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Dairy chain professionals' views on main problems and solutions regarding the management of male calves

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DAIRY CHAIN PROFESSIONALS' VIEWS ON MAIN PROBLEMS AND SOLUTIONS REGARDING THE MANAGEMENT OF MALE CALVES

Dissertação submetida ao Programa de Pós-Graduação em Agroecossistemas da Universidade Federal de Santa Catarina para a obtenção do título de Mestre em Agroecossistemas.
Orientadora: Profª. Dra. Maria José Hötzel

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O presente trabalho em nível de mestrado foi avaliado e aprovado por banca examinadora composta pelos seguintes membros:

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Certificamos que esta é a **versão original e final** do trabalho de conclusão que foi julgado adequado para obtenção do título de mestre em Agroecossistemas.

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Profª. Maria José Hötzel, Dra.
Orientadora

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RESUMO

Os bezerros machos não são considerados economicamente interessantes para a maioria das propriedades leiteiras no sistema de criação atual, tornando-se um excedente para a indústria. Na falta de alternativas para manter os bezerros machos nas propriedades leiteiras, alguns produtores optam por matar os animais logo após o nascimento. Contudo, esse procedimento desperta questões éticas, principalmente para o público geral. Os profissionais das ciências agrárias têm papel fundamental na promoção de mudanças no meio rural. Por esta razão, o principal objetivo deste estudo foi identificar as opiniões dos profissionais envolvidos na cadeia leiteira sobre os principais problemas e possíveis soluções para o manejo do bezerro leiteiro macho no Brasil, centrando a discussão em três práticas de manejo: o uso de sêmen sexado, a criação do bezerro leiteiro macho para a produção de carne e o descarte do bezerro leiteiro macho após o nascimento. Participaram da pesquisa 344 profissionais, respondendo a um questionário online contendo perguntas fechadas (múltipla escolha e escala Likert) de caráter quantitativo e perguntas abertas de caráter qualitativo. As questões abordaram temas sobre os cuidados dos bezerros machos, os principais problemas de cada prática, as alternativas presentes para a solução da questão do bezerro macho, a opinião sobre o papel dos consumidores e a opinião sobre a sustentabilidade da cadeia leiteira nos próximos anos. Participantes relataram que os cuidados com os bezerros machos são inferiores aos das bezerras fêmeas, especificamente durante a alimentação e provisão de colostro. A prática mais predominante nas propriedades leiteiras no Brasil foi doação do bezerro meacho apontada por 60% dos participantes. Muitos participantes (n=150) não sabiam como é feito o descarte do bezerro e consideravam o ato de descartar o bezerro leiteiro macho como uma prática eticamente inaceitável e inapropriada para solucionar a questão do bezerro leiteiro macho. Na opinião dos participantes (n=135) há um aumento das preocupações dos consumidores com o comprometimento do bem-estar dos animais. Os participantes consideravam a questão do bezerro leiteiro macho complexo, necessitando de mais de uma prática para efetivamente solucionar a questão, apontando como ideal o uso do sêmen sexado para diminuir o nascimento de bezerros machos, associado com o uso de raças de dupla aptidão e sêmen de corte, para destinar os bezerros leiteiros machos para a produção de carne. Mudanças no sistema de produção atual são necessárias, começando pelo melhor cuidado dos animais desde o nascimento. Os profissionais envolvidos na cadeia leiteira têm papel fundamental na atualização dos conhecimentos para garantir uma educação apropriada para os produtores de leite. Porém, nossos resultados sugerem que os profissionais envolvidos na cadeia leiteira de modo geral não estão preparados para ajudar os produtores de leite de forma eficaz, o que pode colocar em risco a reputação e a sustentabilidade da cadeia leiteira nos próximos anos.

Palavras-chave: bem-estar animal; consumidores; sêmen sexado; transporte; descarte

ABSTRACT

Male calves are not economically interesting for most dairy farms in the current system, considering a surplus for the dairy industry. Therefore, in the absence of alternatives to keep male calves in the dairy farm, some dairy farmers choose to kill the animals as soon after birth. However, it is a practice that raises questions about animal welfare, especially by the general public. Professionals play a key role in facilitating changes in the rural environment. For this reason, the main objective of this study was to identify the knowledge and attitudes of professionals involved in the dairy chain on the main problems and possible solutions for the management of male dairy calves in Brazil, regarding three management practices: the use of sexed semen, rearing male dairy calves for meat and culling male dairy calves. For this, 344 responses were collected from professionals through an online questionnaire containing closed questions (multiple choice and Likert scale) of quantitative character and open questions of qualitative character, covering questions about the care of male calves, the main problems of each practice, the alternatives present for the solution of the male calf issue, consumers opinion and the impact of factors on the sustainability of the dairy supply chain in the coming years. Participants reported that care between male calves and female calves is inferior, particularly during feeding. The most prevalent practice in dairy farms in Brazil noted by participants (60%) was the donation of the male calve. It is possible that the fate of the male calve is ignored by professionals involved in the dairy chain, overlooking the fact that many dairy farmers kill the male calves soon after birth. Many participants (n=150) do not know how concussion is done and considered culling male dairy calves as an alternative ethically unacceptable and inappropriate for animal welfare to solve the male calves' issue. Participants' opinion (n=135) about the increase in consumers' concern for compromised animal welfare and participants consider it a legitimate demand. Participants considered that male dairy calves are a complex issue, suggesting the need for more than one management practice to address it effectively, mentioned the use of sexed semen to decrease the birth of male calves, coupled with the use of dual-purpose breeds and beef semen to direct dairy male calves to beef production. Changes in the current system are necessary, starting with better care of the animals from birth to their destination. Professionals involved in the dairy chain play a key role in updating knowledge to ensure an appropriate education for dairy farmers. However, our results suggest that dairy chain professionals are not well prepared to help dairy farmers in an effective way, putting at risk the reputation of dairy chain sustainability in the coming years.

Keywords: animal welfare; consumers; sexed semen; transportation; culling

RESUMO EXPANDIDO

Introdução

A produção de leite é considerada uma importante atividade que contribui para o desenvolvimento de inúmeros países (FAO, 2018). O Brasil, país considerado para o estudo, está classificado entre os maiores produtores de leite do mundo (FAO, 2018). Nas últimas décadas, a cadeia produtiva leiteira obteve um crescimento significativo associado ao aumento de eficiência produtiva das propriedades. Porém, as mudanças no modelo de produção de leite trouxeram inúmeros desafios, principalmente as questões éticas relacionadas com a saúde e o bem-estar do rebanho leiteiro. Com isso, muitos aspectos dos sistemas de produção entraram em desacordo aos valores do público geral.

A gestação de uma vaca de leite tem como principal objetivo estimular a produção de leite. Enquanto a bezerra fêmea tem como potencial ser futura repositora do rebanho leiteiro, os bezerros machos não são economicamente interessantes para a maioria das propriedades leiteiras no sistema de criação atual. O incremento do potencial genético para aumento da produção de leite ocorreu em detrimento das características desejadas para a produção de carne. Por isso, os bezerros leiteiros machos que não são utilizados tornam-se um excedente para a indústria do leite, e na maioria das vezes indesejados para a indústria da carne. Sendo assim, na falta de alternativas para manter os bezerros machos nas propriedades leiteiras, alguns produtores optam por matar os animais logo após o nascimento.

A eutanásia é um procedimento em que é possível aliviar sintomas como dor e sofrimento e há métodos considerados aceitáveis para realização da prática. Porém, a concussão na cabeça (traumatismo craniano) é a forma mais comum de matar os bezerros leiteiros machos em muitos países, inclusive no Brasil. Contudo, a realização da concussão cerebral é um procedimento que desperta questões sobre o bem-estar dos animais, trazendo preocupações em várias partes, como pelo público (HÖTZEL et al., 2017; RITTER et al., 2022), pelos produtores de leite (CARDOSO et al., 2017) e pelos profissionais especializados no bem-estar dos animais (RIOJA-LANG et al., 2020).

Profissionais envolvidos na cadeia leiteira têm papel fundamental na facilitação de mudanças no meio rural. Pesquisas já apontaram o papel dos veterinários como um meio importante para a implementação de medidas de controle de doenças e de biossegurança nas fazendas (RICHENS et al., 2018; DENIS-ROBICHAUD et al., 2019). O fato de o bezerro leiteiro macho ser menos atrativo para a indústria leiteira pode resultar em uma menor atenção dos profissionais a esses animais, junto com a falta de informações atualizadas sobre o assunto e a baixa receptividade dos produtores para mudanças, o que pode prejudicar a qualidade da performance dos profissionais durante as assistências. Particularmente em relação à criação e saúde de bezerros, os profissionais têm pouco interesse e envolvimento para prestar assistência necessária aos produtores (RENAUD et al., 2018; RODRIGUES, 2021). Sendo assim, os conhecimentos e as opiniões dos profissionais envolvidos na cadeia leiteira devem ser explorados a fim de expandir o debate sobre os bezerros leiteiros machos. As decisões necessárias para promover um melhor manejo do destino do bezerro leiteiro macho devem basear-se num equilíbrio de aspectos ambientais, econômicos e sociais ou éticos (VON KEYSERLING et al., 2013), podendo contribuir a alcançar políticas e uma gestão mais eficaz, centradas na melhoria do bem-estar dos animais, e contribuir para uma indústria leiteira mais sustentável (CROYLE et al., 2019; BALZANI et al., 2021). Por esta razão, o principal objetivo deste estudo foi identificar os conhecimentos e atitudes dos profissionais envolvidos na cadeia

leiteira sobre os principais problemas e possíveis soluções para o manejo do bezerro leiteiro macho no Brasil.

Objetivo específico

Investigar o conhecimento e as atitudes dos profissionais da cadeia leiteira no Brasil em relação a três práticas de manejo do bezerro leiteiro macho: o uso de sêmen sexado, a criação do bezerro leiteiro macho para a produção de carne e o descarte do bezerro leiteiro macho após o nascimento.

Aspectos metodológicos

Profissionais envolvidos na atividade leiteira de todo o Brasil foram convidados para participar da pesquisa de forma anônima (sem identificação) e voluntária através de redes sociais, como Facebook e Instagram, pelo e-mail e contato pelo Whatsapp. As 344 respostas utilizadas na pesquisa foram coletadas de janeiro a abril de 2021. O questionário foi realizado de forma online e era dividido em cinco seções contendo perguntas fechadas (múltipla escolha e escala Likert) e quatro questões abertas. As respostas fechadas, de caráter quantitativo, foram analisadas por estatística descritiva e as respostas abertas por análise qualitativa.

Resultados e discussão

A maioria dos participantes que responderam o questionário eram da região sul e sudeste do país, sendo predominantemente do sexo masculino, dentro da faixa etária dos 26 a 35 anos de idade. A atividade atual que representava a maioria dos participantes eram profissionais que realizam atividades a campo (técnicos, extensionistas e representantes comerciais). Participantes relataram que a doação do bezerro macho após o nascimento é prática predominante nas propriedades leiteiras no Brasil. Embora sem registros oficiais, o descarte do bezerro leiteiro macho após o nascimento é uma das práticas mais reportadas na literatura (HÖTZEL et al., 2014; FRUSCALSO et al., 2017). É possível que o destino do bezerro macho seja ignorado pelos profissionais envolvidos na cadeia leiteira, e por isso desconsideram o fato que os produtores de leite matam os bezerros machos logo após o nascimento. Quando os participantes foram questionados sobre os métodos comuns para matar o bezerro leiteiro macho, quase metade dos participantes (n=150) reportaram não ter conhecimento sobre a prática ou ser realizada sem o uso de anestesia (n=126). A concussão na cabeça é reportada como método comum praticado em diversos países, mesmo sendo considerada eticamente inaceitável, além de ser um procedimento doloroso para não optar pelo uso de sedativos.

