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Cow Culling Rates and Causes in 12 Pasture-Based Dairy Herds in Southern Uruguay, a Pilot Study

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Abstract: The reasons for culling dairy cows in Uruguay are largely unknown. This study aimed to describe the culling rates of dairy cows and identify the causes of cow culling in 12 commercial herds in Uruguay. We conducted a prospective longitudinal observational study from June 2019 to May 2020 on 12 dairy farms stratified by herd size. Six farms with 51–199 cows, five with 200–500 cows, and one farm with more than 500 cows in the departments of Colonia and San José were included. The cows were pure Holstein and Holstein–Jersey crossbreeds. The overall dairy cow population on these 12 farms was 3126 cows (range: 74–740 cows per farm). The data were analyzed using descriptive statistics. The total annual culling rate was 23.1% (721/3126), including sales to slaughter (18.1%; 565/3126), on-farm mortality (4.5%; 141/3126), and dairy sales (0.5%; 15/3126). Cow culling for slaughter because of health (including reproductive) problems represented 70.7% (510/721) of the overall culling rate, most of which were due to reproductive failure (29.3%, 211/721), mastitis (25.9%, 187/721), poor udder conformation (6.2%, 45/721), lameness (4.6%, 33/721), and other diseases (4.7%, 34/721). Mortality represented 19.6% (141/721) of the overall culling rate. Cow culling for slaughter due to health (including reproductive) problems and mortality constituted 90.3% (651/721) of the total culled cows. In conclusion, dairy cows were culled mainly due to illnesses that lead to slaughter or death. Implementing effective measures to improve reproductive rates, reduce mastitis and lameness, and prevent other diseases, such as leukosis, paratuberculosis, and digestive disorders in the studied population would reduce cow culling, increasing cow longevity, animal welfare, and farm profitability.

Keywords: culling; dairy cows; mortality; pasture; Uruguay

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1. Introduction

Dairy production is vital for global food security and plays a significant role in the economy of Uruguay. In 2023, Uruguay registered 3042 dairy farmers producing 2275 million L/year of milk, out of which 30% was destined for domestic consumption and

70% for export, with the dairy sector occupying the fourth position in export revenues from the agricultural sector [1]. Uruguayan dairy farming systems are predominantly pasture-based, and the annual diet of dairy cows comprises grazed pastures plus concentrates and preserved fodder (i.e., corn or sorghum silage and haylage) offered as supplements [2]. In 2023, the annual milk production per adult (lactating and non-lactating) cow was 5888 L, and the mean stocking rate was approximately 1.1 cows/hectare. In Uruguay, 83.6% of the dairy herd belongs to the American and Canadian biotypes of the Holstein breed, 6.3% to the New Zealand Holstein biotype, 0.9% to Jersey, 0.8% to Normande, and 8.4% are crossbreeds [3]. The national dairy herd population decreased from 738,000 in 2001–2005 to 693,000 in 2023. During the same period, the population of adult cows (lactating and non-lactating) decreased from 415,000 to 386,000 [1]. However, there is scarce scientific literature describing the general characteristics of dairy farming in Uruguay.

Cow culling is defined as the departure of cows from a herd for sale, slaughter, salvage, or death [4]. High cow culling rates due to illnesses, reproductive problems, and/or mortality may negatively affect the herd size planned expansion [5,6] and profitability [7–9]. Herds with cow culling rates (slaughter and/or mortality) higher than the supply of replacement heifers eventually decrease in size [5,10]. A sustained high culling rate due to illness and mortality indicates poor animal welfare [11,12] and affects the economic performance of farm businesses [13], thus requiring effective on-farm control programs.

Herd-level cow culling rates can vary significantly between farms and regions, and a culling rate from 19% to 29% is considered appropriate [14]. Low culling rates do not necessarily indicate good herd management practices, as they may occur because of the retention of cows that should have been culled [15]. A comprehensive evaluation of each farm is needed to assess the productive, reproductive, and health status of the herd, and the economic conditions under which cow culling occurs [4].

