standing to be mounted compared with sound herd mates. Lame cows that are served are less likely to conceive and have an increased risk of conception failure (Huxley and Whay, 2006) [25]. The high levels of production do not necessarily lead to increased lameness, although genetic correlations between levels of production and the incidence of lameness suggest that continued high selection for milk production will likely exacerbate the problem (Bertoni *et al.*, 2007) [5]. High milk yield is a risk factor for lameness, which explains the higher prevalence in multi-parous compared with primi-parous cows. It is important to emphasise that any reduction in yield associated with lameness may not be tangible at the herd level because cows that suffer with lameness are higher yielding than the herd average. At cow level, this study demonstrated that a reduction in milk yield associated with a case of lameness may not occur for several months (Archer *et al*., 2010) [1].

Lameness scoring systems

The locomotion scoring systems have been used to quantify lameness prevalence and to grade severity (Manson and Leaver, 1988) [29]. However, simple systems may fail to detect noticeable changes in posture and weight bearing which might relate to pain experienced by the individual animal (Kestin *et al.*, 1992) [27]. In the two most popular systems (Manson and Leaver, 1988 in UK & Sprecher *et al*., 1997 in USA) [29, 42], observer assigned LS range from 1 to 5 and increase as the severity of lameness is judged to increase. The locomotion scoring system developed by Sprecher *et al*., (1997) [42] is most applicable to cows housed in free stall barns since, unlike Manson and Leaver (1988) [29]. It does not require cows to rise from a lying position as a part of the scoring assessment. However, both systems utilize two key indicators, gait and back posture, to assess lameness scoring. Visually scored on a scale of 1 to 5, where a score of 1 reflects a cow that walks normally and a score of 5 reflects a cow that is three legged lame, a locomotion score is made in a few seconds per cow. Generally locomotion scores of 2 and 3 are considered to represent sub clinically lame cows whereas locomotion scores of 4 and 5 represent those cows that are clinically lame. The mobility scoring refers to a structured subjective system for the assessment of a cow's gait, designed to reduce variations between observers (Bell and Huxley, 2009) [4]. The background to the terminology has recently been reviewed and a standard scoring system, which provides case definitions for both lame and severely lame cows to aid in early diagnosis, has been adopted by the industry-funded body like Dairy Co, training in the application of the scoring system is very helpful to improve repeatability within and between observers.

Table 1: Standard scoring system for lameness diagnosis (Bell and Huxley, 2009) [4]

Category of score	Score	Description of cow behaviour	Suggested action
Good mobility	0	Walks with even weight bearing and rhythm on all four feet, with a flat back long fluid strides.	No action needed, routine (preventive) foot trimming when/if required. Record mobility at next scoring session.
Imperfect mobility	1	Uneven steps (with regard to rhythm or weight bearing) or shortened strides. Affected limb(s) not immediately identifiable.	Could benefit from routine (preventive) foot trimming when/if required. Further observation recommended.
Impaired mobility	2	Uneven weight bearing on a limb that is immediately identifiable and/or obviously shortened strides (usually with an arch to the centre of the back).	Lame and likely to benefit from treatment. Foot should be lifted and examined to establish the cause of lameness before treatment should be attended soon
Severely impaired mobility	3	Unable to walk as fast as a brisk human pace (cannot keep up with the healthy herd) and has signs of score 2.	Very lame cow will benefit from treatment in urgent attention, nursing and further professional advice. Cow should not be made to walk far and should be kept in a straw/grass yard, culling may be possible solution.

Hock lesion and welfare

Hock lesions are correlated to lameness; they are associated with economic losses and impaired welfare. The typical lesion locations in cattle are the joints, including carpal (knee), tarsal (hock), fetlock, and hip also, skin lesions occur around the articulation of joints (Huxley and Whay, 2006) [25]. The season, Parity, lying time, type of free stall base, herd size, BCS, DIM, free stall dimensions and milk production were some of the risk factors reported previously (Busato *et al*., 2000, Weary and Taszkun, 2000, Rutherford *et al.*, 2008) [11, 47, 39]. Drissler *et al*., (2005) [16] stated that it is reasonable to summarize that the degree of hock damage reflects the degree of comfort or discomfort associated with the lying substrate available. Because dairy cows can spend more than 13 hours per day lying down, the comfort afforded them by the lying substrate is an important determinant of overall welfare. The skin lesions on the legs of cattle likely occur on areas where there are protrusions. When animals lie down, the soft tissue is compressed between these protrusions and the lying surface, resulting in an interruption of perfusion to the tissue (Zurbrigg *et al.*, 2005) [50]. The cows on organic farms had fewer hock lesions than cows on conventional farms (Rutherford *et al*., 2008) [39].

