What slaughterhouse workers' attitudes and knowledge reveal about human-pig relationships during pre-slaughter operations: A profile-based approach

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ABSTRACT

Slaughterhouse workers are strategic capital for the meat industry in terms of operational and animal welfare issues; however, information about the attitudes of workers toward the human-animal relationship is limited. The main aim of our study was to identify the profiles of workers based on their attitudes toward pigs, occupational satisfaction, sociodemographics, and animal handling. The survey included 171 workers in 12 Colombian pig slaughterhouses. A factor analysis and a hierarchical cluster analysis identified four segments or worker profiles. The first comprised workers who relate to animals and their work in a mechanical way, the second comprised professional workers who are emotionally close to animals, the third comprised those committed to animals and their work, and the fourth comprised workers who are apathetic toward animals and work activity. The human-animal relationship at the slaughterhouse level is multifaceted, but is influenced by dependent on work satisfaction and sympathy toward the animals.

1. Introduction

The human-animal relationship is a mutually beneficial and dynamic relationship between humans and animals that is influenced by behaviors that are essential to the health and wellbeing of both (Applebaum, MacLean, & McDonald, 2021). Human attitudes toward animals are influenced by their perceptions, knowledge, values, beliefs, and socioeconomics factors (Estévez-Moreno, Miranda-de la Lama, & Miguel-Pacheco, 2022). An attitude is the psychological tendency expressed by the operator when confronted with an event that generates either the liking or the disliking of the handling or interactions with animals (Eagly & Chaiken, 1993; Heleski, Mertig, & Zanella, 2006). Furthermore, attitudes are complementary to social norms or pressures, which reinforce an intention or motivation to perform a particular behavior toward the animal (Ajzen & Fishbein, 1977; Heleski et al., 2006). In addition, a negative attitude of the worker toward the animals might be caused by a loss of empathy because the worker perceives the animals as objects, rather than subjects (Millán, 1998). Therefore, a person's attitude in their work environment can have a significant effect on human-animal relationships and, consequently, operational efficiency (Pulido et al., 2018; Hemsworth, Rice, Hemsworth, & Coleman, 2021).

Historically, the slaughter of livestock had been carried out in butcher shops and homes; however, during the industrial revolution of the 19th C., the activity was radically transformed by the establishment of industrial slaughterhouses (Fitzgerald, 2010). Those establishments have come to base their operations on the slaughter of many animals in a short period in a series of controlled processes and hygiene standards (Mazanik, 2018). In that way, slaughterhouses became 'factories' in which, despite attempts to mechanize operations, human participation was and is essential in the processing of animals after the journey to the slaughterhouse, the selection of the slaughter order, handling during lairage time, and slaughter (Wang & Pendlebury, 2016). Slaughterhouse work is characterized by high staff turnover, absenteeism, disciplinary measures, demanding schedules, and exposure to death on a daily basis, which can exert psychological pressure that can lead to occupational stress, burnout, and post-traumatic stress syndrome (Emhan, Yildiz, Bez, & Kingir, 2012; Victor & Barnard, 2016). Those conditions can cause anxiety, irritability, sadness, tiredness, disinterest, lethargy, and violence-supportive attitudes (Slade & Alleyne, 2022). Those circumstances can arouse in workers' negative attitudes toward animals, which can affect the human-animal relationship and lead to marked stress in the animals (Hemsworth, Barnett, Coleman, & Hansen, 1989). Stress is the presence of negative emotions that are associated with behavioral and physiological changes that occur if the animal feels threatened (real

or imagined) and cause a reaction to the potential threat (Reiche et al., 2019; Terlouw, 2015). Unlike other livestock, pigs are an additional challenge for workers because they are particularly cognitively complex, emotionally excitable, and vocally expressive animals (Goumon & Faucitano, 2017). Even under favorable conditions for pigs at the slaughterhouse, they are exposed to numerous potential stressors that might compromise their welfare because of fear and pain caused by the presence and interventions of humans, changes in the thermal micro-environment, weather, social mixing, food and water deprivation, fatigue caused in transport, or pain caused by collisions with equipment or other animals (Miranda-de la Lama, Villarroel, & María, 2014; EFSA Panel on Animal Health and Welfare (AHAW) et al., 2020).

Slaughterhouse workers are involved in the slaughter of >70 billion animals, annually (Slade & Alleyne, 2022); however, studies on workers' perceptions of animal welfare are limited, and virtually no studies have examined human-animal interactions from the workers' perspective (Hemsworth, Rice, Hemsworth, & Coleman, 2021). Animal welfare research at the slaughterhouse level often has focused on the influence of workers on the efficiency of certain pre-slaughter processes such as handling, stunning, and bleeding (Carrascal et al., 2021). To promote the design of training programs and the implementation of good practices to improve human-animal relationships in the slaughterhouse, it is necessary to investigate how workers perceive pigs during pre-slaughter operations. The aims of this study were to recognize the practices and human-animal relationships based on the knowledge of workers in pig slaughterhouses in Colombia, and to identify worker profiles based on their attitudes toward pigs, occupational satisfaction, sociodemographics, and management practices.