The annual culling rates of dairy cows in pastured herds vary among countries. In Uruguay, the culling rate of dairy cows, including sales to slaughter and mortality, was estimated to be 23% according to a national survey conducted in 2019 [16]. However, the causes of dairy cow culling in Uruguay have not yet been identified.

Culling dairy cows for slaughter in pasture herds in Ireland and Oceania have been associated with reproductive failure [17–19], poor udder conformation [20], lameness [21], and mortality [22]. As milk production in Uruguay occurs under conditions that differ greatly from those in Ireland and Oceania in terms of climate (subtropical vs. temperate), dairy infrastructure, diet (i.e., forage types and quality), feeding practices, herd management, animal genetics, and farmers' idiosyncrasies [2], the reasons for culling in Uruguay should be explored locally. An accurate quantitative analysis of culling within the dairy production system of Uruguayan herds is necessary to provide a benchmark for current performance and a base for future research, extension activities, and technology transfer. Thus, the aims of this pilot study were to describe the annual culling rate of dairy cows and identify the causes for culling in 12 dairy herds on pasture-based systems in Uruguay.

2. Materials and Methods

2.1. Selection and Location of Dairy Farms

The study was conducted in the departments of Colonia and San José, Uruguay, which contain 177,085 (39.9%) of the 444,322 dairy cows and 1845 (50%) of the 3688 dairy farms in the country [3]. In Uruguay, 75% of dairy herds are small (<200 cows), 17% are medium-sized (199–500 cows), and 8% are large (>500 cows) [3,23]. The study was conducted prospectively from June 2019 to May 2020, and included 12 pasture-based commercial dairy farms that were qualitatively representative of a typical dairy farm in Uruguay. These farms were selected to ensure participation across 3 different herd size strata (51–199, 200–500

and >500 cows). The cow population among the dairy farms ranged from 74 to 740 cows per farm, totaling 3126 cows on the 12 farms during the study period.

The cows were pure Holstein and Holstein–Jersey crossbreeds with forage-based diets that included direct grazing and supplementation with forage reserves and concentrates, which were milked twice daily. The data collected were obtained from all the cows present on the 12 farms at the start of the study and from those that entered the dairy herd during the study period. This included cows with at least one parturition, excluding nulliparous heifers.

2.2. Dairy Farm Visit and Data Collection

In an initial visit to each farm, information about the cows and pregnant heifers was collected and registered in a Microsoft Excel® worksheet, including tag identification number, date of birth, date of first and last calving, and number of calvings in their life. At least one monthly visit was coordinated with the owner and farm advisor to compile information in the database for each herd. Information of each culled cow was collected, including the date and cause of culling, and the date of the last calving and drying. Destination categories were defined as follows: (1) sale for dairy, a cow sold alive to another dairy farm; (2) slaughter, a cow that was sent alive to a slaughterhouse; and (3) death, a cow that died on the farm [4]. Slaughter categories and subcategories (Table 1) were defined in conjunction with veterinary consultants and dairy herd owners.

Table 1. Definition of culling categories and subcategories for cows transported to slaughter.

Category	Subcategory	Definition
Udder problems	Mastitis	Severe acute clinical mastitis or clinical mastitis in the same udder quarter recurring 3 times in the same or consecutive lactations. Chronic mastitis with 2 dysfunctional quarters. High (≥400,000/mL) somatic cell count (SCC) recurring in 3 dairy controls in the same lactation.
	Poor udder conformation	Udder ligament rupture. Teat or udder trauma. Difficult-to-milk nipple (slow milking). Deviated or short nipples.
Reproductive problems	Infertility	Return to estrus, up to 4 breeding attempts and an additional (fifth) attempt in cows with good milk production (>mean +1 SD [1] compared to cows in the herd at the same stage of lactation and parity). Anestrus.
	Abortion	Cows with one or a maximum of two abortions at any stage of pregnancy (>45 days) or found to be non-pregnant at the beginning of the dry period after being confirmed pregnant.
Lameness	Foot	Sole ulcer on the toe or heel without response to treatment. Severe lameness. Lying down for long periods. Chronic laminitis with severe hoof deformation, or acute laminitis in one or more limbs without response to treatment and reluctant to move.
	Trauma in a region of the limb other than the foot	Bone or soft tissue injury involving any part from the metacarpus to the scapula in the anterior limb and/or from the metatarsus to the coxofemoral joint in the posterior limb.

