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# Management practices for fattening beef cattle: a critical analysis of strengths, weaknesses, and herd size effect in relation to animal welfare

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The current farming systems for fattening beef cattle in Europe are generally perceived as detrimental to animal welfare. Although previous studies have identified risk factors in these rearing systems, a comprehensive description of animal welfare conditions across beef cattle farms is still missing. This study collected data on animal welfare and management practices of 49 beef cattle farms located in northeastern Italy. Overall, 38 items referring to farm management and personnel, structures and equipment, and animal-based measures (ABM) were analyzed. Given the wide variability in herd size, its impact on the assessed items was tested by dividing the farms into three equal groups based on the tertiles of their average herd size. The recorded ABMs highlighted satisfactory welfare conditions for the inspected animals, regardless of the herd size. Major shortcomings were observed in farm structures and equipment, like limited space allowances, unsafe flooring systems, lack of specific facilities for cattle moving and restraining, and deficiencies in infirmary areas. Water availability also required improvement, especially considering the increased animal demand under hot environmental conditions. Better personnel skills, effective feeding management, written recordings and protocols, and optimal environmental conditions were more frequent in larger herds. Given the increasing consumer expectations and societal concerns regarding farm animal welfare, this study offered a first comprehensive overview of the current welfare and management conditions of fattening beef cattle, which can serve as a valuable baseline for future research and targeted interventions.

## KEYWORDS

animal-based measures, beef cattle, Classyfarm, management, welfare

## 1 Introduction

Sustainable food production is a key aspect of the Farm to Fork strategy of the European Green Deal. In livestock farming, this strategy aims to reduce the environmental impact while ensuring fair economic returns for farmers and adequate welfare conditions for the animals. Within this plan, livestock farms should reduce the use of antimicrobials, while animal welfare should be improved (EC, 2024). Most beef cattle in the European Union

(EU) are reared ‘intensively’ (EFSA et al., 2025a), a system that is generally perceived as responsible for poor animal welfare by the consumers (Riuzzi et al., 2025). Major risk factors for welfare of beef cattle are related to unfavorable environmental conditions (e.g., insufficient mitigation of excessive temperature and humidity and excess of ammonia in the air), too limited space allowance, type of flooring, nutrition management (e.g., excess of starch in the diet), animal commingling of different origin, and infectious diseases, which may lead to negative consequences on animals’ health, such as respiratory diseases, lameness, heat stress, and behavior disorders (e.g., oral stereotypes) (EFSA et al., 2025b).

Italy rears about 2 million beef cattle annually and is the fourth European beef meat producer after France, Germany, and Spain (ISMEA, 2024). Most of the Italian beef production is concentrated in the northern part of the country (ISTAT, 2024). The main beef cattle breeds fattened in Italy are Charolaise, Limousine, and French beef crosses. Fattening cattle are generally of foreign origin, imported mainly from France at an average weight of 350 kg. Bulls and heifers are typically housed separately in multiple pens on deep-littered solid floors or concrete slatted floors, and fed diets provided as total mixed ration (TMR) with cereals constituting more than 60% of the dry matter. The fattening cycle lasts approximately 210 days, and cattle are slaughtered at about 650 kg of live weight (Cozzi, 2007; Gallo et al., 2014). With these characteristics, the Italian beef farming system can be considered representative of the common European husbandry system for fattening cattle (EFSA et al., 2025a).

Since 2017, the Italian Ministry of Health has implemented the official ‘Classyfarm System’ to monitor animal welfare and management in livestock farming based on risk assessment. This system analyses data collected in four main areas of interest in livestock farming: animal welfare, farm biosecurity, slaughtering, and antimicrobial use ([www.classyfarm.it](http://www.classyfarm.it)). Regarding animal welfare, officially trained veterinarians periodically visit livestock farms and fill in a detailed checklist that covers four macro-areas: Farm Management and Personnel; Structures and Equipment; Animal-Based Measures (ABM); and Emergency Plan and Alert System. The Classyfarm beef cattle welfare assessment stems from the Welfare Quality<sup>®</sup> approach and ensures compliance with the minimum law requirements at both the EU and national level, also considering the more recent indications from all available scientific sources on this topic (e.g., scientific opinions and papers; Bertocchi et al., 2020).

