Attitudes of cattle veterinarians and animal scientists to pain and painful procedures in Brazil

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ARTICLE INFO

Keywords:
Analgesia
Animal welfare
Beef
Dairy
Pain
Questionnaire

ABSTRACT

Recent studies have shown that cattle practitioners are concerned about painful conditions and procedures. An understanding of the attitudes toward pain is fundamental to encourage the use of pain relief in cattle. The goal of this study was to investigate the factors that influence Brazilian professionals toward the use of pain mitigation in cattle, primarily during castration and horn removal (e.g. dehorning, disbudding). To reach this objective, an online survey was conducted with veterinarians and animal scientists. The analysis was based on descriptive statistics, chi-squares tests, Fisher exact tests, and Mann-Whitney U tests. The final sample was composed of 147 respondents. Results of descriptive statistics showed that the use of medicine before a painful procedure (i.e., anesthetic, anti-inflammatory, or sedative-analgesic), was higher for adult cattle than for suckled and newborn calves. In newborn calves, those respondents who were more likely to use pain relief agreed with the statements that i) there is missing information about pain control during castration and ii) defensive movements shown by an animal during or after a procedure to justify pain mitigation in horn removal. The primary reasons for choosing a medicine were similar for both procedures: cost, anti-inflammatory effect, analgesic potency, duration of analgesic effect, duration of sedative effect, and route of administration. There was no difference in professional’s decade of birth and pain mitigation use. These results may be useful to decide how to optimize the use of drugs by veterinary and animal science professions, and continuing education should help to increase pain mitigation usage.

1. Introduction

Animals are routinely subjected to painful procedures, such as castration in cattle, tail docking in piglets, and horn removal in calves (Weary et al., 2006). In animal species, although health concerns are prioritized over those of affective state (Sumner and von Keyserlingk, 2018), veterinarians have the responsibility to promote principles for pain control in animals under their care (Short, 1998; Hewson et al., 2007a; Viñuela-Fernández et al., 2007). The alleviation of pain is an important area of animal welfare research (Rutherford, 2002). Unfortunately, in farm animals, pain has been traditionally overlooked since it is assumed that they are less sensitive than pets (Raekallio et al., 2003; Huxley and Whay, 2006; Viñuela-Fernández et al., 2007), and it remains a serious concern for reasons of animal welfare and ethics.

Castration and horn removal in cattle, regardless of the technique used, generate a pain-inducing response; however, both procedures are often performed without drug administration (Stafford and Mellor, 2005a, 2005b; Theurer et al., 2012; Moggy et al., 2017). Studies detected that anesthesia, as well as the combination of analgesic and anti-inflammatory drugs, can attenuate serum cortisol concentration and, by inference, distress and pain during castration (Stafford et al., 2002; Coetzee, 2011, 2013). The distress caused by horn removal has two phases of cortisol response – an initial peak, occurring after ~30 min, and an inflammatory phase, after 5–6 h - that can be diminished with the administration of local anesthesia (Cooper et al., 1995; McMeekan...
et al., 1998; Mellor et al., 2002) and virtually abolished with local anesthesia and NSAID (McMeekan et al., 1998; Stilwell et al., 2012). The literature focusing on techniques that cause the least pain and the best pain relief to minimize pain-induced distress, in both procedures, are plentiful, but still unclear, as demonstrated by two recent meta-analyses (Canozzi et al., 2017, 2019).

Painful procedures are a public concern (Weary et al., 2006), and pain management is gaining attention and is becoming an important part of practice (Smith, 2013). Much of the research to date about the factors influencing professionals to use pain relief in cattle undergoing castration or horn removal has been performed in countries in North America (Hewson et al., 2007a, b; Misch et al., 2007; Coetzee et al., 2010; Sumner and von Keyserlingk, 2018), Oceania (Laven et al., 2009), and Europe (Raekallio et al., 2003; Whay and Huxley, 2005; Huxley and Whay, 2006; Thomsen et al., 2010).

Brazil is one of the leading in cattle production (USDA, 2019a). The original mid-point beef production is “Triângulo Mineiro” in the Minas Gerais State, and an expressive growth was observed in the north-eastern and midwestern regions (McManus et al., 2016); over 80% of the Brazilian animals correspond to the zebu breed, primarily Nelore, and the rest to taurine breeds (ABIEC, 2019). In milk production, the primary areas in Brazil are in the southern and southeastern regions (USDA, 2019b), with B. Taurus x B. indicus hybrid animals, mostly Holstein and Gir (Empresa Brasileira de Pesquisa Agropecuária (Embrapa) (2019)).

Data characterizing procedures in cattle in this country are scarce, but we can infer that the horn removal is restricted to dairy cattle and to taurine breeds, while the castration is more common and is primarily performed until one year of age and without pain mitigation use. Moreover, the information about why professionals use pain relief in castration and dehorning or disbudding in cattle is very rare, and previous studies have not focused on specific aspects of painful procedures in cattle (Hötzel and Sneddon, 2013; Lorena et al., 2013).

In the light of the preceding, our objective was to investigate the factors that influence Brazilian veterinarians and animal scientists toward the use of pain mitigation in cattle, primarily during castration and horn removal. An understanding of such factors might contribute to the development of policies to improve animal welfare standards since professionals have a direct role in animal welfare (Ventura et al., 2016; Sumner et al., 2018).

