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# Consumers perceptions about the welfare of farm animals in Colombia[1]

# Percepciones de consumidores sobre el bienestar de los animales de producción en Colombia

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## Abstract

**Introduction.** Research focused on listening and understanding public attitudes towards farm animal welfare is proliferating globally. **Objective.** To determine how consumers in Colombia perceive the welfare of farm animals and socio-demographic factors associated with such perceptions. **Materials and methods.** A descriptive and analytical epidemiological study was done through the implementation of a cross-sectional national online survey, conducted from September to October-2021, to obtain information on the knowledge and attitudes of consumers (≥18 years) in Colombia regarding farm animal welfare, as well as socio-demographic characteristics (sex, age, education, occupation, location, growing-up environment, level of contact with livestock farms, and diet). Logistic and multinomial logistic regression models were used to evaluate associations of demographic factors with the level of importance given to animal welfare (AW), perceptions about needs, behavior, and sentience in farm animals, and perceptions about the state and promotion of AW in Colombia. **Results.** Responses from 798 participants were included in the analysis, 85.57 % saw AW as a concept that refers to how to treat animals and improve their quality of life. The level of importance given to AW was 9.78±0.85 (scale from 0 to 10) and was associated with words such as health, food, caring, respect, and comfort. Sex, age, education, level of contact with a farm, and growing-up in rural areas significantly influenced the opinions regarding the concept of AW and the promotion of farm animal welfare in Colombia. **Conclusion.** The participants showed concern about farm animal welfare. The differences found associated with the different socio-demographic factors can be used as a basis for formulating education and empowerment strategies that help modulate changes in the way animals are seen, and what welfare means and what it implies.

**Keywords:** attitudes, domestic animals, opinions, society.

## Resumen

**Introducción.** El bienestar animal tiene como objetivo mejorar la calidad de vida de los animales que están bajo cuidado humano, por eso es importante escuchar y entender las actitudes públicas hacia el bienestar en animales de producción. **Objetivo.** Determinar cómo los consumidores en Colombia perciben el bienestar en animales de producción y factores sociodemográficos asociados a dichas percepciones. **Materiales y métodos.** Se realizó un estudio epidemiológico descriptivo y analítico mediante la aplicación de una encuesta transversal nacional en línea, realizada de septiembre a octubre de 2021, para obtener información sobre conocimientos y actitudes de consumidores (≥18 años) en Colombia, respecto al bienestar en animales de producción, así como características sociodemográficas (sexo, edad, educación, ocupación, ubicación, entorno de crecimiento, nivel de contacto con fincas y dieta). Se utilizaron modelos de regresión logística y logística multinomial para evaluar asociaciones de factores demográficos con el nivel de importancia dado al bienestar animal (BA), percepciones sobre necesidades, comportamiento y sintiencia animal, y percepciones sobre el estado y promoción del BA en Colombia. **Resultados.** Respuestas de 798 participantes fueron analizadas; 85,57% vio al BA como un concepto que refiere a cómo tratar a los animales y mejorar su calidad de vida. El nivel de importancia dado al BA fue 9,78±0,85 (escala de 0 a 10) y se asoció con palabras como salud, alimentación, cuidado, respeto y comodidad. Sexo, edad, educación, nivel de contacto con una finca y crecer en zonas rurales, influenciaron significativamente las opiniones sobre el concepto de BA y la promoción del bienestar en animales de producción en Colombia. **Conclusión.** Los participantes mostraron preocupación por el bienestar de animales de producción. Las diferencias encontradas asociadas a factores sociodemográficos pueden servir de base para formular estrategias de educación y empoderamiento que ayuden a modular cambios en el cómo se ve a los animales y en lo significa e implica su bienestar.


**Palabras clave:** actitudes, animales domésticos, opiniones, sociedad.

## Introduction

Animal welfare science aims to improve the quality of life of the animals that are under human care (Walker et al., 2014), in order to respond to the ethical concerns that society has regarding the care and handling of these animals (Weary & Robbins, 2019). The foregoing emphasizes that animal welfare is a science that has a social mandate (Fraser, 2008).

Animal welfare is a key and transversal component to the pillars of sustainability of any system that uses or houses animals (whether for productive, recreational, or conservation purposes, among others), especially when it comes to the social acceptability of a particular system by the general public (Tarazona et al., 2020). In this regard, Rollin (2020) states that even though "society is very unlikely to abandon animal products", society will only accept animal production if it respects the needs and nature of animals.

Of the different actors that interact in the social mandate of the welfare of farm animals, the main ones are the general public (society) and the producers. These actors tend to be in a constant moral conflict due to entrenched and opposing opinions about care and routine practices that are carried out in production systems (Spooner et al., 2014). The public is generally classified by producers as people who are unaware or uninformed about the daily work on a farm and the needs of animals (Rollin, 2020; Weary & von Keyserlingk, 2017). Additionally, citizens see animal welfare as a concept that goes beyond health, involving aspects such as avoiding animal suffering, freedom of movement, and living a natural life (Lassen et al., 2006). While, for a producer, animal welfare is equivalent to having healthy, efficient, and optimally productive animals (Vanhonacker et al., 2008). The dissent on perceptions regarding the current state of welfare of farm animals is another example of the moral conflict between producers and society, where producers see it more positively compared to citizens (Vanhonacker et al., 2008).

Industries should not ignore the demands of the public since society wields direct and indirect power over them. Indirect power is related to the influence that citizens have in formulating animal protection policies, while direct power is related to ethical consumption and refraining from buying certain products of animal origin (Rollin, 2020). This public power can trigger prohibition and, therefore, the disappearance of some systems or ways of producing food (Tarazona et al., 2020).

In this sense, research focused on listening to and understanding people's attitudes towards the welfare of farm animals is proliferating globally [some examples for Europe: Lassen et al. (2006) and Vanhonacker et al. (2008); North America: McKendree et al. (2014) and Spooner et al. (2014); and Latin America: Estévez-Moreno et al. (2021; 2022) and Schnettler et al. (2008)]. This type of research is known to help identify conflicts and shared values and concerns related to animal welfare between producers and non-producers (Alonso et al., 2020; Spooner et al., 2014). These identified conflicts and shared values and concerns have been the basis for the establishment of strategies to close the gap in dissent (Spooner et al., 2014) and to formulate policies for the care and promotion of animal welfare accepted by all actors, which is essential to achieve sustainability and social acceptability of the livestock production systems (McKendree et al., 2014).

Animal welfare legislation in Colombia is evolving rapidly, being one of few countries worldwide that legally recognizes animals as sentient beings (Law N°. 1774, 2016). Currently, the Colombian Agricultural Institute (*Instituto Colombiano Agropecuario*) is in process of developing animal welfare codes of practice and methodology to evaluate welfare conditions for all farm animals (Ministerio de Agricultura y Desarrollo Rural, 2020a; 2020b). These codes and assessment protocols must be practical and reflect societal expectations, considering diverse opinions among stakeholders (including producers and consumers) and building consensus, which improve the quality and success of the implementation of these codes and protocols (Fraser, 2015).