Table 1. *Cont.*

Category	Subcategory	Definition
Other diseases	Clinical diagnosis issued by the consulting veterinarian occasionally supported by laboratory analysis.	
Low production	Old cows	Adult cows without disease who reached the end of their productive life, older than 69 months of productive life or older than 102 months of life. Dental defects or worn teeth.
	Cows with up to two calvings	Clinically healthy first or second calving cows without history of disease that do not reach 50% of the average milk production of multiparous cows in the herd at similar stage of lactation.
Poor temperament or phenotype	Unruly. Kickers. Cows that are too small or large or have anatomical defects or undesirable phenotypic characteristics.	

[1] standard deviation.

Additional visits to the farms were made whenever the farmer called to report outbreaks of cow mortality and/or culling of cows due to lameness to determine the cause of deaths or establish the clinical diagnosis of lameness. For the diagnosis of the cause of individual deaths, the diagnosis issued by the farm veterinarian was recorded. These diagnoses were based on history and clinical signs, often without performing a necropsy and only occasionally supported or confirmed by laboratory tests (presumptive diagnosis). Several cases of death of unknown cause were recorded. Two necropsies were performed by the veterinarians of the farms, who made the diagnoses based on clinical signs and necropsy findings. The diagnosis of an outbreak of mortality affecting 9 cows was performed by necropsy of 2 animals conducted by veterinary pathologists at the "Plataforma de Investigación en Salud Animal" of the "Instituto Nacional de Investigación Agropecuaria" (INIA) La Estanzuela. The pathologists also performed necropsies on 9 other occasions to diagnose the cause of death.

Variation in herd size during the study year was calculated as the number of cows at the beginning of the study added to the number of cows at the end of the study and divided by two. This variable was categorized into three groups as follows: (i) herd size was maintained at ±5%; (ii) herd size increased by more than 5%; and (iii) herd size decreased by more than 5% [10].

2.3. Analysis of Data

The frequencies of dairy cow culling were calculated using descriptive statistics with Microsoft Excel® and the statistical software R version 4.1.2 [24]. Results are presented in the frequency tables.

3. Results

A total of 721 from a population of 3126 dairy cows were culled from June 2019 to May 2020 (Table 2). The overall cow culling rate in the 12 herds averaged 23.1% (721/3126), ranging from 17.4% to 35.8% in individual herds. Cow culling for slaughter averaged 18.1% (565/3126), ranging from 10.4% to 27.1%. The average on-farm mortality rate was 4.5% (141/3126) ranging from 1.1% to 8.1%. Sales for dairy purposes were 0.5% (15/3126) and varied from 0% to 10.1%. The overall cow herd size on the 12 farms remained relatively stable over the study period, with a slight average increase of 0.7%. The herd size at the end of the study in 10 herds with an average annual culling rate of 22.8 ± 4.3% was within ±5% of the initial size. In one herd with an annual culling rate of 30.5%, the herd size decreased by >5% by the end of the study. The remaining herd increased by >5% (12.8%),

and although its annual culling rate was 35.8%, it was the only herd with a surplus of replacement heifers and sold cows to other dairy farms. These sales represented 10.1% of the total number of cows culled on the farm (Table 2).

Table 2. Frequency of cow culling in 12 herds in the departments of Colonia and San José, Uruguay from June 2019 to May 2020.