O descarte do bezerro leiteiro macho foi indicado pelos participantes como uma alternativa menos aceita do ponto de vista ético, e do bem-estar dos animais. Além de poucos participantes concordarem que o descarte do bezerro leiteiro macho é uma alternativa discutida entre os profissionais envolvidos na cadeia leiteira e que os produtores estão interessados nessa alternativa. As razões pelas práticas inadequadas com os bezerros leiteiros machos estão relacionadas com a falta de alternativas, como a falta de espaço e estrutura apropriadas, e os altos custos com alimentação, mão de obra e entre outros. Porém, a falta de discussão apontada pelos participantes sobre o descarte do bezerro leiteiro macho, mostra a importância de os profissionais envolvidos na cadeia leiteira darem suporte para os produtores em relação a temas dentro da criação do bezerro macho, visando a saúde e o bem-estar dos animais. O fato de o descarte do bezerro leiteiro

macho muitas vezes ocorrer nas propriedades leiteiras, aumentando os riscos com a proliferação de patógenos e a propagação de doenças, há uma preocupação com questões ambientais. No entanto, poucos participantes (n=3) relataram esse problema, mostrando a importância de melhorar o conhecimento dos profissionais para aumentar a eficiência das decisões nas propriedades leiteiras.

O uso do sêmen sexado tem algumas vantagens, como garantir um significativo número de fêmeas repositoras para o rebanho leiteiro futuro e reduzir o número de bezerros machos indesejados (HOLDEN & BUTLER, 2018). Por esse motivo, grande parte dos participantes consideram o uso do sêmen sexado como uma prática efetiva para solucionar a questão do bezerro macho nas propriedades leiteiras. Porém, apesar de diminuir o nascimento de bezerros machos, é importante o uso de alternativas associadas com o uso do sêmen sexado, para não recriar outro problema com o nascimento excedente de bezerras fêmeas nas propriedades leiteiras, assunto bastante discutido na literatura recente (BOLTON & VON KEYSERLINGK, 2021; OVERTON et al., 2020), mas quase não mencionado pelos participantes do estudo.

Os participantes responderam que a criação do bezerro leiteiro macho para a produção de carne é a melhor solução para a questão do bezerro macho nas propriedades leiteiras. Sendo assim, mudanças no sistema de produção atual são necessárias, começando por mudanças nos cuidados logo após o nascimento dos animais. Outra limitação apontada pelos participantes foi em relação à viabilidade da prática, desmotivando os produtores de leite a manter os bezerros nas propriedades pelos altos custos para tornar a criação dos bezerros machos viável. Por fim, os participantes relataram que a questão do bezerro leiteiro macho é uma solução complexa, apontando a necessidade de mais de uma prática para efetivamente solucionar a questão. Embora o transporte seja um tópico importante e amplamente estudado, por comprometer o bem-estar e saúde dos animais, nenhum dos participantes mencionou como um problema relacionado com o manejo do bezerro leiteiro macho. Durante as primeiras semanas de vida, independente do seu destino, bezerros são frequentemente levados da fazenda de origem. Pelo fato de o Brasil possuir uma grande extensão territorial, muitas vezes torna-se longo o período de transporte, agravando as condições dos animais. Portanto, ações são necessárias para garantir a saúde e o bem-estar dos bezerros durante o transporte, como melhorar a comunicação entre órgãos responsáveis pelas legislações e fiscalizações brasileiras com outras partes envolvidas dentro da indústria leiteira, exigindo protocolos que garantam os transportes dos bezerros de forma segura.

Em relação aos principais problemas percebidos das práticas realizadas com o bezerro leiteiro macho, preocupações com o bem-estar e saúde dos animais (n=19) e questões éticas (n=14) foram os mais reportados pelos participantes que responderam sobre o descarte do bezerro leiteiro macho. Enquanto a maioria dos participantes que responderam sobre o uso do sêmen sexado (n=79) e sobre a criação do bezerro leiteiro macho para produção de carne (n=86) apontaram a viabilidade como uma limitação dessas práticas.

Participantes comentaram na pergunta aberta sobre o aumento das preocupações dos consumidores, sendo que a maioria percebia um aumento das preocupações dos consumidores em relação à produção animal (n=135), que é apoiado por outro estudo realizado no Brasil, que relatou 82% do público respondente também está preocupado com o bem-estar dos animais de fazenda (WORLD ANIMAL PROTECTION, 2016). A oposição pública às práticas nas propriedades leiteiras pode comprometer a permissão para conduzir atividades, o que leva a grandes implicações financeiras para a indústria leiteira (HAMPTON et al., 2020). O descontentamento público indica a necessidade de melhorias. Os participantes (n=47) relataram ver os consumidores como agentes de

mudança na produção animal. Portanto, considerar as preocupações do público é um caminho importante para alcançar soluções sustentáveis para as questões da indústria leiteira (BOLTON & VON KEYSERLINGK, 2021).

Na última questão, os participantes responderam sobre o impacto de fatores na sustentabilidade da cadeia leiteira nos próximos anos, os participantes relataram o aumento das demandas associadas com o bem-estar animal e questões ambientais como fatores com maior potencial de impacto. O comprometimento da saúde dos bezerros significa um aumento do uso de antibióticos, que por sua vez está associado ao aumento de resistência antimicrobiana. As discussões para reduzir o uso de antibióticos está cada vez mais presente nos estudos, trazendo medidas para eliminar o uso excessivo desses medicamentos. De acordo com os participantes, se não houver legislações limitando o uso de antibióticos na produção animal acarretará um grande impacto na sustentabilidade da cadeia leiteira nos próximos anos. Mas, apesar da relevância do assunto atualmente, nenhum participante mencionou a questão do uso excessivo de antibiótico como um problema na criação dos bezerros leiteiros machos.

Considerações finais

O conhecimento e as atitudes dos profissionais envolvidos na cadeia leiteira revelaram estar sensibilizados com o tema, mas pouco preparados para dar suporte aos produtores de leite para mudar o atual cenário em relação à questão do bezerro leiteiro macho. Os bezerros machos são considerados de baixo valor para a indústria leiteira, o que se reflete nas atitudes dos produtores durante a criação, como tratamento de qualidade inferior comparado às bezerras fêmeas e a frequente decisão de matar os bezerros machos logo após o nascimento. Essas práticas colocam em risco a reputação da indústria leiteira por um aumento da pressão dos consumidores que não concordam com essas práticas. Mesmo que os participantes não acreditassem no impacto do aumento da população vegetariana e vegana e na oferta dos produtos a base vegetal substitutos do leite de vaca na sustentabilidade da indústria leiteira nos próximos anos, reconheceram o aumento das preocupações dos consumidores como uma demanda legítima.

Além do mais, os participantes reconheceram a complexidade de solucionar a questão do bezerro leiteiro macho, sendo um consenso que é necessário utilizar da combinação de mais de uma alternativa, como uso do sêmen sexado para redução do nascimento de bezerros machos, com o uso de raças dupla aptidão ou sêmen de corte, aumentando o valor dos animais para a criação com foco na produção de carne. Um ponto de importância é garantir a saúde e bem-estar dos bezerros leiteiros machos desde o nascimento até a criação final. Portanto, os profissionais envolvidos na cadeia leiteira têm papel fundamental na atualização dos conhecimentos para garantir uma educação apropriada para os produtores de leite, com o fornecimento de guias e protocolos para o correto cuidado e manejo dos animais, junto com a criação de políticas públicas para a viabilização das práticas, mudanças nas legislações e fiscalizações mais rigorosas, principalmente para controle do uso excessivo de antibióticos e para o transporte dos animais.

FIGURE LIST

TABLE LIST

SUMMARY

1 INTRODUCTION

Dairy production is considered an important human activity that contributes to the development of countries, as well as food security and nutrition (FAO, 2018). Over the last decades, it has globally expanded by more than 50%. Focusing on the country of the study, Brazil is ranked as one of the largest milk producers in the world (FAO, 2018), with noteworthy characteristics, especially regarding the distribution of production throughout the country and the differences in farm size, which influence the overall outcomes. For example, milk production ranges from less than 10L of milk/day to more than 500L of milk/day, although small family farms are responsible for 60% of the milk in the country (IBGE, 2009), as most of the milk is produced in small farms of up to 200 ha (MITIERO JUNIOR et al., 2017).

The dairy production chain has experienced considerable changes over the decades driven by increases in efficiency and productivity. During the process of intensification, animal production shifted from small and family dairy farms to large corporation factory farming systems that accelerated the adoption of advanced technologies (FRASER, 2008; RUTTEN et al., 2013) and the use of genetic selection of highly productive and specialized breeds (ROSSI & GARNER, 2014). At the same time, changes in the model of milk production have brought some ethical challenges related to the health and welfare of dairy cows. Many aspects of the production systems are at odds with public values and, as shown by Cardoso et al. (2016a), animal welfare is considered the most common public concern with dairy production.

The process of cow pregnancy is the principal method to stimulate milk production, and therefore dairy farms aim to get cows pregnant and have a calf every year. Nowadays this is facilitated by the predominance of artificial insemination. To put that in context, in Brazil the dairy herd is represented by 16.2 mi of lactating cows (IBGE, 2020) meaning that millions of calves are supposed to be born per year. While female calves have the potential to be used for replacements and to increase the dairy herd, male calves do not contribute considerably to dairy farm profitability (USDA, 2021). This means that if there is a 50% of chance of calves being born male, there are a considerable number of male calves born every year in Brazil. Hence, they are considered surplus to the dairy industry as they are not considered suitable for use in dairy farms, and many

times are not worthwhile for beef production, as the selection for higher milk production has largely reduced beef production traits, particularly carcass conformation (KEANE et al., 2001; KIRKLAND et al., 2007).

In the absence of alternatives to keep male calves in dairy farms, some farmers kill the animals as soon after birth. Euthanasia is a common method to relieve an animal of suffering, for example, to eliminate or minimize stress or pain. Some acceptable methods of euthanasia are barbiturate overdose and captive bolt complementing with potassium chloride administration, exsanguination, or pithing (CFMV, 2012; AMVA, 2020). However, male dairy calves usually are killed by concussion through a blunt force trauma applied to the head. The American Veterinary Medical Association (AMVA, 2020), the Canadian Code on the Care and Handling of Dairy Cattle (RENAUD et al., 2017), and the Australian Dairy Farmers policy (AUSTRALIAN DAIRY FARMERS, 2020) are opposed to this practice and inform alternative recommendation methods to follow in their guidelines. Even so, many studies reported dairy farms using this inappropriate method of euthanasia in higher frequencies than expected (RENAUD et al., 2017). In most small dairy farms in the southern part of Brazil, this practice is done by the farmers (HÖTZEL et al., 2014), who described this act as unpleasant and undesirable to perform (CARDOSO et al., 2017).

Reasons behind the practice of killing the newborn male dairy calves are lack of resources and on-farm infrastructure necessary to rear the animals, usually related to high cost and labor associated with the management (JOLLY, 2016). Similarly, a study done in the south of Brazil concluded the lack of resources and pasture, and cost of milk as the main reasons to justify culling male calves after birth (HÖTZEL et al., 2014). The dairy industry in New Zealand accounts every year for 40% of male dairy calves as a by-product, which are killed when they are around 4 to 7 days old (BOULTON et al., 2020). The United Kingdom has on average 22% of male dairy calves slaughtered soon after birth (HASKELL, 2020), and similar results have been shown in research done in Brazil, where 23% (FRUSCALSO et al., 2017) and 35% (HÖTZEL et al., 2014) of farmers killed male dairy calves soon after birth. Canadian dairy farms demonstrated that practices involving euthanasia are also usual and the reason is generally linked with economic factors (RENAUD et al., 2017). Lastly, in Australia, where the industry is not well-established for raising male dairy calves, euthanasia of male calves at birth is also common when the cost of rearing becomes economically unviable (CAVE et al., 2005).

