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The Welfare Quality® assessment protocol: how can it be adapted to family farming dual purpose cattle raised under extensive systems in tropical conditions?

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Abstract

Family farming is still the main source of income for many people in the tropical regions of the world. At the same time, modern society is quickly becoming more aware of the welfare of animals for human consumption. The main objective of this study was to illustrate the need to modify certain aspects of the original Welfare Quality® (WQ) protocols developed by the EU-funded WQ project, under the conditions of small community farmers in the tropics. Thirty-four dual purpose farms in the State of Chiapas, Mexico, which had their main production focus on milk but for whom beef production was also of significant value, were evaluated utilising a merged version of the WQ protocols for dairy and beef cattle. Based on their average score, the farms obtained at least an acceptable level in each indicator of welfare. However, after merging indicators from the dairy and beef cattle protocols of WQ in order to adjust it to the prevailing conditions in the tropics, a number of sections are not applicable. This is particularly true of the section related to good housing, where most of the items do not apply due to the absence of infrastructure; the farms obtained a very high score in this section but further studies to verify whether this reflects an accurate assessment of the welfare status should be carried out. In general, the approach of the WQ protocol was useful, however certain aspects are quite different from the conventional intensive farming systems predominantly used in Europe and there is a need to implement a number of modifications.

Keywords: *animal welfare,* Bos indicus, Bos taurus, *dual purpose cows, sustainability, tropics*

Introduction

People are becoming increasingly more aware of the environment and the ethical treatment of animals. Consumers are requiring information on the origin of food produced from animals (Smith & Brower 2012), demanding a halt in the carbon footprint produced by dairy and beef industries, and asking for products free of the residues/chemicals commonly used in commercial farming (Wauchope 1978; Rigby & Caceres 2001). One important aspect of direct concern to the quality of animal products is farm animal welfare, which is indeed becoming a great concern to society in both developed and developing countries.

In emerging economies, family farming is still the main source of income for a large part of the population, particularly in the tropical regions of the world (González-García *et al* 2012). Research is necessary to ensure the sustainability (with respect to animal welfare, environmental parameters, source of income) of such small farms. One way of measuring animal welfare is to use currently available standardised protocols related to housing and management procedures (European Commission 2006). However, these may need modification in relation to the local tropical conditions and management systems. Products from farms having been evaluated using these protocols can be labelled in a specific way to provide consumers with a variety of welfare options, potentially enhancing future trade opportunities for these small community family farms.

Societal concerns and increasing consumer awareness of animal welfare was the main driver behind the EU-funded Welfare Quality® (WQ) project in 2004. Within this project, a set of predominantly animal-based, on-farm animal welfare assessment protocols, including one for dairy cattle, were developed. The cattle welfare assessment protocol has been used in a number of scientific studies (Knierim & Winckler 2009; Popescu *et al* 2013) under European conditions, ie mainly on large commercial farms which are based either on seasonal grazing or indoor

housing all year around with no opportunity for grazing. The WQ system includes four basic areas of concern; good feeding, good housing, good health and appropriate behaviour, with the objective of identifying strengths and weaknesses in animal husbandry and develop strategies to improve welfare (Blokhuis 2008).

Nevertheless, the WQ standards were mostly designed for indoor/partial indoor systems, which inevitably tend to congregate animals in certain parts of the farm, thus facilitating the measurement of variables involving the infrastructure where the animals are kept. These scenarios are not typical for animals raised under tropical conditions, including those dedicated to milk production (Corro *et al* 1999; Absalón-Medina *et al* 2012). Hence, different indicators may be needed to correctly evaluate the animal welfare status under these conditions.

The main aim of this study was to illustrate the necessity of modifying certain aspects of the original WQ protocols for dairy and beef cattle to accurately evaluate animal welfare under the conditions prevailing in small community farming in the tropics.

Materials and methods

The study was performed in San Pedro Buena Vista, located in the municipality of Villa Corzo in the state of Chiapas, Mexico, at 15°47' N and 92°29' W. The climate in this region is hot and sub-humid with summer rainfall and an average precipitation of 1,247 mm. The study took place in July 2015, ie during the rainy season at a maximum of 31 and minimum of 20°C, with an average humidity of 86%. The temperature and humidity information used in this study was taken daily from a weather application for mobile devices.