In Colombia, the study of consumer perceptions on animal welfare is a developing area of knowledge. To date, there are data from two studies that included Colombians [(university students (Randler et al., 2021) and South American consumers (Estévez-Moreno et al., 2022)], within their target population to assess the impact of socio-demographic factors in human attitudes towards animal welfare. Both studies found that the participating Colombian population showed high pro-animal attitudes and a significant level of ethical concern for the welfare of farm animals.

Considering the growing interest in understanding attitudes towards farm animals in developing societies, the need to generate local knowledge and its importance in the development of consensus-based animal welfare codes, protocols and policies, this study aimed to determine how consumers in Colombia perceive the welfare of farm animals, and socio-demographic factors associated with those perceptions.

## Materials and methods

This study followed a descriptive and analytical epidemiological approach through the implementation of a cross-sectional online survey (written in Spanish) of consumers (over 18 years of age) in Colombia and their knowledge and attitudes regarding the welfare of farm animals. The definition of 'farm animal' used in this study was: "an animal kept, fattened or raised for the production of food or products of animal origin" (Real Academia Española, 2020). This study was reviewed and approved by the Ethics Committee of Corporacion Colombiana de Investigacion Agropecuaria (AGROSAVIA) and by the Ministerio de Agricultura y Desarrollo Rural of Colombia.

The survey was designed through the survey administration software offered by Google (Google Forms; Google, Mountain View, CA, US). All authors reviewed the questionnaire before distribution. An invitation to participate in the study and the link to the final questionnaire was distributed on social networks (Facebook, Instagram, WhatsApp, Twitter, LinkedIn) and the AGROSAVIA news website. Additionally, the invitation and the

link were sent directly to seven veterinary medicine schools in Colombia for distribution through their listserv. The survey remained available for a period of 4 weeks from September 27 to October 25, 2021.

**Sample size estimation**

The epidemiological tool EPITOOLS (Epitools Epidemiological Calculators; Sergento, 2018) was used to estimate the number of participants needed to describe the attributes (regarding perceptions about the welfare of production animals) of the adult population of consumers in Colombia (N = 35,153,585 adults; Departamento Administrativo Nacional de Estadística, 2018) and analyze the relationship between demographic factors and consumer perceptions. Assuming a proportion of people who perceive animal welfare as a concept related to providing animals with a better quality of life of 40 % (European Union, 2016) and a desired precision (accepted error) of 3.50 %, the minimum required sample size was 753 people for a confidence level of 95 %. Based on the study by Estévez-Moreno et al. (2021), where they found that the mean level of importance (on a scale of 0 to 10) attributed to the welfare of farm animals by Mexican women and men was 8.4 and 7.9, respectively, and assuming a standard deviation (SD) of 2.50, a minimum sample size of 786 people was required for a confidence level of 95 % and a power of 80 %.

**Survey, collection and description of data**

The survey used a combination of open and closed questions (multiple choice and scales), previously used in studies of Mexican and Spanish consumers (Estévez-Moreno et al., 2021), European (European Union, 2016), and Canadian citizens (Ventura et al., 2016). The final version of the survey consisted of three sections. The first section described the purpose of the study so that the interested people could make an informed decision about whether or not to participate in the survey. Those interested who agreed to participate were directed to the second section 'Socio-demographic aspects', which consisted of seven closed questions on sex, age, level of education, occupation, place of residence, the environment where they grew up, and type of diet (Table 1).

Once this section was completed, the participants were directed to the third and final section 'General Understanding of Animal Welfare', which began with the definition of 'farm animal' and was composed of one open question and sixteen closed questions. The open-ended question asked them to write three words that come to mind when they think of animal welfare. The next two questions (multiple choice) inquired about what they understood by animal welfare and about the level of contact they have had with livestock production systems. The fourth question asked respondents to rate 'how important is providing welfare to farm animal welfare' to them using a scale of 0 to 10, where 0 = "Not important at all" and 10 = "Very important".

Subsequently, they were asked to answer a series of questions (five on basic needs, behavior, and sentience in farm animals; seven on various aspects related to the promotion of animal welfare in the country; and one on the state of welfare in the country) selecting the most appropriate option in their opinion, using symmetrical five-point Likert scales (they also had the option to indicate 'Do not know'). It was not mandatory to answer all the questions; therefore, the total number of responses varied by question.

**Data management and statistical analysis**

Data were exported from the Google Forms web application to Microsoft Excel (Microsoft Corp., Redmond, WA) for data cleaning and screening. A total of 816 people clicked on the survey link, but only 810 consented to complete the questionnaire. Of these, 12 people were removed because their place of residence was outside of Colombia or they did not indicate their place of residence. A variable for the geographic region was created by

**Table 1.** Distribution of socio-demographic factors of the participants who completed the online survey about consumers perceptions in Colombia regarding the welfare of farm animals. Colombia, Sept-Oct 2021.

**Cuadro 1.** Distribución de aspectos socio-demográficos de los participantes que completaron la encuesta sobre percepciones de consumidores adultos acerca del bienestar de animales de producción. Colombia, sept-oct., 2021.

| Variable | Percentage | 95 % CI[a] |
|---|---|---|
| Sex, n = 791 | | |
| Female | 59.29 | 55.87 – 62.72 |
| Male | 40.71 | 37.28 – 44.13 |
| Age (years), n = 794 | | |
| 18 a 30 | 35.01 | 31.69 – 38.33 |
| 31 a 45 | 34.26 | 30.96 – 37.56 |
| > 45 | 30.73 | 27.52 – 33.94 |
| Level of education[b], n = 797 | | |
| Higher education | 81.05 | 78.33 – 83.77 |
| No higher education | 18.95 | 16.23 – 21.67 |
| Occupation[c], n = 796 | | |
| Student | 23.24 | 20.31 – 26.18 |
| Worker | 65.83 | 62.53 – 69.12 |
| Other | 10.93 | 8.76 – 13.10 |
| Type de diet, n = 795 | | |
| Omnivorous | 93.96 | 92.31 – 95.62 |
| Vegetarian | 4.65 | 3.19 – 6.12 |
| Vegan | 1.38 | 0.57 – 2.20 |
| Environment (growing-up), n = 795 | | |
| Rural | 21.26 | 18.41 – 24.10 |
| Urban | 78.74 | 75.90 – 81.59 |
| Visits to a livestock system, n = 795 | | |
| No, never | 14.59 | 12.14 – 17.05 |
| Yes, at least once | 64.65 | 61.33 – 67.98 |
| Yes, directly involved[d] | 20.75 | 17.9 4– 23.57 |
| Geographic region, n = 798 | | |
| Andean | 86.22 | 83.63 – 88.53 |
| Other[e] | 13.78 | 11.39 – 16.18 |

[a]Confidence interval. [b]Higher education: undergraduate or postgraduate degree, No higher education: primary or secondary school level. [c]Worker: employee and independent worker, Other: retired, unemployed and household tasks. [d]Producer, worker or consultant. [e]Other: Amazon, Caribbean, Orinoquia and Pacific regions. / [a]Intervalo de confianza. [b]Educación superior: pregrado o posgrado, Sin educación superior: nivel de escuela primaria o secundaria. [c]Trabajador: asalariado y trabajador independiente, Otros: pensionados, desempleados y tareas del hogar. [d]Propietario, trabajador o consultor. [e]Otra: regiones de la Amazonía, Caribe, Orinoquía y Pacífica.

grouping the places specified in the question about the place of residence. The organized database was imported into SAS® Studio (Statistical Analysis Systems Institute, 2021). Descriptive statistics calculated included percentages and 95 % confidence intervals (CI), and mean and standard deviation (SD). A word cloud was used to visually capture and describe the words that participants wrote when asked to think about the concept of animal welfare. For this, an online word cloud art creator (WordArt.com) was used.

