Dairy cattle welfare in India: A review

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ABSTRACT
Animal welfare means how an animal is coping with the conditions in which it lives; it is based on ‘five freedoms’ and ‘four principles’ of animal welfare. Dairy cattle are considered as sentient beings due to which husbandry should be provided as per their needs. As cattle and human beings are intrinsically connected to each other, protection of cattle from diseases and unnecessary suffering should become prime responsibility of human. Welfare of dairy cattle cannot be measured directly, as is multidimensional in nature and can be measured by various indicators which are either direct or indirect. In this review we try to analyze dairy cattle welfare, their indicators and their assessment.

Key words: Animal Welfare, Assessment.

Dairy animal rearing in India is a major source of income and employment but their productivity is still very low as compared to other countries, the demand of milk and milk products indicates surge ahead and the only viable and sustainable alternative is to significantly enhance the productivity of dairy animals to fill future demand-supply gap (Gautam et al., 2010). The essence of good farm animal husbandry is to provide the resources and management necessary to ensure the economic production of food and other goods in a way that does not compromise the health and welfare of the animals. For a dairy farmer to be successful at producing milk of good quality, the welfare needs of dairy animals must be met (Fraser et al., 2003). An animal has needs at a basic level – those things that are essential for life– but to achieve good welfare it will also have needs, which, while not essential for survival, will improve living conditions and may also translate into improved productivity (Stull et al., 2005). The health and welfare of animals and the health and welfare of the people that consume them are intrinsically connected (Gonyou et al., 1993). The animals that receive proper care are more productive, decrease in productivity-, such as a drop in milk, illness and injury can indicate welfare problem. Likewise, decrease in reproductive rates or increase in mortality or morbidity should be clear sign that the well-being of livestock in is decline (Whay, 2007). In dairy production systems this will include not only animals producing milk, but also the newborn, young female animals that are used as replacements and males in rearing units (Von Borell et al., 1996). Human beings have long been concerned about the welfare of animals and this concern is still growing (Alban et al., 2001). Because of the 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, bred and kept according to standards of good practices in farms (Dawkins et al., 2003). Consumers of milk and milk products now a day’s want to know how the dairy animals from which these products obtained are handled (Histrov et al., 2011).

Indicators of welfare: Traditionally, farm animal welfare assessment has focused on the measurement of resources provided to the animal such as housing –and- housing design criteria. Although such indirect resource- based welfare assessment criteria are quick, easy and have some degree of reliability, basing the welfare verdict solely on their findings may not necessarily mean that the welfare of the animals is good or poor (Knierim and Winckler, 2009). Other husbandry aspects that affect animal welfare are management practices and the human -animal relationship, but their measurement may be more difficult. However, the provision of good management and environmental resources does not necessarily result in a high standard of animal welfare (Sejian et al., 2011).

Direct animal -level parameters such as health or behavior can be taken as indicators of the animals’ feelings and a measure of bodily state of the animal. These are more reliable because they indicate how the animal has been affected by some factors existing within the proximate environment or housing system of the animal and how it has responded to these factors. Welfare assessment protocols should be based primarily on animal- related parameters (Carenzi and Verga, 2007). It is however challenging to select and develop reliable and at the same time feasible measurements for on- farm assessment protocols. Welfare assessment systems, for use in commercial farms may differ according to both the definition of animal welfare and the

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purpose of the welfare assessment (Bertussek, 1999). Thus, choice of welfare indicators and methods of measurement reflects the basic considerations of how animal welfare is understood (Gonyou, 1993). In addition, the appearance of a given welfare assessment system depends on whether the goal is to certify or control the level of welfare on specific farm, to evaluate the welfare in different production systems, or to serve as an advisory tool that allows the farmer to identify, prevent or solve welfare problems on his/her farm (Whaytt et al., 2003). Baird et al., (2016) stated that providing adequate substrate is a simple and practical step to ensuring better welfare in farm animals.

Behavioral indicators: The study of natural behaviour can tell us what animals do when frightened, ill or in pain, as well as when they are healthy and are not restrained by lack of space or relevant resources. Good stockpersons and dairy managers have always used the behaviour of animals as a guide to their health and welfare (Anna et al., 2011). Behaviour also plays a key role in the scientific study of animal welfare, for two main reasons, first, it is one of the most easily observed indicators, and essential information can often be obtained from it using experience and a systematic approach, without the use of sophisticated equipment. Secondly, behaviour forms a bridge between the narrower concept of clinical health and the wider concept of animal welfare Buchwalder et al., (2000). To know what the behaviour of an animal means in terms of its welfare, it is necessary to have a detailed knowledge of the normal behaviour characteristics of that species of animal.