2. Material & methods

The study was conducted from February to April 2021 as a survey of workers involved in the pre-slaughter and slaughter operations (unloading, regrouping, handling, herding, stunning, and bleeding of pigs) in the central-western region of Colombia, which has one of the highest pig slaughter operations in the country (Porkcolombia – FNP, 2021). Of the 12 **pig** slaughterhouses that were included in the survey, three were in Valle del Cauca (3°25′00″ N 76°31′00″ W, 1561 masl), two were in Risaralda (4°49′00″ N 75°42′00″ W, 1516 masl), one was in Quindío (4°32′00″ N 75°42′00″ W, 1458 masl), and six were in Caldas (5°06′ N 75°33′ W, 3190 masl). The survey and its objectives were sent to the Research Ethics Committee of the Autonomous Community of Aragon (CEICA), which confirmed that an ethical vote of its committee was not necessary(because it would be performed in a foreign country), with the recommendation to perform it based on the guidelines of Good Scientific Practice.

2.1. Study description

In each of the slaughterhouses that participated in the study, the inclusion criteria for the respondents were that in their work, they had direct contact with live animals, and they were at least 18 years of age. All the workers invited to participate in the study ($n = 171$) completed the questionnaire individually and confidentially. At the time of the survey, participants were informed that the study was intended to obtain a broad view of human-animal relations in the slaughterhouse, the conditions and problems of pig handling, and the underlying reasons. They were informed that they would not receive financial compensation for their participation, that the information they provided would be anonymous, and that they did not have to complete the questionnaire or could stop completing it at any time, which would not affect their employment. Written informed consent (by signature or thumb print) was obtained from each participant. Likewise, the managers of each of the slaughterhouse were informed that the information provided by workers would be anonymous and confidential, and would be used for research purposes, only.

2.2. Survey structure

The questions in the questionnaire were written in clear language, using easy-to-understand terms, with consideration for the education level of the participants in the survey. The questionnaire was validated by four operators at one of the slaughterhouses in the study, upon which the definitive version of the questionnaire was based. The time to complete the questionnaire was approx. 20 min. The questionnaire has five sections. Section 1 included the sociodemographic characteristics of the respondents (e.g., gender, age, education, and years of experience in pig slaughterhouses). Section 2 included six questions about the handling of pigs in slaughterhouses: The worker's participation in animal social mixing during lairage (yes/no), respondent's opinion on the most docile type of animal, difficulties during the unloading, means of handling, and injuries observed in animals (multiple-choice questions with unique answer), and causes of death (a multiple-choice question with the option to prioritize three options). Section 3 included 20 questions focused on the human-animal relationship; e.g., *"Are pigs difficult to handle?"*, *"Do pigs react differently depending on the mood I am in when I handle them?"*, *"Are pigs capable of feeling pain and/or have emotions?"*, or *"Do pigs scare me when I am going to handle them?"*. Section 4 included 5 statements adapted from Diener (1984) that addressed workers' perceptions of their level of satisfaction with life, and 5 statements related with their attitudes toward job satisfaction; e.g., *"The conditions of my life are excellent"*, *"I am satisfied with my life"*, *"If I had sons/daughters, I would encourage them to do this work"*, and *"The pay I receive compensate for the work done"*. Responses of Sections 3 and 4 were based on a 5-point Likert scale. For Section 3, the scale ranged from 1 = "Surely not" to 5 = "Surely yes" and for Section 4, the scale ranged from 1 = "strongly disagree" to 5 = "strongly agree". A fifth section related to occupational risks factors was included in the original questionnaire, but was not analyzed in this paper.

2.3. Specifications of the statistical model

The study included univariate descriptive statistics, which included percentages and frequencies, in the sociodemographic characterizations of the 171 pig slaughterhouse workers surveyed. A bivariate analysis was developed to identify significant relations among the variables in Sections 1 and 2 based on either Chi-square or Likelihood Ratio tests ($P < 0.05$). A multivariate Exploratory Factor Analysis (EFA) was used to identify the correlational structure and to reduce the number of variables related to workers' perceptions and attitudes toward the animals they handle (Section 3) in a smaller set of summary variables. The Principal Components Method was used as an extraction model, and the Kaiser-Meyer-Olkin (KMO) Index (KMO > 0.6) and Bartlett test of sphericity ($P < 0.05$) were used to detect a high correlation between variables. Communalities <0.5 and factor loadings >0.5 were used as criteria for statement deletion, and final factors were retained if their eigenvalues were > 1. Finally, the Varimax Rotation Method was used to simplify the interpretation of factors, which were named based on the variables they grouped. The resulting factors were used as the input to perform a hierarchical cluster analysis (using Ward's Method and the squared Euclidean distance). This was aimed to categorize individuals based on numerical scores and identify the workers' profiles. The number of clusters was based on the visualization and interpretation of the dendrogram. A new variable that identified each cluster with a number was created to characterize the worker profiles. Subsequently, significant associations were tested between this variable and the factors resulting from factor analysis, sociodemographics, management practices, and statements about the workers' level of satisfaction with life and with their job. For this purpose, we used Kruskal-Wallis or ANOVA tests followed by U-Mann Whitney and T-Students posthoc tests for quantitative, and Chi-square or Likelihood Ratio tests for qualitative variables ($P < 0.05$). All analyses were performed in SPSS® Statistics 22.

3. Results

3.1. Sociodemographics

Most (>90%) of the 171 slaughterhouse workers surveyed were male, and > 50% were between 18 and 30 years of age. Most had an elementary level of education. >70% had <7 years of experience (Table 1). Workers' opinions on specific pre-slaughter handling practices, animal condition, and handling difficulties were not related with the respondents' sociodemographics; i.e., sex, age, education level, years of experience, and slaughterhouse type ($P > 0.05$).