Nowadays, given the growing interest from consumers and policymakers toward farm animal welfare, it is increasingly important to have a comprehensive understanding of the living conditions of farm animals, in order to guide further scientific research and support the sector’s need for ongoing improvements in husbandry practices. Despite several studies in the literature analyzing specific risk factors that affect the health and welfare of intensively reared beef cattle (Ostojić Andrić et al., 2015; Park et al., 2020; Nalon et al., 2021), a comprehensive overview of the various structural and managerial aspects influencing the quality of life of these animals is still lacking. When discussing animal welfare and quality of life, it is essential to consider all aspects that can

collectively impact animals’ lives, taking into account their specific needs and the variability in farming conditions. In the beef cattle sector, for example, farm dimension (herd size) can influence farm structures and management practices.

Therefore, the present study aimed to be the first observational and exploratory research to provide a comprehensive description of the current welfare and management conditions in the beef cattle fattening sector. To achieve this, data derived from Classyfarm assessments of a sample of Italian beef-fattening farms were analyzed, considering also the potential variability associated with herd size. The resulting information offered a valuable baseline of animal welfare conditions in beef fattening systems, which can be used to design targeted interventions and guide future research aimed at improving beef cattle rearing practices.

## 2 Material and methods

### 2.1 Dataset description

The data analyzed in this study were provided by a beef farmers’ association of northeastern Italy that, in 2023, was one of the first to commission an officially trained veterinarian to assess animal welfare in a sample of associated farms using the Classyfarm system method (Bertocchi et al., 2020). The data made available by the association consisted of the Classyfarm welfare checklist reports of 49 beef cattle farms that fattened batches of young male and female brotards imported from France. None of the farms reared calves (i.e., cattle under 8 months of age).

All data were provided and treated anonymously, precluding any identification of individuals, in compliance with the right to privacy. No sensitive, personal, or confidential data was collected. No animal manipulation was performed to conduct this study, as the data used were retrieved from the Classyfarm database, so no ethical approval was needed.

Data from the Classyfarm welfare checklist reports were digitized into an Excel<sup>®</sup> spreadsheet, where each farm was uniquely identified. Farm-level data comprised the average herd size, expressed as the mean number of animals reared annually, and the scores assigned to each of the 56 overall items in the checklist (IZSLER, 2019). Within the checklist, the items were uniquely numbered and grouped into four assessment areas: Farm Management and Personnel (18 items), Structures and Equipment (18 items), Animal-Based Measures (ABM; 12 items), and Emergency Plan and Alert System (8 items). During farm assessment, each item was scored by the veterinarian into two (insufficient, adequate) or three (insufficient, adequate, optimal) levels, according to specific cut-offs or indications that are detailed in the Supplementary Material (Supplementary Table 1, S2, and S3) and further described in the Classyfarm manual (Bertocchi et al., 2020). Briefly, structural and managerial items were scored according to compliance with minimum law requirements (“acceptable”) and additional improvements in line with the most

recent guidelines by scientific papers and opinions (“optimal”). Given that no reference law was available for ABM, insufficient, adequate and optimal scores were defined based on the scientific literature (mainly Welfare Quality<sup>®</sup> and EFSA publications). Because the data used in this study referred to 2023, the assessment protocol did not consider the most recent indications by EFSA et al. (2025b).

Items belonging to the Emergency Plan and Alert System area (i.e., presence or absence of fire alarm, etc.), which are not directly related to animal welfare, were not considered in the study. Items referred to young calves less than two months of age (namely 20, 28, 32, 42, 43, 44, 45), cattle kept in tied stalls with the use of electric trainers (item 39), and cattle kept in an external rearing area without indoor access (item 35) were also ignored, as no animals in these categories were present in the surveyed farms. Item 33, referring to the overall score obtained by the farm from the biosecurity-dedicated checklist assessment, was excluded from this study due to unavailable evaluation details. Therefore, the final dataset included a total of 38 items: 14 belonging to the Farm Management and Personnel area, 12 belonging to the Structures and Equipment area, and 12 belonging to the ABM area.

## 2.2 Statistical analysis

The analysis was performed using SAS 9.4 (SAS Inst. Inc., Cary, NC, USA). Descriptive statistics were produced to describe the proportion of farms that received insufficient, adequate, or optimal scores per each item considered in this study. Given the great variability in herd size among sampled farms, the potential herd size effect on welfare scores was investigated. The farm sample was stratified into three groups according to tertiles of herd size. Considering the sample size, the tertiles provided the optimal number of farms per group. The comparisons across herd-size

groups (3 levels) were performed using a k-proportions test (PROC GENMOD, assuming a Poisson distribution for a generalized linear model). Poisson regression was used to model the distribution of cell counts in a multiway contingency table (log-linear model; Nelder, 1974). The link function used was the logarithm transformation. *Post-hoc* pairwise comparisons were then performed using the Marascuilo procedure. Results of multiple comparisons were reported for  $P < 0.05$ .