Study farms

The protocol was implemented on 34 dual-purpose farms, whose main production focus was milk, sold to a local cheese factory. Only male calves were sold for finishing, and old cows with sub-par milk production were slaughtered for beef production. The size of the farms ranged between four to fifteen hectares while the herd size ranged from seven to 90 cows, with approximately 2/3 of the farms ranging between 15 and 35 cows. Due to the small size of the herds in the study, all animals (ie not a sub-sample) were observed and a total of 1,093 were evaluated. Herds were mostly composed of crossbred animals (*Bos taurus* × *Bos indicus*), the crosses including, but not limited to, breeds such as Holstein, Zebu, Brown Swiss, Sardo Negro, Gyr and Jersey. The age of the cows varied from 3 to 10 years of age.

All the farms in the study operated under the same system; cattle kept on pasture with morning milking, during which time supplementary feed was dispensed on an individual basis via a trough but without an accurate measurement of the amount of chicken manure, ground corn and dry grass provided. After milking, cows were released to pasture, where the feed consisted of native grass species, such as *Hyparrhenia rufa*, *Digitaria decumbens*, *Panicum maximum*, *Cynodon nlemfluensis*, *Brachiaria brizanta*, *B. dictyoneura*, *Centrosema pubescens*, *C. plumieri*, *Arachis pintoi*, *Clitoria ternatea* and *Canavalia ensiformis*. They stayed in the pasture for the remainder of the day and night and the following morning were brought back to the milking parlour. Calves were kept together with the cows night and day but usually separated and left in a paddock near the milking parlour during milking. Most of the farms performed milking manually and the average milk production per cow ranged from 8 to 14 L. The total pasture area and the design of the livestock facilities varied greatly between farms, from rudimentary milking parlours with simply a roof or single walls made from wood and wire with the capacity for only one cow at a time, to concrete constructions with 5 to 10 individual stalls. Each farm had its own design and measurements for the construction, but the cows were not brought indoors apart from during milking. Herds tended to feature one or two bulls kept with the cows and these were usually passed between different farms to guard against inbreeding.

Welfare assessment

Utilising the WQ protocols for dairy and beef cattle (Welfare Quality® Assessment protocol for cattle 2009); the indicators that could be applicable for all-year-around, grazing-based, dual-purpose systems were selected. These indicators are listed and described below.

The assessment was carried out by continuous observation of the animals for a period of 120 min at pasture. However, due to the prevailing conditions of the farms in this study, a number of features were evaluated during the milking sessions when the animals were gathered in the milking parlour and it was feasible to perform the observations at individual level. These observations covered the whole herd, including cows, calves and bulls when present.

Good feeding

Absence of prolonged hunger

Each animal was observed from behind and from the side in relation to the loin, tail head and vertebrae areas as described in the WQ protocol. Subsequently, the animals were categorised into one of three categories: 0 = regular body condition; 1 = very lean; or 2 = very fat according to the following criteria: A) the condition of the cavity around the tail head, being present in very lean cows, contrary to being full and with folds of fat tissue in very fat cows; B) the region of the loin with a visible depression between backbone and hip bones in very lean cows and presenting a convex area between backbone and hip bones in very fat cows; C) vertebrae with distinguishable ends of transverse processes in very lean cows and not discernible transverse processes in very fat cows; and D) tail head, hipbones, spine and ribs visible in very lean cows and outlines of fat patches under the skin in very fat cows. Regular body condition was determined as an in-between very lean and very fat condition for each criterion. The assessment was performed during milking, when the animals were at an appropriate distance to facilitate observation. The score was determined at herd level calculating the percentage of very lean and very fat cows.

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Absence of prolonged thirst

All water sources within the area where the assessment was performed were counted and measured. Water sources were divided into presence of water sources in the milking parlour to which the animals have access at all times; and water sources at the pasture, including natural sources, such as rivers, streams and ponds. For a more accurate assessment, all types of water sources were considered, including rivers and other natural sources, as the original protocol does not cover such sources of water. The score was estimated dividing the number of animals observed and the total length of water sources available (ie the rim of a water trough).