A number of vices are present, in dairy cows due to poor management, like wind sucking, bar biting, stereotypy etc. (Mason, 1991). Route tracing, bar biting, tongue rolling, and so on are described by Fraser and Broom (1990). Stereotypies are shown in situations in which the individual lacks control of its environment, especially in those that are obviously frustrating, threatening, or severely lacking in stimulation. Their widespread occurrence seen in confined animals and is of great importance in relation to welfare assessment.

Production indicators: A key issue is the extent to which genetic selection for increased production affected the ability of the animals to adapt to the environment in which they find themselves. Reviewing the negative side-effects of selection for high production, Rauw et al. (1998) concluded that “when a population is genetically driven towards high production, fewer resources will be left to respond adequately to other demands like coping with stressors”. The key problem as noted (Rauw et al., 1998) in high producing farm animals that there are insufficient resources for adequate coping and hence poor welfare whenever resources are limiting. There are good reasons why health problems causing poor welfare can lead to lower productivity. Activation of the immune system during an illness requires metabolic energy and illness often results in reduced feed intake—thus resources may be limited and may be diverted into immune function rather than milk production, growth, or reproduction. For example, Huzzey et al. (2007) showed that cows that became ill with metritis produced approximately 8kg/day less milk during the first 3 weeks of lactation. Clearly, a decline in milk production can be indicative of illness. Short-term changes in milk yield have also proven to be useful in assessing cows’ responses to stressful events. A variety of acute stressors, such as novel surroundings, can reduce oxytocin secretion, leading to blocked milk ejection and hence reduced milk yield (Bruckmaier and Blum, 1998). In these circumstances, the observed decline in milk yield can be seen as an indicator of reduced welfare. The important point is that a high level of milk production is no guarantee of high welfare, nor is a low level of production to be taken as an automatic sign in poor welfare.

Reproduction indicators: As reproductive parameters the conception rate at first insemination, the number of inseminations per pregnancy, the calving interval and the culling rate have been considered. There are strong motives for including reproduction in selection programs, both economical and welfare related (Berglund, 2008). Female fertility cannot be easily defined as a single trait as it comprises different aspects. Some of these aspects are related to the prompt resumption of cyclicity and the showing of recognizable estrous behavior, while others are related to the ability of the cow to become (and remain) pregnant with a limited number of inseminations. In addition, cows should have good calving ability and give birth to viable calves (Berglund, 2008). Calving to first service interval (CFSI), calving interval (CI), calving to conception interval (CCI), and number of services per conception (NSC) were indicators of fertility in cows in each farm. Farmers can be surveyed about aspects of their management system relating to age at first calving of heifers and their management of reproductive health and fertility.

Health indicators: Mastitis

There are many definitions of health and disease, but the following are helpful when considering the relationship between health and welfare. A disease is a physical or mental condition where a normal function of an animal is disturbed and harmed. Illness is the subjective sensation of experiencing a disease state. Sickness is the state of being ill, whereas health is the absence of illness or injury. Good health also includes positive attributes, such as fitness, soundness and/ vigour. Suffering because of disease or injury is an important aspect of animal welfare, but the importance of animal health in relation to animal welfare is sometime under-estimated. Here two important disease mastitis and lameness reviewed in details, which are very important from welfare point of view. Mastitis is a painful condition in dairy
cows but there are levels of sub-clinical mastitis that have only a small effect on welfare. The somatic cell count and clinical inspection are the most common methods of monitoring sub-clinical and clinical mastitis. Mastitis is a major welfare problem in dairy cows and it reduces the income of the farmer also (Capdeville and Veissier, 2001). Despite many years of research devoted to mastitis the disease remains a serious problems. The first report in India the annual economic losses caused by mastitis was estimated at Rs 529 million (Dhanda and Sethi, 1962). In the year 2001, the estimates escalated to Rs 60532.1million (Dua, 2001). Various risk factors like breed, parity, stage of lactation, level of milk production, teat tip to floor distance, housing and milking management have been associated with the incidence of mastitis. In addition to above factors, udder and teat characteristics have also been reported to be associated with the incidence of mastitis (Sharma and Singh, 2003). The trauma caused by milking machines to teat tissues (Sordillo, 2005) and genetic selection for extremely high milk yields have been identified as predisposing factors for infection of mammary glands (Heringstad et al., 2003 – Tyler and Cullor, 2002). High yielding cows are generally considered to be more susceptible to intra mammary infection e.g. Holstein Friesian (HF), Jersey, HF and Jersey crossbred cows than Desi (Zebu) breeds of cows (Sharma and Singh, 2003). Most cases of mastitis are caused by infections by pathogenic bacteria (Waage et al., 1999) introduced through the teat opening (Tyler and Cullor, 2002). The higher incidence of clinical mastitis is also associated with lower reproductive performance (Pryce et al., 1998). The overall prevalence of clinical mastitis ranged between 5.5% and 3% in crossbred cows (Bitew et al., 2010).