3.2. Handling practices

The survey identified a number of management practices that involve human-animal interactions at the slaughterhouse level. Most (86%) of the respondents indicated that they did not do social mixing upon the arrival of pigs at the slaughterhouse. Those who did indicated that they did it based on the weight or number of animals and, specifically, if the facilities did not permit animals to be held in individual lairage pens. Almost half (45%) of the respondents indicated that female pigs of any age were the most docile during pre-slaughter operations, and others indicated cull pigs (21.1%), immunocastrated male pigs (18.1%), and castrated male pigs (15.8%).

Slaughterhouse workers indicated that the most common problems at the unloading of animals were the presence of non-ambulatory or dead-on arrival (DOA) animals (40%), extreme weather conditions (very hot or very wet day) (35%), aggressive pigs (28%), and lack of official documentation (23%) (Table 2). The most commonly cited means of herding animals were plastic bottles (empty or filled with gravel) (67%), shouting (24%), and the use of water from a hose (15%). The most commonly cited animal welfare problems were fatigue (54%) and lameness (26%). The most commonly cited causes of death were fatigue (72%) and obesity (15%).

3.3. Factor analysis of workers' attitudes

The factor analysis identified four factors (total variance explained >60%), with a KMO = 0.770 and Bartlett's test of sphericity <0.001, that characterized the human-animal relationship based on the responses of pig slaughterhouse workers, which indicated a high correlation between the variables (Alpha Cronbach = 0.669) (Table 3). The first factor (Sympathy), explained 27.3% of the total variance and included six variables that reflect the emotional closeness of the worker toward the pigs. Those individuals strongly agreed that the welfare of pigs is as

Table 1
Demographics of the respondents ($n = 171$) in surveys at 12 Colombian pig slaughterhouses.

Abattoir workers	n	Percentage
Gender		
Men	158	92.4
Women	13	7.6
Age (years)		
18 a 30	86	50.3
31 a 40	46	26.9
>40	39	22.8
Education level		
Elementary	101	59.1
Secondary	47	27.5
Higher	23	13.5
Slaughterhouse type		
National Abattoir	131	76.6
Local Abattoir	28	16.4
Export-type Abattoir	12	7
Years of experience		
<7	121	70.8
≥7	50	29.2

Table 2
Main difficulties in unloading animals, problems observed in animals (at unloading or while in pens), the most frequent means of handling, and causes of death in animals based on the perceptions of workers (n = 171) at 12 pig slaughterhouse in Colombia *.

Variables	Percentage	Frequency
Difficulties in unloading		
Non-ambulatory animals or dead	39.8	68
Extreme weather conditions	34.5	59
Aggressive animals	28.1	48
Lack of legal documentation	23.4	40
Lack of available holding pens	16.4	28
Reduced space inside the truck	12.9	22
Poor lighting	7.0	12
Facilities (design - poorly maintained)	2.4	4
No ear tag	0.6	1
Wet floors by urine or faecal matter	0.6	1
Means of handling		
Bottles (empty or filled)	67.3	115
Shouting	24.0	41
Water	15.2	26
Flags	8.2	14
Rattle	6.4	11
Blows or hitting	5.3	9
Whistles	3.5	6
Paddle, strings	3.5	6
Electric prod	2.3	4
Portable cart	0.6	1
Main welfare issues		
Fatigue	53.8	92
Lameness	25.7	44
Fractures	16.4	28
Hernias	13.5	23
Prolapse	12.9	22
Injuries or wounds	12.3	21
Most common cause of pig death		
Fatigue	71.9	123
Overweight	15.2	26
Fighting	9.9	17
Illness	5.3	9
Injuries or wounds	4.1	7
Heart attack	3.5	6

* Possibility of up to 3 responses.

important as that of humans, that pigs should be free of fear or stress, that it is important to speak gently to pigs while handling, and they feel bad when they see a pig suffer or a co-worker mistreat a pig. The second factor (Antipathy) explained 14.4% of the total variance and included three variables that reflect a worker's difficulty in imagining what pigs feel when they are handled, and moving them without hitting them, and the perception that they are always aggressive toward humans. The third factor (Cruelty) was defined by two variables associated with a worker's perception of pain in pigs and the performance of painful practices and explained 11.9% of the total variance. The fourth factor (Self-confidence) was defined by two variables associated with a worker's perception of their skill in handling pigs and the need for physical effort to move the pigs and explained 10.9% of the total variance.

3.4. Worker profiles

To characterize groups or profiles of workers, the four factors (Sympathy, Antipathy, Cruelty, and Self-confidence) identified in the factor analysis were used in a hierarchical cluster analysis (Table 4). The median values for those factors and occupational satisfaction varied between 1 and 5 because those values were based on the 5-point Likert Scale. Profiles differed significantly ($P < 0.05$) in attitude about occupation satisfaction, handling and its effects on animals, years of work experience, and educational level. Profiles did not differ significantly ($P > 0.05$) in the sex or age of the workers. The first profile (Mechanical workers or Mw) included 34.5% ($n = 59$) of the respondents and those were persons who had sympathy toward pigs, but a neutral opinion

Table 3

Factor analysis of the variables that characterized the human-animal relationship based on the perceptions of workers (n = 171) at 12 slaughterhouses in Colombia.