2. Material and methods

2.1. Survey protocol

A questionnaire was based on those previously used to investigate the pain perception and painful procedures in cattle (Huxley and Whay, 2006; Misch et al., 2007; Laven et al., 2009; Coetzee et al., 2010; Thomsen et al., 2010) and other species (Dohoo and Dohoo, 1996; Joubert, 2001; Hewson et al., 2007b; Lorena et al., 2013).

The questionnaire was designed by the first author using an online free survey program (Google Forms, California, USA). A draft survey was pre-tested with Brazilian graduate students in animal science who had an interest in cattle production (n = 10) and veterinarians and animal scientists (n = 10) who work in cattle management in Brazil to refine and clarify topics of ambiguity. Their comments resulted in minor changes.

Data were collected from July 2016 to July 2017. Reminders were sent during July, August, and September 2016 and during February 2017. An invitation letter sent with the questionnaire explained the purpose of the project, assured anonymity, highlighted that participation was voluntary and thanked them for their participation (Supplementary Material).

We used different methods to recruit participants. First, we used a convenience sampling method complemented by snowball sampling. Second, we contacted regional unions and asked them to distribute the questionnaire to their mailing list. The online survey was compatible with access via computer, tablet, or smartphone. The participants’ names did not appear on the questionnaire, and all the data were analyzed without identifying the respondents.

The methods used to recruit participants might have introduced a limitation in our research. Convenience and snowball sampling are non-probabilistic. This limitation is even more challenging because we do not have information about how many professionals were in the list of regional unions (this information is classified) and, by using snowball sampling, we could not record to how many respondents the survey was distributed to; thus, we were not able to estimate a response rate. Because of such limitations, our results must be viewed with care. We acknowledge that our results do not necessarily generalize to the whole population of Brazilian veterinarians and animal scientists.

2.2. Survey design

The sampling frame was cattle veterinarians’ and animal scientists’ practitioners (dairy and beef), from Brazil, who have practices where they perform painful procedures (i.e., castration and horn removal (dehorning or disbudding)). In Brazil, the animal scientist profession has been regulated since 1968 (Conselho Federal de Medicina Veterinária (CFMV), 1968), and the professionals work with farm animals, exploring aspects of genetics, nutrition, reproduction, growth, and development (Conselho Federal de Medicina Veterinária (CFMV), 2019a). Currently, there are 131,256 veterinarians and 8936 animal scientists registered in the Federal Veterinary Medical Council CFMV, Conselho Federal de Medicina Veterinária, the organization responsible for establishing professional policies and for regulating both professions in Brazil Conselho Federal de Medicina Veterinária (CFMV), 2019b).

Castration was defined as any action to remove, destroy or degenerate the testicles; dehorning as the removal of horns; and disbudding as the prevention of horn growths (Stafford and Mellor, 2005a, 2005b). Since the development of horns in some breeds occurs later than in others, and the different techniques (e.g., chemical, hot-iron, physical methods) are more related to animal age, it is not easy to set definite ages for each procedure (Stafford and Mellor, 2011). Also, Wikman et al. (2016) highlighted that the use of the terms “dehorning” and “disbudding” varies and can cause confusion. In this sense, our questionnaire did not differentiate between the procedures; therefore, throughout this manuscript, both procedures will be mentioned as synonyms (dehorn/disbud) or as “horn removal”.

The final survey consisted of 70 questions, applied to both professionals, and took approximately 30 min to complete. A complete copy of the survey is available on request from the corresponding author. Given the purpose of this manuscript, only part of the survey was analyzed, and we chose to present in Supplementary Material only the variables that were analyzed in this manuscript. See Table A in the Supplementary Material for variables and scales used in our analysis.

2.3. Statistical analysis

Online data were exported to Microsoft Excel and checked for completeness and errors. Of all survey responses, only five were excluded due to missing data, which was defined as respondents who began the survey but did not finish it. Therefore, answers from 147 professionals, for both procedures, were analyzed.

Statistical analyses were performed in two steps. First, we used descriptive statistics to characterize the sample and to describe the primary features of the use of pain mitigation before painful procedures. Second, we split respondents into groups: those who use pain mitigation before each painful procedure and those who do not. The use of pain mitigation (i.e., anesthetic, anti-inflammatory, or sedative-analgesic), was assessed by a binary variable (1 = yes; 2 = no). We assessed the use of pain mitigation before two painful procedures: castration and horn removal; and in three classes: newborn (until 2 months
or ≤70 kg), suckled (from 2 to 8 months or 71–200 kg), or adult (more than 8 months or > 200 kg). Veterinarians and animal scientists who did not castrate or dehorn/disbud any cattle were removed from the analysis.

To explore for potential differences between those who use pain mitigation before each painful procedure and those who do not use pain mitigation before each painful procedure, we used chi-square tests and Fischer exact tests to explore for potential differences between those who use pain mitigation before each painful procedure and those who do not use pain mitigation before each painful procedure, we used Mann-Whitney U tests when the variable was ordinal (i.e., perceptions about detection and treatment of pain, and average number of cattle castrated or dehorned/disbudded per year, and decade of birth). Statistical analyses were performed using the Stata program (version 14, StataCorp., College Station, TX, USA). Differences were considered significant at P < 0.10.

3. Results

3.1. Descriptive statistics

Descriptive statistics of all variables are presented in the Supplementary Material (Table A). Our sample was unbalanced in terms of gender, and most respondents were between 20–50 years of age. Most of professionals were from the southern (61.90 %) or southeastern (19.73 %) regions of Brazil. The percentage of respondents who use pain mitigation before castration and horn removal was higher for adult cattle than for suckled and newborn calves. The primary reasons for choosing a medicine before both procedures were similar: costs, anti-inflammatory effect, analgesic potency, duration of analgesic effect, duration of sedative effect, and route of administration.