## 3 Results

The average herd size of the 49 beef cattle farms considered in the study was  $556 \pm 680$  heads reared per year ( $\pm$  SD), ranging from 21 to 2,853 heads, with a median of 316 heads. Based on herd-size tertiles, farms were classified as small ( $\leq 176$  heads per year;  $n = 17$ ), medium (177–485 heads per year;  $n = 16$ ), and large ( $>485$  heads per year;  $n = 16$ ). Forty-six percent of the farms were assessed during winter months (i.e., December, January, February), 21% were visited during spring (i.e., March, April, May); 16% in summer (i.e., June, July, August), and 17% in autumn (i.e., September, October, November).

Proportions of the scores received by the 49 beef farms per each item according to the three main areas of assessment (Farm Management and Personnel, Structures and Equipment, and ABM) are reported in Table 1, 2 and 3, respectively. Items whose scores were affected by the class of herd size (average number of heads reared per year) at the k-proportions test are shown in Table 4. The k-proportions test to compare the three levels of herd size was performed only on the “adequate” score of each item. The statistical test could not be run on the “insufficient” score due to the high frequency of “zero” values among items and classes of herd

TABLE 1 Proportion of beef cattle farms (overall  $n = 49$ ) according to the score received in each item of the Farm Management and Personnel area.

Item <sup>1</sup>	Scoring levels	Insufficient	Adequate	Optimal	Herd size effect ( <i>P</i> )
(16) Number of stockpersons	3	0%	4%	96%	0.117
(17) Experience and training of stockpersons	3	0%	24%	76%	0.020
(18) Animal grouping strategy	3	0%	12%	88%	0.530
(19) Daily inspections of animals	3	0%	61%	39%	0.008
(21) Treatment of sick or injured animals	3	2%	67%	31%	0.045
(22) On farm culling procedures	3	0%	94%	6%	0.326
(23) Animal handling	2	4%	96%	–	0.141
(24) Feeding strategy	3	0%	12%	88%	0.024
(25) Differentiated feeding strategy according to the fattening phase	3	0%	39%	61%	0.002
(26) Feeding frequency and feed availability	3	0%	4%	96%	0.602
(27) Proportion of concentrates in the diet	3	0%	29%	71%	0.113
(29) Water availability	3	4%	90%	6%	0.192
(30) Cleanliness of drinkers	3	0%	43%	57%	0.017
(31) Housing and bedding management and cleanliness	3	0%	69%	31%	0.739

<sup>1</sup>Classyfarm checklist identification number is reported in brackets. The effect of the class of herd size (small, medium, large) is reported as *P*-value.

TABLE 2 Proportion of beef cattle farms (overall n = 49) according to the score received in each item of the Structures and Equipment area.

Item <sup>1</sup>	Scoring levels	Insufficient	Adequate	Optimal	Herd size effect (P)
(34) Absence of housing and facilities hazards	2	0%	100%	–	–
(36) Housing system	3	0%	96%	4%	0.602
(37) Resting area space allowance	3	10%	82%	8%	0.715
(38) Safety of flooring system	3	12%	55%	33%	0.758
(40) Space at the manger	3	0%	88%	12%	0.557
(41) Size and number of drinkers	3	0%	86%	14%	0.061
(46) Facilities for moving animals	3	31%	61%	8%	0.061
(47) Facilities for catching animals	3	16%	47%	37%	0.208
(48) Infirmary area	3	8%	49%	43%	0.222
(49) Environmental temperature and humidity	3	0%	49%	51%	0.001
(50) Air quality and gas concentration	3	0%	8%	92%	0.347
(51) Lightening	2	0%	100%	–	–

<sup>1</sup>Classyfarm checklist identification number is reported in brackets.

The effect of the class of herd size (small, medium, large) is reported as *P*-value.

size, for which none of the cells reached a sufficient count (i.e., >5) to perform the analysis. On the other hand, given that some items were binary scored (i.e., “optimal” level was absent), testing for the “adequate” score resulted in the only viable option.