Variables	Factors			
	Sympathy	Antipathy	Cruelty	Self-confidence
Is the welfare of pigs as important as that of humans?	0.791			
Should pigs be free from fear or stress?	0.789			
Do I think it is important to scratch and pet pigs to calm them down?	0.785			
Is it important to speak gently to pigs while handling them?	0.751			
When I see a pig suffer, do I feel as bad as when I see a human suffer?	0.735			
When I see a partner mistreat a pig, do I feel sad?	0.728			
Is it hard for me to imagine what pigs feel when I handle them?		0.783		
Is it difficult for me to move the pigs without hitting them?		0.763		
Are pigs always aggressive toward people?		0.623		
Do I think it is appropriate to cut off pigs' ears or tails to make them easier to handle?			0.845	
Do pigs feel less pain or suffering than a dog or cat?			0.829	
Are pigs difficult to handle?				0.879
Do I need to exert a lot of physical effort to move a pig?				0.675
Explained variance (%)	27.264	14.388	11.990	10.878

KMO sample adequacy measure: 0.770. Bartlett's test of sphericity: *P*-value <0.001. Total variance explained: 64.5%. Total Cronbach's Alpha: 0.669.

toward the antipathy factor, they disagree with the cruelty factor, and had a neutral opinion about their abilities to handle the animals. Furthermore, they were satisfied with the contact with pigs as part of their work, they agreed with the salary they received, and would encourage their sons to pursue the career, but their opinion was neutral about encouraging their daughters to do so. In that profile, individuals had >7 years of experience in this type of work and the most social mixing with the animals upon arrival at the slaughterhouse. The second profile (Concerned workers or Cw) included 16.4% of the sample (*n* = 28) and included workers who had more sympathy toward pigs and disagreed with the antipathy factor. Those workers disagreed with the cruelty factor and strongly disagreed with the self-confidence factor that reflected their abilities to handle the animals. In addition, they were the workers who were most satisfied with the contact/handling of pigs as part of their work, they were satisfied with the salary they received and, would encourage their sons and daughters to do this type of work. In that profile, workers felt that the lack of available pens in the slaughterhouse was the main difficulty in handling animals. The third profile (Professionalized workers or Pw) included 29.2% of the sample (*n* = 59) and were workers who had sympathy toward pigs and a very against opinion toward the antipathy and cruelty factor, and a neutral opinion about their abilities to handle animals. In addition, they were satisfied with the contact/handling of the pigs as part of their work, the salary they received, and would encourage their sons and daughters to do this type of work. Those in this profile indicated that prolapses were the main problem with animals upon their arrival at the slaughterhouse. That profile had the highest proportion of workers who had more than a high school education. The fourth profile (Apathic workers or Aw") included 19.9% of the sample (*n* = 34) included individuals who had a neutral opinion about the factors antipathy and sympathy for the pigs, although they strongly disagreed with cruelty and disagreed with the

factor of self-confidence in their abilities to handle the animals. Those in this profile had a neutral attitude about their satisfaction with working with pigs, the salary they received, and whether they would want their son to work in a slaughterhouse. They disagreed that they would encourage their daughter to work in the industry, and indicated that blows from blunt objects was the main injury that occurred to pigs in the slaughterhouse. Their educational background was high school and they had >7 years of work experience.

4. Discussion

The nature of the relationship matters as it will modulate not only animal health and welfare but also productivity and product quality as well as handler work quality and job satisfaction (Tallet, Brajon, Devillers, & Lensink, 2018). Recently, interest has grown in studying how farmers perceive animals and how these perceptions impact animal and human welfare (Des Roches, Veissier, Boivin, Gilot-Fromont, & Mounier, 2016); however, studies of the perceptions of other livestock-related professions are limited (Valadez-Noriega et al., 2018). For example, despite their important role in animal welfare in the pre-slaughter logistics chain, very little is known about the perceptions and attitudes and knowledge of the animals they interact with of slaughterhouse workers. Furthermore, little is known about whether they develop strategies for coping with the emotions in their work, and whether those workers can be profiled scientifically. Our study is the first to gather that type of information from workers at commercial pig slaughterhouses. Information about those workers from our study improves our understanding of them and provides a basis for developing strategies to improve the sustainability of the meat industry through specialized training, and for improving the conditions in which they work.

4.1. Sociodemographics

In our study, 8% of the respondents were women, which indicates that occupational gender segregation in animal handling in Colombian slaughterhouses has remained the norm. Historically, the handling and slaughtering of animals has been a male activity because of the separation of gender roles in emotional and physical terms (Nielsen et al., 2015). Another possible explanation might involve gender inequality that stems from marriage or motherhood, which might have a deterrent effect on a woman's choice of demanding work such as in slaughterhouses - incompatible work hours, demanding and harsh working conditions (Stellman, Lucas, & Anderson, 2013). Historically, in Colombian slaughterhouses, women were limited to tasks such as inspection, washing carcasses and viscera, packing meat, and cleaning the facilities (Bustamante et al., 2015). More recently, however, Colombian women have increased their presence in occupations that have been, male positions, traditionally, and reduced segregation in the pursuit gender equity in labor (Sims, 2021). That trend might improve animal welfare because women tend to show greater empathy toward animals, express traditionally female roles of care and concern, better control their emotions (anger and fear) in stressful situations, and favor the prevention of occupational accidents (Apostol, Rebega, & Miclea, 2013; Losada-Espinosa, Miranda-De la Lama, & Estévez-Moreno, 2020; Lupis, Lerman, & Wolf, 2014). Those innate qualities, however, might be important factors in the development of mental pathologies, which can occur in female slaughterhouse workers (Guilland & Moraes-Cruz, 2017). Depression has been the most prevalent condition in those women, which suggests that the relationships between environmental work factors and mental health have an important gender component (Lander et al., 2015; Serranheira, Souza-Uva, & Espírito-Santo, 2009).