Additionally, the cleanliness of water sources was assessed according to the original protocol. It was considered clean when there was no evidence of crusts of dirt and/or food residues present. In the case of natural water sources, it was considered clean water when no foul odours and/or abnormal colours were present, and whether it was still or running water.

Good housing

Comfort around resting

The entire herd was observed and the time it took for any individual cow to lie down during the observation period was recorded, as indicated in the WQ protocol. The time recorded started when one carpal joint of the animal was bent and lowered before even touching the ground and ended when the hindquarter touched the ground and the animal pulled the front leg out from beneath the body. The total duration (s) of the event was recorded.

Moreover, any event where an animal struck any housing equipment while lying down was recorded. Due to the nature of the farms studied, it was only possible to assess this event at the milking parlour since it was the only area with housing equipment. The percentage of animals striking housing equipment was calculated.

Animals lying partly or completely outside the lying area were assessed considering this area appropriate if it was dry and clean, did not lead to any trauma with objects and was covered by natural or artificial shade. Furthermore, the percentage of animals lying outside such spaces was calculated.

The scoring of the cleanliness of the animals was carried out at the milking parlour, for the entire herd and performed as described in the WQ protocol, examining the animal, including the sides of the animals and underbelly, but excluding head, neck and legs below the carpal joint and tarsal joint, respectively. Cleanliness was assessed using the degree of dirt on the body parts, either liquid dirt or plaques (three dimensional layers of dirt). At an individual level, the animals were scored as dirty when more than 25% of the body was covered with plaques or more than 50% of the body was covered with liquid dirt. At herd level, the percentage of dirty animals was also calculated.

Good health

Absence of injuries

Lameness was assessed throughout the whole observation period, covering the entire herd, noting the presence of the indicators in the WQ protocol for moving animals. Hence, the following aspects were recorded: irregular foot fall, reluctance to bear weight on a foot, uneven temporal rhythm between hoof beats and weight not taken for equal time by each of the four feet; for standing animals, the indicators considered were resting a foot (trying to avoid taking the weight), frequent weight-shifting between feet or repeated movements of the same foot. At individual level, an animal was considered lame when displaying any of the signs either for animals in movement or standing and subdivided if the animal was moderately lame (not harshly affecting the movement) and severely lame, when the movement of the animal was affected considerably. At herd level the percentage of not lame, moderately lame and severely lame animals was calculated.

The occurrence of integument alterations was recorded at the milking parlour. The alterations were divided into two categories, hairless patches when the animals displayed an area larger than 5 cm of hair loss with no damaged skin, and lesions/swellings when the animals had an area larger than 5 cm of damaged skin either in the form of a scab or a wound, dermatitis due to ectoparasites, ear lesions, completely or partly missing teats, as indicated in the original WQ protocol. At individual level, the total number of hairless patches and lesions/swellings were counted, at herd level, the percentage of animals with no skin lesions was calculated, as was the percentage of animals with mild skin lesions (at least one hairless patch and no lesions per swelling) and the percentage of animals with severe skin lesions (at least one lesion per swelling).

Absence of disease

The number of coughs was noted during the whole observation period and considering all the animals present in the area, including cows, calves and bulls. At herd level, the mean number of coughs per animal was calculated.

Observations for the presence of any disease indicators, nasal and ocular discharge, hampered respiration, diarrhoea and bloated rumen were made during milking, considering all the cattle in the farm, including cows, bulls and calves.

Nasal discharge was noted when a clearly visible flow from the nostrils was present. Ocular discharge was recorded when a clearly visible discharge (wet or dry) from the eye, extending down by at least 3 cm, was observed. The presence of hampered respiration was registered when a deep and overtly difficult breathing was present accompanied by an expiration visibly supported by the muscles of the chest and a pronounced sound. Diarrhoea was scored by the presence of loose, watery manure below the tail head on both sides of the tail. Bloated rumen consisted of a bulge being present between the hip bone and the ribs on the left side of the animal. All of the disease indicators were scored at herd level calculating the percentage of animals

displaying these abnormalities. Finally, due to the absence of production records, mortality figures were collected via direct questioning of the producer.

