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Exploring industry perspectives and preferences about calf handling and restraint methods used during spring processing of calves in western Canada

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ABSTRACT

Calf processing events have important animal health, management, and sociocultural roles in the beef cattle industry. In western Canada, the three most commonly used methods for spring processing are roping and wrestling (RW), roping and Nord fork (NF), and tilt table (TT). The objective of this study was to understand the preferences and perceptions of handling event participants about calf handling and restraint methods commonly used during western Canadian beef calf processing events during the spring season. Data were collected using a mixed-methods online questionnaire. Quantitative analysis was used to describe the study participants and determine preference rankings. Qualitative, thematic analysis was used to explore participants' perceptions about the common handling and restraint methods and to identify values within and across participants. The majority of participants were farm hands or staff members (92.8%), followed by owners (4.9%), family members (1.4%), friends (0.5%), and others (0.4%). The most preferred method to use was RW, and TT was the least preferred (χ^2 = 3239.1, df = 6, $p < 0.001$). Participants shared values regarding calf safety and stress, processing efficiency, convenience, human safety, and labor intensity when explaining their preference to use calf handling and restraint methods for spring processing. Responses highlighted the need for understanding and skill in low stress handling and processing tasks in order for any of the methods to be effective. These values identify aspects to address when developing best practice recommendations for calf handling and restraint. Furthermore, focusing communication through the lens of these shared values will likely positively engage participants in extension efforts and community discussions.

Lay Summary

Extensive beef production often relies on handling and restraint of calves at a few months old for applying a common set of processes for health and management purposes. Often called "spring processing" this can include such things as administration of vaccines, identification, and castration. In western Canada the 3 common methods to handle calves for spring processing are roping and wrestling (RW), roping and Nord fork (NF), and tilt tables (TT). Most people that participate in these events prefer RW, however, all participants shared values of limiting calf stress, optimizing processing efficiency and convenience, ensuring human and calf safety, and minimizing labor intensity. Notably, participants highlighted that despite preferences to use certain methods each method requires skill and understanding of low stress handling principles and the processing tasks to be humane and effective.

Key words: beef cattle, mixed methods, perceptions, processing, values

INTRODUCTION

Spring calf processing events, commonly known as "brandings" in North America, are important sociocultural events for people within the ranching community (Bird Rondeau et al., 2013), with family, friends, and neighbors often coming together for these events annually. During this event beef calves approximately 6 to 12 wk of age are handled and restrained for various management procedures (González et al., 2010; Chamorro et al., 2016). The method used to handle and restrain calves varies across operations (Moggy et al., 2017a; Schachtschneider et al., 2019). In a survey of western Canada, the most common methods reported were roping and wrestling (RW), roping and Nord fork (NF), and tilt table (TT), (Moggy et al., 2017a).

The RW and NF methods incorporate a rider on a horse using a rope to catch the calves and bring them to either humans or a metal device for restraint and processing, respectively. The TT method is a more mechanical innovation, aimed at reducing human labor requirements, where calves must be moved into small squeeze chute that restrains the calf from movement and then rotates 90° to a lateral position to allow for access for processing procedures. The duration of calf exposure to the handling and restraint associated for all methods is often 1 to 2 min, however, there has been little investigation if the experience of calves or humans differs between methods. The two studies that have assessed animal-based indicators of these handling methods provide alternative insights. One study highlighted potential for acute discomfort associated with roping (Arkangel, 2023) and the other concluded there was less stress associated with methods involving roping vs. TT based on physiological and behavioral indicators (Schachtschneider et al., 2019). In the study

by Schachtschneider et al. (2019) it was mentioned that the handlers noted the efficacy of the roping method due to calmer behavior from calves. Industry publications have discussed the potential merits of TT methods for reducing human labor (Winters, 2007), yet research highlights the importance of culture in use of methods involving roping in North America (Bassi et al., 2019a, b). In a recent study of public perspectives of RW, NF, and TT methods 71% preferred the TT method and, regardless of method, the quality of the calf's experience, perception of handler actions and pragmatic needs for a good life for the calf influenced how people evaluated their preference (Goldhawk et al., 2024). The diversity of indicators from humans and animals involved in different calf handling methods highlights the complexity of understanding associated stressors and best practices for human and animal welfare.

Currently in Canada there exists the Code of Practice for the Care and Handling of Beef Cattle, which is a national science-based guideline developed by industry stakeholders through the National Farm Animal Care Council (National Farm Animal Care Council, 2013). It aims to inform people in the Canadian beef industry about desired animal welfare outcomes and science-informed best practices, such as those pertaining to husbandry procedures carried out during spring calf processing events (e.g., castration and branding) (National Farm Animal Care Council, 2013). While the beef Codes focus on humane animal handling principles and proper use of equipment such as electric prods, there is an absence of recommendations regarding the handling and restraint methods involved during calf processing. This lack of information on welfare outcomes or considerations with handling and restraint methods is also present within the scientific literature, which is the basis for the Code development.