**Health indicators: Lameness**

Dairy lameness is a very visible well-being issue as well as a production and economic issue. Lameness continues to be a common problem across many types of housing. Lameness of dairy cattle is a very visible well-being issue as well as a production and economic issue. It is considered that lameness is related to the genetics of the animal, housing and nutrition. 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). Locomotion scoring is a relatively quick and simple qualitative assessment of the ability of cows to walk normally. Visual locomotion scoring of cows is normally used in lameness research as a method to identify lameness. 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 (Sprecher et al., 1997). In a survey of the primary causes of cow deaths, lameness or injury ranked highest at 20%, followed by 16.5% due to mastitis and 15.2% as a result of calving problems~ Lameness was reported to be the third most common reason dairy cows culling after mastitis and calving problems (Espejo et al., 2006). Lameness causes pain and discomfort. Cows suffering from lameness develop hypoalgesia (Whay et al., 1997) and alter their behavior in an attempt to relieve the pain by changes in body posture, (Juarez et al., 2003) reduced walking activity, and more frequent shifts of their weight from one leg to the other (Neveux et al., 2006). Hoof lesions are a main cause of lameness (Webster, 2001) and have been associated with concrete flooring (Vokey et al., 2001). There are additional indications that rates of lameness increase with increasing milk yield. Lameness has also been tied to insufficient physical activity. Lameness can be a cause of severe pain (Webster, 2000), and 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 by between 1.5 kg per day and 5 kg per day for 2 to 7 weeks (Esslemont, 1996). Lameness is an important cause of culling, either directly or indirectly by reducing reproduction capacity (Rajala-Schultz and Grohn, 1999). Milk production may also be reduced (Warwick et al., 2001 – FAWC, 1997) and fertility adversely affected (Sprecher et al., 1997) in lame dairy cattle. Sood and Nanda (2006) found that lameness appeared to have suppressed the playful behaviour during estrus probably owing to pain related stress. Locomotion scoring (LS) systems are useful in assessing the severity, duration and prevalence of lameness. In the two most popular systems (Manson and Leaver, 1988 in UK – Sprecher et al., 1997 in USA), observer assigned locomotion score (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) is most applicable to cows housed in free- stall barns since, unlike Manson and Leaver (1988), 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~ thereby guiding the scorer to assign the appropriate Lameness Scoring. Hassall et al. (1993) showed that 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. Locomotion scoring is relatively quick and simple qualitative assessment of the ability of cows to walk normally. LS profiles collected regularly within a dairy can provide a running index of the extent of lameness as well as being an index of the impact of interventions designed to alleviate lameness. Pachalag et al. (1988) in their study of hoof disorders in the NDRI herd
noted that the highest incidence was found in Karan fries (11.98%) followed by Karan Swiss (7.05%), sahiwal and others (5.24%) and least in buffaloes (2.85%). Maiti et al. (1996) reported that higher affections were noted in Holstein cross (16.4%) followed by jersey cross (13.8%) and least in Haryana cross (5.6%) in the IVRI herd. Pynunlal Blahwar (2003) reported that Karan Fries animals are affected the minimum (5.6%) followed by Karan Swiss (4.55%), sahiwal (2.40%) and Murrah (1.16%).