Regression models were used to evaluate the association between socio-demographic factors (outcomes) and perceptions about animal welfare as explanatory variables (qualitative ordinal variables treated as discrete

quantitative variables). A model was run for each socio-demographic factor, except for the variable "type of diet" due to lack of variation. Logistic regression models were run for binary outcomes: sex (male vs. female), growing-up environment (rural vs. urban), and education (with higher education vs. without it). Multinomial logistic regression models were used for outcomes with 3 levels: age (18-30, 31-45 and >45 years), occupation (worker, student, and other), and level of contact with a farm (direct, indirect, and never).

The regression models assessed the log of odds of the outcome happening (e.g., the log of odds of being a male participant vs. a female one; for the variable sex) by fitting the data to a logit function using the probability of the outcome happening (p) and the probability of not happening (1-p), adjusted by its predictors (i.e., explanatory variables) (equation 1, 2 and 3). For the multinomial models, it was assessed the log of odds of each outcome-level happening against the other 2 levels (e.g., the log of odds of being a participant who works (worker) vs. a participant who is a student, worker vs. other, and a student vs. other; for the variable occupation):

$$Log(odds) = Logit(p) = Ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1\chi_1 + \beta_2\chi_2 + \cdots + \beta_i\chi_i \quad (1)$$

$$p = \frac{1}{1 + e^{-(\beta_0 + \beta_1\chi_1 + \beta_2\chi_2 + \cdots + \beta_i\chi_i)}} \quad (2)$$

$$odds = \frac{p}{1-p} = e^{\beta_0 + \beta_1\chi_1 + \beta_2\chi_2 + \cdots + \beta_i\chi_i} \quad (3)$$

Where, $\beta_0$ is the model constant, and $\beta_i$ is the estimated parameter for each explanatory variable $\chi_i$. Table 2 presents the descriptions of the variables $\chi_i$.

The variable region (Andean vs. other [includes the other regions]) was included in the models as a fixed effect to control for clustering by region. Univariable regression models were first performed to analyzed associations between each dependent variable and each of the explanatory variables (significance level of $p<0.20$; Hosmer & Lemeshow, 2000). Subsequently, the existence of correlation (Spearman's correlation coefficient $>|0.7|$) between the explanatory variables was evaluated to determine collinearity. If two variables were correlated, only one of the variables (the one with the highest significance in the bivariate analysis) was included in the multivariable analysis. The multivariable model included all significant independent variables in the univariable analysis ($p<0.20$), and backward gradual elimination was used, where only significant variables remained ($p<0.05$) and confounding variables (non-significant variables that, when eliminated, caused a >20 % change in the coefficient of any other explanatory variable in the model; Dohoo et al., 2009).

## Results

### General description of participants

A total of 798 participants and their responses were included in the analysis. Of the total participants, 59.29 % were women. The majority of participants were between 18 and 45 years old, had an undergraduate university degree, were employed, urban residents, with an omnivorous diet, and had visited a livestock production system at least once or several times in the past. Only 14.59 % of the participants reported never having visited a farm. Most of the participants resided in the Andean region (Table 1).

**Table 2.** List of questions that inquired about the perception of adult consumers on 1) basic needs, behavior, and sentience in farm animals; 2) various aspects related to the promotion of animal welfare in the country; and 3) the state of animal welfare in the country. Colombia, Sept-Oct 2021.

**Cuadro 2.** Lista de preguntas que indagaron acerca de la percepción de consumidores adultos sobre 1) necesidades básicas, comportamiento y sintiencia en animales de producción; 2) diversos aspectos relacionados con la promoción del bienestar animal en el país; y 3) el estado del bienestar animal en el país. Colombia, sept-oct., 2021.

| Question (independent variables) | n | Mean ± SD |
|---|---|---|
| How important is providing welfare to farm animals?[a] | 764 | 9.78 ± 0.85 |
| *Basic needs, behavior and sentience*[b] | | |
| Do you believe that farm animals should be well-fed, healthy and have adequate resting places? | 794 | 4.97 ± 0.20 |
| Do you believe that farm animals should be able to express the natural behavior of their species? | 791 | 4.73 ± 0.60 |
| Do you believe that farm animals should be free of fear and stress? | 795 | 4.90 ± 0.39 |
| Do you believe that farm animals can feel pain and suffering? | 795 | 4.69 ± 0.94 |
| Do you believe that farm animals can feel positive (e.g. happiness and pleasure) or negative emotions (e.g. boredom, melancholy)? | 790 | 4.76 ± 0.59 |
| *Aspects related to the promotion of animal welfare in the country*[b] | | |
| Do you believe that the welfare of farm animals in our country should be improved? | 794 | 4.92 ± 0.32 |
| Do you believe that children should be educated about animal welfare in schools? | 796 | 4.91 ± 0.34 |
| Do you believe that new animal welfare laws are needed to prevent abuse and mistreatment of farm animals? | 791 | 4.82 ± 0.56 |
| Would you like to be informed about the living conditions of the animals where the products you eat/ consume come from? | 793 | 4.68 ± 0.73 |
| Do you think that producers should be financially compensated for the improvements in animal welfare they make? | 792 | 4.42 ± 0.98 |
| Do you believe that imported foods should be respectful of animal welfare? | 790 | 4.89 ± 0.40 |
| Do you think that the information on food labels should contain information about how animals were raised and their welfare? | 795 | 4.67 ± 0.70 |
| *State of animal welfare in the country*[c] | | |
| Do you think that the living conditions of farm animals in Colombia have improved in the last 10 years? | 634 | 3.87 ± 0.67 |

[a]Answers given using a scale of 0 to 10, where 0 = "Not important at all" and 10 = "Very important; [b]Answers given using a symmetrical five-point Likert scale, where 1 = "Surely not" and 5 = "Definitely yes"; [c]Answers given using a symmetrical five-point Likert scale, where 1 = "Has gotten much worse" and 5 = "Has improved very much". / [a]Respuestas dadas usando una escala de 0 a 10, donde 0 = "Para nada importante" y 10 = "Muy importante"; [b]Respuestas dadas usando una escala Likert de cinco puntos, donde 1 = "Definitivamente no" y 5 = "Definitivamente sí". [c]Respuestas dadas usando una escala Likert de cinco-puntos, donde 1 = "Ha empeorado muchísimo" y 5 = "Ha mejorado muchísimo".
Mean and standard deviation (SD) of the level indicated by the participants in each question. / Media y desviación estándar (SD) del nivel indicado por los participantes en cada pregunta.