3.2. Castration: differences between those who use pain mitigation and those who do not use pain mitigation before the procedure

We tested the relation between the use of pain mitigation before each painful procedure with the following variables: gender, whether respondents attended continuing education in animal welfare, and the reasons to choose a specific type of medicine. The results are presented in Table 1. The reasons “side effects”, “analgesic potency”, and “duration of sedation” were associated to the use of pain mitigation before castration of adult cattle. The reasons “anti-inflammatory effects”, “analgesic potency”, “duration of sedation”, and “route of administration” were associated to the use of pain mitigation before castration of suckled calves. The reasons “analgesic potency”, “duration of analgesic effects”, and “route of administration” were associated to the use of pain mitigation before castration of newborn calves.

We tested if practitioners who use pain mitigation before castration of cattle (i.e. newborn calves, suckled calves, adult cattle) would differ from those who do not use pain mitigation before castration regarding their perceptions of detection and treatment of pain, the average number of cattle castrated per year, and decade of birth. The results are presented in Table 2. Practitioners who agree more with the statement “Missing information about possible benefits of pain control in cattle” use pain mitigation before castration of newborn calves. Practitioners who agree more with the statement “Cattle recover better after surgery if they have received analgesics” use pain mitigation before castration of newborn and suckled calves. Practitioners who castrate more animals per year use pain mitigation before castration of newborn calves.

3.3. Horn removal: differences between those who use pain mitigation and those who do not use pain mitigation before the procedure

We tested the relation between the use of pain mitigation before horn removal with the following variables: gender, whether respondents attended continuing education in animal welfare, and reasons to choose a specific type of medicine. The results are presented in Table 3. Continued education in animal welfare was associated to the use of pain mitigation before horn removal of newborn calves. The reasons “side effects”, “costs”, “anti-inflammatory effect”, and “analgesic potency” were associated to the use of pain mitigation before horn removal of newborn calves. The reasons “side effects”, “costs”, “anti-inflammatory effect”, “analgesic potency”, and “duration of analgesic effect” were associated to the use of pain mitigation before horn removal of suckled calves. The reasons “costs”, “anti-inflammatory effect”, “analgesic potency”, and “duration of analgesic effect” were associated to the use of pain mitigation before horn removal of adult cattle.

We tested if practitioners who use pain mitigation before horn removal of newborn calves were more likely to use pain mitigation before horn removal of suckled calves.

### Table 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Chi-Square test (Newborn calves)</th>
<th>Chi-Square test (Suckled calves)</th>
<th>Chi-Square test (Adult cattle)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (Female; Male)</td>
<td>χ²(1, N = 99) = 0.582, p = 0.446</td>
<td>χ²(1, N = 107) = 2.371, p = 0.124</td>
<td>χ²(1, N = 125) = 0.099, p = 0.926</td>
</tr>
<tr>
<td>Continuing education in animal welfare (Yes; No)</td>
<td>χ²(1, N = 99) = 0.964, p = 0.326</td>
<td>χ²(1, N = 107) = 0.075, p = 0.784</td>
<td>χ²(1, N = 125) = 0.049, p = 0.824</td>
</tr>
<tr>
<td>Costs (Yes; No)</td>
<td>χ²(1, N = 99) = 0.280, p = 0.597</td>
<td>χ²(1, N = 107) = 0.022, p = 0.882</td>
<td>χ²(1, N = 125) = 0.081, p = 0.776</td>
</tr>
<tr>
<td>Side effects (Yes; No)</td>
<td>p = 0.440a</td>
<td>p = 0.109a</td>
<td>p = 0.017a</td>
</tr>
<tr>
<td>Sedative effect (Yes; No)</td>
<td>χ²(1, N = 99) = 1.024, p = 0.312</td>
<td>χ²(1, N = 107) = 0.883, p = 0.347</td>
<td>χ²(1, N = 125) = 2.497, p = 0.114</td>
</tr>
<tr>
<td>Anti-inflammatory effect (Yes; No)</td>
<td>χ²(1, N = 99) = 1.073, p = 0.300</td>
<td>χ²(1, N = 107) = 4.762, p = 0.030</td>
<td>χ²(1, N = 125) = 0.583, p = 0.445</td>
</tr>
<tr>
<td>Antitoxic effect (Yes; No)</td>
<td>p = 1.000a</td>
<td>p = 0.560a</td>
<td>p = 0.625a</td>
</tr>
<tr>
<td>Combination with adrenaline (Yes; No)</td>
<td>p = 0.496a</td>
<td>p = 1.000a</td>
<td>p = 0.495a</td>
</tr>
<tr>
<td>Analgesic potency (Yes; No)</td>
<td>χ²(1, N = 99) = 18.484, p &lt; 0.001</td>
<td>χ²(1, N = 107) = 12.385, p &lt; 0.001</td>
<td>χ²(1, N = 125) = 3.976, p = 0.046</td>
</tr>
<tr>
<td>Duration of analgesic effect (Yes; No)</td>
<td>χ²(1, N = 107) = 7.223, p = 0.007</td>
<td>χ²(1, N = 107) = 2.151, p = 0.142</td>
<td>χ²(1, N = 125) = 0.983, p = 0.322</td>
</tr>
<tr>
<td>Route of administration (Yes; No)</td>
<td>χ²(1, N = 99) = 4.992, p = 0.025</td>
<td>χ²(1, N = 107) = 5.532, p = 0.019</td>
<td>χ²(1, N = 125) = 0.507, p = 0.477</td>
</tr>
<tr>
<td>Dose volume (Yes; No)</td>
<td>χ²(1, N = 99) = 0.020, p = 0.887</td>
<td>χ²(1, N = 107) = 3.149, p = 0.076</td>
<td>χ²(1, N = 125) = 6.658, p = 0.010</td>
</tr>
<tr>
<td>Duration of sedative effect (Yes; No)</td>
<td>χ²(1, N = 99) = 1.588, p = 0.208</td>
<td>χ²(1, N = 107) = 1.048, p = 0.306</td>
<td>χ²(1, N = 125) = 0.067, p = 0.795</td>
</tr>
<tr>
<td>Which indications the drug is licensed for (Yes; No)</td>
<td>χ²(1, N = 99) = 2.382, p = 0.123</td>
<td>χ²(1, N = 107) = 0.132, p = 0.720</td>
<td>χ²(1, N = 125) = 0.048, p = 0.828</td>
</tr>
<tr>
<td>Purchase policy in practice (Yes; No)</td>
<td>p = 0.244a</td>
<td>p = 0.152a</td>
<td>p = 0.100a</td>
</tr>
<tr>
<td>Relationship to drug company representative (Yes; No)</td>
<td>p = 1.000a</td>
<td>p = 0.560a</td>
<td>p = 0.199a</td>
</tr>
</tbody>
</table>