Qualitative research methods are increasingly used in the veterinary and agricultural fields to gain rich understandings of people's perceptions, preferences, and values (Sonoda et al., 2018; Biesheuvel et al., 2021; American Psychological Association, 2022a, b, c). Qualitative research in livestock industries that engaged populations such as those working directly with the animals, the public, veterinarians, and students has provided insights into topics such as disease prevention, animal welfare, uptake of best practice recommendations, and decision making processes (Podberscek, 2000; Serpell, 2005; Valeeva et al., 2007; Jansen et al., 2009; Brennan and Christley, 2013; Ruston et al., 2016; O'Kane et al., 2017; Sonoda et al., 2018; Tamioso et al., 2018; Biesheuvel et al., 2021; Doidge et al., 2021; Smid et al., 2021; Ventura et al., 2021; Ferree et al., 2022; Skjølstrup et al., 2022; Sullivan et al., 2022). Knowledge of perceptions, preferences, and values of those participating in livestock production can provide context for the development and implementation of pragmatic recommendations, as well as informing education efforts and bridging communications among industry stakeholders (Spooner et al., 2012, 2014; Moggy et al., 2017b; Biesheuvel et al., 2021; Ventura et al., 2021). Goldhawk et al. (2024) have provided insights on these factors in relation to calf handling methods from the general public across Canada, however, understanding these factors from individuals experienced with production practices is essential in ensuring sustainable production practices (Bracke et al., 2005).

Therefore, the objective of this study was to understand and describe the preferences and perceptions of how people who participate in processing events perceive RW, NF, and TT handling and restraint methods used for pre-weaned beef calves on western Canadian cow-calf operations.

MATERIALS AND METHODS

Inclusion Criteria

Adults who participated in at least one calf processing event in western Canada (i.e., British Columbia, Alberta, Manitoba, or Saskatchewan) within the last 5 yr were eligible for inclusion in this study. The 5-yr window of time was selected to accommodate for release of the survey during COVID-restrictions, which may have affected individuals' ability to participate in processing events within shorter timeframes.

Positionality Statement

The initial idea and design for this study was provided by the authors CG and EP, experts in animal behavior and welfare. Input was then provided by all authors of this study, who all work in the field of veterinary medical science or animal welfare. The original questionnaire was developed by CG and modified by LA. All authors as well as the staff of W.A. Ranches at the University of Calgary provided input integral to the development of the final questionnaire. Data collection was supervised by CW and EP, and thematic analysis was conducted primarily by LA with input from CA, CW, and EP. Finally, all authors read and contributed to the writing of this manuscript. The lead author, LA, is an Asian-American international graduate student who was conducting research about production animal welfare and behavior at a Canadian public university. As a graduate student, she has observed and helped with calf processing events over 2 yr in central Alberta during COVID restrictions. Though these experiences were limited in number, each one of these opportunities provided her with a deeper insight into western Canadian processing events and undoubtedly contributed to the lens through which the data of this study was interpreted. Lastly, although she has a background in production animal science and animal care, much of her knowledge comes from veterinary clinics, research laboratories, university lectures, and published literature, which may differ from the on-farm knowledge of many of the participants in this research.

Ethical Considerations

This study was approved by and conducted in accordance with guidelines set by the Conjoint Faculties Research Ethics Board of the University of Calgary (REB21-1809). Informed consent was obtained from each participant before their participation in the survey. Before obtaining consent, potential participants were provided with information about the purpose of this study, inclusion criteria, what was expected from the participant, what type of personal information would be collected, benefits of participating, what would happen to the information provided, and what it meant to consent to participating in this study (available in Supplementary Materials). This included provision of the author's contact information and encouragement to contact the author for any clarifying questions regarding the provided information. Additionally, the first question of the survey asked potential participants to confirm that they 1) had experience participating at a calf processing event (i.e., spring processing, processing, or branding) in western Canada within the last

5 yr and 2) consented to participating in the survey study. Those who answered to "Yes" to both questions were then directed to the questionnaire, while those who answered "No" were then thanked for their time and the questionnaire was terminated. Participants were free to choose not to answer any questions throughout the questionnaire.

Upon completion of the questionnaire, participants had the choice to provide their name and email address to be entered for a chance to win one of ten $50 gift cards. During data analysis, all personal identifying information was removed, and participants were assigned random, computer-generated numbers to ensure anonymity. Further, all data collected for this study was made accessible only to the researchers directly involved in this study to maintain confidentiality of the data.

Data Collection

The questionnaire was developed in Qualtrics (Version 2022; Qualtrics, Provo, UT) and initially reviewed by four experts in beef calf processing and qualitative research (e.g., professors in veterinary clinical communications and animal behavior and welfare). Then, a pilot study of the questionnaire was conducted with ranch staff of W.A. Ranches at the University of Calgary prior to distribution to evaluate the quality of questions asked, possible points of confusion, and overall design.