## Perceptions on animal welfare

The majority of consumers who participated in the survey (85.59 %) saw animal welfare as a concept that refers to the way animals are treated and seeks to provide them with a better quality of life; 6.15 % and 6.02 % saw it as a concept that refers to the duty to respect all animals and as a factor that contributes to improving the quality of products of animal origin, respectively. Only 0.50 % of the participants indicated that it is the same as animal

protection or indicated that they did not know. On average, participants assigned animal welfare a very high level of importance, with a mean score of 9.78 (range: 0 to 10) (Table 2). A total of 2,383 words were written by all the participants when asked to think about the concept of animal welfare. Nine words made up 50 % of the total number of words, where 'health' was the most frequent term, followed by 'nutrition', 'care', 'respect', 'comfort', 'freedom', 'food', 'good treatment', and 'protection' (Figure 1).


**Figure 1.** Word cloud built with the words used by the participants when responding to the question 'Write three words that come to your mind when thinking of animal welfare' (responses to an online survey of adult consumers). Colombia, Sept-Oct. 2021.

Words frequency is reflected by their size.

**Figura 1.** Nube de palabras construida con las palabras utilizadas por los participantes al responder a la pregunta 'escribir tres palabras que se le vinieran a la mente cuando pensaran en bienestar animal' (respuestas a una encuesta online realizada a consumidores adultos). Colombia, sept-oct., 2021.

La frecuencia de las palabras se refleja en su tamaño.

## Association between demographic factors and perceptions

### *a) Sex*

Sex was significantly associated with the level of importance given to the question 'how important is it to provide welfare for farm animals' and with the level of perceived improvement that the living conditions of farm animals in Colombia have had in the last 10 years (Table 3). Specifically, for each increase in the level of importance given to 'provide welfare', the probability that the participant was male (vs. female) was reduced 0.62 times. For each increase in the level of perceived improvement in the living conditions in the past decade, the probability that the participant was male (vs. female) increased 1.37 times.

**Table 3.** Logistic regression models of perceptions/attitudes about animal welfare associated with sex and the environment where the participants grew up (responses from an online questionnaire of adult consumers). Colombia, Sept-Oct. 2021.

**Tabla 3.** Modelos de regresión logística de percepciones/actitudes sobre el bienestar animal, asociadas al sexo y al entorno donde crecieron los participantes (respuestas a una encuesta online realizada a consumidores adultos). Colombia, sept-oct., 2021.

| | | | | 95% CI[d] | | |
|---|---|---|---|---|---|---|
| **Models and variables** | **ß[a]** | **SE[b]** | **OR[c]** | **LCL** | **UCL** | **p-value** |
| *Model 1. Probability of being a male vs. a female participant* | | | | | | |
| Importance to provide welfare for farm animals[e] | -0.47 | 0.15 | 0.62 | 0.46 | 0.83 | 0.002 |
| Level of perceived improvement of living conditions of farm animals in Colombia[f] | 0.32 | 0.13 | 1.37 | 1.06 | 1.79 | 0.017 |
| Region, Andean vs. Other[g] | 0.31 | -0.18 | 0.69 | 0.45 | 1.08 | 0.11 |
| Intercept | 3.27 | 1.55 | | | | |
| *Model 2. Probability of being a participant who grew up in a rural vs. an urban environment* | | | | | | |
| 'Producers should be financially compensated for improvements in animal welfare they make'[h] | 0.26 | 0.10 | 1.30 | 1.06 | 1.60 | 0.01 |
| Region, Andean vs. Other[g] | -0.03 | 0.12 | 0.93 | 0.57 | 1.51 | 0.78 |
| Intercept | -2.47 | 0.50 | | | | |

[a]Regression coefficient. [b]Standard error. [c]Odds ratio. [d]Confidence interval for the OR (LCL: lower limit; UCL: upper limit). [e]Level of importance evaluated using a scale from 0 to 10, where 0 = "Not important at all" and 10 = "Very important". [f]Level of perceived improvement evaluated using a five-point Likert scale, where 1 = "Has gotten much worse" and 5 = "Has improved very much". [g]Other = Amazon, Caribbean, Orinoquia, and Pacific regions; [h]Level of belief evaluated using a 5-point Likert scale, where 1 = "Surely not" and 5 = "Definitely yes". / [a]Coeficiente de regresión. [b]Error estándar. [c]Odds ratio (por su nombre en inglés). [d]Intervalo de confianza para el OR (LCI: límite inferior; LCS: límite superior). [e]Nivel de importancia evaluado en una escala de 0 a 10, donde 0 = "Para nada importante" y 10 = "Muy importante". [f]Nivel de mejoramiento percibido evaluado usando una escala Likert de cinco-puntos, donde 1 = "Ha empeorado muchísimo" y 5 = "Ha mejorado muchísimo". [g]Otra = Regiones de la Amazonía, Caribe, Orinoquía y Pacífica; [h]Nivel de creencia percibido evaluado usando una escala Likert de 5-puntos, donde 1 = "Definitivamente No" y 5 = "Definitivamente sí".

*b) Environment growing up*

The environment where the respondents grew up was significantly associated with the perception of the economic compensation of producers for making improvements in the welfare of their animals. Specifically, for each increase in the level of belief that producers should be compensated, the probability of being a participant who grew up in a rural environment (vs. urban) increased 1.3 times (Table 3).

*c) Age*

The variable age was significantly associated with the level of perceived improvement in the living conditions of farm animals in Colombia in the last 10 years ($p = 0.02$; Table 4). Specifically, for each increase in the level of perceived improvement in animal living conditions, the probability that the participant was between 18 and 30 years old or between 31 and 45 years old (vs. being over 45 years old) was reduced 0.66 and 0.71 times, respectively.

**Table 4.** Multinomial logistic regression model of perceptions/attitudes about animal welfare associated with the age of participants (responses from an online questionnaire of adult consumers). Colombia, Sept-Oct. 2021.

**Tabla 4.** Modelo de regresión logística multinomial de percepciones/actitudes sobre el bienestar animal asociadas con la edad de participantes (respuestas a una encuesta online realizada a consumidores adultos). Colombia, sept-oct., 2021.

| | | | | 95 % CI[d] | | |
|---|---|---|---|---|---|---|
| **Variable** | **ß[a]** | **SE[b]** | **OR[c]** | **LCL** | **UCL** | **p-value** |
| *Probability of being a participant between the ages of 18-30 vs >45 years* | | | | | | |
| Level of perceived improvement of living conditions of farm animals[e] | -0.41 | 0.15 | 0.66 | 0.48 | 0.89 | 0.008 |
| Region, Andean vs. Other[f] | 0.57 | 0.27 | 1.77 | 1.03 | 3.06 | 0.037 |
| Intercept | 1.14 | 0.67 | | | | |
| *Probability of being a participant between the ages of 31-45 vs > 45 years* | | | | | | |
| Level of perceived improvement of living conditions of farm animals[e] | -0.33 | 0.15 | 0.71 | 1.03 | 3.06 | 0.031 |
| Region, Andean vs. Other[f] | 0.37 | 0.26 | 1.45 | 0.87 | 2.42 | 0.14 |
| Intercept | 1.08 | 0.66 | | | | |
| *Probability of being a participant between the ages of 18-30 vs 31-45 years* | | | | | | |
| Level of perceived improvement of living conditions of farm animals[e] | -0.08 | 0.13 | 0.92 | 0.70 | 1.21 | 0.56 |
| Region, Andean vs. Other[f] | 0.19 | 0.28 | 1.22 | 0.69 | 2.13 | 0.48 |
| Intercept | 0.06 | 0.59 | | | | |

[a]Regression coefficient. [b]Standard error. [c]Odds ratio. [d]Confidence interval for the OR (LCL: lower limit; UCL: upper limit). [e]Level of perceived improvement evaluated using a five-point Likert scale where 1 = "Has gotten much worse" and 5 = "Has improved very much". [f]Other = Amazon, Caribbean, Orinoquia, and Pacific regions. / [a]Coeficiente de regresión. [b]Error estándar. [c]Odds ratio (por su nombre en inglés). [d]Intervalo de confianza para el OR (LCI: límite inferior; LCS: límite superior). [e]Nivel de mejoramiento percibido evaluado en una escala de 1 a 5, donde 1 = "Ha empeorado muchísimo" y 5 = "Ha mejorado muchísimo". [f]Otra = Regiones de la Amazonía, Caribe, Orinoquía y Pacífica.