Within Farm Management and Personnel area, the greatest proportion of farms was scored as optimal for most items (n = 8), namely farm personnel number and skills (items 16 and 17), animal grouping strategy (item 18), animal feeding management (items 24, 25, 26, 27), and cleanliness of water drinkers (item 30). Only a few insufficiencies were recorded for treatment of sick and injured animals (item 21), animal handling (item 23), and water availability (item 29). Six out of 14 items (namely 17, 19, 21, 24,

25, and 30) were significantly affected by the class of herd size ( $P < 0.05$ ; Table 1). Larger herds had more skilled personnel (item 17), daily inspections of the animals with written reports (item 19), specific protocols for treatment of sick and injured animals (item 21), well-controlled feeding management with supervision of a nutritionist and feedstuff analysis (item 24), and specific diets for different fattening phases (item 25). Cleanliness of water drinkers (item 30) was better in medium-sized herds ( $P < 0.05$ ; Table 4).

Almost all the items belonging to the Structures and Equipment area had a higher prevalence of acceptable scores, with the sole exceptions of environmental conditions in terms of temperature and humidity (item 49) and air quality (item 50), which showed a

TABLE 3 Proportion of beef cattle farms (overall n = 49) according to the score received in each item of the Animal-Based Measures area.

Item <sup>1</sup>	Scoring levels	Insufficient	Adequate	Optimal	Herd size effect (P)
(52) Avoidance distance	3	0%	41%	59%	0.465
(53) Agonistic behaviors between animals	3	0%	12%	88%	0.190
(54) Body condition score	3	0%	0%	100%	–
(55) Body cleanliness	3	0%	35%	65%	0.188
(56) Integument lesions	3	0%	0%	100%	–
(57) Lameness	3	0%	2%	98%	0.349
(58) Severe respiratory disease between 8 and 40 days of arrival to the farm	3	0%	4%	96%	0.602
(59) Severe respiratory disease after 41 days of arrival and until slaughtering	3	0%	2%	98%	0.349
(60) Mild respiratory or enteric symptoms between 8 and 40 days of arrival to the farm	3	0%	12%	88%	0.166
(61) Mild respiratory or enteric symptoms after 41 days of arrival and until slaughtering	3	0%	0%	100%	–
(62) Annual mortality rate	3	0%	4%	96%	0.575
(63) Body mutilations	3	0%	8%	92%	0.314

<sup>1</sup>Classyfarm checklist identification number is reported in brackets.

The effect of the class of herd size (small, medium, large) is reported as *P*-value.

TABLE 4 Proportion of beef cattle farms (overall n = 49) within classes of herd size according to the score received per each item.

Item <sup>2</sup>	Herd size <sup>1</sup> (n. of farms)									P-value
	Small (n = 17)			Medium (n = 16)			Large (n = 16)			
	I <sup>3</sup>	A	O	I	A	O	I	A	O	
(17) Experience and training of stockpersons	0%	47% <sup>a</sup>	53%	0%	6% <sup>b</sup>	94%	0%	19% <sup>ab</sup>	81%	0.020
(19) Daily inspections of animals	0%	82% <sup>a</sup>	18%	0%	69% <sup>ab</sup>	31%	0%	31% <sup>b</sup>	69%	0.008
(21) Treatment of sick or injured animals	6%	82% <sup>a</sup>	12%	0%	75% <sup>ab</sup>	25%	0%	44% <sup>b</sup>	56%	0.045
(24) Feeding strategy	0%	29% <sup>a</sup>	71%	0%	6% <sup>ab</sup>	94%	0%	0% <sup>b</sup>	100%	0.024
(25) Differentiated feeding strategy according to the fattening phase	0%	71% <sup>a</sup>	29%	0%	31% <sup>b</sup>	69%	0%	13% <sup>b</sup>	88%	0.002
(30) Cleanliness of drinkers	0%	41% <sup>ab</sup>	59%	0%	19% <sup>b</sup>	81%	0%	69% <sup>a</sup>	31%	0.017
(49) Environmental temperature and humidity	0%	82% <sup>a</sup>	18%	0%	44% <sup>b</sup>	56%	0%	19% <sup>b</sup>	81%	0.001

<sup>1</sup>Herd size (average number of heads reared per year): small ( $\leq 176$ ); medium (177–485); large ( $> 485$ ).

<sup>2</sup>Classyfarm checklist identification number is reported in brackets.