Absence of pain induced by management procedures

This section was assessed through direct observation of the animals and aided by the presence of a structured questionnaire which included questions for producers about management procedures performed on farms and the use of anaesthetics and/or analgesics during management procedures. In order to prevent the avoidance of any procedure, the farmers were asked directly about specific procedures, such as disbudding/dehorning, tail docking, castration, use of branding iron, ear-tagging and use of nose ring: the farms were scored at herd level with a decision tree included in the WQ protocol.

Appropriate behaviour

Expression of social behaviours

Agonistic and cohesive behaviours were assessed simultaneously through continuous recording of the whole herd during 120 min at pasture. The WQ protocol covers five agonistic behaviours (head butt, displacement, chasing, fighting and chasing-up) and two cohesive behaviours (social licking and playful horning). The number of agonistic and cohesive behaviours were noted and, at herd level, the mean per animal and hour was calculated for each group of behaviours.

Expression of other behaviours

This indicator was evaluated considering the availability of an outdoor paddock or access to pasture for the animals. In accordance with the prevailing conditions of dual purpose farming in the tropics, the animals spent the entire day at pasture, with the exception of milking, which took a maximum of 2 h per day. Animals were kept in a pen while waiting to be milked and put into another pen afterwards, until the whole herd was milked and cows were released to pasture.

Good human-animal relationship

Avoidance distance was recorded during milking, in an open but limited space, where the animals were able to evade the evaluator's touch if they so desired. The animals were not familiar with the evaluator who scored this section.

Positive emotional state

Positive emotional state was assessed using a visual analogue scale (VAS). The observations were performed when the animals were at pasture, through observation of the entire herd for a period of no longer than 20 min as indicated in the WQ protocol.

Calculation of scores

Calculation of scores was performed in accordance with the statistics included in the WQ protocol (Welfare Quality® 2009). The final result is represented by a number from 0 to 100 and the farms are divided into four categories according to their final score in each category, as follows — Excellent: 80.1–100; Improved: 60.1–80; Acceptable: 20.1–60; and Not classified: 0–20.

Results

The scores for the evaluated farms are shown in Appendix 1 (see supplementary material to papers published in *Animal Welfare* on the UFAW website: http://www.ufaw.org.uk/t-ufaw-journal/supplementary-material). A total of nine farms (farms 1, 4, 8, 9, 12, 19, 27, 32 and 33) reached a level above the minimum scores to be considered acceptable in all the categories; hence, 74% of the assessed farms scored below acceptability in one or more indicator categories of animal welfare. Based on the average score, the farms in the study area obtained an acceptable level with respect to each indicator of animal welfare considered in the protocol (Appendix 1). Absence of prolonged hunger and absence of pain induced by management procedures represented a major weakness for the dual-purpose farms in the region. Ease of movement, as well as expression of other behaviours obtained the highest score; this may be directly related to the grazing conditions of the system. Good human-animal relationship also obtained the top score, indicating that, despite being at pasture for the majority of their time, cows were still used to human contact.

The percentage of farms per each indicator of animal welfare and per category of classification are shown in Figure 1. Regarding the indicators for good feeding, the absence of prolonged hunger, assessed by body condition, was the indicator that recorded the lowest results among all the parameters evaluated. None of the farms were classified as 'improved' in this section, while 16 were scored below the acceptable level. Another major problem was the indicator 'absence of prolonged thirst'. While six farms reached the excellence level with regard to this indicator, four did not reach the minimum score for acceptability, and the remainder were scored at the acceptable level, but below the medium score. All farms were classified as being above the acceptable level regarding comfort around resting. In total, 74% of the farms scored excellent and only 6% (2 farms) were below the level for being classified as 'improved'. The cows assessed in the farms in this study took between 3 and 5 s to lay down on soft ground without any physical obstacles affecting their movement, however only 13 reached the top score. As regards the category for good health, 100% of the farms were ranked at or above the improved level regarding absence of injuries, and 85% reached the excellence level. Eleven percent of the farms scored below the acceptable level in relation to the indicator 'absence of disease', 23% were ranked at the excellence level, while the remainder were classified into the acceptable category, as can also be seen in Figure 1. 'Absence of pain induced by management procedures' was the second major animal welfare issue observed in this study, with eleven farms not reaching the minimum score for acceptance, and only one scoring excellent. With regard to the indicator 'expression of social behaviours', 62% reached the excellence level, 23% reached the improved level, 12% were ranked as acceptable and one farm did not reach the minimum score to be classified. Interactions between cows were relatively uncommon, however interactions with other animals were noted, since it was a common practice to keep