In our study, 77% of the workers surveyed were < 40 years old, 59% had a basic education, 71% had <7 years of work experience, and > 75% of the workers learned their trade in the slaughterhouse. In Colombia, slaughterhouses are a source of rural or peri-urban employment that

Table 4

Profiles of the workers (n = 171) at 12 slaughterhouses in Colombia based on their perceptions and attitudes toward the human-animal relationship, demographics, animal handling conditions, and job satisfaction.

Variables	Group 1 Mechanical Workers (Mw)	Group 2 Committed Workers (Cw)	Group 3 Professionalized Workers (Pw)	Group 4 Apathic Workers (Aw)	P
	n = 59	n = 28	n = 50	n = 34	
Attitudes toward the human-animal relationship – Factor analysis (median)					
Sympathy [B]	4.33 [a]	4.83 [b]	4.17 [a]	3.00 [c]	< 0.001
Antipathy [B]	3.00 [a]	2.00 [b]	1.67 [c]	2.67 [a]	< 0.001
Cruelty [B]	2.00 [a]	1.50 [a]	1.00 [b]	1.00 [b]	< 0.001
Confidence in abilities [A]	3.50 [a]	1.50 [b]	3.00 [a]	2.50 [c]	< 0.001
Attitudes toward job satisfaction (median)[B]					
The contact and handling of pigs in my work brings satisfaction to my life	4.0 [a]	4.5 [b]	4.0 [a]	3.0 [c]	< 0.001
The payment I receive compensates me for the work I do	4.0 [a]	4.0 [a]	4.0 [a]	3.0 [b]	< 0.01
If I had sons, I would encourage them to do this work	4.0 [a]	4.0 [a]	4.0 [a]	3.0 [b]	< 0.01
If I had daughters, I would encourage them to do this work	3.0 [a]	4.0 [b]	4.0 [b]	2.0 [c]	< 0.01
Handling operations and welfare issues observed in the animals (%)					
Difficulty in unloading due to lack of pens [C]	2.9	5.3 [(+)]	5.8	2.3	<0.05
Social mixing at arrival [D]	8.8 [(+)]	1.8	2.3	1.2	<0.05
Prolapsed animals [C]	2.9	2.3	7.0 [(+)]	0.6	<0.05
Skin lesions (blunt force injuries) [D]	0.0	0.0	1.8 [(+)]	1.8 [(+)]	<0.05
Years of experience (%)[C]					
<7 years	59.3 [(−)]	78.6	70.0	85.3 [(+)]	<0.05
≥7 years	40.7 [(+)]	21.4	30.0	14.7 [(−)]	
Demographic features (Abattoir's workers - %)[C]					
Gender					
Female	10.2	10.7	4.0	5.9	N.S.
Male	89.8	89.3	96.0	94.1	
Age (%)[C]					
18 a 30	42.4	53.6	50.0	61.8	
31 a 40	25.4	17.8	34.0	26.5	N.S.
> 40	32.2	28.6	16.0	11.7	
Education level (%)[C]					
Elementary	33.9	35.7	26.0	11.8 [(−)]	
Secondary	55.9	50.0	52.0	82.4 [(+)]	<0.05
Higher	10.2	14.3	22.0 [(+)]	5.9	

Differences are significant if $P < 0.05$ based on an [A] ANOVA, [B] Kruskal-Wallis Test, [C] Chi-square test or [D] Likelihood Ratio. [a, b, c] indicates differences on the same line based on a U-Mann-Whitney Test or T-Student test (significance level of $P < 0.05$). N.S.: No significant differences between groups. [(+) (−)] indicate adjusted standardized residuals above or below 2.0 or − 2.0, respectively.

require low-skilled labor, which facilitates the entry of young and inexperienced personnel, or immigrants (e.g. Venezuelans). Workers under the age of 40 are considered to be one the most productive; however, they are vulnerable to physical and mental exhaustion because of the demands for physical strength, attention, concentration, and a constant state of vigilance (Guilland & Moraes-Cruz, 2017), which might explain the high worker turnover in the slaughterhouses in our study. High turnover might be caused by long working hours, night shifts, animal handling, physically demanding activities, and a high probability of accidents (Martins, Amaral, & da Silva, 2018; Tirloni, dos Reis, Ramos, & Moro, 2017). In short, difficult working conditions contribute significantly to persistent labor turnover, and working in a slaughterhouse seems to be a temporary occupation for many until they find a better work option (Lopina, Rogelberg, & Howell, 2012).

4.2. Handling practices

In our study, workers indicated that non-ambulatory animals were the main problem during unloading being characterized by their inability to move under their own power because of musculoskeletal injuries or extreme fatigue (Pilcher et al., 2011). Rough animal handling, animal features (i.e., overweight, sick or injured), truck and facility design, extreme weather, complex routes, and long journey time are factors that contribute to the presence of those types of animals

(Ritter et al., 2009). Extreme weather at unloading was the second most common problem reported by workers, which might have been because some animals were from genetic lines that are susceptible to heat stress (Porcine Stress Syndrome - PSS) (Benjamin, 2005; Ritter et al., 2006). Furthermore, in the tropical conditions in which the slaughterhouses studied and the rural areas they serve are located, the combination of high temperatures and humidity are major contributors to increases in injuries (both ambulatory and non-ambulatory) and DOA rates. Pigs often are transported in conditions that are outside of their thermal comfort zone (16–17 °C), which is compounded by the limited heat stress responses that pigs have because they do not sweat (Machado et al., 2021). Another difficulty of unloading was aggressiveness and other behavioral changes (e.g., restlessness, agitation) in the pigs, which can occur in response to extreme weather or social mixing, and can lead to scratches, bites, or ears cuts among animals (Pietrosemoli & Tang, 2020). The fourth most commonly cited cause of difficulty at unloading was problems with animal documentation upon arrival at the slaughterhouse, which reflected a lack of planning of logistical operations during transport and or at the slaughterhouse (Miranda-de la Lama, 2013).