Variables	Herd No. 1	2	3	4	5	6	7	8	9	10	11	12	Total
Average number of cows	74	92	148	156	179	174	235	288	357	339	344	740	3126
Overall culling, % (*n*)	24.5 (18)	26.2 (24)	35.8 (53)	18.0 (28)	25.7 (46)	30.5 (53)	17.4 (41)	26.4 (76)	18.5 (66)	26.2 (89)	26.4 (91)	18.4 (136)	23.1 (721)
Culling for slaughter, % (*n*)	19.0 (14)	19.6 (18)	19.6 (29)	14.1 (22)	24.6 (44)	27.1 (47)	11.1 (26)	21.9 (63)	10.4 (37)	21.5 (73)	23.8 (82)	14.9 (110)	18.1 (565)
Culling for mortality, % (*n*)	5.4 (4)	6.5 (6)	6.1 (9)	3.9 (6)	1.1 (2)	3.5 (6)	6.4 (15)	4.5 (13)	8.1 (29)	4.7 (16)	2.6 (9)	3.5 (26)	4.5 (141)
Culling for dairy sales, % (*n*)	0	0	10.1 (15)	0	0	0	0	0	0	0	0	0	0.5 (15)
Variations in the herd size compared to initial size, %	2.7	−1.1	12.8	−1.9	2.2	−14.9	−0.4	−2.1	1.7	−0.6	−0.6	4.3	0.7

The reasons for cow culling in the 12 herds are shown in Table 3. Of the 721 cows culled, 565 (78.3%) were transported to slaughter. Culling due to mortality and sales for dairy represented 141 (19.6%) and 15 (2.1%) of the culled cows, respectively. Reproductive failure, udder problems, lameness, and other diseases represented the reason for culling in 70.7% (510/721) of the total culled cows. This value increased to 90.3% (651/721) when the deaths on the farm (n = 141) were included. Cow culling due to mastitis varied from 2.2% to 8.1% between farms, while culling due to infertility ranged from 1.4% to 12.6%. Culling due to infertility occurred on average at 380.9 days postpartum. The culling of cows due to abortions ranged from 0.6% to 6.1%. Culling due to foot problems included sole ulcers in 1.8% (13/721) and laminitis in 1.3% (9/721) of the cows. Out of the cows culled due to low production (6.8%, 49/721), 65.3% (32/49) were young cows with up to two calvings without apparent disease, while 34.7% (17/49) were healthy cows culled due to old age. The causes of cow culling due to disease in the 12 herds are shown in Table 4.

Table 3. Frequency of causes of cow culling in 12 herds with an overall population of 3126 cows in the departments of Colonia and San José, Uruguay, from June 2019 to May 2020.

Culling Causes	No.	% Of Culled Cows	Range Between Herds %
Sale for slaughter	565	78.3	10.4–27.1
Udder problems			
Mastitis	187	25.9	2.2–8.1
Poor udder conformation	45	6.2	0–3.4
Reproductive problems			
Infertility	123	17.1	1.4–12.6
Abortion	88	12.2	0.6–6.1
Lameness			
Foot	22	3.1	0–3.2
Trauma in a region of the limb other than the foot	11	1.5	0–1.4
Other diseases	34	4.7	0–2.7

Table 3. *Cont.*

Culling Causes	No.	% Of Culled Cows	Range Between Herds %
Low production			
Old cows	17	2.4	0–5.4
Young cows up to two calvings	32	4.4	0–2
Undesirable temperament or phenotype	6	0.8	0–1.1
Mortality	141	19.6	1.1–8.1
Sales for dairy	15	2.1	0–10.1
Total	721	100	17.4–35.8

Table 4. Frequency of other diseases associated with cow culling for slaughter in 12 herds in the departments of Colonia and San José, Uruguay, from June 2019 to May 2020.

Diseases (Reported by Veterinarians)	No.	%
Unknown	10	29.4
Leukosis	9	26.5
Ruminal overload and/or meteorism	3	8.8
Paratuberculosis	2	5.9
Eye tumors	2	5.9
Vaginal tear	1	2.9
Abomasal displacement	1	2.9
Dystocia	1	2.9
Photosensitization	1	2.9
Hypocalcemia	1	2.9
Metritis	1	2.9
Traumatic reticuloperitonitis	1	2.9
Vulvar tumor	1	2.9
Total	34	100

The total annual cow mortality rate in the 12 herds averaged 4.5% (141/3126), ranging from 1.1% to 8.1% in individual farms. In most of the cows that died (29.8%, 42/141) during the study period, the cause of death was not identified (Table 5). The most frequently reported causes of death included hypocalcemia in 15.6% (22/141), trauma (other than traumatic reticuloperitonitis and/or pericarditis) in 11.3% (16/141), leukosis in 7.1% (10/141), metritis in 5% (7/141), ruminal overload in 5% (7/141), and traumatic reticuloperitonitis and/or pericarditis in 4.3% (6/141) (Table 5).