<sup>3</sup>I, Insufficient; A, Adequate; O, Optimal.

<sup>ab</sup>Values with different superscripts differ significantly among classes of herd size ( $P < 0.05$ ).

Only items influenced by herd size at  $P < 0.05$  in the k-proportions test for the “adequate” score are reported.

higher proportion of optimal scores (Table 2). This area recorded the highest frequency of deficiencies compared to the other two, both in terms of the number of items ( $n = 5$ ) and the proportion of farms with insufficient scores (from 8 to 31%). Insufficient scores were recorded for space allowance for resting (item 37) and safety of the flooring system (item 38), facilities for moving (item 46) and catching animals (item 47), and features of the infirmary area (item 48). Only item 49, related to environmental temperature and humidity, was affected by the class of herd size, with better scores in larger herds ( $P < 0.05$ ; Table 4).

The ABM area did not exhibit insufficiencies for any of the evaluated items. Each item within this area had a clear prevalence of optimal scores across all herd size classes (Table 3).

Overall, only 7 items were influenced by the class of herd size, most of them belonging to the Farm management and Personnel area and none of them belonging to the ABM area. Generally, better scores were more frequently recorded in bigger farms ( $P < 0.05$ ; Table 4).

## 4 Discussion

The variability in herd size of the farms included in this study is typical of the Italian beef fattening professional sector. Indeed, according to the classification of the National Official Registry of cattle for the year 2023 (VETINFO, 2025), excluding farms with less than 20 animals as reasonably not professional enterprises, 54% of the Italian beef fattening farms have less than 100 heads (covering 13% of the national beef fattening population), 36% had herd size between 100

and 500 heads (holding 40% of Italian beef fattening cattle), and 10% fatten above 500 heads (equal to 47% of beef cattle fattened in Italy). In this study, 22% percent of the farms had less than 100 heads, 45% fattened between 100 and 500 heads, and 33% had herd sizes above 500 heads. This distribution reflected both the national situation and regional specialization, given the slightly higher proportion of bigger farms. The following discussion of the results will be carried out by grouping items according to main topics. To help the reader, the items' identification numbers will be reported throughout the discussion.

### 4.1 Stockmanship and farm management

Skilled stockpersons play a critical role in promoting animal health and welfare, and Salvin et al. (2020) reported the frequent lack of specifically trained stockpersons as a major issue for beef farming. Previous studies (Cozzi et al., 2009; Gottardo et al., 2009) emphasized that adequately trained personnel are essential for effective animal surveillance (e.g., early detection of diseases or other problems), appropriate housing and feeding management to ensure comfort and reduce stress, and proper handling during routine procedures (e.g., vaccination, weighing) as well as during critical situations involving injured or ill animals. This study highlighted that most farms had an optimal ratio of stockpersons to animals, regardless of the herd size (item 16, Table 1). Three-quarters of the farms had personnel with over 10 years of experience and specific training (item 17, Table 1). In compliance with EU regulation (Council Directive 1998/58/EC - European Council, 1998), all farms performed at least two daily animal inspections (item 19, Table 1). Larger farms had more experienced and specialized staff and were more likely to conduct more daily

animal inspections with written reports (Table 4), reflecting a higher level of organization and data recording.

Stockperson's attitude and approach toward the animals strongly influence their responses and overall stress levels. For example, the use of electric prods to speed up moving and loading operations should be avoided as it provokes excessive fear and negatively affects cattle welfare (Cozzi et al., 2009). Establishment of positive stockperson-animal relationships, based on the knowledge of cattle etiologic and behavioral patterns, is essential to ensure animal welfare and personnel safety (Boivin et al., 2003; Waiblinger et al., 2006), particularly in the beef sector, where human-animal interactions are not frequent and usually linked to frightening practices (e.g., medical treatments). Almost all the study farms showed adequate animal handling, but two small farms still used offensive tools like electric prods to move animals (item 23, Table 1). The quality of the relationship with stockpersons can be indirectly measured by the avoidance distance test, which is a way to assess cattle's confidence towards humans (Windschnurer et al., 2009). Results of this test in the study farms were overall encouraging (item 52, Table 3).