Globally, the pig industry has specialized implements for herding pigs such as barriers, hoods, flags, boards, and plastic paddles (Grandin, 2015). However, in Colombia, these implements are not used, although respondents in our survey indicated that plastic bottles (empty or full)

often were used to herd pigs because the harm they can cause to an animal is minimal compared to that of blunt objects, and they produce a useful auditory stimulus to encourage the animals to move, possibly, because pigs are sensitive to low frequency (42 to 40,500 Hz) repetitive sounds, due to their high auditory sensitivity (Grandin, 2000; Heffner & Heffner, 1990). In our survey, shouting and whistling was the second most common herding method. Shouting provokes fear in animals and is an aversive reinforce (Hemsworth et al., 2002; Waiblinger et al., 2006), whereas whistling can alert the animals to the handler's approach and prevent scaring them (Hemsworth et al., 2011). The third most commonly used method of herding at the pig slaughterhouses in our study was the use of water to move the animals. Additionally, applied water can help lower the body temperature of animals in hot weather and help fatigued pigs recover upon arrival at the slaughterhouse (Fox et al., 2014).

In our study, workers identified fatigue and lameness as the two main animal welfare problems at the slaughterhouse level. Fatigue occurs because of the high physical demands on animals during transport and associated operations, and is characterized by a reluctance to move and, in some cases, respiratory distress (Johnson et al., 2013). During pre-slaughter operations, animals consume much more energy than usual but, in most cases, the animals can recover by resting (Losada-Espinosa, Villarroel, María, & Miranda-de la Lama, 2018; Ritter et al., 2009). Lack of space, discomfort and difficulty in maintaining balance (due to smooth vehicle floor surfaces, generated by rainwater or lack of traction steps), time, transport speed, and density, contact with more animals and or handlers than normal are other factors that contribute to an increase in energy consumption (Ritter et al., 2006; Romero, Sánchez, & Hernandez, 2022). Lameness can be caused by pre-slaughter handling difficulties that include fights caused by the mixing of animals in limited space in the truck or lairage pens, which can change the social and hierarchical organization of animal groups in a way that causes agonistic encounters that can cause severe injuries such as bruises and fractures, which are indicators of poor animal welfare (Harley et al., 2014). In our survey, fatigue and overweight were the most commonly cited causes of death in pigs at the slaughterhouse. Fatigue is the outcome of non-ambulatory animals that fail to recover during their stay and lairage time at the slaughterhouse (Ritter et al., 2006). Overweight can contribute to fatigue because of hemodynamic and cardiac structure. Our study has shown the importance of focusing slaughterhouse efforts on the types of risks identified by workers, which can form the basis of holistic mitigation strategies.

4.3. Workers' attitudes: Factor analysis

The factor analysis identified four factors that define the human-animal relationship in the opinion of slaughterhouse workers. The first two factors refer to empathy, this term is defined by De Waal (2012) as the secondary development of a conceptual tool around the emotional contagion of adopting the other's perspective or imagining oneself in the other's position. Empathy is important in interpersonal relationships, influences the relationships between humans and non-human species, and how we treat and care for animals (Colombo, Crippa, Calderari, & Prato-Previde, 2017). The first factor (sympathy) reflects the positive emotions of closeness, respect, and responsibility toward the pigs by the workers. Theoretically, sympathy is a positive emotion that reflects concern for the state of another person or animal, and includes attempts to improve this state (De Waal, 2008). Sympathy is a pro-social behavior and is part of an evolutionarily stable strategy that allows the establishment and strengthening of bonds within intra- and extra-species social groups (Adriaense, Koski, Huber, & Lamm, 2020). Furthermore, the personal values of the workers influence the manifestation and intensity of sympathy, which can be enhanced through training (Losada-Espinosa et al., 2020).

The second factor (antipathy) included variables that reflect a worker's fear of the animals, which can cause aggressive treatment as an anticipatory response to any possible reaction of the pigs (Coleman, Hemsworth, & Hay, 1998). Antipathy is a feeling of disaffection, rejection, or adverse mood and is the opposite of sympathy (Arkow, 2020). Although humans have an innate propensity to affiliate with other animals (Biophilia Hypothesis, see Wilson, 1984), humans innately perceive that some animals are potentially dangerous; e.g., snakes, insects. Most do not perceive pigs as dangerous; however, farm or slaughterhouse workers know that, in stressful situations, there is a risk of accidents during handling or of being attacked by animals (Losada-Espinosa et al., 2020). For that reason, workers can develop fears, phobias, or an open antipathy for some of the animals that they handle. Such a superficial perception of potentially harmful stimuli is favored by natural selection because it reduces the probability of not detecting a real danger, this is known as the smoke detector principle proposed by Nesse (2005). The implication is that the antipathy toward pigs or some pigs based on appearance, category, size, sex, or behavioral profile that develops in a worker might be a self-protection mechanism, which is still less risky than is failing to detect a potentially dangerous animal. Antipathy might cause some workers to use cruel behaviors that they justify because of the potential "dangerousness of an animal" (Prokop & Randler, 2018).