**Health indicators: Hock lesion**

Hock damage of dairy cattle is a problem in many herds. The term ‘hock lesion’ describes clinical manifestation of hock damage, which may vary from mild hair loss to severe ulceration and swelling (Lavan and Livesey, 2011). Hock lesions are very good indicators of poor welfare due to less comfort to the animals. Multiple scoring systems for hock lesions are in use. In most of the system a number is assigned to the severity level. Several cow related risk factors for hock lesions have been identified, namely, lameness, age, body condition score, cow size, hygiene, milk yield, stage of lactation and breed. Management related risk factors for hock lesions include:  
- Environmental factors: cubicle dimensions and bedding materials.  
- Housing factors (foot in contact with hard surface, litter).  
- cow related risk factors for hock lesions:  
  - Age: older cows have higher incidence of hock lesions.  
  - Body condition score: lower BCS increases the risk of hock lesions.  
  - Breed: dairy breeds have higher incidence of hock lesions compared to beef breeds.  
- Management factors:  
  - Housing: cows in cubicles lay down for significantly longer periods compared to cows in loose housing.  
  - Nutrition: poor nutrition reduces milk yield.  
  - Disease: presence of disease increases the risk of hock lesions.

**Animal–human relationship:** Animals may experience positive or pleasant emotions in the presence of humans that may arise from rewarding events and associations. There are three main lines of evidence concerning the implications for the welfare of farm animals: handling studies in controlled environmental condition, observations in commercial settings and intervention studies in commercial settings. Although handling at an early age may be highly influential, subsequent handling is also influential and has potential to modify early learning effects.

The most studies aspect of the human animal relationship from the perspective of the farm animal has been fear responses to humans, both behavioural and physiological. Fear is considered a powerful emotional state that normally gives rise to defensive behaviour or escape (Waiblinger et al., 2006). Fear of humans is exacerbated by poor handling methods in animals, reduced by appropriate experience of human contact. Calm and gentle contact with cattle improves later welfare and production. The animal’s relationship to humans the perception of humans and of the interactions with humans, was shown to have a major impact on animal health, productivity, and welfare and thus is an important parameter to include in on-farm welfare assessment (Waiblinger et al., 2003). The human–animal relationship is an important issue when assessing animal welfare on farms. In many farm animal species, the relationship to humans affects their welfare considerably. A feasible, reliable methodology for assessing responses of cows to humans would be helpful for large-scale surveys on this topic. Measuring avoidance distance to assess animal’s relationship to humans was shown to be a feasible and stable measure in dairy cow herds (Waiblinger et al., 2003).

**Dairy cattle housing:** Shelter management is the manipulation of microclimate of animals to suit best to their welfare thus reducing the climatic stress without adding much to the cost of construction. Productivity of animals can be improved by providing proper shelter as the energy output in fighting climatic stress is saved (Nagpal et al., 2005). Dairy cattle housing should provide the animal with protection from harsh environmental extremes. Good housing systems are those that are well construct for ease of management and maintenance at all times. Good animal housing systems are those that enhance provision of all the five freedoms that an animal should have to satisfy its welfare. If these basic needs cannot meet in the animal house, then health, welfare and production of the animal will be compromised (Hristov et al., 2011). Shinde (1984) in a study of crossbred cows in loose housing observed that temperature and humidity of environment significantly reduced milk yield. Singh et al., (1993) reported that the normal cow in a straw yard spent more time lying down and ruminating (5.1 hr) than normal cows in cubicles (3.3 hr). Lame cows in cubicles lay down for significantly longer during the day (3.3 hr) than normal cows in cubicles (3.1 hr). Pratap et al., (1996) reported foot lesions included hoof deformity, inter-digital hyperplasia, hoof erosion, ulcer, sand crack and abscess at an organized farm.

**Body Condition Scoring (BCS):** Body condition score (BCS) is an arbitrary scale for estimating the quantity of fat and muscle in specific anatomical regions on a live animal (Edmonson et al., 1989, Wildman et al., 1982). Singh et al. (1994) identified BCS is an ideal tool for proper productive, reproductive, feeding and health management of dairy cow. BCS is an accepted, non-invasive, quick, inexpensive and subjective measures of assess body reserves regardless of body measurement and body weight. 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. These body energy reserves are indicative of body condition. BCS has been found to influence the productive performance of cow; it
will be optimum only when it is in desired body condition score (BCS) range at that stage. It is a better tool to evaluate the condition of animal than body weight and body measurements as live weight change is poor estimates of tissue mobilization in lactating dairy cattle due to gut fill and shifts body water as fat is mobilized for milk production. Body condition score can be used to assist producers with balancing feed requirements for dairy cattle. The estimation of BCS by notation though is simple and subjective it allows indirect measures of the energy status of females. However, live weight change is a poor estimate of tissue mobilization in lactating dairy cows (Wildman et al., 1982). Therefore, BCS has received considerable attention as a means to estimate tissue mobilization (Domecq et al., 1997). 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). Specific regions include in body condition scoring are the spinous and transverse processes of the lumbar vertebrae, the ideal (hook bone) and ischial (pin bone) tuberosities, the ilio-sacral and ischeal-coccygeal ligaments, the tail head and the thurl region (or rump, the region bounded anteriorly by the ileal tuberosity and ilio-sacral ligament, caudally by the ischeal tuberosity and the ischeal-coccygeal ligament anterogradely by the greater trochanter of the femur.