Culling male dairy calves by concussion is a procedure that raises animal welfare issues, thus this practice brought concern and attention related to the methods used to kill unwanted male calves in dairy farms by the public (HÖTZEL et al., 2017; RITTER et al., 2022), dairy farmers (CARDOSO et al., 2017) and professional animal welfare experts in the field (RIOJA-LANG et al., 2020). Additionally, other common practices in dairy farms are falling out of public values and have been the subject of criticism, such as the early separation of calves from their dam (VENTURA et al., 2013; HÖTZEL et al., 2017; SIROVICA et al., 2022), and disbudding or dehorning calves (ROBBINS et al., 2015; PLACZEK et al., 2021). In most cases the public is unaware of common practices on farms (VENTURA et al. 2016; HÖTZEL et al., 2017); however, when facts about the procedures in the daily routine that affect animal welfare are explicit to the public, debates become widespread (HÖTZEL et al., 2017). The public's understanding of good welfare practices consists of reasonably natural life for animals (CARDOSO et al. 2016a; CLARK et al. 2016; PLACZEK et al., 2021). For example, in the United States, not many farms provide dairy cows access to pasture, meaning that cows are not able to graze frequently, going on the opposite side of what the public expected for dairy cow's life (CARDOSO et al., 2016a).

Given the potential for public opinion to promote changes in husbandry practices to improve welfare outcomes, it is essential that the dairy industry provide information and transparency of daily practices to the public. Changes to current invasive practices, or to the procedures related to the unreasonable killing of animals are required and, fundamentally, professionals involved in the dairy chain must become more involved in ethical discussions, as it is known that agricultural extension in the rural environment has a fundamental role in facilitating voluntary behavioral change (RÖLLING, 1988). For example, Hötzel and Sneddon (2013) conducted a study in the south of Brazil showing that the introduction of dehorning techniques on dairy farms was possible after farmers were convinced by extensionists about the necessity of doing the practice in calves but failed to mention the necessity to use pain control during the procedure. This report is consistent with another study that noted the little knowledge of dairy farmers about the existence of methods to mitigate the pain of dehorning, which was explained by the fact that the advisors never mentioned these methods (CARDOSO et al., 2016b). Nevertheless, a recent study involving, Canadian dairy farmers in Ontario demonstrated that they used pain control during dehorning influenced by veterinarians (SARACENI et

al., 2022). Accordingly, previous research highlights the value of veterinarians as an important motivator for farmers to implement disease control and biosecurity measures on their farms (RICHENS et al., 2018; DENIS-ROBICHAUD et al., 2019).

Considering that male dairy calves are less attractive in the dairy industry, extensionists in Brazil may devote little or no attention to these animals. Also, lack of updated information and low receptivity by farmers might negatively affect the performance of professionals during assistance. According to reports from dairy farmers in Canada (RENAUD et al., 2018) and Brazil (RODRIGUES, 2021), veterinarians had little interest and involvement in calf health and rearing. Thus, the knowledge and opinions of professionals involved in the dairy chain should be explored to expand the debate regarding rearing male calves in the dairy system. The management of male dairy calves is a complex problem in the dairy industry and each country faces specific challenges. Regardless of that, the fate of male dairy calves is a present and urgent topic to be addressed worldwide, thus it is necessary to understand professionals' views to find possible solutions that can lead to a more successful establishment of collaborative learning between stakeholders. Decisions to address the fate of male calves in the dairy industry must be based on a balance of environmental, economic, and social or ethical aspects (VON KEYSERLING et al., 2013). This may help achieve effective policies and management practices focused on enhancing the welfare of animals and contribute to a more sustainable dairy industry (CROYLE et al., 2019; BALZANI et al., 2021).

2 OBJECTIVES

The aim of this study was to investigate the knowledge and attitudes of dairy chain professionals in Brazil regarding three male dairy calves' managements: the use of sexed semen, rearing male dairy calves for beef, and culling male dairy calves at birth.

3 METHODS

3.1 PARTICIPANT RECRUITMENT

Professionals involved in the dairy industry in Brazil were invited to participate anonymously and voluntarily in the survey. Participants were recruited through social media (Facebook and Instagram), e-mail, and WhatsApp invitations to answer an online questionnaire about the dairy production system, without further information about the main topic of the survey. The questionnaire link was sent at first to participants from the first author's personal network of contacts, who were also requested to share the link with the purpose of spreading the questionnaire among as many professionals in the field as possible. Before answering the questionnaire, a brief text informed participants about the anonymity of their answers and that they could withdraw from the survey at any time by closing the form, followed by a question of agreement that allowed participants to start to answer the survey. Data were collected between January to April of 2021.

3.2 QUESTIONNAIRE STRUCTURE

The questionnaire (APPENDIX A), was created in a Google Forms, was divided into five sections containing closed questions in multiple choices and Likert scale format and four open questions. All participants answered the same questionnaire, except for section 3 where they were randomly assigned to answer only about one of the three management practices regarding male dairy calves in dairy farms, i.e., the use of sexed semen, rearing dairy male calves, or culling the male dairy calves.

The questionnaire started in Section 1 with sociodemographic questions (sex, age, region of current work, undergraduate or graduate education, time working in the field, current activity, and location of work), with the last question being about the involvement of the participant with dairy farmers that aimed to select only the participants involved in the dairy chain. In Section 2 participants were asked about their perception of the predominance of practices regarding male calves in Brazilian dairy farms, the most common method used to cull male calves, and how the male calves are cared for compared to female calves.

Section 3 was designed to understand the views of participants about practices used to manage male calves in dairy farms, after reading a brief text introducing the

subject participants were assigned randomly to one of three management practices (sexed semen, rearing male dairy calves for beef, or culling male dairy calves). Participants were then requested to rate on a 5-point Likert scale their agreement (1= completely disagree to 5= completely agree) about some statements related to male dairy calves: is an alternative for small and medium-sized, is an alternative for large-sized dairy farms, is economically viable alternative for small and medium dairy, is economically viable for large-sized dairy farmers, dairy farmers are interested in this alternative, it is an acceptable alternative from an ethical point of view, it is a viable alternative from a technical point of view, is sufficient technical knowledge available to assist dairy farmers with this alternative, is discussed among with milk chain professionals, is an appropriate alternative from an environmental point of view and is an appropriate alternative from an animal welfare point of view.

In this section participants were also asked to answer two open questions, one about the main problem or limitation they perceived in the designated management practice to address the issue of male calves in dairy farms, and one asking for suggestions for the best solutions to manage male calves in dairy farms. Participants were also requested their opinion about different solutions to address the issue of male dairy calves (rearing dairy male calves for beef, use of sexed semen to reduce male births, culling dairy male calves after birth, crossbreeding with beef breeds, and using dual-purpose breeds), whether they considered it very good, acceptable, or unacceptable.

Section 4 of the questionnaire asked participants how they assessed the impact on the sustainability of the dairy supply chain in the coming years, of issues like milk produced artificially in the laboratory, alternative products or plant-based substitutes to cow's milk, the increase of vegetarian and vegan population, changes in environmental legislation and stricter inspection, legislation changes aiming to improve animal welfare, concerns about zoonoses, increased consumer demand regarding environmental issues and increased demand regarding animal welfare. This was followed by an open question asking participants to comment on the increase in consumers' concerns and demands regarding animal welfare.

Animal welfare was questioned in the last section of the questionnaire, in which participants were also requested to rate in 5-points Likert scale: whether they believed the capacity of animals in feeling pain, fear, happiness, boredom, and about the 5 freedoms, i.e., being free from hunger and thirst, free of pain, injury, or disease, free of discomfort,

of fear and stress and free to express natural behaviors, and also were requested to participants express the most important factors to promote animal welfare.

3.3 DATA ANALYSIS

Only responses from participants who reported being involved with dairy farmers were considered for the analysis. Because of that, from the initial sample of 434 responses collected from the online questionnaire, 344 responses were considered in the study. The quantitative data (closed questions with multiple choices and 5-point Likert scales) were analyzed using descriptive statistics, and the open questions were submitted to thematic analyses using a deductive approach (BRAUN & CLARKE, 2006), a process of detailed reading of the data to establish familiarization with the text, generating codes, and developing them into themes. After extensive reading of the data, the open answers were tabulated, coded into themes, and created tables using the Excel® program.

Questions with the five-point Likert scale were reclassified into three points. Some of the demographic information was grouped to better data arrangement. The questionnaire asked about the Undergraduate Education and participants chose between technical level or others, veterinary, agronomy, animal science, and others; technical level or others were grouped during the analysis. The same occurred to Current activity, participants could select in the questionnaire between field professionals, researchers, professors, commercial representative, extensionist, management position, dairy farmers, or others; we included commercial representative, extensionist and management position to field professionals, and answers from dairy farmers were excluded from the study. Lastly, the dairy cooperative and dairy industry were grouped to provide the data from location of work.

4 RESULTS

Information about demographic data of participants is presented in Table 1. The survey covered all the regions of Brazil with predominance of participants from the South and Southwest of the country. Most participants were male, ages ranging from 26 to 35 years old, and the current activity was represented by professionals involved in field activities. Most participants had a higher education with 62% holding a graduate education.

Table 1. Demographic data of participants (n=344)

Demographic data	Dairy advisors (n=344)	%
Sex		
Female	126	37
Male	218	63
Age		
18 to 25 years old	64	19
26 to 35 years old	145	42
36 to 45 years old	75	22
46 to 55 years old	31	9
56 to 65 years old	25	7
66 years old and over	4	1
Region of currently work		
South	152	44
Southwest	117	34
North	8	23
Northwest	44	13
Center-West	23	7
Undergraduate Education		
Technical Level	14	4
Veterinary	168	49
Agronomy	38	11
Animal Science	105	30
Other	19	5
Graduate Education		
Yes	212	62
No	132	38
Time working in the field		
0 to 5 years	115	33
6 to 10 years	94	27
11 to 15 years	45	13
16 years or more	90	26
Current activity		
Field Professional	177	51
Researcher	29	8

Professor	25	7
Student	48	14
Other	65	19
Location of work		
Public company	72	21
Private company	113	33
University	70	20
Self-employed	50	15
Dairy industry or Cooperative	39	11

Participants believed that the care of male and female calves is different in dairy farms (Figure 1), especially regarding the feeding of male calves, which participants reported to receive less milk than female calves. Many participants did not know how culling is done in dairy farms (n=150), but many were aware that culling is done by concussion without the use of anesthesia (n=126) and just few participants (n=14) indicated that it is done by concussion with anesthesia. Few participants exemplified practices that they believed are used to cull male calves in dairy farms such as colostrum deprivation, leaving the calf behind until death, stabbing in the heart, and injections (cb30, lidocaine and xylazine).

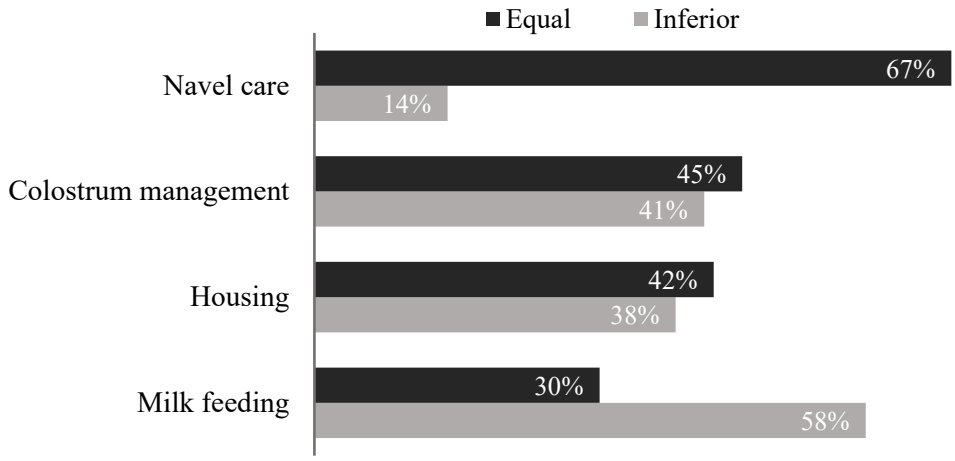

Figure 1 – Participants' opinion (%) about male dairy calves' care compared to female calves in dairy farms. Participants selected if the procedure with male dairy calves was performed with the same quality or lower quality management when compared to female calves.

When questioned about the predominance of 7 possible managements for male dairy calves, most participants pointed out the donation after birth as a practice that occurred in the majority of dairy farms. While raising male dairy calves to use for breeding purposes was considered as not common in the dairy farms (Figure 2).