The third factor (cruelty) comprised two questions that were associated with antipathy and cruelty. The first question reflects the opinion of workers who do not recognize that pigs have the same capacity for emotions as companion animals. The second question, on the other hand, refers to the normalization of cruel practices (such as ear and tail docking) to make fatigued pigs walk on arrival at the slaughterhouse. The capacity to suffer is the basis of moral concern for animals, and belief in animal sentience is a strong predictor of attitudes toward animals and their use (Peden et al., 2020). Cruelty to animals is defined as any act or omission that contributes to the pain, suffering, or unnatural death of animals, or in any way threatens their welfare (Longobardi & Badenes-Ribera, 2019). Kellert and Felthous (1985) found that the most common motives for cruelty toward animals are to control an animal or influence its behavior, to retaliate against an animal, to satisfy a prejudice against a particular animal, to express violent and aggressive behaviors through an animal toward other people or animals, to impress others with one's capacity for violence, to entertain coworkers or friends, to retaliate against other people, and to displace hostility from a person to an animal. In a slaughterhouse, all of those motivations can exist among workers, and the presence of this factor in our study confirmed that cruelty factor is part of the multi-dimensionality of human-animal relationships.

The fourth factor (self-confidence) involved a suite of questions bearing on worker attitudes that are associated with an "excess of self-confidence" when handling pigs. Those attitudes are based on an excessive self-consciousness in persons who do not exhibit humility in their praxis, and are prone to practice and defend unethical, questionable, and unsustainable practices, which create the conditions for unintended negative consequences (Gorzelak et al., 2017). Probably, long-term routine handling of animals can lead to excessive self-confidence in some workers, which can be accompanied by complacency among coworkers (Murphy & O'Connell, 2017). In addition to the damage that they can cause to animals, those attitudes can reduce self-regulation, which affects performance and increases the probability of an occupational accident (Coury, Kumar, & Jones, 1999).

4.4. Workers' profiles: Hierarchical cluster analysis

In Colombia, slaughterhouse work has been professionalized because the country has been engaged in a process of infrastructure, legal, and operational modernization (Romero, Uribe-Velásquez, Sánchez, & Miranda-de La Lama, 2013). Historically, slaughterhouse work has been considered 'dirty work' and of dubious prestige (Baran, Rogelberg, & Clausen, 2016). Those types of jobs are considered undesirable, morally objectionable, and carry a social stigma because they involve physically

demanding, unpleasant, dirty, and culturally taboo activities such as death, prostitution, and waste (Ashforth & Kreiner, 2014). Our study had the assumption that slaughterhouse workers are not a homogeneous group and that their attitudes toward animals and their work are diverse, and it identified four worker profiles, based on their attitudes toward animals, their socio-demographic characteristics, job satisfaction, work experience, and their concern for pig welfare. It is important to segment or profile workers because it is possible to identify persistent inherent personal attitudes and work styles that positively or negatively affect human-animal relationships in a challenging environment such as a slaughterhouse. Profiling provides a basis for designing strategies for training and mitigation of handling and welfare problems, and to improve human-animal relations (Pulido et al., 2018).

4.4.1. Profiles of animal welfare ambiguous workers

Although the Mw and Aw profiles did not overtly indicate that workers were emotionally distant to the pigs, they did indicate lower thresholds of emotional distance toward the pigs. Even though our survey was anonymous, that might have been a product of an individual's desire to maintain some consistency in providing 'politically correct' responses (Valadez-Noriega et al., 2018). The two profiles included characteristics associated with burnout syndrome such as apathy, in which the affected person presents a mechanical attitude, or exhaustion, in which the affected person presents an emotional and cognitive collapse, which causes dissatisfaction in the work environment (Fournier & Mustful, 2019).

In our study, the Mw profile had a high evaluation of the sympathy factor (statistically, similar to the Pw group) and distant from the cruelty factor, but was neutral for the antipathy factor and for overconfidence in their animal handling skills. They were workers who had >7 years of experience in the activity (although unrelated to age) and felt that their sons could do the work, but were neutral about whether their daughters should do the same. Similar behaviors and attitudes have been described in other slaughterhouse workers because the tasks demand motor skills and strength, are repetitive, fast, and unvarying; e.g., handling animals, slaughtering, skinning, and butchering under conditions of a fast-moving chain (Mendes, Dos Santos, & Ichikawa, 2017). Grandin (1988) described the Mw profile as persons who have a mechanical attitude toward the handling or killing of animals efficiently and painlessly, chats about the weather and gossips with their co-workers, but does not shout at or speak to the animals. For example, to those individuals, the social mixing of animals from different origins is an animal welfare problem because it disrupts the repetitive nature of their work. Those attitudes stem from workers perceiving animals as objects and, typically, the objectification is directed toward the species(s) they work with, and they might be sensitive and close to other species; e.g., companion animals (Owens, Davis, & Smith, 1981). That might be an emergent worker profile because it is associated with experience and, possibly, at the beginning of their work in the slaughterhouse they might have had another profile; e.g., Aw. A person who has fully adopted a mechanical attitude no longer has any emotion about the work (Grandin, 1988). Serpell (1996) demonstrated that persons who regularly slaughter animals become progressively desensitized to the act. Their first exposure to slaughtering might have been disturbing to them, but they became used to it, the act of killing became an emotionless reflex, and they adopted the standard efficiency and speed of operations required in the slaughterhouse.