Table 5. Frequency of reported causes of cow mortality in 12 herds in the departments of Colonia and San José, Uruguay, from June 2019 to May 2020.

Causes	No.	%
Unknown	42	29.8
Hypocalcemia	22	15.6
Trauma	16	11.3
Leukosis [1]	10	7.1
Metritis	7	5.0
Ruminal overload and/or meteorism	6	4.3
Traumatic reticuloperitonitis and/or pericarditis [2]	6	4.3
Acidosis	3	2.1
Suffocation by immersion in water or mud	3	2.1
Dystocia	3	2.1
Acute mastitis	3	2.1
Paratuberculosis	2	1.4

Table 5. *Cont.*

Causes	No.	%
Septicemia [3]	2	1.4
Hypomagnesemia and hypocalcemia	2	1.4
Septic pododermatitis	2	1.4
Intestinal obstruction	2	1.4
Asphyxiation by hanging	1	0.7
Ketosis	1	0.7
Bacterial endocarditis	1	0.7
Ruminal tympany secondary to esophageal fibropapilloma [4]	1	0.7
Bacterial pneumonia	1	0.7
Paratuberculosis and salmonellosis [5]	1	0.7
Abscedative peritonitis [6]	1	0.7
Uterine prolapse	1	0.7
Mammary vein rupture [7]	1	0.7
Salmonellosis [8]	1	0.7
Total	141	100

[1–8] Diagnoses confirmed by "Plataforma de Investigación en Salud Animal" of INIA La Estanzuela, Colonia, Uruguay; [1] 1/10 leukosis cases; [2] 3/6 cases of traumatic reticuloperitonitis and/or pericarditis; [3] 2/2 septicemia cases; [4–8] one case of each diagnosis.

4. Discussion

Studying the causes of the culling of dairy cows in Uruguay represents a challenge, as most farmers and veterinarians do not use standardized classification criteria and nomenclature. In addition, relatively few farms keep proper health records for individual animals [25], which hampers conducting retrospective studies. To overcome these issues, here we prospectively applied an internationally accepted classification scheme for the causes of culling of dairy cows in 12 dairy farms in Uruguay [4]. This, which we consider a pilot study, establishes the methodological bases to eventually carry out additional local studies on a larger number of farms and cattle in the future.

Although the number of cows included in the study would have been sufficient to represent the population of dairy cows in the target departments of Colonia and San José (considering a proportion of cows culled per year of 25%, a confidence level of 95% and an acceptable margin of error of 1.5%), the greatest difficulty for a study representing this population lies in the need to achieve representation at the farm level, and the need of random sampling. Because of these constraints, we elected farms by convenience (non-random sampling), selecting farms that showed interest in and commitment for participation. Thus, although our results cannot be extrapolated to a broader population, they represent a contribution to the understanding of the causes of culling of dairy cows in Uruguay, in the face of the absolute lack of local information on this topic.

In this study, the total annual cow culling rate in the 12 dairy herds was 23.1%. The highest proportion of culling (18.1%) was for slaughter, 4.5% was due to mortality, and 0.5% corresponded to sales for dairy purposes, which were registered in only one of the farms included in the study. Excluding dairy cow sales, the culling rate was 22.6%. For pasture-based production systems, this value is lower than that registered in farms in Argentina (28%) [26], and higher than those reported in New Zealand (13.2%) [18]. There is no single optimal culling rate applicable to all herds owing to a variety of factors [4]. In other countries, the annual culling rate varies among herds [10,27]. In our study, the culling rates in some herds were less than 18%, indicating that such rates could be achieved by controlling diseases, including reproduction disorders, which are the main causes of culling for slaughter and mortality. Ideally, cost-benefit economic analysis should be conducted to define the optimal cow culling rate for individual dairy herds in Uruguay, as low culling

rates do not warrant profitability [15], particularly if productively inefficient animals are retained in the herd. Furthermore, unwanted culling due to disease is usually not profitable.