*d) Level of education*

It was found that for each increase in the level of belief given to 'Do you believe that farm animals should be free from fear and stress', the probability of being a participant with higher education increased 1.71 times (Table 5). Likewise, it was found that for each increase in the level of belief given to 'Imported foods should be respectful of animal welfare', the probability of being a participant with higher education increased 1.64 times.

*e) Occupation*

The type of occupation was significantly associated with perceptions about whether 'farm animals should be able to express the natural behavior of their species' (p= 0.04), about 'being informed about the living conditions of the animals where the products you eat/consume come from' (p= 0.019), and whether 'producers should be financially compensated for improvements in animal welfare that they make' (p= 0.017; Table 6). Specifically, the probability that the respondent was a student (vs. worker) increased 1.51 times for each increase in the level of perceived belief that animals should be able to express natural behaviors. Likewise, the increase in the level of belief about being informed regarding the living conditions of farm animals was associated with the probability

**Table 5.** Logistic regression models of perceptions/attitudes about animal welfare associated with the probability of being a participant with a higher education degree (at least an undergraduate degree) versus a participant without it (secondary education as the highest educational level achieved); responses from an online questionnaire of adult consumers. Colombia, Sept-Oct 2021.

**Tabla 5.** Modelo de regresión logística de percepciones/actitudes sobre el bienestar animal asociadas con la probabilidad de ser un participante con educación superior (por lo menos nivel educativo de pregrado) *versus* un participante sin educación superior (bachillerato como nivel educativo máximo alcanzado); respuestas a una encuesta online realizada a consumidores adultos. Colombia, sept-oct., 2021.

| | | | | 95 % CI[d] | | |
|---|---|---|---|---|---|---|
| **Variable** | **ß[a]** | **SE[b]** | **OR[c]** | **LCL** | **UCL** | **p-value** |
| 'Farm animals should be free of fear and stress'[e] | 0.53 | 0.24 | 1.71 | 1.06 | 2.75 | 0.028 |
| 'Imported foods should be respectful of animal welfare'[e] | 0.49 | 0.21 | 1.64 | 1.09 | 2.47 | 0.018 |
| 'New animal welfare laws are needed to prevent abuse and mistreatment of farm animals'[ef] | -0.40 | 0.24 | 0.67 | 0.41 | 1.07 | 0.097 |
| 'To be informed about the living conditions of animals where products you eat/consume come from'[ef] | -0.31 | 0.17 | 0.73 | 0.52 | 1.03 | 0.071 |
| Region, Andean vs Other[g] | 0.42 | 0.16 | 2.34 | 1.20 | 4.55 | 0.012 |
| Intercept | 0.18 | 1.43 | | | | |

[a]Regression coefficient. [b]Standard error. [c]Odds ratio. [d]Confidence interval for the OR (LCL: lower limit; UCL: upper limit). [e]Level of belief evaluated using a five-point Likert scale, where 1 = "Surely not" and 5 = "Definitely yes". [f]Confounder variables. [g]Other = Amazon, Caribbean, Orinoquia, and Pacific regions. / [a]Coeficiente de regresión. [b]Error estándar. [c]Odds ratio (por su nombre en inglés). [d]Intervalo de confianza para el OR (LCI: límite inferior; LCS: límite superior). [e]Nivel de creencia percibido evaluado usando una escala Likert de cinco-puntos, donde 1 = "Definitivamente no" y 5 = "Definitivamente sí". [f]Variables confusoras. [g]Otra = Regiones de la Amazonía, Caribe, Orinoquía y Pacífica.

of that thought coming from a student and not from a worker (employee or independent; OR= 1.57) or a retired/unemployed/person dedicated to household duties (OR= 1.61). For each increase in the level of belief that producers should be economically compensated for the improvements in animal welfare they make, the probability of the participant being a student (vs worker) was reduced 0.78 times.

*f) Level of contact with a livestock production system*

The level of contact that the participants have had with production systems was significantly associated with the perception of whether farm animals should be free from fear and stress (p= 0.04) and with the level of perceived improvement that living conditions of farm animals in Colombia have had in the last 10 years (p<0.0001); Table 7). Specifically, the probability of being a participant who has visited a farm at least once or being a participant who is directly involved with a farm (vs. never having visited one) increased 1.45 and 2.71 times, respectively, for each increase in the perceived level of improvement in the living conditions in the last decade. The probability of being a participant who is directly involved with a farm (vs. visited a farm at least once) increased 3.54 times for each increase in the level of belief that farm animals should be free from fear and stress; and increased 1.85 times for each increase in the level of perceived improvement in the living conditions in the last decade.

**Table 6.** Multinomial logistic regression model of perceptions/attitudes about animal welfare associated with the type of occupation[a] of the participants; responses from an online questionnaire of adult consumers. Colombia, Sept-Oct. 2021.

**Tabla 6.** Modelo de regresión logística multinomial de percepciones/actitudes sobre el bienestar animal asociadas con el tipo de ocupación[a] de los participantes; respuestas a una encuesta online realizada a consumidores adultos. Colombia, sept-oct., 2021.

| | | | | 95 % CI[e] | | |
|---|---|---|---|---|---|---|
| **Variable** | **ß[b]** | **SE[c]** | **OR[d]** | **LCL** | **UCL** | **p-value** |
| *Probability of being a participant whose occupation was being a student vs. a worker* | | | | | | |
| 'Farm animals should be able to express the natural behavior of their species'[f] | 0.41 | 0.18 | 1.51 | 1.05 | 2.17 | 0.02 |
| 'To be informed about the living conditions of animals where products you eat/consume come from'[f] | 0.45 | 0.16 | 1.57 | 1.12 | 2.17 | 0.006 |
| 'Producers should be financially compensated for improvements in animal welfare they make'[f] | -0.25 | 0.08 | 0.78 | 0.65 | 0.92 | 0.004 |
| Region, Andean vs. Other[g] | 0.91 | 0.31 | 2.49 | 1.34 | 8.43 | 0.003 |
| Intercept | -4.86 | 1.15 | | | | |
| *Probability of being a participant whose occupation was other vs. worker* | | | | | | |
| 'Farm animals should be able to express the natural behavior of their species'[f] | 0.34 | 0.23 | 1.41 | 0.89 | 2.21 | 0.13 |
| 'To be informed about the living conditions of animals where products you eat/consume come from'[f] | -0.02 | 0.16 | 0.97 | 0.78 | 1.35 | 0.89 |
| 'Producers should be financially compensated for improvements in animal welfare they make'[f] | -0.08 | 0.12 | 0.91 | 0.71 | 1.17 | 0.48 |
| Region, Andean vs. Other[g] | 0.33 | 0.35 | 1.40 | 0.69 | 2.83 | 0.34 |
| Intercept | -3.24 | 1.27 | | | | |
| *Probability of being a participant whose occupation was student vs. other* | | | | | | |
| 'Farm animals should be able to express the natural behavior of their species'[f] | 0.07 | 0.27 | 1.07 | 0.62 | 1.84 | 0.80 |
| 'To be informed about the living conditions of animals where products you eat/consume come from'[f] | 0.47 | 0.21 | 1.61 | 1.06 | 2.45 | 0.02 |
| 'Producers should be financially compensated for improvements in animal welfare they make'[f] | -0.16 | 0.13 | 0.85 | 0.65 | 1.11 | 0.22 |
| Region, Andean vs. Other[g] | 0.57 | 0.44 | 1.77 | 0.74 | 4.25 | 0.19 |
| Intercept | -1.61 | 1.60 | | | | |