The Aw profile was characterized by workers who were neutral toward the sympathy and antipathy variables in the factor analysis. This apparent neutrality is really an indication of an emotional distance toward the animals, which could be an emotional self-defense mechanism of the worker (Fournier & Mustful, 2019), because of a contradiction between job expectations and the reality of having to kill might cause moral stress (Andrukonis, Hall, & Protopopova, 2020). Furthermore, that profile primarily comprised young workers who had little experience in slaughterhouse work, who were dissatisfied with their salary and had low job satisfaction. Job dissatisfaction in workers <30 years of age has been widely reported because workers have experienced workplace violence by co-workers or have worked in a violent environment (Brown, Myers, Casteel, & Rauscher, 2020). Reeve, Rogelberg, Spitzmüller, and DiGiacomo (2005), found that animal shelter employees who were directly involved in euthanasia had significantly higher levels of job stress, stress-related somatic complaints, and lower levels of job satisfaction than did animal shelter employees who were not involved in euthanasia, which suggests that animal slaughter might be an important cause of work-related stress (Slade & Alleyne, 2022).

4.4.2. Profiles of animal welfare friendly workers

In our study, the Cw and Pw profiles were close to positive emotions toward pigs and openly opposed to antipathy toward pigs. Workers' positive empathy toward animals, especially the species with which they work can be an important factor in job satisfaction, quality of life, health, and safety (Pol et al., 2021). The Cw profile scored the highest in the study toward the factor of sympathy toward pigs and are distant with the factor of antipathy, cruelty and self-confident attitude toward their animal handling skills. Most of the workers in that profile had >7 years of experience in the activity (although unrelated to age), had the highest work and life satisfaction, and would encourage sons and daughters to work in a slaughterhouse. For those workers, pigs have an ambivalent role because they see them as sentient beings and as a commodity. Thus, there is a paradoxical conflict between the moral values of a person and his/her behavior, which is nevertheless justified to protect his/her interests (Wellbrock & Knierim, 2020). This type of worker tries to resolve this ambivalence by developing a positive emotional closeness to the pigs through non-violent handling of the pigs (Andrukonis et al., 2020). That profile has been found among sow caretakers by Pol et al. (2021), who reported that good treatment of sows allows them to handle them better, which reduces the probability of accidents, and improves productivity.

Those designated as "professionalized workers" had a high evaluation of the sympathy factor (statistically, similar to the Mw group), were the furthest removed from the cruelty and antipathy factors, but were neutral on overconfidence in their animal handling skills. Most of the workers with that profile had >7 years of experience in the activity (although unrelated to age), had the highest job and life satisfaction rating, and would encourage their children to work in a slaughterhouse. A possible explanation for all these results might be because it is the profile that had the highest number of better-trained employees. Horrillo, Obregón, Escribano, and Gaspar (2022) reported that the most professionalized workers showed the greatest responsibility and capacity to successfully adopt good biosecurity practices in extensive pig farms. An example of the professionalizing attitude of the Pw profile is that they identified prolapses as the most important animal welfare problem in their work, although skin lesions are perceived as part of the risk. Professionalizing attitudes in workers is a set of personal qualities and behaviors associated with assertiveness, honesty, punctuality, integrity, initiative, empathy, and compassion (Dart, McCall, Ash, & Rees, 2022). Professionalism is a value that is highly dependent on culture. In Colombia, for >50 years, SENA (*National Service of Apprenticeship / public organization*) has been offering technical and technological training to professionalize workers, which has created a professional work culture that is committed to strategic objectives in industry, commerce, and the agri-food sector (Ochoa-Rojas, 2021). Given the characteristics of the profile, it is possible that those workers are the most likely to assimilate training and adopt animal welfare standards.

5. Conclusions

Our study identified four segments or profiles of slaughterhouse workers. The first were workers who relate to animals and their work in a mechanical way, the second were professional workers who are

emotionally close to animals, the third were those committed to animals and their work, and the fourth were workers who are apathetic toward animals and work activity. Possibly, those profiles are not static and workers might evolve among themselves depending on the work, family, and social environments to which they belong. Our study contributes in a pioneering way to the understanding of the attitudes and knowledge of slaughterhouse workers, which will assist industry and academics in developing training strategies to promote or improve human-pig relationships at the slaughterhouse level by considering differences among workers. Likewise, future research aimed at improving the human-pig relationship should focus on strategies to modify or mitigate certain worker attitudes related to cruelty, negative empathy, job dissatisfaction and excessive self-confidence in handling animals.

Authorship statement

All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated sufficiently in the work to take public responsibility for the content, including participation in the concept, design, analysis, writing, or revision of the manuscript.

CRediT authorship contribution statement

Adriana P. Pastrana-Camacho: Conceptualization, Validation, Investigation, Data curation, Writing – original draft, Writing – review & editing. **Laura X. Estévez-Moreno:** Conceptualization, Methodology, Supervision, Data curation, Formal analysis, Writing – review & editing. **Genaro C. Miranda-de la Lama:** Conceptualization, Methodology, Supervision, Writing – original draft, Writing – review & editing, Visualization, Project administration.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the study reported in this paper.

Data availability

Data will be made available on request.

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