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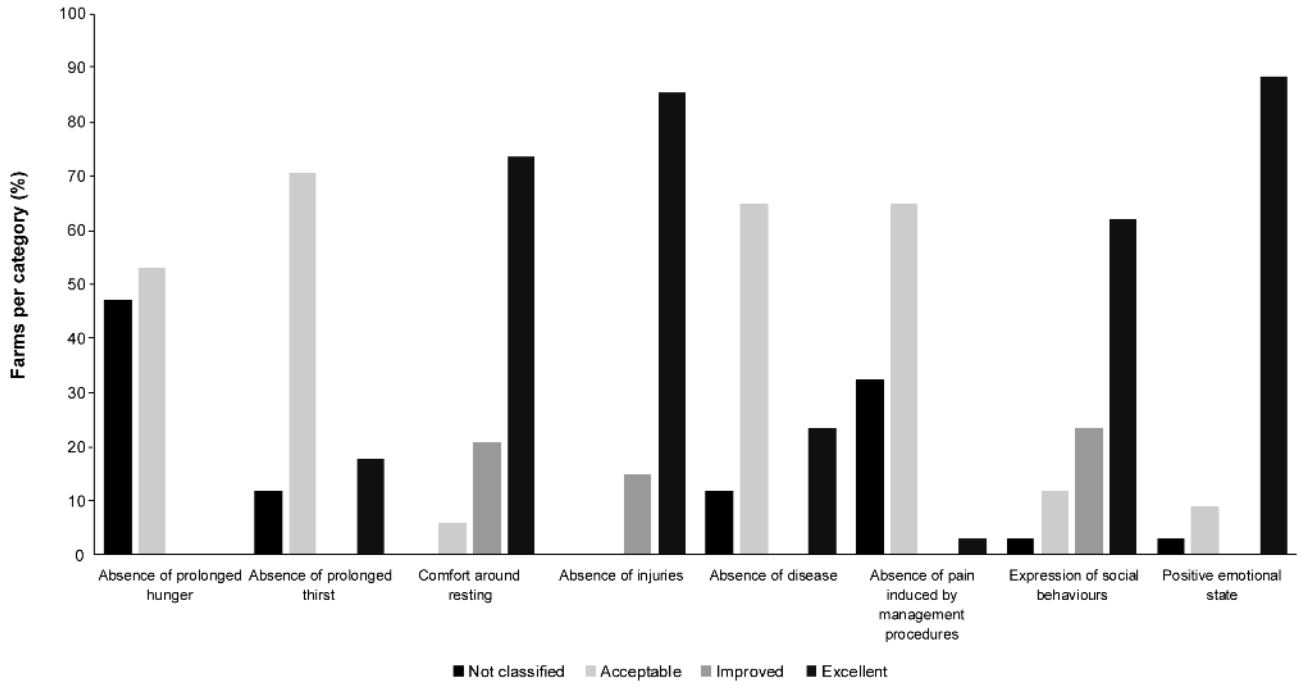
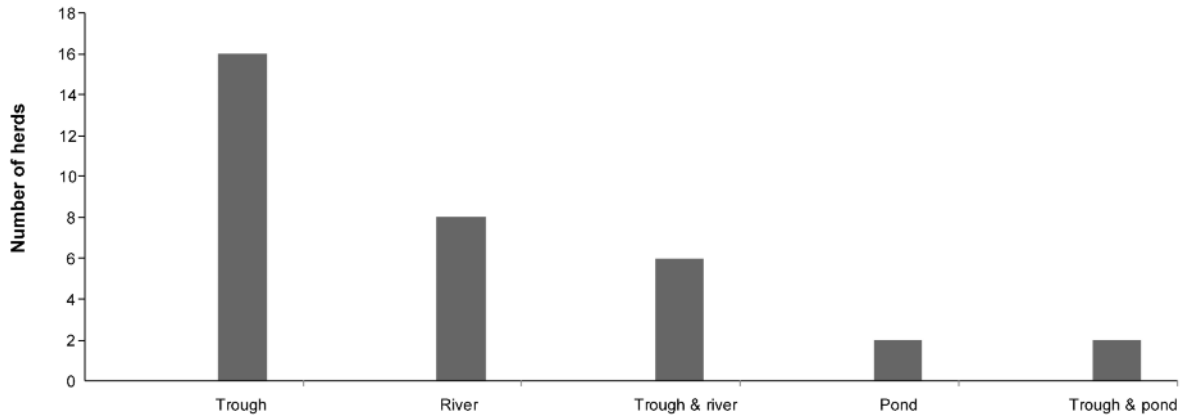
Figure 1