This study identified two reasons that explained 61% of all culls in the studied herds: udder problems (32.1%) and reproductive problems (29.3%). These values are higher than those in countries with pastoral dairy production systems such as New Zealand (45.4%) [17] and Australia (30.6%) [21]. Efforts to reduce dairy cow culling for slaughter should focus on both problems. In this study, culling due to mastitis (25.9%, 187/721) was higher than that reported in the United Kingdom [28], the USA [29], New Zealand [17,18] and Australia [21]. The frequency of culling due to mastitis is often higher in countries with confined production systems than in those with grazing systems [30]. However, the Uruguayan pasture-based dairy system has a higher culling rate due to mastitis than production systems under confinement. These data suggest the need to improve udder health and hygienic udder management, and to identify the risk factors and causes of mastitis to prevent and control this disease, which has significantly impacted dairy herds in Uruguay over the last 20 years [31–33]. Therefore, field veterinarians and dairy farmers should follow the mastitis control measures recommended for Uruguay [34]. Additionally, further research is needed on the control of mastitis in local herds, given the characteristics of their farming systems with daily outdoors grazing and herds predominantly of the American Holstein biotype, which are less adapted to grazing conditions.

In the present study, infertility was the most frequent cause of culling due to reproductive failure (17.1%, 123/721). This frequency is lower than that reported in New Zealand [17,35] and similar to that reported in Australia [21]. In this study, given that culling due to infertility occurred after the cow received four or five breeding attempts without becoming pregnant, the average time from calving to culling due to infertility was 380.9 days. In one of the dairy farms in this study, cow culling due to infertility was 1.4%, suggesting a target for improvement in other farms without retaining infertile cows.

Another variable that indicates low reproductive efficiency is the calving-conception interval, which should be $\leq$85 days [36]. In Uruguay, this period has increased in recent decades, from 131–150 days between 1997 and 2005 [37] to 169 days between 2008 and 2022 [38–40]. Gastal et al. [41] described an average calving-conception period of 147 days from 2010 to 2018 in dairy herds in Southern Uruguay. This long calving-conception interval can be reduced in Uruguayan dairy herds, given that additional data from a group of 4839 cows in 10 herds revealed an average calving to conception interval of 106 days (C. Lemaire, personal communication, 2022 [42]). The deterioration of the reproductive efficiency of dairy cows is a growing problem worldwide [43]. American Holstein is the most common dairy breed in North America, Europe, and Uruguay [3]. In Uruguay, the pregnancy rate at the first service in New Zealand biotype Holstein cows was higher (52.3%) than that of the American biotype Holstein (35.9%) in a pasture-based system, which suggests better reproductive performance of the New Zealand genetic lines [44]. Therefore, the use of the New Zealand Holstein biotype, which is well adapted to Uruguayan pasture-based systems, seems to be a plausible option for achieving greater reproductive efficiency and reducing the slaughter of cows due to low reproductive efficiency.

This study found that abortions contributed significantly (12.2%, 88/721) to dairy cow culling. In Uruguay, a 14% average annual prevalence of abortions was estimated in 10 herds with 4839 pregnant dairy cows between 2014 and 2016 (C. Lemaire, personal communication, 2022 [42]). Another study determined the etiology in 53% (54/102) of abortion cases subjected to laboratory investigation, while in 47% (48/102) of the cases, the cause was undetermined [45]. The most common infectious causes were *Neospora caninum* (55.6%, 30/54), *Coxiella burnetii* (11.1%, 6/54), and *Campylobacter fetus* subsp. *venerealis* (3.7%, 2/54), whereas other diseases, such as salmonellosis and bovine parainfluenza virus,