* Fisher exact test (used when a group had less than 10 observations).

a No test because all participants responded the same alternative.
removal in cattle (i.e. newborn calves, suckled calves, adult cattle) would differ from those who do not use pain mitigation before horn removal regarding their perceptions of detection and treatment of pain, the average number of cattle dehorned/disbudded per year, and decade of birth. The results are presented in Table 4. Practitioners who agree more with the statement "I would like to use medicines to minimize suffering in cattle during painful procedures" use pain mitigation before horn removal of suckled calves and adult cattle. Practitioners who agree more with the statement "If there are no defensive movements during or after a painful procedure, there is no need for pain mitigation use" a certain level of pain is useful as it prevents the cattle from being too active use pain mitigation before horn removal of newborn calves, suckled calves, and adult cattle. Practitioners who agree more with the statement "Cattle recover better after surgery if they have received analgesics" use pain mitigation before horn removal of suckled calves and adult cattle.

4. Discussion

4.1. Profile of the respondents

The survey was designed to assess the factors influencing the use of drugs during painful procedures, specifically castration and horn removal, by animal scientists and veterinarians in Brazil. The existence of a consensus between the public (Stafford and Mellor, 2005b; Misch et al., 2007; Gottardo et al., 2011; Queiroz et al., 2018) and professionals (Schwartzkopf-Genswein et al., 2012; Becker et al., 2013; Sumner and von Keyserlingk, 2018) about the necessity of a moral and ethical treatment of animals undergoing painful procedures highlights the importance of our study.

Studies conducted in Canada (n = 327; Hewson et al., 2007a), Scandinavian countries (n = 352; Thomsen et al., 2010), Great Britain and Ireland (n = 615; Huxley and Whay, 2006) and New Zealand (n = 166; Laven et al., 2009) had a larger sample than our research (n = 147). The relatively small sample may be because completing and returning the questionnaire was voluntary (Huxley and Whay, 2006), the absence of a contact list provided by an organization or company in the field (Misch et al., 2007; Laven et al., 2009), or the length, which could decrease response rate (Coetzee et al., 2010). In addition, because we do not have enough official data about the sociodemographic characteristics of the whole population of cattle care professionals, our results must be viewed with care.

By a legal requirement, not legislative acts, in Brazil, only veterinarians should undertake surgical procedures on animals, as well as administer or prescribe drugs (Conselho Federal de Medicina Veterinária, 2008); however, this is impracticable and expensive (Hötzel and Sneddon, 2013). In general, these husbandries are perceived to be a common practice and are conducted by veterinarians, animal scientists, experienced employees and agricultural technicians.

In our survey, almost 70 % of respondents were male. Data from Conselho Federal de Medicina Veterinária (CFMV) (2019b)