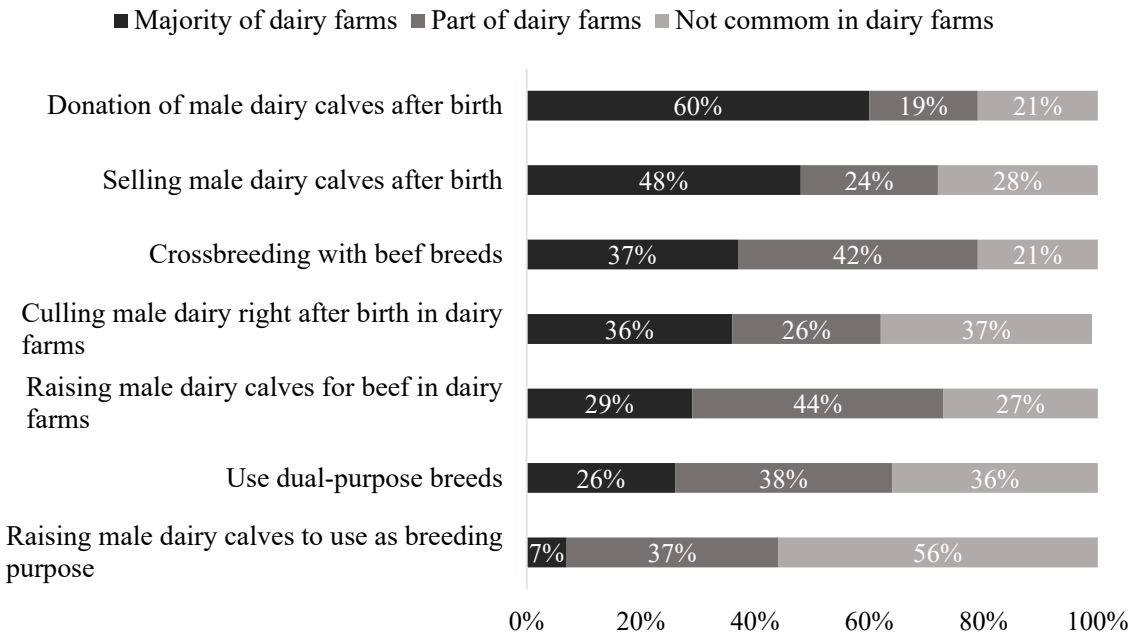

Figure 2 – Participants' perception of the predominance management practices used for male calves in Brazilian dairy farms.

4.1 PARTICIPANTS' OPINIONS ABOUT THE USE OF SEXED SEMEN, REARING THE MALE DAIRY CALVES FOR BEEF AND CULLING MALE DAIRY CALVES.

The use of sexed semen was considered by most than half of the participants as a practical and economically viable alternative for small, medium, and large-sized dairy farms. Culling male dairy calves was not considered a practical nor economically viable alternative for large-sized dairy farms (Figure 3).

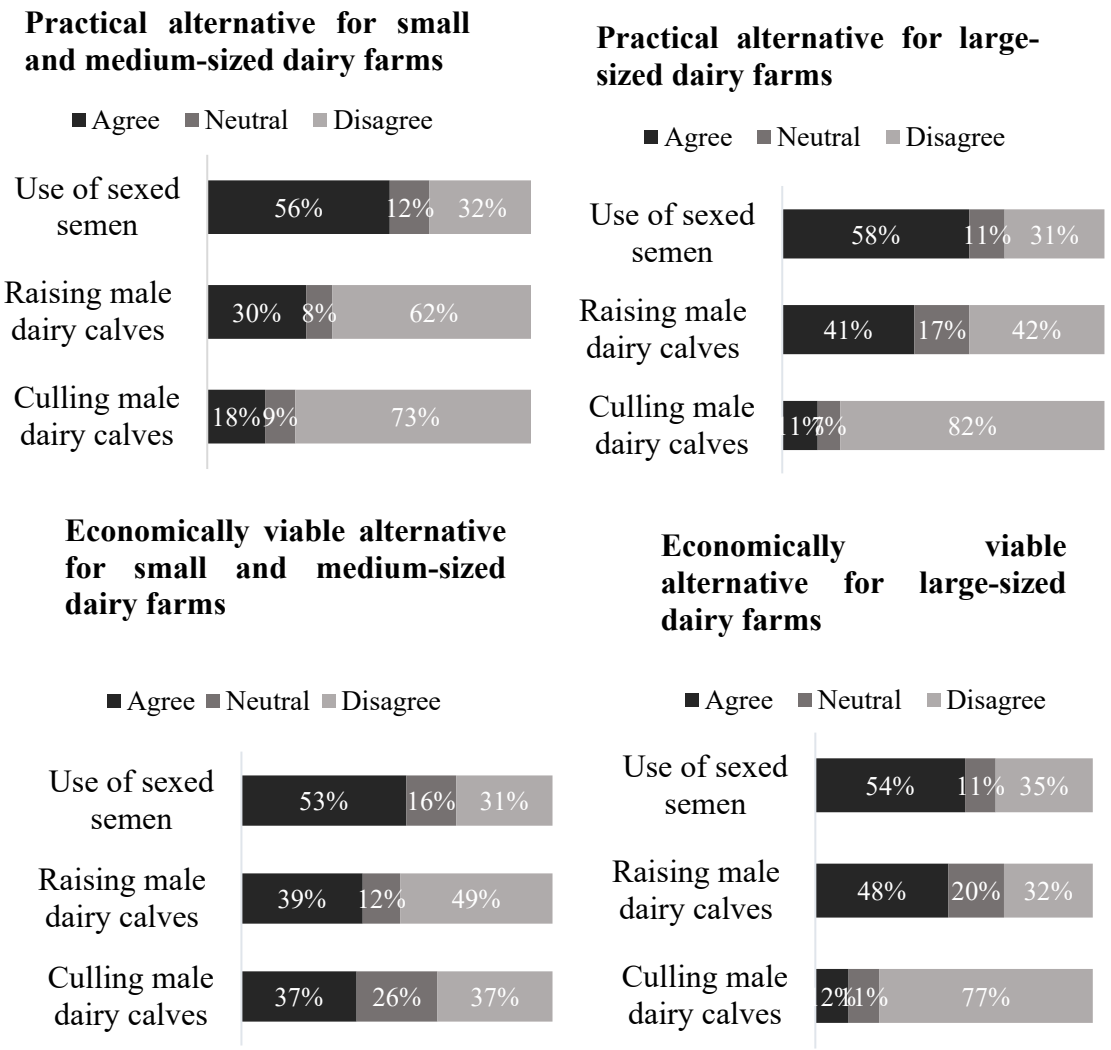

Figure 3 – Participants' opinion (%) about the 3 management practices of male calves in Brazilian dairy farms.

Figure 4 shows that for most participants rearing male dairy calves for beef and the use of sexed semen was considered an acceptable management practice, from an ethical and animal welfare point of view. Culling male dairy calves was not considered an acceptable alternative from any point of view: ethical, environmental, technical, and animal welfare.

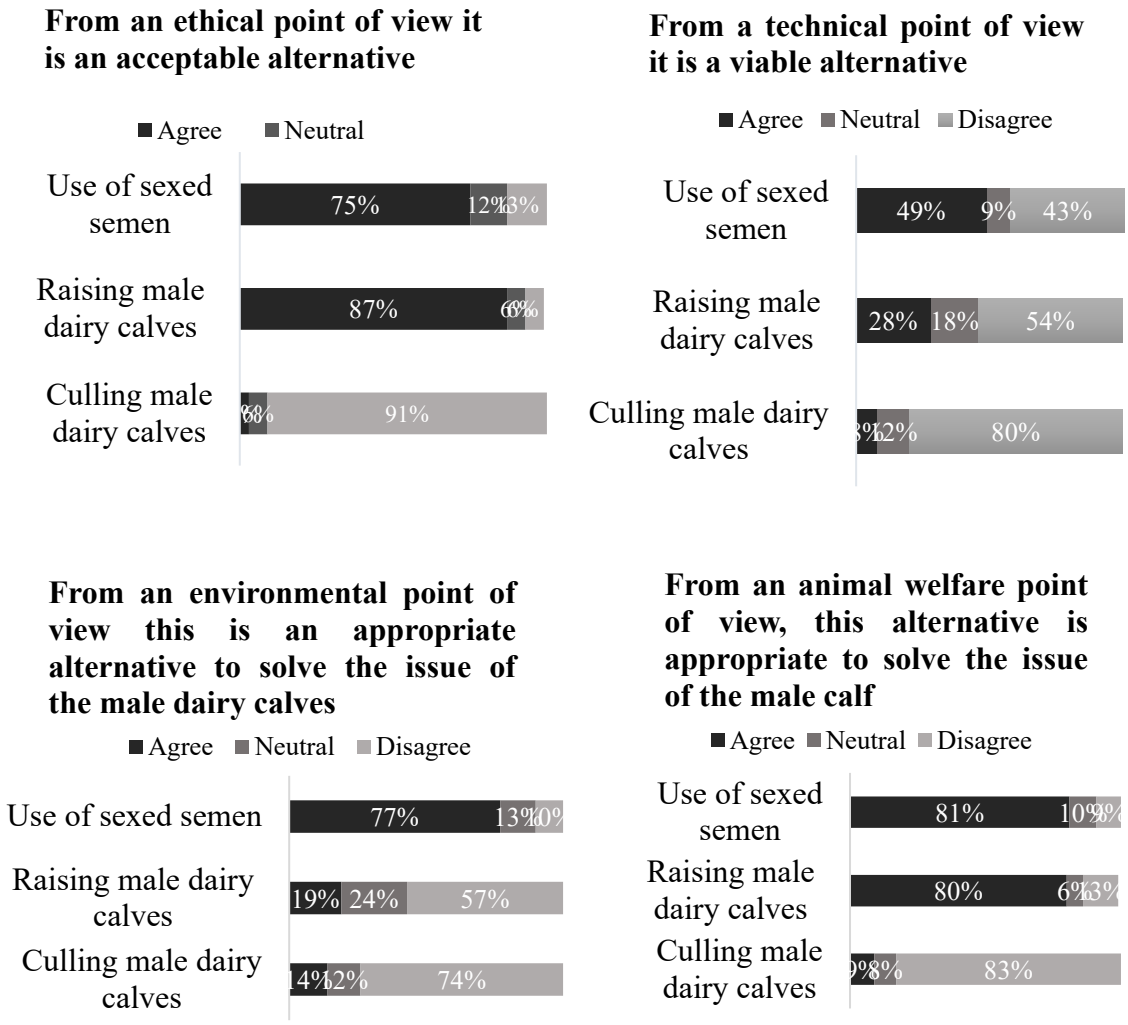

Figure 4 – Participants' opinion (%) about the 3 management practices of male calves in Brazilian dairy farms.

Only a few participants agreed that culling male calves is a management practice discussed among professionals and just a small part of the participants agreed that dairy farmers are interested in this alternative (Figure 5).