The finalized questionnaire (Supplementary Materials) took approximately 30 min to complete. It used a mixed-method approach to collect both quantitative and qualitative data from participants. The questionnaire was made available online, and responses were collected over a period of 3 mo (i.e., April to July). A recruitment letter including the QR code and link to the questionnaire was distributed through newsletters sent out by provincial beef associations (e.g., Alberta Beef Producers, Saskatchewan Cattlemen's Association, Manitoba Beef Producers, and British Columbia Cattlemen's Association) and other associations (i.e., Alberta Farm Animal Care Association, Canadian Cattlemen's Association, and Western Canadian Association of Bovine Practitioners). Additionally, the QR code and link to the questionnaire were posted on social media (i.e., Twitter).

Data Analysis

All responses were collected through Qualtrics and then imported to Microsoft Excel (Version 16.62; Microsoft Corporation. Dubai, UAE). Responses were only analyzed if respondents completed questions addressing participants' preferences and perceptions regarding different processing handling and restraint methods (Questions 29 through 40, Supplementary Materials). Incomplete surveys (i.e., those that did not have questions 29 through 40 completed) were removed from analysis. All data was manually reviewed to the best of the author's ability to verify authenticity of respondents by examining provided email addresses and searching for similar phrasing across responses.

Quantitative data.
All quantitative data were statistically analyzed using a combination of Microsoft Excel and R Studio: Integrated Development for R (Version 1.3.1093; RStudio, PBC. Massachusetts, USA).

Participants were subcategorized into the respondent types of either "owner" or "non-owner" based on their self-identified role. Percentages of participants for each demographic category were then calculated within each respondent type. Percentages of participants who noted that their main source of income does or does not come from cow-calf operations, as well as percentage of participants who noted they had experience with a particular task performed during processing, were calculated for all participant responses combined as well as within each respondent type. Data regarding the number of calves processed per processing day, number of days spent processing calves, and number of people participating in processing events each day were analyzed based on only owner responses.

The distribution of rankings for producer preference of handling and restraint method was analyzed using chi-squared tests.

Qualitative data.
Questions analyzed using qualitative research methods were those asking participants to explain why they identified a particular handling and restraint method as most or least preferred. Data were organized and analyzed in Microsoft Excel. Specifically, the data was analyzed using an iterative six-step thematic analysis as described by Braun and Clarke (2006, 2020). Familiarization with the data was achieved by reading through and organizing the responses according to what method they referred to and whether it was an explanation for a method being the most or least preferred. Following this, initial codes were assigned to parts of the data and organized in a separate spreadsheet, from which groupings of codes were created by combining codes of similar meaning. Resultant codes were used to develop initial themes, which were then reviewed and defined as final themes. Lastly, comparisons were made across final themes for each method to identify shared and divergent values of participants. All parts of the analysis from familiarization with the data to defining the themes were conducted using an iterative and reflexive approach guided by the research question itself as well as understanding of the different methods of handling and restraint included in this study. Additionally, during the development and definition of themes, findings from the study were presented to and discussed with experts in beef calf processing and qualitative research (CA, CW, and EP) to critically review and inform final themes such that they were reflective of the data.

RESULTS

A total of 999 responses were received. Of this, 853 responses were included in the study based on completion of questions addressing participants' preferences and perceptions regarding different calf handling and restraint methods used during processing. Respondents included operation owners (n = 42; 4.9%), farm hands or staff members (n = 792; 92.8%), family members (n = 12; 1.4%), friends (n = 4; 0.5%), and others (n = 3; 0.4%). The majority (97%) reported participating in all three handling methods. Other methods mentioned were human-only wrestling, head and heel roping, and using an alley for vaccination only, and these were reported by less than 1% of all respondents.

Demographics

Demographics of respondents are reported in Table 1. Among all respondents 96.8% (29 owners, 792 farm hands or staff members, 3 family members, 2 others) indicated that their main source of income came from cow-calf operations, while

Table 1. Demographics of participants (n = 853) in western Canadian processing events who identified as either owners (n = 42, 4.9%) or non-owners (n = 811, 95%) of a cow-calf operation

		Non-Owners		Owners	
		n	%	n	%
Province	BC	192	23.7	1	2.4
	AB	245	30.2	30	71.4
	SK	175	21.6	10	23.8
	MB	195	24	1	2.4
Age Group	<35	344	42.4	17	40.5
	36–50	401	49.4	16	38.1
	51–65	3	0.4	3	7.1
	65+	1	0.1	2	4.8
	Other	62	7.6	4	9.5
Gender	Male	735	91	22	47
	Female	14	2	17	45
	Other	0	0	0	0
	Prefer Not to Disclose	62	7	3	8
Education	Before High School	0	0	0	0
	High School	0	0.3	5	11.9
	University Degree	375	46.2	15	35.7
	Trade/Technical School	365	45	10	23.8
	Graduate/Professional Degree	6	0.7	6	14.3
	Prefer Not to Disclose	0	0	3	7.1

Table 2. Tasks typically performed during processing by respondents who identified as owners of cow-calf operations (n = 42), those who identified as non-owners (n = 811), and all respondents combined (n = 853) who responded to a questionnaire about processing events on western Canadian cow-calf operations