Table 3

Differences between those who use pain mitigation and those who do not use pain mitigation before horn removal in each class of animals (Chi-square tests and Fischer exact tests).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Chi-Square test (Newborn calves)</th>
<th>Chi-Square test (Suckled calves)</th>
<th>Chi-Square test (Adult cattle)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (Female; Male)</td>
<td>$\chi^2(1, N = 90) = 0.279, p = 0.597$</td>
<td>$\chi^2(1, N = 93) = 0.033, p = 0.856$</td>
<td>$\chi^2(1, N = 88) = 0.003, p = 0.959$</td>
</tr>
<tr>
<td>Continuing education in animal welfare (Yes; No)</td>
<td>$\chi^2(1, N = 90) = 4.846, p = 0.028$</td>
<td>$\chi^2(1, N = 93) = 2.479, p = 0.115$</td>
<td>$\chi^2(1, N = 88) = 0.600, p = 0.439$</td>
</tr>
<tr>
<td>Costs (Yes; No)</td>
<td>$\chi^2(1, N = 90) = 9.960, p = 0.002$</td>
<td>$\chi^2(1, N = 93) = 6.716, p = 0.010$</td>
<td>$\chi^2(1, N = 88) = 4.591, p = 0.032$</td>
</tr>
<tr>
<td>Side effects (Yes; No)</td>
<td>$p = 0.094^{*}$</td>
<td>$p = 0.026^{*}$</td>
<td>$p = 0.293^{*}$</td>
</tr>
<tr>
<td>Sedative effect (Yes; No)</td>
<td>$p = 0.139^{*}$</td>
<td>$p = 0.486^{*}$</td>
<td>$p = 0.414^{*}$</td>
</tr>
<tr>
<td>Anti-inflammatory effect (Yes; No)</td>
<td>$\chi^2(1, N = 90) = 2.857, p = 0.091$</td>
<td>$\chi^2(1, N = 93) = 3.123, p = 0.077$</td>
<td>$\chi^2(1, N = 88) = 4.156, p = 0.041$</td>
</tr>
<tr>
<td>Antitoxic effect (Yes; No)</td>
<td>$p = 0.497$</td>
<td>No test $^b$</td>
<td>$p = 0.538$</td>
</tr>
<tr>
<td>Combination with adrenaline (Yes; No)</td>
<td>No test $^a$</td>
<td>No test $^a$</td>
<td>No test $^a$</td>
</tr>
<tr>
<td>Analgesic potency (Yes; No)</td>
<td>$\chi^2(1, N = 90) = 7.187, p = 0.007$</td>
<td>$\chi^2(1, N = 93) = 6.955, p = 0.008$</td>
<td>$\chi^2(1, N = 88) = 3.897, p = 0.048$</td>
</tr>
<tr>
<td>Duration of analgesic effect (Yes; No)</td>
<td>$\chi^2(1, N = 90) = 2.457, p = 0.117$</td>
<td>$\chi^2(1, N = 93) = 5.244, p = 0.022$</td>
<td>$\chi^2(1, N = 88) = 7.650, p = 0.006$</td>
</tr>
<tr>
<td>Route of administration (Yes; No)</td>
<td>$\chi^2(1, N = 90) = 1.437, p = 0.231$</td>
<td>$\chi^2(1, N = 93) = 0.408, p = 0.523$</td>
<td>$\chi^2(1, N = 88) = 1.115, p = 0.291$</td>
</tr>
<tr>
<td>Dose volume (Yes; No)</td>
<td>$p = 0.729^{*}$</td>
<td>$p = 0.740^{*}$</td>
<td>$p = 0.151^{*}$</td>
</tr>
<tr>
<td>Duration of sedative effect (Yes; No)</td>
<td>$\chi^2(1, N = 90) = 0.222, p = 0.638$</td>
<td>$\chi^2(1, N = 93) = 0.884, p = 0.347$</td>
<td>$\chi^2(1, N = 88) = 2.305, p = 0.129$</td>
</tr>
<tr>
<td>Which indications the drug is licensed for (Yes; No)</td>
<td>$p = 0.494^{*}$</td>
<td>$p = 1.000^{*}$</td>
<td>$p = 0.304^{*}$</td>
</tr>
<tr>
<td>Purchase policy in practice (Yes; No)</td>
<td>$p = 0.597^{*}$</td>
<td>$p = 0.242^{*}$</td>
<td>$p = 0.538^{*}$</td>
</tr>
<tr>
<td>Availability of product support (Yes; No)</td>
<td>$p = 0.215^{*}$</td>
<td>$p = 0.242^{*}$</td>
<td>$p = 1.000^{*}$</td>
</tr>
<tr>
<td>Relationship to drug company representative (Yes; No)</td>
<td>No test $^a$</td>
<td>No test $^a$</td>
<td>No test $^a$</td>
</tr>
</tbody>
</table>

* Fisher exact test (used when a group had less than 10 observations).

$^a$ No test because all participants responded the same alternative.
Farm animals are not as sensitive to pain as pets
Missing information about possible benefits of pain control in cattle
I would like to use medicines to minimize suffering in cattle during painful procedures
Farmers would like their cattle to be treated with pain mitigation, but the price is a major concern
An important reason for administering analgesia in cattle during painful interventions is the reduced risk of injuries for the person performing the procedure
Analgesia may mask a deterioration in the general condition of cattle
If there are no defensive movements during or after painful procedure, there is no need for pain mitigation use
A certain level of pain is useful as it prevents the cattle from being too active
Cattle recover better after surgery if they have received analgesics
Average number of animals dehorned

Table 4
Differences between those who use pain mitigation and those who do not use pain mitigation before horn removal in each class of animals (Mann-Whitney tests).