Percentage of farms per category of classification and separated by each indicator of animal welfare according to the Welfare Quality® protocol. Ease of movement, expression of other behaviours and good human-animal relationship are not shown in the graph since 100% of the farms reached the category excellent.

Figure 2



Different sources of water available for the cattle herds in this study (n = 34). Three different sources were observed (troughs, rivers and ponds), as well as two different combinations of these, trough + river and trough + pond.

the cows together with calves and bulls, and interactions between them were more frequently spotted. In almost all the farms, cows scored above the acceptable level for positive emotional state, however one farm did not reach the minimum score for acceptability.

In this study, three different sources of water were observed: troughs (artificial container intended to provide water to animals), rivers (natural flowing watercourse) and ponds (natural or artificial pit in the ground). Some farms presented combinations of two different sources. As can be seen in Figure 2, the use of troughs is the most common method for supplying water among the farms in the study; 18 utilised troughs as the only source of water, whilst seven combined them with the other two types observed (rivers and ponds). The presence of a river was the main source of water for 12 farms, and for six of them it was the only water source available. Four farms had ponds, and in three these were the only available source of water.

Discussion

Since the Welfare Quality® protocol was designed to assess intensive farms with a clear objective of high production; it does not necessarily correspond to the characteristics observed under the system implemented in grazing dual purpose farming in the tropics. This study aimed to evaluate whether the protocol could still be a useful tool assessing animal welfare under the mentioned system. However, after merging indicators from the dairy and beef cattle WQ protocols to adjust it to the conditions in the tropics, a number of sections were found not to be applicable to these farms. This is particularly true of the segment related to good housing, as most of the items do not apply due to the absence of infrastructure (ie no indoor housing); the farms did obtain a very high score in this section but further studies to verify whether this reflects an accurate assessment of the cows' welfare should be carried out. A number of items might be replaced by alternative factors, for example, lying outside the lying area vs lying in the shade. However, difficulties arose while assessing this section since animals tended not to lie down much while on pasture and, if they did, there was no marked preference for shade or sun. This aspect might be easier to evaluate during the hottest part of day (Galina *et al* 1982; Orihuela *et al* 1983) and in the dry season, which is warmer. The section 'animals colliding with housing equipment' does not apply to the conditions prevailing in our study area; instead, a better approach might be to assess the stocking density, ie the number of animals per m^2 in the area where the cows were kept during the night and the site for milking, ie the area around the milking parlour (Waiblinger *et al* 2001; Schneider 2010).

In the part related to good feeding, 47% of the farms were scored below the acceptable level. This could be a result of the poor nutritional content of grass native to the study area, and further work would be helpful to clarify this further.

In the section on good health, there are a number of aspects that should be reconsidered. The number of coughs as an indicator of absence of disease can be incorrectly classified if it is performed while animals are ruminating, since they could be 'coughing' for this very reason, ie the sounds that are emitted during regurgitation can be mistaken for mild coughing if the evaluator is not accustomed to the assessment. There was an absence of records kept by the producers, particularly in the section related to mortality, and it was necessary to trust the information provided by the producers as to the numbers of animals that had actually died. However, in most cases, the reason for deaths was referred to as accidents rather than diseases. The herd size in farms being assessed varied considerably, ranging from seven to 90 animals. Thus, an animal presenting signs of disease in a small herd can result in a high percentage but without successfully reflecting the health condition of the whole herd. In relation to absence of pain induced by management procedures, it should be mentioned that the farmers in this region do not practice tail-docking or castration, but other procedures that may cause pain but which are not considered in the original protocol were identified. For example, ear-tagging, hot iron branding, and cows routinely injected with intramuscular oxytocin during milking. Additionally, the absence of a livestock crush or any other area designed for performing these procedures, as well as other common features, such as deworming or vaccination, could be major causes of stress (Orihuela & Solano 1994).