Task performed during processing	Owners Count (%)	Non-owners Count (%)	All respondents Count (%)
Castration	21 (50.0)	800 (98.9)	821 (96.4)
Roping	16 (38.1)	796 (98.3)	812 (95.3)
Wrestling	18 (42.9)	796 (98.3)	814 (95.5)
Working the tilt table	12 (28.6)	793 (97.9)	805 (94.5)
Vaccination	30 (71.4)	16 (2.1)	46 (5.4)
Administration of a pain reliever	24 (57.1)	9 (1.1)	33 (2.9)
Hormone implanting	18 (42.9)	7 (0.9)	25 (2.9)
Ear tagging	24 (57.1)	10 (1.2)	34 (4.0)
Dehorning	12 (28.6)	5 (0.6)	17 (2.0)
Hot iron branding	22 (52.4)	9 (1.1)	31 (3.6)
Freeze branding	0 (0.0)	0 (0.0)	0 (0.0)
Record keeping	0 (0.0)	0 (0.0)	0 (0.0)
Placing the Nord fork on the calf	11 (26.2)	5 (0.6)	16 (1.9)
Moving calves into ally that leads to tilt table	9 (21.4)	6 (0.7)	15 (1.8)
Other [a]	0 (0.0)	3 (0.4)	3 (0.4)

[a]Some noted that another task they typically performed during processing included administering amprolium and tattooing calves.

3.2% indicated that their main source of income did not come from cow-calf operations. All respondents were also asked what task(s) they typically perform in their role during processing (Table 2).

Respondents who identified as owners were asked additional questions about their operations. Percentage of commercial and purebred or seedstock cow-calf herds (average percentage ± SD), number of cattle by production group present during spring processing season (mean ± SD), and most common breed of calves (percentage (%)) have been summarized in Table 3. Owners also responded to additional questions specifically about processing (n = 41). It was reported that approximately 159 ± 18.6 calves were processed per processing day, an average of 2.8 ± 3.9 d were spent processing calves, and an average of 12.0 ± 8.5 people per day participated in a given processing event. Those who were reported to typically help process calves included family members, friends, neighbors, farm hands, and staff members (Table 4). The majority of owners noted that calves were 6 to 12 wk of age at the time of spring processing, and most calves were processed in May and June (Table 4).

Preference and Acceptability of Handling and Restraint Method Used During Calf Processing

Among the three common handling and restraint methods used during calf processing, the most preferred method was RW, and the least preferred method was use of the TT (Figure 1; χ^2 = 3239.1, df = 6, $p < 0.001$). Overall, each method received greater than 50% of respondents ranking as somewhat or totally acceptable (Figure 1).

Perceptions of Common Calf Handling and Restraint Methods Used During Processing

Though respondents differed in their most or least preferred method of handling and restraining preweaned beef calves, respondents revealed points of similarity when communicating their reasoning for choosing a particular method as their most or least preferred. Major themes shared among all methods regarding why a method was selected as most preferred included processing efficiency, convenience associated with the method, maintaining calf safety, and minimizing stress. Major themes shared among all methods regarding why a method was chosen as least preferred included concerns regarding calf safety, calf stress, human safety, and labor intensity.

A few respondents noted that some or all of the methods of handling and restraint have the potential to be equally effective in the context of processing given well-trained staff. For example, one respondent stated that, "*the key to success in any type of branding situation is ensuring that the people you have working for you understand how to the handle animal safely and in the most low-stress manner.*"

Roping and wrestling.

Many of the respondents who chose RW as their most preferred method referred to the perceived time-efficiency of processing using this method, which they thought made it especially useful for processing calves in large herds. Respondents also indicated this method was most preferable due to the associated convenience, noting the ease of

Table 3. Operation demographic information based on responses to a questionnaire by people who participated in western Canadian processing events and identified as owners of a cow-calf operation (n = 42, 4.9% of total survey respondents)

Operation demographic descriptors	Mean ± SD[a] or Counts (%)[b]
Percentage of cow-calf herd designated as commercial or purebred/seedstock (n = 40)[a]	
Commercial	91.2 ± 18.0
Purebred/Seedstock	8.8 ± 18.0
Number of cattle present on the operation during spring processing by production group (n = 39)[a]	
Nursing cows and heifers (i.e., those that calved during that year's calving season)	234.0 ± 168.0
Calves of processing age (i.e., those born during that year's calving season)	221.8 ± 164.2
Most common breed of calves on the operation (n = 42)[b]	
Angus	34 (81.0)
Charolais	1 (2.4)
Hereford	1 (2.4)
Limousin	0 (0.0)
Simmental	1 (2.4)
Commercial crossbred	0 (0.0)
Other[c]	5 (11.9)

[a]Percentages of cow-calf herd and the number of cattle types present on the operation are presented in means and standard deviations (SD).
[b]For most common breed of calves on the operation, participants could only choose one response. These values are presented in counts and percentages.
[c]Respondents identified the most common breed of calves on their operation as: Corriente; Speckle Park; Angus cross; or more than one most common breed (e.g., equal split between Angus, Charolais, and Gelbvieh; Angus and Simmental).