[a]Three categories: Student, Worker (employee and independent worker), and Other (retired, unemployed and household tasks). [b]Regression coefficient. [c]Standard error. [d]Odds ratio. [e]Confidence interval for the OR (LCL: lower limit; UCL: upper limit. [f]Level of belief evaluated using a five-point Likert scale, where 1 = "Surely not" and 5 = "Definitely yes". [g]Other = Amazon, Caribbean, Orinoquia, and Pacific regions. / [a]Tres categorías: Estudiante, Trabajador (empleado y trabajador independiente) y Otro (pensionado, desempleado, hogar). [b]Coeficiente de regresión. [c]Error estándar. [d]Odds ratio (por su nombre en inglés). [e]Intervalo de confianza para el OR (LCI: límite inferior; LCS: límite superior). [f]Nivel de creencia evaluado usando una escala Likert de cinco-puntos, donde 1 = "Definitivamente no" y 5 = "Definitivamente sí". [g]Otra = Regiones de la Amazonía, Caribe, Orinoquía y Pacífico.

## Discussion

This study provides information about the perceptions of adult consumers in Colombia regarding the welfare of farm animals in the country. However, it is important to note that in the present study there was a higher proportion of people from the Andean region and a higher proportion of people with a higher level of education compared to the target population of adult consumers in Colombia (an average of 11.53 % of the population in Colombia has

**Table 7.** Multinomial logistic regression model of perceptions/attitudes about animal welfare associated with the level of contact[a] that participants have had with livestock production systems; responses from an online questionnaire of adult consumers. Colombia, Sept-Oct. 2021.

**Tabla 7.** Modelo de regresión logística multinomial de percepciones/actitudes sobre el bienestar animal asociadas con el nivel de contacto[a] que han tenido los participantes con sistemas de producción animal; respuestas a una encuesta online realizada a consumidores adultos. Colombia, sept-oct., 2021.

| Variable | | | | 95% CI[e] | | |
|---|---|---|---|---|---|---|
| | ß[b] | SE[c] | OR[d] | LCL | UCL | p-value |
| *Probability of being a participant who had visited a farm at least once vs. never* | | | | | | |
| 'Farm animals should be free of fear and stress'[f] | -0.07 | 0.39 | 0.29 | 0.42 | 2.03 | 0.85 |
| Level of perceived improvement of living conditions of farm animals[g] | 0.38 | 0.17 | 1.45 | 1.03 | 2.05 | 0.031 |
| Region, Andean vs. Other[h] | -0.56 | 0.48 | 0.57 | 0.21 | 1.28 | 0.25 |
| Intercept | 1.42 | 2.12 | | | | |
| *Probability of being a participant who is directly involved in a farm vs. never* | | | | | | |
| 'Farm animals should be free of fear and stress'[f] | 1.19 | 0.62 | 3.29 | 0.97 | 11.08 | 0.054 |
| Level of perceived improvement of living conditions of farm animals[g] | 0.99 | 0.23 | 2.71 | 1.72 | 4.25 | <0.0001 |
| Region, Andean vs. Other[h] | -1.01 | 0.51 | 0.36 | 0.13 | 0.99 | 0.049 |
| Intercept | -7.90 | 3.27 | | | | |
| *Probability of being a participant who is directly involved in a farm vs. had visited a farm at least once* | | | | | | |
| 'Farm animals should be free of fear and stress'[f] | 1.26 | 0.50 | 3.54 | 1.32 | 9.53 | 0.012 |
| Level of perceived improvement of living conditions of farm animals[g] | 0.61 | 0.17 | 1.85 | 1.32 | 2.60 | 0.0003 |
| Region, Andean vs. Other[h] | -0.45 | 0.25 | 0.64 | 0.39 | 1.04 | 0.069 |
| Intercept | -9.33 | 2.65 | | | | |

[a]Three categories: Never had visited a farm, had visited a farm at least once, and being directly involved (as a producer, worker or consultant to the system). [b]Regression coefficient. [c]Standard error. [d]Odds ratio. [e]Confidence interval for the OR (LCL: lower limit; UCL: upper limit). [f]Level of belief evaluated using a 5-point Likert scale, where 1 = "Surely not" and 5 = "Definitely yes". [g]Level of perceived improvement evaluated using a five-point Likert scale where 1 = "Has gotten much worse" and 5 = "Has improved very much". [h]Other = Amazon, Caribbean, Orinoquia, and Pacific regions. / [a]Tres categorias: Nunca haber visitado una finca, haber visitado una finca al menos una vez, y estar directamente involucrado (por ser un productor, trabajador o asesor del sistema). [b]Coeficiente de regresión. [c]Error estándar. [d]Odds ratio (por su nombre en inglés). [e]Intervalo de confianza para el OR (LCI: límite inferior; LCS: límite superior). [f]Nivel de creencia percibido evaluado usando una escala Likert de cinco-puntos, donde 1 = "Definitivamente No" y 5 = "Definitivamente 5"). [g]Nivel de mejoramiento percibido evaluado usando una escala Likert de 5-puntos, donde 1 = "Ha empeorado muchísimo" y 5 = "Ha mejorado muchísimo". [h]Otra = Regiones de la Amazonía, Caribe, Orinoquía y Pacífica.

an undergraduate and/or postgraduate level of education; Departamento Administrativo Nacional de Estadística, 2019), so this may limit the possibility of generalizing the results to the total adult population in Colombia.

In general, it was found that the majority of the participating population understands 'animal welfare' as a concept that refers to how animals are treated and to provide them with a better quality of life, which was perceived as something very important, especially concerning ensuring good health, food, care, comfort, and freedom, as well as treating them well, respecting them and protecting them (word cloud). The fact that people correctly understand what animal welfare is and what it implies in countries like Colombia, where the concept is in an initial phase of development compared to European countries (de Oliveira Souza et al., 2019), may take time and have socio-economic limitations.