Edmondson et al. (1989) have developed a more practical condition scoring chart for Holstein cows. The actual score of the animal depends on the visibility/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 (Croston and stollard, 1976 – Nicholson and sayers, 1987). Dun et al. (1983) reported a correlation coefficient of 0.59 between body weight and condition score. Similarly, Nielsona et al. (1983) also reported a correlation coefficient of 0.62 between these two traits. Baxter (1994) had reported a correlation co-efficient of 0.62 (P<0.01) between body condition and milk production at five weeks of lactating cows. The procedures to know the body condition of an animal with a fair degree of objectivity i.e. Body Condition Scoring techniques were, however introduced much later. Most body condition scoring (BCS) systems in dairy cattle use the 5-point scoring system with quarter point increments. The scale used to measure BCS differs between countries, but low values always reflect emaciation and high values equate to obesity. So BCS also considered as one of the most important indicators of welfare (Sprecher et al., 1997). A body condition score of 1.5 one or two months after calving is not desirable because it indicates severe lack of adequate nutrition (negative energy balance). A body condition score of about 3.0 should be typical of a cow recovering body reserves in mid-lactation (Sprecher et al., 1997). 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. As milk production declines in late lactation, cows gain body weight efficiently.

Cow cleanliness / Cow hygiene: Cleanliness does have a relationship with animal welfare, through links with mastitis, lameness and gastrointestinal problems. Napolitano et al. (2005) selected five ano-genital areas, back of the udder, the bottom part of the hind legs (from the hock to the dewclaws), the udder sides and belly and the thighs for scoring cow cleanliness score/ cow hygiene score.

Cook (2004) 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), with dirtier cows positively correlated to mastitis incidence (Valde et al., 1997; Ward et al., 2002) and individual cow somatic cell count (Reneau et al., 2005). Sanaa et al., (1993) stated number of cleanliness scoring systems for dairy cows have been developed to record the degree of contamination to different anatomical areas with dirt and faecal matter, which gives an overall assessment of the cleanliness of the whole animal (Hughes, 2001; Bowell et al., 2003; De Rosa et al., 2003; Cook, 2004; Reneau et al., 2005). A number of factors can potentially affect cow cleanliness including housing design, with small cubicles associated with dirtier cows (Bowell et al., 2003) and faecal consistency, where increasing fluid consistency is positively correlated with dirtier cows (Ward et al., 2002). Hauge et al. (2012) studied about cattle cleanliness that affects hygienic milk production, thermoregulation, health and 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., 2003). Ruud et al., (2010). Iwanczuk (1997) observed that milk yield was shown to be significantly affected by mastitis intensity and hygienic condition in the shed. Bodman and Rice (1996) identified 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. Ellis et al. (2007) validated a cow cleanliness scoring system over a wide range of UK dairy farms and found it was both repeatable and a practical technique to use on farm and found dirtier cows positively correlated with increased somatic cell count (SCC).

CONCLUSIONS

Animal welfare issues have grown in importance in recent years not only in developed countries but also in developing countries where improvement of animal welfare
practices can lead to not only improved production and health of the animals but also increased trade opportunities. Such countries, where land and labour are cheaper than in developed countries, are likely to have a natural commercial advantage by producing farm products more cheaply. The Indian dairy farming system comprises traditional smallholder production system and commercial dairy farming which is relatively of recent origin and is growing. The animal welfare issues and problems in these two production systems may be different due to different farming practices and use of modern production technology. So for little effort has been made in India to understand dairy animal welfare or to identify the indicators of welfare or to assess the level of welfare. Therefore the status of dairy animal welfare under our different dairy farming systems needs to be studied so that the animal welfare areas or management practices which jeopardize animal welfare could be identified and a strategy could be developed for enhancing the animal welfare.

REFERENCE


Nieko et al. (1983 ) also reported a correlation co efficient of 0.62 between these two traits.