Cleanliness and welfare

Cleanliness does have a relationship with animal welfare, through links with mastitis, lameness and gastrointestinal problems. There are numbers of cleanliness scoring systems for dairy cows have been developed to record the degree of contamination and different anatomical area on the body of the dairy cows with dirt and faecal matter which are identified according to different point scoring system which gives an

overall assessment of the cleanliness of the Dairy cows. (Hughes, 2001; De Rosa *et al.*, 2003, Reneau *et al.*, 2005) [24, 14, 36]. The key areas like personal hygiene, cow environment, cow cleanliness, clipped udders, water use, udder wash, pre dipping, udder drying etc. contributing to elevated bacteria counts and suggested practices which can inhibit bacterial growth. The cattle cleanliness affects hygienic milk production, thermoregulation, and health. There are so many studies takes place on milk hygiene which also confirmed the relationships between cleanliness of animals in dairy herds and factors associated with housing, feeding and management conditions, and hide quality (Reneau *et al.*, 2005) [36]. Cook *et al.*, (2004) [12] described that designing clean comfortable housing, even if it is not the lowest cost or cheapest to maintain, is key in determining the health and longevity of the dairy cow on the farm. Dairy cow cleanliness is possibly an indicator of cow welfare (Bowell *et al.*, 2003) [6].

Various environmental pathogens *E coli* and *Streptococcus uberis* now constitute a major cause of mastitis infection. The *S uberis* is increasingly associated with raised cell counts. As these organisms are mainly found in bedding and slurry, the cleanliness of the cows can provide a useful indicator of the degree of challenge which animals may be exposed to. This challenge can and should be controlled (Bradley and Green, 2000) [7]. Various factors such as yield, stocking density and consistency of faeces are of paramount importance with regard to cleanliness of straw yards. It has been shown that if freshly calved cows, particularly high yielding ones, have a nutritional imbalance which causes them to produce large quantities of faeces, then irrespective of the type of straw used and how it is managed, clean surface can be maintained. On the other hand, low yielding or dry cows on rations which do not promote loose faeces generally remain clean, as does the surface of their beds. The space allowance for the bedded area in straw yards should be based on the stage of lactation as well as the total number of animals. During calving, sand is one of the most preferable inert materials and has good drainage properties. It is therefore the best and safest material for bedding of cows, provided certain important factors are taken into consideration. Sand does not ferment and it is therefore valuable when used as a base material in calving boxes and calving yards. It should be laid 12 cm (5") deep and topped with clean, dry straw. In addition, it also provides a non-slip surface for calving animals (Ward *et al.*, 2001) [46].

Cleanliness score

Napolitano *et al.*, (2005) [32] selected five anal and genital areas, back of the udder, the bottom part of the hind legs (from the hock to the dewclaws), the udder sides, belly and the thighs for scoring cow cleanliness score or cow hygiene score. As various pathogenic organisms are mainly found in bedding and slurry, the cleanliness of the cows could provide a useful indicator of the degree of challenge which animals may be exposed too. This challenge could and should be controlled, for this a scoring system had been followed to assign cleanliness score. In this process the cows in the farm were scored a numerical value based on their cleanliness. This scoring was performed on cows and the cows were assigned separate scores, on a scale of 1 to 5 with increments of 0.5 where score 1 specify very clean, to score 5 which indicate heavily soiled condition.

Table 2: Criteria used to assign a cleanliness score and clinical description to cattle (Ward *et al.*, 2001) [46]

Cleanliness Score	Clinical Description	Assessment criteria
1	very clean	There is no soil found in flank, hind legs, udder and tail regions of the dairy cattle.
2	Clean	There will be a single anatomical site among the four sites (flank, hind legs, udder and tail) which will be soiled.
3	Moderate clean	Two anatomical sites among the all taken four sites will be soiled.
4	Soiled	Three anatomical sites will be soiled among the all four sites.
5	heavily soiled	All of the anatomical site will be soiled including flank, hind legs, udder and tail.

Conclusion

Improvements to animal welfare in food production systems can play a significant role in improving the welfare of people by such means as improving access to food of animal origin, improving economic returns through increased livestock productivity, improving the efficiency of draft animals, and reducing risks to human health through improved food safety and animal health. Beyond such practical and economic benefits, attention to animal welfare can have broader social benefits. It can contribute to teaching an ethic of care; it can be a force for social cohesion within a community or a business; and positive relations with animals are an important factor in human (as well as animal) well being. As a general approach, improving the welfare of animals should begin with an assessment of the risks and opportunities in the entire system or production chain, and a search for improvements that will be practical in the given situation. Assessment should include science-based assessment of the needs and welfare of the animals, and risk assessment to identify causes of sub-optimal welfare. In many cases the most effective approach is likely to be a continual improvement process based on achievable targets rather than the importation of radically different procedures based on technology and values.

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