Appropriate facilities and equipment for moving and/or restraining beef cattle are also important to reduce animal stress, speed up specific procedures, and improve personnel safety (Grandin, 1997; Gustafsson, 1997). A previous study by Gottardo et al. (2009) revealed that 67% of the surveyed Italian beef farms lacked dedicated moving alleys, whereas 94% had no truck-loading ramps. Even in this study, the lack of specific handling and restraining facilities was the main shortcoming of farm equipment (items 46 and 47, Table 2). Only four farms met Grandin (1997) standards for optimal moving facilities, like the presence of corridors and movable barriers with closed walls (item 46).

The most recent EFSA opinion (EFSA et al., 2025b) confirmed the importance of keeping beef cattle in stable groups. Frequent regrouping of pen-mates leads to physical conflicts to establish a new hierarchy, which are often violent and can cause negative health and welfare consequences (Mounier et al., 2006; Gottardo et al., 2009). The Classyfarm protocol does not specifically monitor this practice, but all farms included in the study achieved good scores for their incoming cattle batches' grouping strategy (item 18, Table 1).

Good farming practices recommend transferring sick or injured animals to an isolated and comfortable area, called "sick bay" or "infirmarium" area, like a straw-bedded pen (Cozzi et al., 2009). Only four farms in this study lacked this specific area (item 48, Table 2), whereas half of the remaining farms presented ameliorative solutions like providing larger spaces to house at least 3% of the average number of animals on the farm. Most farms had skilled personnel, supported by veterinarians, caring for sick or injured animals (item 21, Table 1). About one-third of the farms had also written procedures for managing common health issues (e.g., lameness, enteric disorders, respiratory diseases), which were more common in larger operations (Table 4). Only one small farm lacked proper procedures for the treatment of sick and injured animals (Table 1 and 4). When cull cattle are unfit for transport to slaughter, on-farm

euthanasia is recommended to avoid excessive suffering (Cockram, 2021). In these cases, all the study farms ensured that the procedure was performed by a veterinarian or trained personnel, using appropriate equipment. In three farms, these procedures were also formally documented (item 22, Table 1).

Body mutilations such as castration, tail docking, and dehorning are invasive and painful practices still quite common in several European beef farms (EFSA et al., 2024). The Classyfarm checklist does not record the type of mutilation performed, but the results of this study showed that body mutilations are fairly rare in Italian beef farms: only four farms of the sample performed some mutilations, always in compliance with the legislation in force (item 63, Table 3).

## 4.2 Housing and environment

In compliance with the minimum law requirements (Council Directive 1998/58/EC - European Council, 1998), all the farms in the sample had suitable housing for hosting animals, without harmful equipment or environment (item 34, Table 2). Moreover, as usual for the Italian beef supply chain, all farms had loose housing systems (item 36, Table 2). Ameliorative intervention to the indoor loose housing of the animals may include free access to an outdoor loafing area or a pasture (EFSA et al., 2025b). These solutions (mandatory to get the optimal score for item 36) were present only in two farms of the surveyed sample, highlighting an area of further improvement in the current Italian beef cattle farming systems (Table 2).

Previous studies on Italian fattening farms (Gottardo et al., 2009; Mariottini et al., 2022) identified limited space allowance, type of flooring, and hygiene and management of the resting area as the main structural weaknesses. Adequate space allowance in the resting area is essential to ensure appropriate behavior and limit conflicts and injuries among pen mates, especially in indoor loose housing systems (EFSA et al., 2025b). Moreover, it affects beef cattle body cleanliness and the incidence of skin lesions and lameness (EFSA et al., 2025b; Hickey et al., 2003; Gygas et al., 2007). In agreement with several studies in the literature (Hickey et al., 2003; Gygas et al., 2007; Keane et al., 2017) and the recommendations of the SCAHAW, (2001), Classyfarm set the minimum resting space for finishing beef cattle at 2.5 m<sup>2</sup>/head per 400 kg body weight (BW) with an additional 0.5 m<sup>2</sup>/head for every 100 kg up to 800 kg BW. Most of the study farms met this standard (item 37, Table 2), with some farms providing even more space, but four farms provided less than the minimum. However, in light of the latest EFSA et al. (2025b) opinion, which suggests increasing the indoor space allowance for animals weighing >400 kg to approximately 13 m<sup>2</sup> per head, it seems that space allowance should still be considered as a major shortcoming in beef cattle farms. On the other hand, housing and bedding were generally well managed in terms of cleanliness (item 31, Table 1). The Classyfarm checklist does not record the type of flooring, but most farms had flooring systems suitable to prevent slipping and ensure a safe movement for the animals (item 38, Table 2). Only a small proportion of them still presented excessively smooth or slippery flooring, thus endangering animals when moving. The overall

prevalence of optimal scores for ABMs such as body cleanliness (item 55), integument lesions (item 56), and lameness (item 57) indicated generally good management of animal housing (EFSA et al., 2025b).