Table 4. Description of spring processing events based on responses to a questionnaire by people who participated in processing events on western Canadian that identified as owners of the cow-calf operation (n = 42, 4.9% of total survey respondents)

| Spring processing descriptors	Count (%)
Type of people who help process calves[a]	
Family members	36 (85.7)
Friends/neighbors	31 (73.8)
Farm hand/staff members	13 (31.0)
Other	0 (0.0)
Age of calves at time of spring processing	
Less than 6 wk	10 (23.8)
6–12 wk	28 (66.7)
12 or more weeks	4 (9.5)
Month(s) during which spring processing takes place[a]	
March	2 (4.8)
April	6 (14.3)
May	29 (69.0)
June	17 (40.5)
July	4 (9.5)
Other[b]	1 (2.4)

[a]Respondents could select all responses that applied to their operations for "Type of people who help process calves" and "Month(s) during which spring processing takes place" so the sum of percentages for these is greater than 100%.
[b]One respondent indicated that calves were processed during the month of November at their operation.

training new people to handle and restrain calves using this method and that it is both easier and faster for these people to carry out husbandry procedures due to the secure immobilization of the calf. Another common view was that RW was perceived to lead to decreased levels of stress experienced by calves throughout processing, as it is "*quicker*," associated with a "*quieter*," "*calmer atmosphere*," and there is not necessarily a need to separate cows and calves, thereby minimizing the stress associated with cow-calf separation. Lastly, some respondents noted this method was most preferable due to a perceived decreased risk of calf injury during processing. They reasoned that this method allows for better control and secure immobilization of calves, and that the ground on which calves are processed using this method (i.e., pasture) is more suitable for safely processing calves.

It should be noted that multiple respondents mentioned that this was their most preferred method specifically when working with a well-trained processing crew. This is demonstrated by one respondent who pointed out that, "*when you rope and wrestle with people that are efficient and knowledgeable at the jobs that they are doing, this is the smoothest, less stressful [method] on the livestock*."

In contrast, those who indicated RW as their least preferred method expressed concerns about increased levels of stress experienced by calves throughout processing, potential risks for calf, human, and horse injury, and difficulty finding help.

Those who noted concerns that RW may lead calves to having a more stressful experience specifically pointed out that this method, "*seems rough*." It was also perceived that calves may experience higher levels of stress during processing due to the method involving increased human handling of the calf. Potential risk of calf injury was also brought up as a concern about this method, as some respondents heard about or witnessed calf injuries due to dragging them. Respondents also highlighted a perceived increased risk of calf injuries and accidents due to inexperienced or irresponsible ropers or wrestlers, noting that "*the problem with this method is it takes a level of skill to do well and safely that many do not possess*." Respondents expressed concerns about potential risks for horse injury as well, as this method was perceived to be physically demanding for the working horses. Finally, those who identified RW as their least preferred method stated that a challenge associated with this method is the difficulty of finding help to effectively process calves. They highlighted that carrying out this method not only requires many horses and people, but also handlers that are highly skilled, and this was exhibited by one respondent, who noted that, "*You need very experienced ropers and wrestlers. If the ropers and wrestlers are inexperienced this can cause safety issues for the calves and handlers*."

Roping and Nord fork.
Respondents who indicated NF as their most preferred method to use perceived this method to be efficient, as a number of calves can be processed at a time by "*hav[ing] multiple stations going at once*." Further, respondents associated this method with an improved ability to carry out husbandry
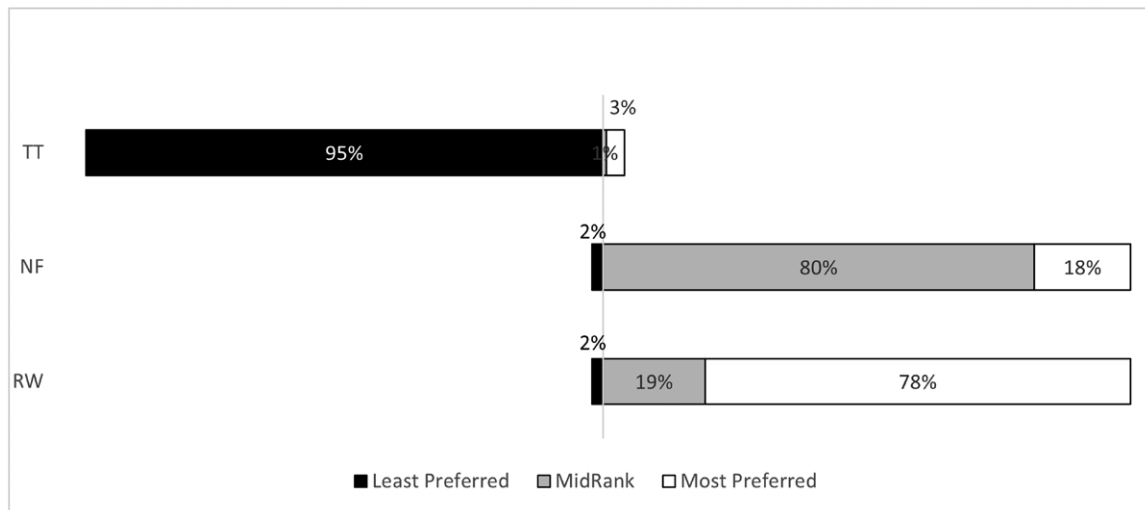
Figure 1. Ranking of preference to use handling and restraint methods (RW, roping and wresting; NF, roping and Nord Fork; TT, tilt table) by those who have participated in calf handling and restraint events for spring processing in western Canada within the last 5 yr (n = 853).