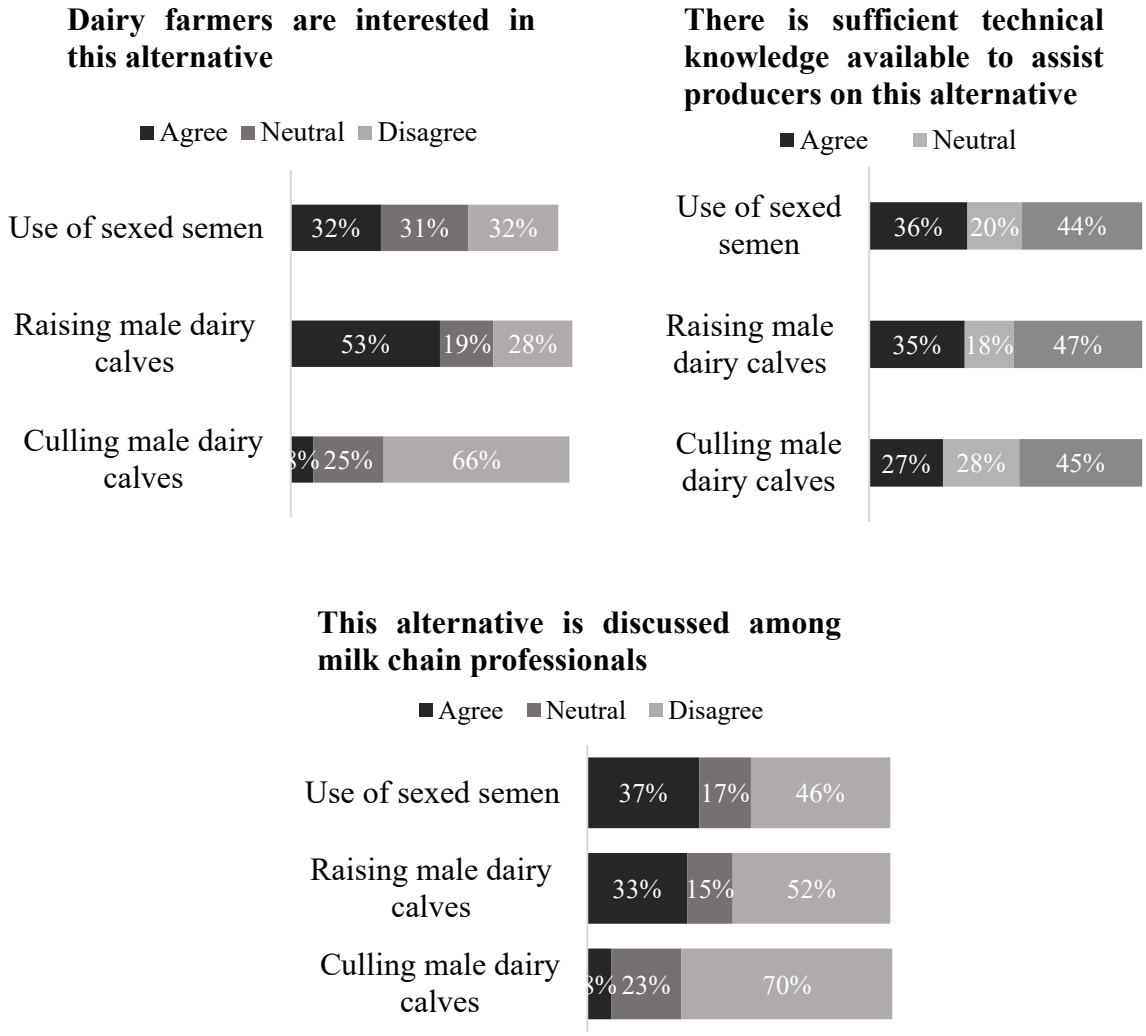

Figure 5 – Participants' opinion (%) about the 3 management practices of male calves in Brazilian dairy farms.

Table 2 shows the main problems raised by participants regarding the three management practices to deal with male dairy calves. Animal welfare and health issues and ethical concerns were the most frequent issues raised by participants that answered about culling male dairy calves; just a few participants mentioned environmental issues, and most did not give useful answers. Participants answering about the use of sexed semen and rearing male dairy calves for beef believed that feasibility was the main limitation to those management practices

Table 2. Main problems of each alternative to address the fate of male dairy calves, according to participants.

	Management Practices		
	Use of Sexed Semen (n=119)	**Rearing male dairy calves for beef (n=126)**	**Culling male dairy calves (n=99)**
Feasibility	79	86	-
Lack of knowledge	10	18	-
Lack of suitability of specialized Dairy breeds for beef production	-	18	-
Depends on the farmers' reality	12	9	1
Lack of market opportunities	-	8	-
Lack of stakeholders' interest	1	6	-
Animal welfare and health	-	5	19
Negatively affects heifers' rearing	-	5	-
Cultural issues	-	3	-
Reproduction outcomes	33	-	-
Surplus heifer calves	2	-	-
Low semen variety	2	-	-
Environmental issues	1	-	3
Ethical concerns	-	-	14

4.2 SOLUTIONS TO MANAGE DAIRY MALE CALVES IN DAIRY FARMS, ACCORDING TO PARTICIPANTS.

The most mentioned solution to manage male dairy calves in the open question was meat production, followed by using sexed semen. Many participants believed that at least two alternatives need to be combined to manage male calves in dairy farms, while some

believed that the solution depends on each farm's reality. Few mentioned culling or using male calves for breeding purposes as a solution.

When asked their opinion regarding the management practice to solve the male dairy calves issue mentioned in the questionnaire (Figure 6), most participants considered the use of sexed semen very good and culling male dairy calves unacceptable.

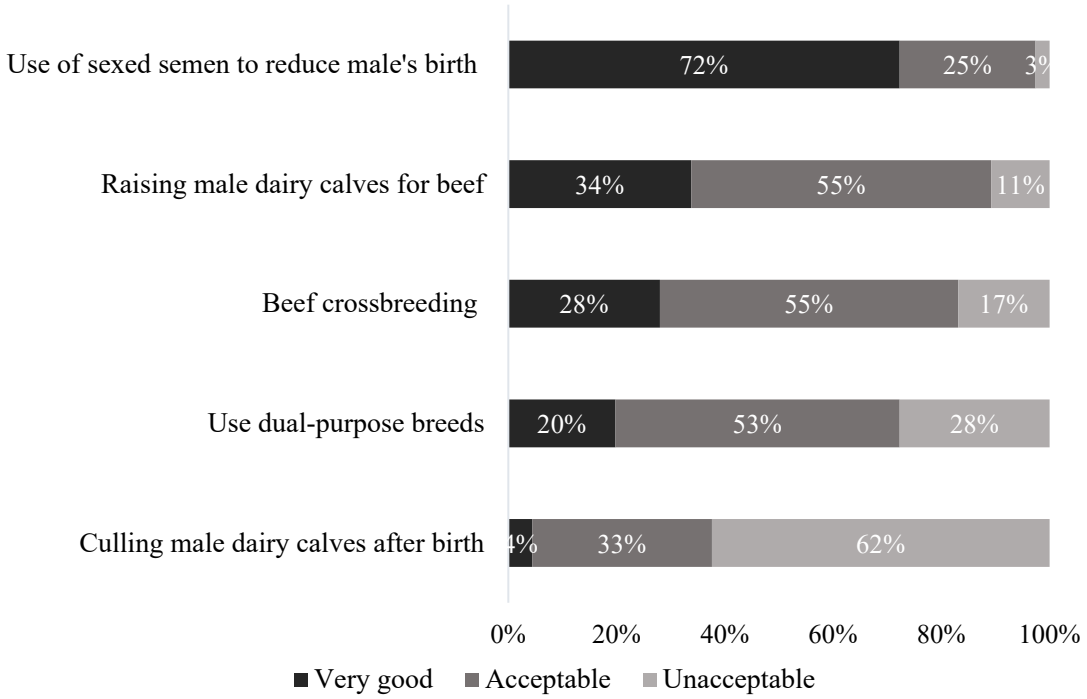

Figure 6 – Participants' opinions regarding different management practices to solve male dairy calves' issues.

4.3 INCREASE IN CONSUMERS' CONCERNS AND DEMANDS REGARDING ANIMAL WELFARE

The number of answers of participants about the increase of consumers' concerns and demands regarding animal welfare, in the open question, are shown in descending order: 1) perceptions of increasing consumers' level of concern about topics related to animal production system, (n=135); 2) consumers are seen as agents of change in the animal production system (n=47); 3) animal welfare concerns may influence purchase behavior (n=43); 4) consumers' have misconceptions regarding animal production

(n=42); 5) animal welfare is a consumers' legitimate demand (n=27), 6) need to improve communication with consumers (n=23); 7) consumers have limited knowledge about animal production (n=20); 8) and consumers are not concerned (n=15).

4.4 MOST IMPORTANT FACTORS TO PROMOTE ANIMAL WELFARE IN DAIRY FARMS

Participants expressed as the most important factors to promote animal welfare in dairy farms: housing (n=208), management (n=142), and the biological functioning of the animal, represented by answers involving the ability of animals to feel or express their natural behavior (n=91). Most of the participants believed that calves have the ability of feeling emotions and agreed with the Five Freedoms.

Table 3. Participants' opinions (n=344) about factors regarding animal welfare

	Participants' opinion on animal welfare		
	Total capacity	**Intermediate**	**No capacity**
Calf's ability to feel pain	96%	2%	2%
Calf's ability to feel afraid	93%	5%	3%
Calf's ability to feel joy	90%	8%	3%
Calf's ability to get bored	84%	11%	6%
	Participants' opinion regarding the five freedoms		
	Very important	**Intermediate**	**Not important**
Calves should be free from hunger and thirsty	96%	2%	2%
Calves should be free of pain and disease	99%	1%	0%
Calves should be free of discomfort	94%	5%	1%
Calves must be free of fear and stress	93%	6%	1%

Calves should be free to express natural behaviors	92%	6%	1%

4.5 FACTORS POTENTIALLY INFLUENCING THE SUSTAINABILITY OF DAIRY SUPPLY CHAIN IN THE COMING YEARS

Participants were asked their opinion about the impact of some factors in the sustainability of the dairy supply chain in the coming years. According to participants, the increase in factors associated with animal welfare and environmental issues will have the greatest impact on the sustainability of the dairy supply chain (Figure 7).

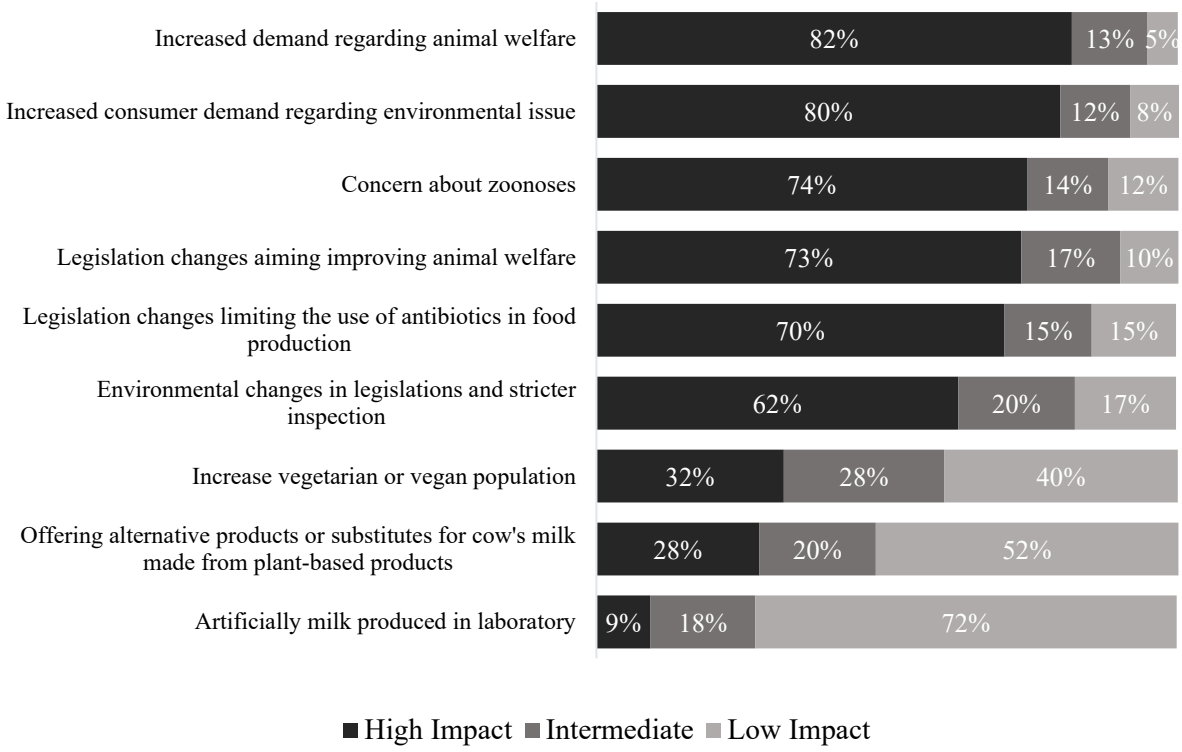

Figure 7 – Participants' opinions about factors that may impact the sustainability of the dairy supply chain in the coming years. Data are on 5-point Likert scales, with higher numbers indicating a higher impact on the sustainability of the dairy supply chain.