Nevertheless, the perceptions exhibited by Colombian participants are similar to what is evidenced by studies on consumer perceptions in European countries such as Norway (Ådnegard Skarstad et al., 2007). In this study, consumers defined animal welfare in two ways: first, animals "live in freedom" (access to natural habitat and can express their natural behavior) and second, animals receive good care and have a good producer-animal relationship

(a clean environment, adequate nutrition, and animals are seen by the producer as individual sentient beings). Furthermore, in the present study, the level of importance assigned to animal welfare was higher (9.78/10) than the level assigned by consumers in Spain and Mexico (8.10 and 8.40/10, respectively) in a study conducted by Estévez-Moreno et al. (2021), where the authors highlighted that concern for animal welfare is no longer an exclusive characteristic of the inhabitants of developed countries, but something that is becoming "universal human values".

It should be noted that the word cloud generated with the words that the participants of this study associated with animal welfare, not only evoke aspects of the conceptual framework of the three circles of animal welfare (health and biological functioning, affective states, and natural life; Fraser et al., 1997). Also include aspects related to duty, with the responsibility that people have towards the animals in human care, which is a representation of the extension of the concept of animal welfare beyond the three circles of welfare, encompassing the "duty of care", as suggested by Weary and Robbins (2019).

The perceived utility and the strength of the affection that humans see in/feel for animals are only part of the "puzzle" in understanding human attitudes toward animals, since there are other factors related to animal attributes, people attributes (characteristics and experiences), and cultural aspects that modulate human behavior towards animals (Serpell, 2004). In this study, it was found that sex, age, educational level, type of occupation, the environment where the person grew up and the level of previous contact with livestock production systems influenced how adult consumers in Colombia perceive farm animal welfare and its importance, as well as their attitude on aspects such as the possibility for farm animals to express behavior and experience emotions, the promotion of animal welfare in the country, and the state of animal welfare in the country.

As the level of importance given to animal welfare increased, the probability of being male (within the group of participants) decreased. These results are consistent with the findings of other studies that showed that men tend to have a more carefree attitude towards animal welfare (Estévez-Moreno et al., 2021; McKendree et al., 2014; Randler et al., 2021), although, in studies carried out at the European Union level (Eurobarometer), sex has been identified as a non-significant factor (European Union, 2016). It is interesting to note that the study by Randler et al. (2021), which was carried out in twenty-two countries, including Colombia, found that the sex difference was more pronounced in those countries with a low level of sex inequality. The autors highlights the importance of reducing inequalities as a tool to improve the human attitude towards animals in society.

In the present study, it was also identified that as the level of perceived improvement in the living conditions of farm animals increased, the probability that the respondent was a man increased, as well as the probability of being a participant who was directly involved with a farm (producer, worker or consultant). Previous studies have found that men (vs. women in Belgium; Van Poucke et al., 2006) and producers (vs. citizens in the Netherlands and Belgium; Te Velde et al., 2002 and Vanhonacker et al., 2008, respectively) are more positive when talking about the state of animal welfare in their country. One could argue, as Vanhonacker et al. (2008), that producers base themselves on their hands-on experience and the point of view of 'health and productivity are synonymous with welfare', to affirm that animal welfare has improved in the last decade, and not in terms of painful experiences or pleasurable and opportunities to express natural behaviors typical of the species, which is a predominant point of view among people in the general public (Te Velde et al., 2002).

Additionally, it is important to recognize that there is a phenomenon known as "farm blindness" which according to Mee (2020) means "a misperception by farmers that what they see every day on their own farm is normal, … particularly when it is not". This phenomenon arises from either not recognizing the problem, not seeing the problem as a problem, or from recognizing it but being blind to it, which may be associated with a lack of records, underestimation of the impact of the problem, desensitization or lack of knowledge (Mee, 2020).

Age was also identified as a factor associated with the level of perceived improvement in the living conditions of farm animals in the last decade, where the younger participants, the more pessimism they expressed regarding the level of perceived improvement. Although in the present study no association was found between age and the

level of importance given to providing animal welfare. There are studies (Estévez-Moreno et al., 2021; McKendree et al., 2014) that have found that young populations see animal welfare as something very important compared to older populations, which may explain why in the present study young people (18 to 30 and 31 to 45 years old) were more reluctant to perceive positive changes in animal welfare in Colombia. Another possible explanation for the previously mentioned finding may be linked to what Grandin (2014) reports regarding changes that some animal activist groups have had, where they have gone from seeking to reform livestock production systems to seeking to eliminate them, and that young people tend to believe everything that comes out on the social networks of these groups making them more pessimistic about the state of animal welfare in the country. The foregoing helps to highlight how essential it is to promote transparency in the industries, that they listen to the public, and that they share with it what they do and what they are willing to do to improve the welfare of the animals involved (Grandin, 2014; Rollin, 2020).

Positive perceptions about animals being able to be free from fear and stress were associated with participants having at least an undergraduate educational level and being directly involved with a livestock production system. Accepting that animals should be free from fear and stress implies a prior acceptance of the animal's capability to experience negative emotions, which is directly influenced by the level of knowledge and familiarity with the species in question (Valros & Hänninen, 2018).

Regarding being directly involved with a production system, a Belgian study showed that producers consider a good human-animal relationship to be very important as part of good well-being, and give a higher rating (compared to citizens) to aspects related to animal suffering (pain and fear) and stress when asked if they believed that that aspect represents a potential animal welfare concern in current production systems (Vanhonacker et al., 2008).

Furthermore, perceptions about whether animals should be able to express the natural behavior of their species were positively influenced when the participant was a student, as well as wanting to be informed about the living conditions of the animals where the products they consume come from. These findings may be influenced by age, where students, in general, are going to be a younger population than people who are working, retired, unemployed, or dedicated to household duties.

In general, consumers associate animal welfare with access to natural environments and being able to perform natural behaviors (Spooner et al., 2014), which may be derived from the importance that consumers globally give to naturalness as an essential characteristic of the food industry, despite this being more common among older people (Román et al., 2017). The findings of this study regarding the fact that students want to be informed are similar to what is evidenced by European consumers, where young people (15-24 years old) or who are still studying have shown a greater interest in obtaining information about the management conditions and treatment given to farm animals (European Union, 2016).

Regarding the type of occupation, being a worker (vs. student) or being a person who grew up in a rural environment were positively associated with definitely believing that producers should be compensated for the changes they make for improving the welfare of their animals. One possible explanation for this finding is that being economically active, working to earn a living, and being familiar with the life and work in the fields, may lead to feeling more empathy for farmers and their efforts to improve both the lives of animals and themselves, since livestock production is their livelihood. Empathy is defined as "the ability to imagine and understand the thoughts, perspective, and emotions of another person" (Oxford Dictionary), and some research has shown that empathy towards similar people (e.g. ethnicity) tends to be higher, where the response to situations faced by these similar people would be how they would respond to themselves (Brown et al., 2006; Gutsell & Inzlicht, 2012).

The main limitation of this study is that how in which the survey was distributed could have generated some type of selection bias since access to the survey was only possible through the internet and social networks, and it was voluntary. A non-response bias could have occurred by excluding people with limited internet access or who are not active on social networks, as well as a volunteer bias because the people who voluntarily decided to

complete the survey could be people interested in animal welfare and share certain characteristics that may differ from the general population of adult consumers in Colombia. Additionally, a social desirability bias could have occurred since the participants could complete the survey based on what they think it would be correct to answer, but not on what they truly believe; however, the survey was anonymous and participants could not be identified, which could help reduce this type of bias.