<table>
<thead>
<tr>
<th>Statement</th>
<th>Newborn calves (N = 90)</th>
<th>Suckled calves (N = 93)</th>
<th>Adult cattle (N = 88)</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is difficult to recognize pain in animals</td>
<td>U = 926.500 p = 0.456</td>
<td>U = 1066.500 p = 0.900</td>
<td>U = 883.000 p = 0.996</td>
</tr>
<tr>
<td>Farm animals are not as sensitive to pain as pets</td>
<td>U = 981.000 p = 0.803</td>
<td>U = 1077.500 p = 0.976</td>
<td>U = 880.000 p = 0.973</td>
</tr>
<tr>
<td>Missing information about possible benefits of pain control in cattle</td>
<td>U = 904.500 p = 0.384</td>
<td>U = 1045.500 p = 0.777</td>
<td>U = 806.000 p = 0.480</td>
</tr>
<tr>
<td>I would like to use medicines to minimize suffering in cattle during painful procedures</td>
<td>U = 904.500 p = 0.311</td>
<td>U = 857.000 p = 0.941</td>
<td>U = 661.500 p = 0.019</td>
</tr>
<tr>
<td>Farmers would like their cattle to be treated with pain mitigation, but the price is a major concern</td>
<td>U = 959.000 p = 0.672</td>
<td>U = 962.500 p = 0.331</td>
<td>U = 801.500 p = 0.441</td>
</tr>
<tr>
<td>An important reason for administering analgesia in cattle during painful interventions is the reduced risk of injuries for the person performing the procedure</td>
<td>U = 962.000 p = 0.696</td>
<td>U = 1017.000 p = 0.603</td>
<td>U = 822.000 p = 0.570</td>
</tr>
<tr>
<td>Analgesia may mask a deterioration in the general condition of cattle</td>
<td>U = 970.000 p = 0.741</td>
<td>U = 1067.000 p = 0.908</td>
<td>U = 838.500 p = 0.671</td>
</tr>
<tr>
<td>If there are no defensive movements during or after painful procedure, there is no need for pain mitigation use</td>
<td>U = 860.000 p = 0.099</td>
<td>U = 975.000 p = 0.280</td>
<td>U = 718.500 p = 0.053</td>
</tr>
<tr>
<td>A certain level of pain is useful as it prevents the cattle from being too active</td>
<td>U = 811.500 p = 0.071</td>
<td>U = 782.500 p = 0.010</td>
<td>U = 632.000 p = 0.013</td>
</tr>
<tr>
<td>Cattle recover better after surgery if they have received analgesics</td>
<td>U = 839.000 p = 0.134</td>
<td>U = 743.500 p = 0.005</td>
<td>U = 550.500 p = 0.002</td>
</tr>
<tr>
<td>Average number of animals dehorned</td>
<td>U = 1004.000 p = 0.966</td>
<td>U = 945.500 p = 0.162</td>
<td>U = 748.500 p = 0.131</td>
</tr>
</tbody>
</table>

4.2. Attitudes about pain mitigation

Claims about the moral status of cattle as animals help to explain the veterinary and animal science professions’ attitudes toward pain mitigation; however, there is a wide variation between the attitudes of individual practitioners towards pain (Raekallio et al., 2003; Huxley and Whay, 2006; Laven et al., 2009), and between the attitudes of farmers and professionals (Becker et al., 2013). It is likely that veterinarians have a higher level of empathy for animals compared to the general population, due to their choice of occupation (Norring et al., 2014). However, the lack of knowledge on animal behavior and pain by veterinarians (Ventura et al., 2016) might explain the frequent underestimation of pain in cattle (Becker et al., 2013).

In our survey, participants indicated that the cost, anti-inflammatory effect, analgesic potency, duration of analgesic effect, duration of sedation, and route of administration were the most important factors considered when choosing pain relief. Our results were similar to those from Thomsen et al. (2010), who added antitoxic effects as another important factor when choosing analgesics by Scandinavian bovine practitioners’.

Our results are in line with other authors, who showed that economic aspects, i.e. the cost of pain relief, could be considered as a barrier preventing improvements in cattle welfare (Huxley and Whay, 2006; Hötzel and Sneddon, 2012; Moggy et al., 2017; Ventura et al., 2016). For Brazilian cattle veterinarians, the cost of NSAID is considered an important factor for 29.5 % of the respondents (Lorena et al., 2013). Dairy cattle farmers and veterinarians place different priorities on the cost of mitigating pain (Sumner et al., 2018). Low income associated with low animal product prices and difficulties in securing loans from banks to invest in infrastructures (Ventura et al., 2016) are probable explanations. Only about 10 % of the cattle veterinarians in Brazil think the cost is not important (Lorena et al., 2013). However, Sumner and von Keyserlingk (2018) relate a paradoxical view: some believe the cost is prohibitive, whereas others think the cost is a non-issue to farmers since they are more interested in cattle performance and the value of the veterinarian visit. Some farmers in Canada indicated that if pain mitigation improved calf weight gain they would be more willing to adopt these strategies (Moggy et al., 2017).

More than half mentioned the importance of anti-inflammatory effects, which could suggest this analgesic as a standard in many cattle practices (Watts and Clarke, 2000; Huxley and Whay, 2006; Lorena et al., 2013). As shown by Whay and Huxley (2005), each veterinary surgeons in the UK has three NSAID, one α2- adrenoreceptor agonists and one local anesthetic agent available in their practice for use in cattle; and the most frequently cited NSAIDs are flunixin meglumine, meloxicam and ketoprofen (Whay and Huxley, 2005; Huxley and Whay, 2006; Coetzee et al., 2010; Becker et al., 2013; Winder et al., 2016). Meloxicam is a newer NSAID, and studies have shown it can be effective in relieving pain associated with horn removal (Theurer et al., 2012) and castration (Coetzee et al., 2012).

4.3. Castration and the use of pain mitigation

All the physical methods used to castrate cattle have side effects and cause pain with a moderate pain score by practitioners (Fitzpatrick et al., 2002); however, it is an ancient husbandry practice used to produce docile cattle, to reduce unwanted breeding, and to modify carcass quality (Stafford and Mellor, 2005b). To avoid the effects of this painful procedure in finishing cattle, and since we still cannot completely control pain (Canozzi et al., 2017), a hormonal method has been proposed to reduce sexual and aggressive behavior. This method consists in an immunoncontraceptive vaccine to induce antibodies against GnRH and, according to Marti et al. (2015), did not evoke any physiological or behavioral changes indicative of pain and is a welfare-friendly alternative.