Exposure to excessive heat, indicated by temperature humidity index (THI) values above 70, is the major climate challenge to cattle welfare in Mediterranean regions (Segnalini et al., 2013). Under this condition, beef cattle experience negative health and welfare consequences that can lead to reduced BW gain and increased risk of mortality (Summer et al., 2019). Therefore, strategies to mitigate heat stress should be implemented in indoor-housed beef cattle. All farms included in this study provided animals with at least adequate environmental conditions in terms of temperature and humidity (item 49, Table 2), supported by sufficient natural ventilation through open housing structures or by mechanical ventilation systems. Half of the farms had more sophisticated automatically controlled microclimate conditioning systems (i.e., optimal score, Table 2), which were less frequent in small-size farms and peaked in large-size ones (Table 4). The impact of air quality on fattening cattle health has been poorly studied, but SCAHAW, (2001) recommended air NH<sub>3</sub> and CO<sub>2</sub> concentrations to be below 20 ppm and 5,000 ppm, respectively. These limits were fully respected by all the study farms (item 50, Table 2). Moreover, in compliance with current animal welfare legislation (Council Directive 1998/58/EC - European Council, 1998), all farms provided animals with adequate natural or artificial lighting during the daytime and ensured a resting period of at least 8 h/day (item 51, Table 2).

### 4.3 Animal feeding

Correct feeding management for beef cattle is important to maximize growth performance, but also to preserve their health. As most cattle fattened in Italy originate from French pasture-based systems, an adequate transition period is needed to smoothly shift from a forage-based to a high-energy diet, avoiding nutritional imbalances and associated health problems (EFSA et al., 2025b). Proper TMR composition according to animal category, preparation, and daily distribution are the main factors affecting the risk of gastrointestinal disorders (Cozzi et al., 2009). In accordance with recent EFSA recommendations (2025b), most farms in this study achieved optimal scores for indicators related to feeding management. In the surveyed farms, beef cattle were ensured a gradual transition from fibrous to concentrate-based diets by implementing distinct feeding phases (item 25, Table 1). More than two feeding phases during the fattening cycle (e.g., conditioning, fattening, and finishing) were more likely to be adopted in medium and large farms than in small ones, which were more prone to adopt only two feeding phases (i.e., conditioning and fattening) (item 25, Table 4). Appropriate formulation, preparation, and delivery of rations tailored to the animals' physiological stage and nutritional requirements, using safe and suitable feedstuffs, was generally ensured among farms (item 24, Table 1). Moreover, medium- and large-size farms adopted more frequent monitoring and revision of the ration to guarantee feed quality and adequacy to the animal needs (i.e., optimal score) compared with small-size ones (item 24, Table 4). The proportion

of concentrates in the diet was generally kept at least below 80%, but more frequently below 70% with at least 1 kg of hay or straw (item 27, Table 1). Avoiding excessive inclusion of concentrates, while still supporting efficient fattening, is essential to prevent gastrointestinal disorders (EFSA et al., 2025b). Free access to the manger is essential to ensure correct animal feeding as the highest frequency of aggressive interactions in loose-housed cattle occurs in the areas around the feeding places (Miller and Wood-Gush, 1991). EFSA et al. (2025b) recommended a minimum feed trough space of 60 cm per animal when feed is provided ad libitum. All the study farms guaranteed the animals continuous feed availability over 24 hours (item 26, Table 1) and adequate space at the manger (item 40, Table 2), allowing the simultaneous presence of at least 70% of the pen mates. Excellent scoring in ABMs like animal body condition score (item 54, Table 3) and frequency of agonistic behaviors (like mounting, fighting, or head butting; item 53, Table 3) indirectly confirmed the overall appropriate feeding management adopted in the surveyed farms.