contributed to a lesser extent [45–47]. Other less common causes of abortion, such as bovine polyomavirus-1, have recently been described in dairy cattle in Uruguay [48]. High frequency of *N. caninum* abortions suggests that previously described control strategies for this disease should be applied to reduce serological prevalence and abortions [49,50]. We found herds with high (6.1%) and low (0.6%) rates of cows culled due to abortion. Therefore, it seems possible to reduce the culling of cows for this cause. Preventing abortions is necessary to reduce cow culling rates due to reproductive problems, and it is possible to propose a rate close to the 0.6% observed in a herd in this study or to consider reference values used by countries with pasture-based systems to minimize abortions. In Australia, the target pregnancy loss rate after a positive pregnancy test between 16 and 20 weeks is approximately 2%. When this rate is greater than 2%, the cause of abortion should be investigated to prevent abortion [51]. Holstein animals carrying several genetic hereditary diseases that cause reproductive losses have been identified in Uruguay [52,53], therefore, the impact of such diseases should not be underestimated. Abortion associated with selenium deficiency ("white muscle disease") was recently diagnosed in a near-term Holstein fetus from a dairy farm in Colonia, Uruguay (F. Giannitti, personal observation).

Culling cows for slaughter because of lameness accounted for 4.6% (33/721) of the cases. This frequency was higher than that observed in New Zealand [17,21] and Australia [54]. In this study, lameness was the fourth most frequent cause of culling cows for slaughter. However, there was no culling of cows owing to lameness in some of the dairy farms included in the study, which indicates that under the current conditions in Uruguay, culling owing to lameness can be reduced. The use of footbaths, along with a hoof maintenance program, is advisable [55]. Mainly within the first 30 days postpartum, cows should be monitored to control metritis and the nutritional or metabolic problems associated with laminitis. The culling rate of cows owing to trauma to regions of the extremities other than the feet was 1.5% (11/721). To reduce culling, it is necessary to optimize management measures, including culling unruly cows and avoiding inadequate floors to prevent trauma. We recommend that first-calving cows should be separated from multiparous cows to avoid dominance-associated accidents.

The impact of other infectious, nutritional, and metabolic diseases on cow culling is unknown in most countries, and data on the causes of culling are limited. In this study, the culling rate of cows for slaughter due to other diseases was 4.7% (34/721), which was higher than that registered in Australia, where milk fever (hypocalcemia) and ruminal meteorism represented only 0.65% and 0.52% of the reasons for culling, respectively [21]. In this study, culling owing to these diseases was higher than that registered in countries with similar production systems [17,54]. Although cow culling due to other diseases varied from farm to farm, as expected, two farms did not cull cows in this category, suggesting that culling can be minimized in Uruguayan herds. According to clinical diagnoses, the most frequent diseases were bovine leukosis, ruminal overload and/or tympany/meteorism, paratuberculosis, and tumors affecting the eyes. A similar situation has been reported in Spain, where the most frequent diseases are infectious, metabolic, and/or digestive in origin [56]. This study provides a preliminary overview of diseases that cause culling in 12 Uruguayan dairy herds. However, it is necessary to confirm presumptive diagnoses using more specific laboratory analyses. In addition, it is important to prevent metabolic and/or nutritional diseases during the dry period, monitor cows during early lactation, and establish timely corrective measures. During this study, two notifiable diseases were diagnosed and confirmed at the laboratory: bovine leukosis and paratuberculosis. In Uruguay, paratuberculosis has a within-herd serologic prevalence of 5.6% to 16% and 70–72% of herds are infected [57,58]. The mean prevalence of leukosis in dairy cattle was 78.8%, and the virus was present on 95% of Uruguayan farms in 2018 (F. Fernández,

personal communication, 1998 [59]). These data suggest that the control of leukosis and paratuberculosis would help reduce culling for slaughter and mortality.

The culling rate of cows for slaughter due to low production was 6.8% (49/721). This proportion was lower than that reported in New Zealand [35]. High-yielding dairy cows have a lower risk of being culled [29]. In our study, 65.3% (32/49) of the cows culled due to low production were young cows with up to two calvings without apparent disease, but with a history of abortion at 5–7 months of gestation or a poor body condition. Considering that both abortion and low body condition result in low milk production [60], the reason for culling in these cows might have been incorrectly registered by veterinarians and/or farmers in our study.

The culling rate of cows for slaughter because of old age was 2.4% (17/721). This value was lower than those reported in New Zealand [17], Australia [21], and the United Kingdom [28]. Culling of cows for slaughter due to old age represented 34.7% (17/49) of the total culling due to low production, and other cows culled in this category were young cows (65.3%, 32/49). In this study, most cows were culled for reasons other than at the end of their productive life, which constitutes early culling. Thus, animal health and longevity must be improved to increase the length of productive life.