procedures such as dehorning and administering injectable vaccinations, conveying this method's perceived efficiency and convenience in the context of calf processing. Some reasoned that it is convenient because a fewer number of people are required for processing and there is "*no need to find or train wrestlers*" to restrain calves. Another reason provided by respondents in favor of this method was the perception that this method minimizes calf stress throughout the processing event, as this method was perceived to be associated with a short processing time, minimized separation of cow-calf pairs, and decreased human handling. Some respondents perceived this method to be safer for calves, as "*[they] are well restrained [so] it is easier to complete all tasks with less risk of injury to calves.*" It was also noted that there was a perceived decreased risk of calf injury during processing using this method because of the greater quality of handling overall due to workers being less tired given decreased labor required per individual calf. A similar labor theme was noted in that for some Nord forks were preferred due to the perception that it is safer for the human handlers and requires less physical exertion.

One respondent stated that honoring culture and tradition was the reason for this method being ranked as the most preferred among the three methods. This respondent explained that using roping and Nord fork to process calves, "*…is a culture and tradition of [their] family, and [they] believe it's what is less stress to the animal and helps the team when process[ing] to not be as tired at the end trying to wrestle calves.*"

Those who indicated NF as their least preferred method referenced a perceived risk of calf injury and increased level of stress experienced by the calf. Respondents noted that this may be caused by dragging or accidents involving misuse of the Nord fork, which can result in "*people having to run after the calf and wrestle it… [which] just causes more stress on the animal.*" Some respondents also perceived this method as having an increased risk of human injury due to accidents involving ropes. Others expressed concerns regarding horse safety, which one respondent expressed that, "*expecting [horses] to maintain tension on the rope for the duration of processing of every calf is much more work.*" Additionally,

the Nord fork itself was noted as a tripping hazard for both horses and humans. Some respondents noted that this was their least preferred method due to the difficulty finding help to effectively process calves using this method given that "*more people [and] more horses [are] needed.*" Some also perceived this method to be inefficient due to the insufficient security it provides for calf restraint, leading to difficulty carrying out husbandry procedures. It was also pointed out that the environment associated with this method is perceived to be disorganized, as "*most places process three or four calves at a time and drag paths are not always as predictable as multiple Nord fork setups would require them to be.*" Finally, there were some respondents who noted this method as their least preferred due to their lack of familiarity with the method.

Tilt table.

Respondents who indicated that the TT was their most preferred method to use for handling and restraint during processing referenced minimization of calf stress due to "*less human contact on the calf*" and a quiet processing environment. Respondents also noted a perceived decreased risk of calf injury during processing using this method because unlike other methods (i.e., RW and NF) which involve roping, calves handled and restrained using the TT are not "*overstretched or dragged by a horse which can injure it.*" Many respondents also associated the use of the TT for processing with increased human safety. One respondent highlighted this perceived decreased risk of accidents resulting in human injury, noting that with this method, there are, "*no horses or cows running around in your workspace. Less people [are] needed which leads to a more organized operation.*" Additionally, many respondents noted that they perceived this method to be a less physically intensive method of processing calves and pointed out the convenience of this method as it provides, "*good animal restraint [and] easy access to inject safely.*" Moreover, this method was viewed as convenient, because less labor is required per person, fewer numbers of people and horses are required, and no experienced wrestlers are needed to process calves. A few respondents preferred the perceived efficiency of processing, especially when processing large calves or when processing must occur over many days.

Finally, some respondents noted that they preferred use of TT because of the organized and "*more hygienic*" processing environment associated with this method.

One reason TT was least preferred was due to a perceived increased risk of calf injury, as calves can get injured, "*being pushed and banged through the chute*" and smaller calves are not completely immobilized, and therefore, "*have more room to move and [potentially] hurt themselves.*" It was also perceived by one respondent that the long duration of time spent processing using this method leads handlers to become increasingly tired throughout the day, leading to decreased quality of human handling, which may result in calves getting injured. Many also perceived that calves experience increased levels of stress using this method because calves, "*have to be completely separated from mothers for longer,*" are "*in the handling system/ally/pens for long periods of time,*" and are exposed to a loud processing environment. Additionally, many respondents reasoned that this was an inefficient method of handling and restraining calves, because processing calves using this method takes a longer duration of time as calves can only be processed one at a time. Further, some noted difficulty carrying out husbandry procedures using this method due to the insufficient head restraint, particularly prevalent with restraint for small calves. Some respondents also expressed that this was their least preferred method due to the associated human injury and labor intensity, as respondents reported shin injuries, injuries directly related to working the TT, and tiredness from long hours that can lead to increased risk of accidents resulting in human injury. This was exemplified by quotes from two respondents; one expressed, "*It's hell on people… Pushing calves up to an alley to go on a tilt table is an excellent opportunity to get kicked all day long,*" while the other noted that a high level of energy is required to, "*constantly tip calves over [when] most [tilt tables] are well used and are finger pinchers.*" Another concern for this method shared by respondents was the feasibility of structural implementation. Some respondents pointed out that "*to set up a system with a snake to a tilt table at every location is not feasible,*" conveying the challenge of building and incorporating such a system into an existing operation. Lastly, some respondents perceived this method to be associated with an unsanitary and unnatural processing environment because, "*calves are usually releasing themselves all over it,.*"

Shared values.