Beef cattle's daily water consumption depends on BW, production stage, diet composition, water quality and availability, and environmental factors like THI. Wagner and Engle (2021) reported that, under mild temperature environmental conditions (about 21 °C), finishing cattle weighing about 540 kg may consume 53 L of water per day, but peak water demands during the hottest periods may exceed 80 L/d. Moreover, fecal or chemical contamination decreases cattle's voluntary water consumption (EFSA et al., 2025b). Therefore, ensuring ad libitum access to fresh and clean drinking water is recommended to optimize beef cattle's health and efficiency. Farms in this study generally satisfied the minimum requirements for water provision (item 29, Table 1; and item 41, Table 2), but improvements are needed. New recommendations by EFSA et al. (2025b) confirmed the minimum linear space of 6 cm per animal for water troughs, but lowered the minimum number of animals per water bowl to 10, and recommended the presence of more than one water point per pen to prevent prolonged thirst in case of malfunctioning or dirtiness. Two farms in this study did not ensure sufficient water for all the animals (item 29, Table 1), and the use of constant-level troughs (scored as optimal) was not widely adopted in the study farms (item 29, Table 1; and item 41, Table 2). Drinking water was generally clean (item 30, Table 1), particularly in medium (and small) farms, maybe due to the lower number of water points to be kept under control (Table 4).

### 4.4 Animal health

Fattening beef cattle undergo several stressors that challenge their health and predispose them to disease outbreaks, like commingling and transport, and changes in housing, feeding, and climate. The first weeks after receiving animals at the fattening farms are the most critical for beef cattle health and mortality (Rumor et al., 2015; Santinello et al., 2024), with respiratory disease being the most frequent health issue (Diana et al., 2020). Keeping diseases and mortality under control is a key issue to ensure animal welfare and productivity, and the Classyfarm checklist assesses the incidence of respiratory diseases, discriminating between mild and severe outbreaks, during the receiving phase (from 8 to 40 days of

arrival) and the rest of the fattening period (from 41 days to slaughtering).

The farm sample of this study showed a low proportion of animals affected by diseases and mortality. Severe respiratory outbreaks were generally below 5% of the animals within 40 days of arrival and below 2% during the following fattening period (items 58 and 59, [Table 3](#)). A greater proportion of mild respiratory events or enteric symptoms (between 10 and 20% of the animals) during the receiving period was recorded only in 6 farms, staying below 10% in all the others (item 60, [Table 3](#)). The proportion of the same mild health events was always below 10% during the rest of the fattening period (item 61, [Table 3](#)). Overall, the results of this study were more comforting than those obtained by [Masebo et al. \(2023\)](#), who reported an incidence of respiratory disease of about 31% among 264 Limousine young bulls 15 days after arrival in Italy. The results were even more encouraging considering that most of the farms were assessed during winter, which is the time of the year most at risk for respiratory disease outbreaks ([Diana et al., 2021](#)). The annual mortality rate in this study was less than 5% in two farms, whereas it was less than 2% in the remaining ones (item 62, [Table 3](#)), which was in line with the average annual mortality rates reported by [Rumor et al. \(2015\)](#) in a previous survey on Italian beef farms.

## 4.5 Conclusions

This study provides a first comprehensive overview of the Italian beef cattle fattening farms from an animal welfare perspective. Overall, the animal-based measures yielded encouraging results, indicating a generally good welfare status among the inspected cattle. Irrespective of herd size, stockperson-related variables were positive, since most farms employed an adequate number of trained stockpersons with long experience in the sector. The main shortcomings identified were associated with housing conditions, including insufficient space allowance, unsafe flooring systems, lack of dedicated facilities for cattle movement and restraint, and inadequacies in infirmary areas. Improvements in water provision are also needed, especially considering the increased water requirements under potential heat stress periods. Only a limited number of welfare indicators were influenced by herd size, reflecting the high level of standardization of the current Italian beef production system. The detailed description of animal welfare and management conditions for indoor fattening of beef cattle outlined in this study provides a valuable baseline for addressing ongoing challenges in this sector and guiding future research to improve beef cattle rearing conditions.

## Data availability statement

The data that support the findings of this study are available from the corresponding author, LM, upon reasonable request.

## Ethics statement

Ethical approval was not required for the study involving animals in accordance with the local legislation and institutional requirements because the data used in this study were retrieved from an already existing database provided by a breeders' association, and no animal manipulation was performed to generate the dataset used in this study.

## Author contributions

IL: Methodology, Writing – original draft, Data curation. LM: Writing – review & editing, Visualization. BC: Writing – review & editing, Formal analysis. AQ: Writing – review & editing, Data curation, Investigation. GC: Project administration, Methodology, Conceptualization, Resources, Writing – review & editing, Supervision.

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## Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fanim.2026.1759828/full#supplementary-material>

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