The annual cow mortality rate in the 12 herds was 4.5% (141/3126) and on-farm deaths represented 19.6% of the total cow culling. This value is higher than the 2.1% reported in New Zealand [18] and 3.2–4.3% reported in Ireland [19]. In Uruguay, a 5% mortality rate in cows was estimated in a recent survey [16], which is slightly lower than the 6.9% mortality rate previously estimated in 13 commercial dairy farms [61]. In this study, we found that the mortality over total cow culling (141/721) was higher than that in other countries with grazing systems. Moreover, higher than or equal to countries with confined systems, characterized by having a high mortality rate [62–64]. Mortality varied from herd to herd; in one herd, mortality was greater than 8%, which is a very high mortality rate in cows and indicates animal welfare problems [65], however in another herd, it was 1.1%, which suggests that adequate diagnostic services, investigation of risk factors, and adequate control and prophylactic methods may reduce mortality rates. In this study, although the cause of death was undetermined in many cases, hypocalcemia, trauma, bovine leukosis, metritis, ruminal overload, traumatic reticuloperitonitis, and/or pericarditis were the most frequently detected causes of mortality. These data are similar to those reported in Denmark, where traumatic reticuloperitonitis and locomotor disorders were the most frequent causes of mortality [66], while in Sweden, they were foot and/or limb diseases, metabolic disorders, and udder diseases [67]. In Finland, udder and digestive disorders and disorders associated with parturition are more frequent cause of death in dairy cows [68] and mastitis was most often the underlying or both immediate and underlying cause of death [69]. It is necessary to optimize animal handling and follow correct guidelines for nutrition and diet management to avoid death due to ruminal overload, meteorism, and metabolic and/or nutritional diseases. Traumatic reticuloperitonitis should be prevented directly by avoiding the ingestion of wires and/or indirectly using intraruminal magnets or magnets in forage harvesting machines for livestock feeding.

A reasonable annual culling rate due to health problems, including reproductive failure, mastitis, nipple injury, calving difficulties, lameness, metabolic disorders, and other health problems should not exceed 50–60% of the total cow culling [70] or up to 66% when deaths are included [15,71]. In this study, the culling rate for slaughter due to health problems was 70.7%, a value that reached 90.3% when on-farm deaths (mortality) were included, suggesting that several factors related to disease control, hygiene, cattle management, and nutrition need to be improved to reduce the annual culling rate of cows in the dairy herds.

The annual culling rate of cows sold for dairy purposes in this study was 0.5%, lower than in New Zealand (1.4%) [16], Ireland (14%) [19], Australia (6.4%) [21], Estonia (6.8%) [72], and Canada (15.8%) [73]. The sale of dairy cows to continue their productive life on other dairy farms is not frequent in Uruguay because most farms have high calf mortality rates [25], therefore, they use all their calves for replacement without increasing the herd. Additionally, an important number of young dairy heifers (9227 in 2023) are exported to other countries [74]. In this regard, six of the farms in our study sold female calves for export. These factors probably contribute to the lack of growth in the dairy herds observed in this study.

5. Conclusions

Registering and systematizing the causes of cow culling are important for identifying opportunities to improve herd profitability and animal welfare. This study determined an annual dairy cow culling rate of 18.1% for slaughter and a mortality rate of 4.5% in 12 dairy herds in the departments of Colonia and San José, Uruguay. Sales of cows for dairy purposes were negligible, which is partially explained by the minimal increase (average of 0.7%) in herd size due to high cow culling and insufficient replacement rates. Health (including reproductive) problems are the main causes of cow culling and the culling rate of cows that have finished their productive lifespan due to aging is low. The most frequent causes of cow culling for slaughter are udder and reproductive problems, and mortality. To reduce culling, it is necessary to implement appropriate and rapid diagnostic and epidemiological surveillance services and to support research activities aimed at controlling infectious, metabolic, and nutritional diseases in dairy herds. It is also necessary to investigate which breeds are better adapted to the pasture-based production systems prevailing in Uruguay.

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