5 DISCUSSION

Many studies have discussed limitations to keep male calves in dairy farms, including lack of pasture or the cost of milk (HÖTZEL et al., 2014), limited markets (CREUTZINGER et al., 2021), and the low economic value attributed to male dairy calves (HOLDEN & BUTLER, 2018). As shown in the current study, the most prevalent practice in dairy farms in Brazil noted by participants was the donation of the male calve, resulting that the destination of male calves might be ignored by professionals involved in the dairy chain, overlooking the fact that many dairy farmers kill the male calves soon after birth. Moreover, common management practices in dairy farms to cull male calves after birth were pointed out by participants as an unknown practice. For this reason, participants believed in the increase in consumers' concerns for compromised animal welfare and consider it a legitimate demand. Ethical and welfare concerns have been raised regarding the inadequate practices applied when killing those animals, especially by the public (HÖTZEL et al., 2017; RITTER et al., 2022).

In this study, which aimed to identify the knowledge and attitudes of professionals involved in the dairy chain on the main problems and possible solutions for the management of male dairy calves in Brazil, it was possible to notice that even professionals considering the fate of male dairy calves as a complex issue, they are possibly not technically prepared to respond to the demands of changing the current scenario of male dairy calves.

5.1 CULLING MALE DAIRY CALVES

The issue of male dairy calves has different potential solutions. Some examples are culling calves immediately after birth, rearing them to be used for meat production, or using sexed semen to reduce the number of male calves on dairy farms. Participants believed that the most common practice in Brazilian dairy farms is the donation of male calves after birth. Although there is no official data to report, culling male calves after birth by dairy farmers is one of the most prevalent management practices reported in the literature (HÖTZEL et al., 2014; FRUSCALSO et al., 2017). It is possible that the destination of male calves is overlooked by professionals in the dairy chain, who might thus ignore the fact that some dairy farmers kill male calves just after birth. Also, donating

male calves might be considered a palliative measure, as it solves the problem temporarily, but is unlikely to contribute effectively as a solution for the calf, especially when farmers are not entirely concerned about the care given to the calf after it leaves the farm (RODRIGUES, 2021). The importance of professionals involved in the dairy chain to be responsible, to support farmers on how to dispose of male calves or guarantee a safe destination for those animals and consider a donation as a viable resource only when it is conciliated with other alternatives to the male dairy calf issue.

When questioned about common ways of culling male dairy calves, a part of the participants reported being unaware of the procedures performed for this purpose. The use of blunt force trauma was reported in studies in Brazil but also in other countries. For example, in Brazil, the practice is reported by 35% of farmers in western Santa Catarina (HÖTZEL et al., 2014) and 23% of farmers in Rio Grande do Sul (FRUSCALSO et al., 2017). In Australia, some dairy farmers continue to use blunt force trauma to cull male calves after birth (BEGGS et al., 2015), and 34% of Canadian dairy farmers use this practice (RENAUD et al., 2017). Additionally, participants expressed that culling the male calves was not a practical alternative for dairy farmers, which is supported by their opinion that there is no sufficient assistance for dairy farms to the execution of this practice. Blunt force head trauma applied in calves manually is difficult to perform consistently, as their skulls are considered too hard to immediately destroy the brain tissue resulting (AVMA, 2020). Improper execution of this practice is thus ethically unacceptable, highlighting the need to train people to conduct humane euthanasia, following guidelines, which includes the use of sedative (FVE, 2017).

A considerable portion (One third) of participants stated that culling is done by concussion without the use of anesthesia. This result corroborates other studies done with calves and pigs producers, showing a lack of or insufficient use of anesthesia or analgesia when dehorning (CARDOSO et al., 2016b) and when castrating animals (ALBERNAZ-GONÇALVES et al., 2020). Motivations behind this practice could be related to a lack of recognition as a painful procedure or increasing production costs. Indeed, a study that explored the knowledge and attitudes of pig farmers showed that the main reasons for refusing pain relief use were difficulties in management and rising costs of production (ALBERNAZ-GONÇALVES et al., 2020). According to guidelines for the euthanasia of animals, calves are expected to be unconscious prior to or in the course of the practice to

effectively interrupt cardiovascular and respiratory functions and to minimize pain and distress experienced during the procedure (AMVA, 2020).

Participants in the current study did not consider culling male calves to be an interesting practice for dairy farmers. Indeed, aside from welfare implications for the animals, killing surplus male calves involves moral concerns when the calf is perceived as a product or surplus waste, undermining its intrinsic value (AERTS et al. 2009; VON KEYSERLINGK & WEARY, 2017). Additional moral concerns refer to dairy farmers that are involved in this practice. Dairy farmers interviewed in studies in southern Brazil reported the urge to kill male calves due to an absence of alternatives rather than wanting to kill, resulting in feelings of guilt, besides fearing other people's reactions when aware of this practice (CARDOSO, 2011; RODRIGUES, 2021). We believe that in some situations dairy farms are forced to make a trade-off, as the value designated to a calf is often inferior to the cost to raise it. Reasons behind killing male calves are related to space and financial limitations (CARDOSO, 2011) or lack of access to housing facilities (RENAUD et al., 2017). Participants pointed out the absence of discussion among professionals about the management practices that were the focus of the study, especially in relation to culling male calves on dairy farms. Reed et al. (2022) discussed the necessary steps that can be taken to improve the management of male dairy calves, such as the importance of dairy advisors supporting and educating farmers on an effective and correct guide to performing euthanasia and explaining the implications of the welfare issues related to inappropriate methods to kill male dairy.

Not surprisingly, professionals mentioned animal welfare, health, and ethical concerns as the main problem when discussing culling male calves. Concerns about the way male dairy calves are killed have been discussed in other studies. For example, (BEGGS et al., 2015) discussed the poor welfare resulting from issues with the operator training and error when conducting the killing of animals, and Bolton and Von Keyserlingk (2021) warned that the practice is not well accepted by the public given ethical concerns, which is supported by finding of Hötzel et al. (2017). In contrast, just few participants mentioned environmental concerns as a problem when culling male dairy calves. The disposal of newborn male calves has environmental and health implications when it comes to burying the animals on farms, such as increasing pathogen proliferation and spreading diseases in the soil, plants, and water (KALBASI et al., 2005; MAURO & SILVA, 2019). Pereira and Dutra (2012) reported that 52% of beef cattle farms maintain

animal carcasses on pasture. Despite this, the recommended environmental approach for the disposal of dead animals is composting (KALBASI et al., 2005; MAURO & SILVA, 2019). Participants mentioned the increase in consumer demands regarding environmental issues as a factor to have a higher impact on the sustainability of the dairy supply chain in the coming years. The environmental aspect of the fate of male dairy calves is an important topic and crucial to ensuring the continued viability of the dairy industry (BOLTON & VON KEYSERLINGK, 2021). The importance of better knowledge of professionals in the topic, along with the development of legislation to guide professionals involved in the dairy chain in assisting dairy farmers on this subject.

5.2 USE OF SEXED SEMEN

The use of sexed semen has some advantages, most notably guaranteeing a significant amount of replacement heifers to the future milking herd and reducing the number of unwanted male calves (HOLDEN & BUTLER, 2018). This might explain why a high percentage of participants in the study considered the use of sexed semen an effective management practice to address the fate of male calves on dairy farms. However, some authors argue that the use of sexed semen could resulting a number of heifers that may exceed the need for replacement in the future milking herd, recreating the problem of the "surplus" calf. The oversupply of female calves is a hot topic mentioned in recent research (BOLTON & VON KEYSERLINGK, 2021; OVERTON et al., 2020) given the importance of identifying other alternatives to minimize the reputational risks for the dairy industry (BALZANI et al., 2021), but was barely mentioned by participants in the study. A surplus of replacement heifers implies a significant rise in costs to dairy farms and raising replacement heifers becomes more costly than the market price, resulting in financial loss (OVERTON et al., 2020). The use of sexed semen is an effective strategy to reduce the number of unwanted male calves, but it will not eliminate the problem and it might result in an extra problem of surplus of heifer calves in the dairy industry, so other strategies are needed to support this method. Increasingly, advantages of the use of sexed semen as a breeding option are gradually becoming introduced to minimize a potential oversupply and enhance male calves' value, for example additionally using semen from conventional beef or dual-purpose breeds on cows that are not selected for breeding dairy herd replacements (HIETALA et al., 2014).

Participants in the current study considered the use of sexed semen a practical and economically viable alternative for small to large dairy farmers. This contrasts with other studies that found herd sizes to influence the decision to pay for advanced breeding tools, such as the use of sexed semen and artificial insemination (KHANAL & GILLESPIE, 2013; VERMA et al., 2020). Clasen et al. (2021) reported that larger dairy farms use more breeding tools in a period of a year than smaller dairy farms. In the open question, most participants that answered about the limitation of the use of sexed semen expressed concerns about feasibility, especially linked to the costs of implementation of the practice. Balzani et al. (2021) reported that the key contributors to the dairy industry (farmers, veterinarians, and dairy farm advisors) in Ireland also considered the cost of sexed semen as a barrier.

Advantages linked to the use of sexed semen go beyond reducing the birth of male dairy calves and include increasing rates of genetic gain (HOLDEN & BUTLER, 2018) and reducing the incidence of dystocia, as heifer calves will be born, which are smaller than the males (VISHWANATH & MORENO, 2018). Even with some advantages to the milking herd in general, only a small part of the participants believed that dairy farmers are interested in this management practice, likely related to concerns about reproduction outcomes that might not justify the high investment, as participants reported to be a main limitation regarding the use of sexed semen. This was true in the early years of the use of sexed semen, when the conception rates were considered low (DE VRIES et al., 2008; HEALY et al., 2013; DEJARNETTE et al., 2021). However, recently the improved technologies for producing sexed semen have enhanced its fertility substantially (XU, 2014; VISHWANATH & MORENO, 2018), especially in well-managed dairy herds.

5.3 REARING MALE DAIRY CALVES FOR BEEF

Most participants answered that raising dairy male calves for meat production is the best solution to address the fate of male calves in dairy farms. This is in agreement with the concept of avoiding the unnecessary killing of animals expressed by the participants and seems ideal to meet public concerns (RITTER et al., 2022). However, male calves are born from dairy cows genetically selected to strategically achieve higher milk production, which affects meat production traits, such as reduced average daily gain, lower dressing percentages, and less desirable carcass conformation (MUIR et al., 2000; ALBERTI et al., 2008), which negatively impacts their suitability for cost-effective meat

production systems. As a result, dairy farmers are less motivated or unable to keep male calves in circumstances of the absence of space and adequate facilities, the costs of feed, and labor requirements linked to the care of raising male calves (HÖTZEL et al., 2014; RODRIGUES, 2021). Participants in the study agreed that the main limitation to rearing male dairy calves for beef was related to the feasibility of the practice. Crossbreeding with beef breeds or using dual-purpose breeds are other strategies to obtain high-value calves. A Canadian study showed that dairy calves sold in auction markets represented by Brown Swiss, Jersey, and Holstein dairy breeds were attributed to the lowest price, while crossbred calves with beef traits sold for a considerably higher price (WILSON et al., 2020).

Participants agreed that the fate of male dairy calves cannot be dealt with a single solution and reported the necessity of more than one management practice to effectively address the issue. The use of male dairy calves in beef production has been reported as an efficient way of producing beef and one of the profitable possibilities models for beef production in the future (SEIGEL, 2013). Countries in Europe already utilize male dairy calves to produce beef; for example, nearly half of beef produced in the UK comes from the dairy herd (BROWN et al., 2020), and in France, part of dairy calves is raised as young bulls and other part are crossbred between a dairy dam and a beef sire (FOSSAERT et al., 2020). Thus, it shows a possible direction to achieve a more sustainable solution for the fate of male calves in the dairy industry. Furthermore, it has been shown in studies that beef from dairy herds has a lower overall carbon footprint compared to conventional beef herds (MOGENSEN et al., 2015; VAN SELM et al., 2021), as dairy beef production accounts to produce many products such as meat, milk, and calves, allocating emissions over all three products (VAN SELM et al., 2021). This production form may become more attractive when considering current environmental concerns, even though just a few participants pointed out that rearing male dairy calves for beef is considered from an environmental point of view an appropriate alternative to solve the issue of male dairy calves.