In relation to udder health, the original protocol only includes serial testing using the California Mastitis Test. This procedure could not be applied in this study, as these rustic units lack adequate infrastructure. Perhaps a modified protocol could instead involve aspects such as udder hygiene at milking. At these farms, this intervention tends to be performed by the calf suckling before and after the cow undergoes milking (Das *et al* 2001). Evidence of clinical mastitis was absent. Data published by Fröberg *et al* (2007, 2008) have shown calf suckling to improve udder health. Furthermore, the relatively low milk production level in these herds most likely contributes to the low incidence of mastitis.

Social interaction between cows might be lower compared to intensive farms, especially when calves and bulls are kept with the cows and the large available pasture area ensures very low stocking density. Additionally, cows under pasture conditions spend most of their time engaged in activities, such as grazing and ruminating. During this study, interactions with animals other than cows, including calves and bulls, but also other species, such as horses, poultry and wild fauna, were commonly observed. Hence, the importance of these events should also be taken into consideration while assessing this type of farm in order that the expression of social behaviour is adequately covered (Masahiko *et al* 2013). Furthermore, if interactions with other species are to be taken into account when evaluating cow welfare, the animal welfare relevance of such interactions first has to be investigated.

The evaluation of positive emotional state is highly subjective since it is difficult to identify the true emotional state of the animals. A decision was taken, whilst the study was in progress, that any animals actively and calmly grazing and ruminating are experiencing positive states (happy, content, enjoying) but this is highly dependent on the evaluator. It may, thus, be better to assess this section together with the expression of social behaviour, including interactions between animals in the entire herd (Das *et al* 2001) (cows, bulls and calves).

The section related to good human-animal relationship was also difficult to assess since animals in tropical systems are kept in large, open spaces and can readily avoid people touching them, without necessarily being afraid.

One of the main problems observed was limited access to water, ie the shortage or absence of water sources either at pasture or in the milking parlour. Most farms only have water sources in one area, which can result in animals going long periods without drinking water. This is a potential welfare problem especially in the hot dry season (Ahmed & El Hag 2003).

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Family farming in the tropics generally involves a limited number of animals, sometimes even less than ten cows. When this type of animal welfare assessment is carried out on a low number of animals, indicators evaluated as percentages, eg health-related problems (ie diarrhoea not always caused by an infection) and body condition will have a considerable influence on that farm's total score since one single animal then constitutes a significant proportion of the herd but without stating that the whole herd is affected or at risk. It is noticeable that the size of the herds can also benefit the approach and utility that the WQ protocol might have in an extensive system, since the difficulties and limitations observed in this study differed from the ones found by Huertas *et al* (2009) when applying the same protocol in extensive larger farms in Latin America. In that particular study, the size of the herd and the lack of routine gathering of the animals were the major problems related to the assessment of features such as disease indicatives and avoidance distance.

Finally, new features could be developed to accurately improve animal welfare in farms using these systems. Important aspects such as the quality of feed and water should include some of the main targets to attend to. The evaluation of cleanliness of water sources, assessed in accordance with the original protocol in this study, should be improved in order to provide more useful information. In the case of natural water sources, evaluating water aspects, such as odour and colour and whether it is still or running should be considered and, moving forward, further studies involving the taking of water samples for analysis of water quality should become a research priority. Also, as suggested by Huertas *et al* (2009), the addition of important aspects typical of the extensive farms in the tropics could be taken into consideration for a proper assessment of the animal welfare, such as risk of predation, ectoparasites, and pasture size and condition.

Animal welfare implications and conclusion

The present study aimed to illustrate the need to modify a number of aspects of the original WQ protocols for dairy and beef cattle to accurately evaluate animal welfare under the conditions prevailing in small community farming in the tropics. In general, the approach of the WQ protocol was also useful under the conditions prevailing in this study, ie for dual purpose cattle in the tropics. However, certain aspects, such as absence of prolonged thirst, animals injured with housing equipment and social interaction, differ from conventional intensive farming systems predominantly used in Europe and a number of modifications are suggested.

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