It should be emphasized that each animal receiving pain control must be handled and restrained, making it a very labor-intensive process for a large number of animals. In addition, specialized training is required of people to administer medicine in cattle (Schwartzkopf- Genswein et al., 2012). Moggy et al. (2017) mentioned that, in cow-calf operations in Canada, the majority of bull calves are castrated before 3 months of age, but pain mitigation usage is more common in cattle between 3 and 9 months. This aspect might explain why we observed that the statement “I would like to use medicines to minimize suffering” was more relevant to respondents who use pain relief in calves less than 8 months than for respondents that do not use pain relief in calves at
this age. Our questionnaire related that drug-related factors, such as anti-inflammatory effects, analgesic potency and duration of effect, and route of administration, were also relevant in suckled calves, as mentioned by Canozzi et al. (2017). To address the pain associated with castration, researchers have been developing practical and affordable approaches. For example, a topical anesthetic spray can be used to reduce pain for up to 24 h (Lomax and Windsor, 2013), and oral delivery for pain control drugs can improve animal health (Coetzee et al., 2012).

Only 20 % of bovine veterinarians in the United States report using an analgesic or local anesthetic at the time of castration (Coetzee et al., 2010). Even for farm animals often being subjected to painful or stress stimuli in early life, pain relief use is less frequent in calves, probably due to i) younger cattle being seen to experience less pain from castration (Hewson et al., 2007b; Viñuela-Fernández et al., 2007; Moggy et al., 2017), ii) the professionals rarely see calves in the day after they have castrated them (Huxley and Whay, 2006), and iii) the farmers are primarily responsible for performing castrations in perinatal calves (Coetzee et al., 2010). Our results show that there is “missing information” about possible benefits of pain control in newborn cattle. Also, the increase in the number of newborn calves castrated per year can encourage the use of pain relief, as the experience gained while in practice was ranked as the most important source of knowledge for veterinarians (Dohoo and Dohoo, 1996; Hewson et al., 2007b). Laven et al. (2009) related that veterinarians in New Zealand who conduct surgical castration and spend half of their time with cattle tend to estimate the pain as lower than those who work with cattle more frequently. Moreover, the analgesic care of patients can be improved through continuing education (Joubert, 2001).

Castration is evaluated by Brazilian veterinarians as the least painful procedure when compared to fracture, laparotomy and dehorning (Lorenza et al., 2013). This could explain why most bovine veterinarians and cow-calf operations do not use pain mitigation strategies for castration (Coetzee et al., 2010; Moggy et al., 2017), although report a high perception of pain score for the procedure (Fitzpatrick et al., 2002; Coetzee et al., 2010) and Lorena et al. (2013) found that the majority of Canadian and Brazilian veterinarians agree with the statement “rate of recovery from surgery is improved with the use of analgesics”, which can be detected by absence of adverse events, such as recumbency, swelling, hemorrhage, and stiffness (Coetzee et al., 2010). Moreover, it is important to remember that the detection of pain in cattle is difficult (Watts and Clarke, 2000).

Although we did not observe the effect of cost in the use of pain control in the castration procedure, many authors mentioned that the low use of analgesic in farm animals is due to economic reasons, such as the low cost of individual animals in relation to the cost of treatments (Weary et al., 2006; Viñuela-Fernández et al., 2007; Coetzee et al., 2010). Besides the cost, special attention is needed concerning the route of administration, period of exposure, and optimal dose (González et al., 2010; Coetzee et al., 2012).

Our results did not show any effect from the respondents’ decade of birth between those who use and do not use pain mitigation during castration in the three different classes of cattle, as related by Laven et al. (2009) and Lorena et al. (2013) to the decade of graduation of Brazilian and New Zealand veterinarians, respectively. However, professionals who graduated in the last 10 years use more opioid analgesics, NSAIDs and local anesthesia-opioid combinations than those who graduated > 10 years ago (Lorenza et al., 2013), probably due to the increased interest in pain, analgesia, and animal welfare in the curriculum.

4.4. Horn removal and the use of pain mitigation

Horn removal recently has been under scrutiny of public opinion and nongovernmental organizations (Gottardo et al., 2011; Wikman et al., 2016) and extensionists in Brazil express a concern that, in the future, societal sentiment may result in the prohibition of such practices (Hötzel and Sneddon, 2013). One probable explanation for this is the low percentage of farms performing the procedure that use some medication (Cozzi et al., 2015) since extensionists express negative attitudes and beliefs toward recommending dehorning protocols to minimize pain (Hötzel and Sneddon, 2013). Despite this, veterinarians consider that dehorning produces a high level of pain (Hewson et al., 2007a; Laven et al., 2009). This can explain the higher agreement by respondents who use pain relief in our survey with the statement “cattle recover better after surgery if they have received analgesics”, which was also related by Raekallio et al. (2003), in Finland, and by Whay and Huxley (2005), in the UK.

Second, the genetic control by selecting polled calves is possible and is more animal-welfare-friendly (Stafford and Mellor, 2011; Schwartzkopf-Genswein et al., 2012; Moggy et al., 2017; Wikman et al., 2016). In Canada, almost 56 % of dairies interviewed reported that ≥90 % of their calf crop are polled (Moggy et al., 2017), as 38 % have used polled dairy sires or purchased semen over the previous 12 months (Winder et al., 2016), to improve the safety of stockmen and cattle (Misch et al., 2007; Hötzel and Sneddon, 2013; Cozzi et al., 2015; Wikman et al., 2016).