Therefore, the rearing of male dairy calves might help the move toward a sustainable dairy industry, achieving a balance between social, economic, and environmental. Lastly, we observe the importance of improving communication between the beef market and the dairy chain as a measure to move away from culling male dairy calves. Although changes are required in the current model of the dairy industry, most

notably it must be initiated from the moment the male calves are born. Given the relatively low economic value of male calves, it is not surprising to see the present attitudes and practices reported by participants regarding male dairy calves. For example, in the study some participants exemplified extremely cruel practices they believed to occur to male calves on dairy farms, such as colostrum deprivation, leaving the calf behind until death, and stabbing the heart, also reported in Hötzel et al. (2014). Hence, performing immediate and effective euthanasia after birth may be a more acceptable welfare option (NIELSEN et al., 2019; BALZANI et al., 2021) rather than leaving the calf to experience neglect and low standards of care, such as prolonged periods off feed, transportation, or other familiar stressful conditions that are usual for surplus calves (BOLTON & VON KEYSERLINGK, 2021).

Calf care practices are a topic discussed in studies due to a lack of prioritization in relation to other classes of animals, besides that is common studies to focus on highlighting the success of proper neonatal calf management to ensure the survival of heifer calves (LOMBARD et al., 2007; WINDEYER et al., 2014), as dairy farms raise heifer calves to provide an adequate supply of replacement to the future milking herd. Wilson et al. (2020) suggested that the time and effort available to care for newborn calves are a barrier to the adoption of better management practices, especially for male calves. This scenario reflects on male calves' management, which according to participants in the study is different compared to heifer calves, mainly in relation to milk and colostrum feeding, as male calves received lower amounts compared to heifer calves. This difference is supported by studies that found that male calves received lower volumes of colostrum (SHIVLEY et al. 2019; RENAUD et al., 2020). However, Renauld et al. (2017) reported that most participants in the study provided male calves the same as or more milk than heifer calves. The diverging results, as was observed regarding the milk feeding, show a lack of clarity among professionals, leading to difficulties in changing the current scenario. Dairy farmers are often unsure about how to provide the best calf care, because of lack of knowledge about the destination of male calves, individual perspectives of the scenario, and emotions (WILSON et al., 2021). The low prioritization of calf care, especially for male calves, highlights the need to achieve a balance between the demands of all classes of animals (WILSON et al., 2021). Reed et al. (2022) reported the importance of application of guidelines (i.e., codes of practice) regarding the care and handling of animals as part of the solution to improve dairy calves welfare, as the

familiarization of dairy farmers with the guidelines is associated with improvements in calves care. We encourage professionals involved in the dairy chain to help farmers in familiarization and education through guidelines to enhance the health and welfare of animals, also improve the efficiency of daily work, increasingly available to devote to calves, especially male dairy calves.

5.4 TRANSPORTATION

Although transport is an important topic discussed in studies, given its potential for compromising the welfare and health of animals, none of the participants in the current study mentioned transportation as a problem related to the management practices with male dairy calves. During the first weeks of life, young calves are frequently transported from the farm of origin to a calf-rearing system for veal or beef production in many different countries (SHIVLEY et al., 2019). In the United States, most male dairy calves are sold to beef facilities to be raised for meat rather than for veal production (USDA, 2016). In Ireland, veal production is not a viable industry, meaning that calves are exported by sea, road, and air to continental Europe to be destined for veal production (McGRATH et al., 2018; BALZANI et al., 2021). For this reason, regardless of whether they are donated or sold to rearing facilities, slaughterhouses, or allocated to another farm, the transportation of male dairy calves is necessary. However, transporting animals is a stressful period as they experience multiple challenges due to different handling procedures, unfamiliar animals and environments, lack of access to food and water, and extreme temperature variations (TRUNKFIEL & BROOM, 1990). Consequently, animals are affected by the decline in health standards, such as dehydration, loss of body weight (KENT & EWBANK, 1968; KNOWLES et al., 1997), or elevated risk of dying during the route (GONZÁLEZ et al., 2012). Moreover, male dairy calves are frequently neonates when transported, and therefore more vulnerable to morbidity and mortality (ROADKNIGHT et al., 2021). Public discomfort with live animal transportation (HOWKINS & MERRICKS, 2000) combined with concerns related to the health and welfare of animals (CLARK et al., 2016) has a growing considerable reputational risk for the dairy industry.

Even without being approached by participants in the study, the transportation of male calves to other facilities could involve long journeys in Brazil due to the large geographic extension of the country. Long transportation has been reported as a factor

that can also affect health (CAVE et al., 2005; GONZÁLEZ et al., 2012) and aggravate calves' conditions resulting from the inappropriate care on the farm of origin (WILSON, 2019). Furthermore, rearing facilities could be concentrated in specific regions, such as Center-West and North which are known to lead meat production in Brazil (IBGE, 2020), alternatively to the Southern region which leads milk production (IBGE, 2020). Thus, many male dairy calves born in southern Brazil might be transported to rearing facilities in very distant locations that ideally have a more prepared structure for raising these animals for meat production.

Many actions are taken to safeguard the animals, and the transportation of calves goes under regulation and legislation in many countries to ensure good outcomes protecting calf health and welfare. Some of the requirements are related to duration, age, and maximum fasting allowed to animals during transport. For example, New Zealand and Europe require that calves must be transported at a minimum of 4 and 14 days years old, respectively (EUROPEAN UNION, 2004; NATIONAL ANIMAL WELFARE ADVISORY COMMITTEE, 2018) and there is a limit of 100 kilometers maximum in a journey of calves less than 10 days in Europe (EUROPEAN UNION, 2004). Recent requirements are made in Canada, limiting the transport of calves up to 12 h instead of 18 h before providing access to food, water, and rest (CFIA, 2019). Additionally, calves are required to meet health criteria including no signs of dehydration and dry navel, and calves less than 9 days cannot be moved to auctions or assembly yards (CFIA, 2019). In contrast in Brazil, the transportation of animals follows guidelines developed by the National Traffic Council (CONTRAN) but unlikely in other countries they are superficial and unspecific, missing important steps to provide good management of animals during transport. Improved communication between CONTRAN and stakeholders involved in the dairy industry to establish more detailed guidelines on how to safely transport animals to meet health and welfare needs and ensure an efficient inspection prior to and during the route.

Compromised health of calves resulted in increased use of antimicrobial in the veal calf sector (BOS et al., 2013) and the use of blanket antimicrobial therapy upon arrival in the facilities. For example, a survey of Canadian experts noted that the health condition upon arrival at calf-rearing facilities is crucial to result in significant use of antimicrobial (WILSON et al., 2020). This is in line with Scott et al. (2019) that reported that a veal facility in Ontario used antimicrobial in a large proportion of calves at least

once over a period of 21 days. Blanket antimicrobial therapy was commonly provided on arrival but has not been demonstrated to be effective in preventing diseases in calves at slaughterhouses as 25% of calves developed diseases after 6 to 8 months (PARDON et al., 2012). High rates of antimicrobial use contributed to the development of antimicrobial resistance in commensal and animal pathogens (CATRY et al., 2016; HUTCHINSON et al., 2017) and elevated risk of antimicrobial-resistant bacteria carriage in humans, especially when in close contact with calves (GRAVELAND et al., 2010).

Efforts to reduce the use of antimicrobials in food production have been discussed in studies of young calves' management (HOLSTEGE et al., 2018) as it is considered a present concern due to antimicrobial resistance in human and animal pathogens. The World Health Organization (WHO, 2022) in Europe developed a plan to mitigate antimicrobial resistance and among the new measures, applied from January 2022, the preventive use of antibiotics in animals is not allowed. The same was demonstrated in a study conducted on Swiss veal farms, which identified the many risks related to the increased use of antimicrobial drug treatments, providing support for further investigations aimed at reducing the use and ensuring initiatives for more prudent use of antibiotics (LAVA et al., 2016). Québec eliminated the use of antimicrobials for preventive purposes in calf production and requested strong reasons when used in a therapeutic way, considering an important model of legislation to promote prudent antimicrobial use (WILSON et al., 2020). This model is supported by the participants in this study, as they believed in the necessity for legislative changes that limit the use of antibiotics in food production, as failure to consider changes in the current practices is liable to potentially impact the sustainability of the dairy supply chain in the coming years. However, it is noteworthy that none of the participants mentioned the issue of antibiotic use as a limitation to practices of rearing the male calf.

5.5 PERCEPTIONS REGARDING CONSUMERS' ATTITUDES TO ANIMAL WELFARE

The participants' perception of an increased level of consumer concerns regarding animal welfare is supported by another study done in Brazil that reported 82% of the public respondents are also concerned with farm animal welfare (WORLD ANIMAL PROTECTION, 2016). The media currently facilitates the dissemination of knowledge and information resulting in consumers' interest in understating the origin of the food

they eat, with a particular focus on animal welfare. One example is the case of the fate of the dairy calves, which significantly increased the exposure in social media and newspapers over the last years (LEVITT, 2019). Consequently, public opposition to dairy practices might compromise the permission to conduct activities in the dairy industry (aka social license to operate) which could have major financial implications for the dairy industry (HAMPTON et al., 2020). Public discontent regarding current management practices in the dairy industry in Brazil (CARDOSO et al., 2017) indicates the necessity of improvements. Participants reported seeing consumers as agents of change in animal production. Considering public concerns is an important path to achieving sustainable solutions for the issues of the dairy industry (BOLTON & VON KEYSERLINGK, 2021).

5.6 CONSIDERATIONS

The knowledge and attitudes of the professionals involved in the dairy chain revealed they are not well prepared to effectively assist dairy farmers in changing the male calf scenario in dairy farms. Male dairy calves are considered a low-value or waste product to the dairy industry, which affects dairy farmers' decisions regarding those animals. An example is participants' reports of inferior quality of care given to male calves compared with heifers and the frequent decision to cull male calves immediately after birth, practices that are currently under public criticism. Although participants acknowledged the consumer's increased concerns related to animal welfare as a legitim demand, just a few participants believed the growing supply of alternative products or substitutes for cow's milk made from plant-based and the growing vegetarian and vegan population may affect the dairy industry in the coming years.

Participants reported that most Brazilian dairy farmers donate male calves after birth. However, donation alone does not represent a solution and it is known that more dairy farmers kill the male calves after birth, indicating that professionals are overlooking the current scenario of dairy farms in Brazil. We see evidence of failure to face and recognize the problem and consequently to effectively address the issue of male dairy calves. Therefore, culling male dairy calves after birth was pointed out by the participants as an ethically unacceptable alternative and inappropriate for animal welfare to solve the issue of the male calf issue. Participants recognized the complexity of the issue of the fate of male dairy calves and believed that more than one management practice must be combined to efficiently address the current scenario. The use of sexed semen to reduce

the number of unwanted male calves, rearing male dairy calves for beef, using cross-bred and dual-purpose breeds to enhance the value of calves were mentioned as an acceptable solution by participants. However, it is essential before implementing those practices to guarantee the health and welfare of male calves from birth, promoting high standards of care until the final destination. Professionals involved in the dairy chain have a fundamental role in educating dairy farmers by the use of guidelines and protocols for the care and handling of calves in dairy farms, during transportation, and when allocated to rearing facilities to be raised for meat. These issues, however, were not raised by participants, suggesting a lack of experience with the practical aspects of the alternative they suggested.

Therefore, the absence of discussions on controversial topics within the dairy industry, such as the culling of male calves in dairy farms highlights the necessity for advancing animal welfare debates in the dairy chain as an important starting point with the aim to reach professionals and improve their attitudes regarding the current practices. To change this scenario, it would be important to offer opportunities for continuous education, specialization, and training programs to professionals currently in the field, to provide updates on issues emerging from recent discussions related to the fate of male dairy calves or other controversial topics in the dairy industry.