In this study, four values were identified as to being held by many respondents, regardless of which method was indicated as most or least preferable. These included: 1) minimizing calf injury and stress, 2) processing efficiency, 3) convenience, and 4) human safety and labor intensity. These values were consistently referred to when respondents were asked to explain why they preferred a particular method the most or least.

The value of minimizing calf injury and stress was upheld by a particular handling and restraint method if it was perceived by respondents to provide secure immobilization of calves, a quiet environment, minimization of cow-calf separation, short processing time, or decreased human handling. Respondents conveyed concern that this value would not be met by a method if it was perceived to be associated with an increased risk of injuries, risk of accidents, level of sound in the environment, or cow-calf separation.

The value of processing efficiency was upheld by a method if it was perceived to allow large herds or specific sizes of calves to be processed quickly, or handlers to carry out husbandry procedures more quickly and effectively. Respondents conveyed concern that this value would not be met by a method if it was perceived to be associated with a disorganized environment, insufficient security of restraint that could lead to difficulty carrying out husbandry procedures, or a system which requires calves to be processed one at a time.

A method upheld the value of convenience if it was perceived to require fewer numbers of people or to not require highly experienced or skilled ropers and wrestlers or horses to process calves. Additionally, this value was upheld by a method if it was perceived to be associated with easy training of new handlers or most practical based on the current set up of the operation. Respondents expressed concern that this value would not be supported if a method was associated with difficulty finding help (i.e., large numbers of people, highly experienced or skilled ropers, and horses) or logistical issues related to structural implementation.

Human safety and limitation of labor intensity were supported by methods if they were perceived to be associated with less physical exertion to process calves or decreased risk of accidents resulting in human injury. Respondents shared the concern that this value would not be met if the method was perceived to be physically demanding or associated with an increased risk of accidents, disorganized environment and/or equipment, or tiredness resulting from long hours, all of which may result in human injury.

DISCUSSION

The goal of this study was to understand and describe the preferences and perceptions of participants in western Canadian beef calf processing events regarding common calf handling and restraint methods. To the authors' knowledge, this is the first study of its kind to explore how participants in western Canadian beef calf processing events perceive the use of RW, NF, and TT in the context of calf processing.

Overall, there was a clear difference in preference to use common handling and restraint methods, with RW being reported as the most preferred to use and TT being the least preferred. This contrasts with results from a sample of the Canadian public, where 71% selected TT as their most preferred method (Goldhawk et al., 2024). Despite different preferred methods, reasoning for the selection from both participants in processing events in the current study and the public population in Goldhawk et al. (2024) focused on the general themes of calf experience, human handlers, and pragmatic requirements of production. There was much common ground in the underlying values of both the participants in these events and the public and the majority ranked them as acceptable methods. Identifying shared values among people is important, because values drive decision-making and informs connection points amongst industry stakeholders for effective communication (Weary et al., 2016; Sonoda et al., 2018; Biesheuvel et al., 2021; Kuczewski et al., 2022).

In the current survey, three of the main values identified (i.e., calf injury and stress, processing efficiency, and convenience) were consistently referenced across all methods as to why a particular method was the most or least preferred. This indicates that how a particular method was perceived to honor these values impacted whether a method was viewed as

favorable or unfavorable. When explaining why a method was their least preferred, however, the value of human safety and minimizing labor intensity was common across all methods. Human safety and labor intensity have both been previously identified to be important considerations for people who work with cattle (Lindahl et al., 2013; Menger et al., 2016; Ceballos et al., 2018). This suggests that handling and restraint methods perceived to fail to uphold values of human safety and labor intensity will likely be viewed negatively by participants in western Canadian beef calf processing events.

The consistent emphasis of human and animal welfare when evaluating methods for calf handling and restraint highlights the importance of these concepts in the community of processing participants, regardless of what method is preferred for use. Preference to use RW/NF methods over TT indicates the positive perception of these methods in context of presence of benefits relative to shared values. For example, many cited animal welfare benefits of lower cow-calf separation time and more humane animal restraint with RW/NF. Fewer respondents preferring TT suggests potentially negative perception of this method in the community surveyed, citing aspects such as prolonged cow-calf separation, inefficient restraint, and challenges for handlers. The emphasis on human welfare issues of exhaustion and injury with TT has been reflected in recent modifications to TT methods introduced to the market such has hydraulic tables that reduce the need for repeated physical effort. However, the current study is limited in that there was no assessment of the type of experience participants had with each method. Past affective states in relation to the memory of a task or event influences individual's perception of that task (Meagher, 2009; Skowronski et al., 2014). Absence of assessment of the quantity or emotional quality of respondents' experience with each method limits ability to interpret participants responses in the context of biasing based on previous experience. Future studies utilizing interview-based techniques would be able to discern the role of experience on perception and preference for calf handling methods.