In agreement with Lorena et al. (2013), we observed that the pain mitigation use in cattle of more than 2 months in age was a determinant for those respondents who agreed with the statement “If there are no defensive movements during or after painful procedure, there is no need for pain mitigation use”, probably due to older animals potentially displaying more behavioral signs of pain (Winder et al., 2016). Unfortunately, the challenge for professionals and farmers is to recognize signs of pain in cattle, since the animal cannot inform us of their pain state (Short et al., 1998; Watts and Clarke, 2000; Becker et al., 2013), one of the key motivators for the use of pain control (Huxley and Whay, 2006; Wikman et al., 2016). In cattle, the horn bud is free-floating in the skin layer above the skull up to 2 months of age. As the calf gets older, the horns start to grow and are best removed by amputation, a technique that requires careful restraint and homeostasis and the use of antiseptics (Misch et al., 2007; Coetzee et al., 2015) since extensionists express negative attitudes and beliefs toward recommending dehorning protocols to minimize pain (Hötzel and Sneddon, 2013). Despite this, veterinarians consider that dehorning produces a high level of pain (Hewson et al., 2007a; Laven et al., 2009). This can explain the higher agreement by respondents who use pain relief in our survey with the statement “cattle recover better after surgery if they have received analgesics”, which was also related by Raekallio et al. (2003), in Finland, and by Whay and Huxley (2005), in the UK.

Despite the importance in the animal pain aspects, a deficiency in the undergraduate curriculum regarding clinical treatment of pain in animals is highlighted by veterinarians of different generations (Dohoo and Dohoo, 1996; Whay and Huxley, 2005), and the knowledge about horn removal is more commonly acquired from field practice (Whay and Huxley, 2005; Hötzel and Sneddon, 2013). Also, the access to information through sources like the internet and social media helps professionals to be aware of different options or management strategies (Lorenza et al., 2013; Winder et al., 2016), and to define a standard protocol for analgesia use on farms, as pointed out by those who work in Ontario (Misch et al., 2007). Professional training in pain management, coupled with the farmers’ good relationship with the practitioners, positions them to implement prevention and treatment plans (Sumner et al., 2018).
of information about pain mitigation. Farmers who delegate calf disbudding more often to veterinarians and a herd that receive health visit by veterinarians at least every week tend to increase pain relief use (Misch et al., 2007; Winder et al., 2016). However, in agreement with our results, the cost is reported as one of the main reasons against the use of a medicine as well as the potential unwillingness of the farmer to pay for it (Whay and Huxley, 2005; Raekallio et al., 2003; Misch et al., 2007; Gottardo et al., 2011; Hötzl and Sneddon, 2013; Wikman et al., 2016; Sumner and von Keyserlingk, 2018). Contrarily, Winder et al. (2016) demonstrate that the most commonly reported reason is the concern for welfare.

Our results also showed that the drug-related factors (e.g., anti-inflammatory effects, analgesic potency, duration of analgesic effects) were more related to cattle over 70 kg. As it was mentioned above, the horn removal in older and heavier animals is more difficult, since it requires careful restraint and pain mitigation use to minimize the trauma (Misch et al., 2007; Gottardo et al., 2011). Moreover, other drug properties, like the ease to administer and its long-acting, are important to achieve optimal pain control and animal welfare (Schwartzkopf-Genswein et al., 2012).

In our survey, the reluctance to use pain relief was emphasized by the agreement with “I would like to use medicines to minimize suffering in cattle during painful procedures” by those who use more pain mitigation. This might arise from the fact that the economic gains cannot balance the cost, since there is no effect on cattle growth performance (Sylvester et al., 2004; Hötzl and Sneddon, 2013; Wikman et al., 2016; Canozzi et al., 2019), and farmers thought that calling a veterinarian to medicate is too expensive (Wikman et al., 2016). Moreover, the professional has a moral dilemma, balancing a duty to treat the pain with responsibility for clients’ financial health (Sumner and von Keyserlingk, 2018). Alternatively, most veterinarians and clinical phase students would treat cattle disbudding pain with sedation, analgesic, and local anesthetics (Norrting et al., 2014).

Decade of graduation is associated with differences in estimated pain scores (Huxley and Whay, 2006). Generally, younger professionals are more in favor of analgesic use and more concerned about the possible negative effects of inflicting pain upon cattle (Thomsen et al., 2010). Despite the above reports, we did not find differences in the decade of birth of professionals on pain mitigation use before procedures in the three different classes of cattle.

If future Brazilian law requires proper medication for castration and horn removal in cattle, it will be necessary to have professional care or consideration of economic gains balance the cost, since there is no effect on cattle growth performance. Farmers who delegate castration and horn removal procedures to veterinarians may be more in favor of analgesic use and more concerned about the possible economic gains balance the cost, since there is no effect on cattle growth performance. Farmers who delegate castration and horn removal procedures to veterinarians may be more in favor of analgesic use and more concerned about the possible negative effects of inflicting pain upon cattle (Thomsen et al., 2008).

5. Conclusions

Although there is growth in public concern about farm animal welfare in the world, the pain control debate is still emerging in Brazil since not all respondents manage the pain in question. Our results demonstrated that veterinarians and animal scientists place greater emphasis on the fact and on the pharmacological effects of drugs. We recommended a more cost-effective analgesic and the cost of pain relief should be incorporated into food policy. Further research is needed and simpler strategies to alleviate suffering and pain experienced by castrated and dehorned/disbudded cattle of different ages. Ultimately, all parties involved in the management of cattle need to work collaboratively, and must encourage, primarily the professionals, the implementation of pain control practices in farms.

Funding

This study was supported by The Brazilian Council of Scientific and Technological Development (CNPq/Project 166250/2015–5).