6 CONCLUSIONS

Our findings suggest that professionals involved in the dairy chain are not well prepared to effectively support dairy farmers in changing the male calf scenario in dairy farms. Yet, consumers are increasingly concerned with the welfare of animals and with environmental issues. For this reason, participants have the perception of the urgency of changing the current management practices because regardless of consumers' decisions related to consumption habits (to eat or not to eat animal products), it is essential for consumers that male dairy calves can have a natural living. The failure to ensure male calves have a purposeful life, such as contributing to beef production, may cause a negative impact on the sustainability of the dairy supply chain in the coming years. Therefore, professionals involved in the dairy chain have a fundamental role in looking for alternatives and supporting dairy farmers. We observed a need for more in-depth knowledge and open debates on the issues related to the fate of male dairy calves among professionals, facilitating the creation of public policies to develop viable practices to be

used in dairy farms, also the development of guidelines and protocols to improve the care and handling of the male dairy calves from birth, during transport until their final destination.

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8 APPENDIX A – Online questionnaire

Prezado(a) participante:

Esse questionário faz parte de uma pesquisa de mestrado da Universidade Federal de Santa Catarina que tem como intuito investigar a visão de profissionais da cadeia do leite sobre questões relacionada aos bezerros machos nas propriedades leiteiras do Brasil. A sua participação é totalmente anônima e voluntária. Seus dados são confidenciais e não serão revelados. Você pode desistir de participar da pesquisa a qualquer momento se fechar o questionário antes de enviá-lo.

1. A sua participação é muito importante para nós. Você concorda em participar dessa pesquisa?

   ( ) sim

Favor responder as questões abaixo com seus dados pessoais

2. Sexo
   ( ) feminino ( ) masculino

3. Faixa etária
   ( ) 18 a 25 anos
   ( ) 26 a 35 anos
   ( ) 36 a 45 anos
   ( ) 46 a 55 anos
   ( ) 56 a 65 anos
   ( ) acima de 66 anos

4. Formação Acadêmica.
   ( ) Ensino técnico - Agrícola
   ( ) Ensino técnico - outro
   ( ) Ensino superior - Medicina Veterinária
   ( ) Ensino superior - Engenharia Agronômica
   ( ) Ensino superior - Zootecnia
   ( ) Ensino superior - outro curso na área de Ciências Agrárias
   Outro: _____

5. Pós-graduação
   ( ) sim
   não

   Se você respondeu sim, em qual área?

   _____

6. Região do Brasil onde trabalha atualmente

( ) Centro-oeste
( ) Sudeste
( ) Sul
( ) Nordeste
( ) Norte

7. Tempo que atua na atividade leiteira
( ) 0 a 5 anos
( ) 6 a 10 anos
( ) 11 a 15 anos
( ) 16 ou mais

8. Assinale a opção que melhor caracteriza a sua atividade atual
( ) Técnico de campo
( ) Pesquisador
( ) Professor
( ) Representante comercial
( ) Extensionista
( ) Cargo gerencial
( ) Estudante
( ) Produtor
Outro: _____

9. Onde atua
( ) Universidade
( ) Empresa privada
( ) Empresa pública
( ) Autonomo
( ) Cooperativa
( ) Laticinio
Outro: _____

10. Na sua atividade você tem interação com produtores de leite? (*Marque todas que se aplicam*)

[ ] Sim
[ ] Não
[ ] Somente esporadicamente Somente de forma indireta

Assinale a alternativa que melhor expresse a sua percepção sobre a predominância das práticas em relação ao manejo do bezerro macho nas propriedades leiteiras do Brasil

11. Criação do bezerro macho na propriedade para produção de carne
( )Todas as propriedades fazem É muito comum
( )Alguns poucos fazem
( )É muito raro
( )Nenhuma propriedade faz

12. Criação do bezerro macho na propriedade para venda como tourinhos

( )Todas as propriedades fazem É muito comum
( )Alguns poucos fazem
( )É muito raro
( )Nenhuma propriedade faz

13. Doação do bezerro macho nos primeiros dias de vida
( )Todas as propriedades fazem É muito comum
( )Alguns poucos fazem
( )É muito raro
( )Nenhuma propriedade faz

14. Venda do bezerro macho nos primeiros dias de vida
( )Todas as propriedades fazem É muito comum
( )Alguns poucos fazem
( )É muito raro
( )Nenhuma propriedade faz

15. Descate do bezerro macho logo após o nascimento, realizado na propriedade
( )Todas as propriedades fazem É muito comum
( )Alguns poucos fazem
( )É muito raro
( )Nenhuma propriedade faz

16. Cruzamento com raças de corte
( )Todas as propriedades fazem É muito comum
( )Alguns poucos fazem
( )É muito raro
( )Nenhuma propriedade faz

17. Uso de raças de dupla aptidão
( )Todas as propriedades fazem É muito comum
( )Alguns poucos fazem
( )É muito raro
( )Nenhuma propriedade faz

18. Qual é a forma mais comum de realizar o descarte do bezerro macho nas propriedades leiteiras? (*Marque todas que se aplicam*)
[ ]Concussão sem anestesia
[ ]Concussão com anestesia
[ ] Não sei
Outro: _____

Nas propriedades que vendem ou doam os bezerros, selecione as opções de como são cuidados do bezerro macho em relação a bezerras fêmeas (pode escolher mais de uma opção):

[ ] Mesma quantidade de leite
[ ] Menor quantidade de leite
[ ] Mesmo alojamento
[ ] Outro alojamento
[ ] Mesma quantidade e qualidade de colostro fornecida
[ ] Menor quantidade e qualidade de colostro fornecida
[ ] Mesmo procedimento da cura do umbigo
[ ] Outro tipo de procedimento da cura do umbigo
Outro: _____

Nas propriedades leiteiras, a gestação de um bezerro é necessária para a produção de leite nas vacas. Enquanto a bezerra fêmea tem o potencial de aumentar ou repor animais no rebanho, o bezerro macho não tem utilidade para a maioria dos produtores de leite. Existe algumas opções em relação ao manejo do bezerro macho e gostaríamos de saber sua opinião sobre uma delas. Na próxima sessão há diferentes tipos de questionários abordando essas opções de manejo. Por favor, escolha uma das alternativas para ser redirecionado aleatoriamente a uma das opções.

( ) ax7yer
( ) gssf7jj
( ) kdbsf7

DESCARTE DO BEZERRO MACHO / USO DO SÊMEN SEXADO / CRIAÇÃO DO BEZERRO LEITEIRO MACHO PARA PRODUÇÃO DE CARNE

Indique a sua opinião sobre as perguntas abaixo, sendo:
1- Discordo Totalmente
2- Discordo
3- Não sei
4- Concordo
5- Concordo Totalmente

1. A (alternativa aleatoriamente selecionada pelo participante) é uma alternativa prática para pequenos e médios produtor de leite solucionarem a questão do bezerro macho

   Discordo Totalmente 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Concordo Totalmente

2. A (alternativa aleatoriamente selecionada pelo participante) é uma alternativa prática para grandes produtores de leite solucionarem a questão do bezerro macho

3. A (alternativa aleatoriamente selecionada pelo participante) é uma alternativa economicamente viável para pequenos e médios produtores de leite solucionarem a questão do bezerro macho

   Discordo Totalmente 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Concordo Totalmente

4. A (alternativa aleatoriamente selecionada pelo participante) é uma alternativa economicamente viável para os grandes produtores de leite solucionarem a questão do bezerro macho

   Discordo Totalmente 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Concordo Totalmente

5. Os produtores de leite têm interesse nessa alternativa (alternativa aleatoriamente selecionada pelo participante)

   Discordo Totalmente 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Concordo Totalmente

6. Do ponto de vista ético, a (alternativa aleatoriamente selecionada pelo participante) é uma alternativa aceitável

   Discordo Totalmente 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Concordo Totalmente

7. Do ponto de vista técnico, (alternativa aleatoriamente selecionada pelo participante) é uma alternativa viável

   Discordo Totalmente 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Concordo Totalmente

8. Existe suficiente conhecimento técnico disponível para dar assistência aos produtores sobre essa alternativa (alternativa aleatoriamente selecionada pelo participante)

   Discordo Totalmente 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Concordo Totalmente

9. A (alternativa aleatoriamente selecionada pelo participante) é uma alternativa discutida entre os profissionais da cadeia leite

   Discordo Totalmente 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Concordo Totalmente

10. Do ponto de vista ambiental, (alternativa aleatoriamente selecionada pelo participante) é uma alternativa adequada para solucionar a questão do bezerro macho

    Discordo Totalmente 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Concordo Totalmente

11. Do ponto de vista do bem-estar animal, (alternativa aleatoriamente selecionada pelo participante) é uma alternativa adequada para solucionar a questão do bezerro macho

    Discordo Totalmente 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Concordo Totalmente

12. Qual é a sua opinião sobre os principais problemas ou limitações da (alternativa aleatoriamente selecionada pelo participante) como alternativa para solucionar a questão do bezerro macho? *Pergunta aberta*

13. Avalie as opções para solucionar a questão do bezerro macho

1. Criar o bezerro macho leiteiro para produção de carne
   ótima ( ) aceitável ( ) inaceitável ( )
2. Uso de sêmen sexado para reduzir o nascimento de machos
   ótima ( ) aceitável ( ) inaceitável ( )
3. Descartar o bezerro macho logo após o nascimento
   ótima ( ) aceitável ( ) inaceitável ( )
4. Fazer cruzamento com raças de corte
   ótima ( ) aceitável ( ) inaceitável ( )
5. Usar raças de dupla aptidão
   ótima ( ) aceitável ( ) inaceitável ( )

14. Considerando que várias opções podem ser utilizadas, o que você recomendaria como alternativa ideal para manejar a questão do bezerro macho na produção leiteira? *Pergunta aberta*

A PRODUÇÃO DE LEITE EM 2030

Indique a sua opinião a respeito do potencial impacto dos seguintes fatores na sustentabilidade da cadeia de produção leiteira nos próximos anos

1. Produção de leite artificialmente em laboratório
   Pouco potencial 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Muito potencial

2. Oferta de produtos alternativos ou substitutos do leite de vaca de base vegetal
   Pouco potencial 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Muito potencial

3. Aumento da população vegetariana ou vegana
   Pouco potencial 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Muito potencial

4. Mudanças nas legislações ambientais e maior fiscalização
   Pouco potencial 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Muito potencial

5. Mudanças nas legislações visando melhorar o bem-estar animal
   Pouco potencial 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Muito potencial

6. Mudanças nas legislações limitando o uso de antibióticos na produção de alimentos
   Pouco potencial 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Muito potencial

7. Maior exigência dos consumidores em relação a questões ambientais
   Pouco potencial 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Muito potencial

8. Preocupação com zoonoses
   Pouco potencial 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Muito potencial

9. Maior exigência dos consumidores em relação ao bem-estar animal
   Pouco potencial 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Muito potencial

Por favor, comente sobre a sua opinião a respeito deste último tema (a preocupação dos consumidores) *Pergunta aberta*

BEM-ESTAR ANIMAL

1. Capacidade de um bezerro sentir dor
   Nenhuma capacidade 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Total capacidade

2. Capacidade de um bezerro sentir medo
   Nenhuma capacidade 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Total capacidade

3. Capacidade de um bezerro sentir alegria
   Nenhuma capacidade 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Total capacidade

4. Capacidade de um bezerro ficar entediado
   Nenhuma capacidade 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Total capacidade

5. Bezerros devem ser livres de fome e sede
   Nada importante 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Extremamente importante

6. Bezerros devem ser livres de dor, ferimentos e doença, pela prevenção ou diagnóstico e tratamento imediato
   Nada importante 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Extremamente importante

7. Bezerros devem ser livres de desconforto, fornecendo um ambiente apropriado, incluindo abrigo e uma área confortável para descanso
   Nada importante 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Extremamente importante

8. Bezerros devem ser livres de medo e estresse
   Nada importante 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Extremamente importante

9. Bezerros devem ser livres para expressar comportamentos naturais
   Nada importante 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) Extremamente importante

Na sua opinião, liste os elementos mais importantes para promover o bem-estar animal e um rebanho leiteiro. *Pergunta Aberta*

Obrigada por participar da nossa pesquisa. No espaço abaixo fique a vontade para deixa qualquer comentário ou sugestão que gostaria de trazer sobre a questão do bezerro leiteiro macho. *Pergunta Aberta*