Interesting to note was the absence of direct mention of economic cost when respondents provided explanations for why a method was indicated as most preferred. This is consistent with a previous survey study that revealed that finance was not a primary motivator among cow-calf producers (Jumper et al., 2021). It is also in line with evidence from qualitative works in other livestock industries (i.e., dairy and sheep) highlighting that economic factors are not the only influencers of on-farm decisions (Jansen et al., 2009; Biesheuvel et al., 2021; Doidge et al., 2021). Some respondents did note concerns related to implementing the systems necessary to carry out methods such as the TT, which has some economic implications. Additionally, economic factors may have been indirectly considered when participants mentioned the requirement for specific resources, such as skilled handlers, process efficiency, and infrastructure requirements. However, the general lack of direct mention of economic cost suggests that though it may have a limiting effect, economic cost is not a primary factor when assessing preference to use one of the three handling and restraint methods included in this study.

The vast majority of survey respondents identified as farm hands or staff members, and a majority identified as male. Responses from operation owners, however, indicated that the majority of people who come to help process calves are family members, friends, and neighbors. Historically, much of the western Canadian industry has consisted of family-run

ranches (Bird Rondeau et al., 2013), and this disconnect may possibly mean that how individuals self-identify (e.g., family member or staff member) may not be the same as what operation owners perceive them to be. Additionally, the majority of the survey respondents were < 55 yr old, while results from the 2021 Canadian Census of Agriculture indicate farming has a higher percentage of older people than the study population (Statistics Canada, 2023). This may indicate that respondents were not fully representative of the target population possibly due to survey distribution limitations.

A limitation of the study was that questions regarding humane handling education were asked prior to ranking, preferences, and questions regarding perspectives of animal welfare. The introduction of these questions may have primed participants and therefore biased themes of human or animal welfare, or inadvertently incited a social desirability bias in responses. Selection bias (Thrusfield, 2005) may have also been present due to the requirement for survey respondents to have access to an electronic device and internet connection to participate in this study. It is also possible that respondents may have misunderstood questions or response options within the questionnaire, leading to misinterpretation bias. However, to minimize this, the questionnaire was developed in conjunction with experts in the field and piloted with ranch staff from W.A. Ranches at the University of Calgary before data collection. Given that this is a survey study conducted by a public research university, there is also the further possibility of social desirability bias (Green and Thorogood, 2013) in which respondents may have provided responses that would be seen as socially acceptable but not necessarily true. To minimize this bias, all respondents were made aware that their responses would be anonymized to maintain confidentiality. Finally, it should be noted that responses were not received for all questions from all respondents, which means analysis could only be conducted on the responses provided for those questions.

Participants in events can provide expert insights into areas of focus for determining best practices. In alignment with the current recommendations for best practices in the Canadian beef Codes of Practice was the mention of the importance of understanding and skill in low stress handling and processing tasks for any of the three methods to be effective. Future research on calf handling and restraint methods should include assessment of reliable animal-based indicators of calf injury and stress, processing efficiency, convenience of processing, and human safety and labor intensity, as well as understanding and skill required for each method, and quality of human-animal interactions. These additional insights would support evidence-based decisions and recommendations. Further, while economics were not directly mentioned in reasoning for preferring to use a method, the importance of economics in operational decisions in the beef industry and consistency of mentioning of indirect economic considerations suggest that future studies should include the economic costs associated with the use of each method.

CONCLUSION

This research indicates that based on responses from participants in western Canadian beef calf spring processing events that while most ranked the methods as acceptable, RW was most preferred to use and TT was least preferred. Analysis of responses for why a method was identified as most or least preferred reveal that regardless of preference, many of the participants share the same

values (i.e., calf safety and minimizing stress, processing efficiency, convenience, and human safety and labor intensity) in the context of calf handling and restraint for spring processing. Findings of this study can be used to provide context for the development and implementation of pragmatic requirements and recommendations for handling and restraining beef calves during spring processing, as well as inform future communications and education efforts.

Supplementary Data

Supplementary data are available at *Translational Animal Science* online.

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Author Contributions

Lindsey Arkangel (Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing—original draft, Writing—review & editing), Claire Windeyer (Data curation, Formal analysis, Investigation, Methodology, Supervision, Writing—review & editing), Christy Goldhawk (Conceptualization, Investigation, Methodology, Writing—review & editing), Cindy Adams (Formal analysis, Investigation, Methodology, Supervision, Writing—review & editing), and Ed Pajor (Conceptualization, Funding acquisition, Investigation, Methodology, Resources, Supervision, Writing—review & editing)

Conflict of interest statement

The authors have no actual or potential conflict of interest to declare.

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