## Conclusions

Adult consumers perceived to provide welfare to farm animals as something very important, which they associated with a good quality of life, as well as with good health, nutrition, care, and comfort, without neglecting the importance of respect and protection these animals deserve. Sex had an impact on the perceived importance of animal welfare as well as on the perceived improvement it has had in Colombia, being women more pro-welfare but less optimistic about advances in the last decade. The closest the contact participants had with a livestock productive system, the more optimistic they were about animal welfare improvements and the strongest their opinion was regarding as a key element that farm animals should be free from fear and stress. Level of education, occupation, and growing-up environment were factors associated with attitudes regarding economic compensation for producers who make changes to improve the welfare of their animals. Students being against and workers and people raised in rural areas in favor.

Even though in developing countries such as Colombia the concept of animal welfare is in an initial phase of development, the results of this study show that the consumers in the Colombian society, who participated in this survey, care and are concerned about the welfare of farm animals. The differences found in this study associated with the socio-demographic factors can be used as a basis for formulating strategies for education, empowerment, and strengthening of the various groups that conform the Colombian society (e.g. women, youth, producers, rural and urban communities) that help to modulate changes in the way animals are seen, in what animal welfare means and what it implies.

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## References

Ådnegard Skarstad, G., Terragni, L., & Torjusen, H. (2007). Animal welfare according to Norwegian consumers and producers: Definitions and implications. *The International Journal of Sociology of Agriculture and Food, 15*(3), 74–90. https://doi.org/10.48416/ijsaf.v15i3.285

Alonso, M. E., González-Montaña, J. R., & Lomillos, J. M. (2020). Consumers' concerns and perceptions of farm animal welfare. *Animals, 10*(3), Article 385. https://doi.org/10.3390/ani10030385

Brown, L. M., Bradley, M. M., & Lang, P. J. (2006). Affective reactions to pictures of ingroup and outgroup members. *Biological Psychology, 71*(3), 303–311. https://doi.org/10.1016/j.biopsycho.2005.06.003

Departamento Administrativo Nacional de Estadística. (2018). *Censo Nacional de Población y Vivienda. 2018 – Colombia. ¿Cuántos somos? Información general*. https://sitios.dane.gov.co/cnpv/#!/

Departamento Administrativo Nacional de Estadística. (2019). *Censo Nacional de Población y Vivienda. 2018 – Colombia. Mapas temáticos. Educación y Primera Infancia. Nivel educativo*. https://bit.ly/2kt8sMI

de Oliveira Souxa, A. P., Oliveira Leite, L., & Forte Maiolino Molento, C. (2019). Animal welfare in Central and South America: What is going on? In S. Hild, & L. Schweitzer (Eds.), *Animal Welfare: from Science to Law* (pp. 88–102). La Fondation Droit Animal, Éthique et Sciences. https://www.fondation-droit-animal.org/documents/AnimalWelfare2019.v1.pdf

Dohoo, I. R, Martin, W., & Stryhn, H. (2009). *Veterinary epidemiologic research* (2nd ed.). VER, Inc.

Estévez-Moreno, L. X., María, G. A., Sepúlveda, W. S., Villarroel, M., & Miranda-de la Lama, G. C. (2021). Attitudes of meat consumers in Mexico and Spain about farm animal welfare: A cross-cultural study. *Meat Science, 173*, Article 108377. https://doi.org/10.1016/j.meatsci.2020.108377

Estévez-Moreno, L. X., Miranda-de la Lama, G. C., & Miguel-Pacheco, G. G. (2022). Consumer attitudes towards farm animal welfare in Argentina, Chile, Colombia, Ecuador, Peru and Bolivia: A segmentation-based study. *Meat Science, 187*, Article 108747. https://doi.org/10.1016/j.meatsci.2022.108747

European Union. (2016). *Attitudes of Europeans towards animal welfare* (Special Eurobarometer 442). EU publications. https://doi.org/10.2875/884639

Fraser, D. (2008). *Understanding animal welfare: the science in its cultural context*. Wiley-Blackwell.

Fraser, D. (2015). Turning science into policy: The case of farm animal welfare in Canada. *Animal Frontiers, 5*(3), 23–27. https://academic.oup.com/af/article/5/3/23/4638759

Fraser, D., Weary, D. M., Pajor, E. A., & Milligan, B. N. (1997). A scientific conception of animal welfare that reflects ethical concerns. *Animal Welfare, 6*, 187–205.

Grandin, T. (2014). Animal welfare and society concerns finding the missing link. *Meat Science, 98*(3), 461–469. https://doi.org/10.1016/j.meatsci.2014.05.011

Gutsell, J. N., & Inzlicht, M. (2012). Intergroup differences in the sharing of emotive states: neural evidence of an empathy gap. *Social Cognitive and Affective Neuroscience, 7*(5), 596–603. https://doi.org/10.1093/scan/nsr035

Hosmer, D. W., & Lemeshow, S. (2000). Model-building strategies and methods for logistic regression. In W. A. Shewhart, & S. S. Wilks (Eds.), *Applied logistic regression* (2nd ed., pp. 91–142). John Wiley & Sons Inc.

Lassen, J., Sandøe, P., & Forkman, B. (2006). Happy pigs are dirty! – conflicting perspectives on animal welfare. *Livestock Science, 103*(3), 221–230. https://doi.org/10.1016/j.livsci.2006.05.008

Ministerio de Agricultura y Desarrollo Rural. (2020a). *Resolución de 2020 número 000136*. https://bit.ly/3B6LW12

Ministerio de Agricultura y Desarrollo Rural. (2020b). *Resolución de 2020 número 000253*. https://bit.ly/3yWU8Oq

McKendree, M. G. S., Croney, C. C., & Widmar, N. J. O. (2014). Effects of demographic factors and information sources on United States consumer perceptions of animal welfare. *Journal of Animal Science, 92*(7), 3161–3173. https://doi.org/10.2527/jas.2014-6874

Mee, J. F. (2020). Denormalizing poor dairy youngstock management: dealing with "farm-blindness". *Journal of Animal Science, 98*(1), S140–S149. https://doi.org/10.1093/jas/skaa137

Randler, C., Adan, A., Antofie, M. -M., Arrona-Palacios A., Candido, M., Boeve-de Pauw, J., Chandrakar, P., Demirhan, E., Detsis, V., Di Milia, L., Fančovičová, J., Gericke, N., Haldar, P., Heidari, Z., Jankowski, K. S., Lehto, J. E., Lundell-Creagh, R., Medina-Jerez, W., Meule, A., L., … Vollmer, C. (2021). Animal welfare attitudes: effects of gender and diet in University samples from 22 countries. *Animals, 11*(7), Article 1893. https://doi.org/10.3390/ani11071893

Real Academia Española. (2020). *Diccionario panhispánico del español jurídico*. https://dpej.rae.es/

Rollin, B. (2020). Animal welfare viewpoint: why should industry worry about food animal quality of life. In T. Grandin and M. Cockram (Eds.), *The slaughter of farm animals* (pp. 309–313). CAB International.

Román, S., Sánchez-Siles, L. M., & Siegrist, M. (2017). The importance of food naturalness for consumers: Results of a systematic review. *Trends in Food Science & Technology, 67*, 44–57. https://doi.org/10.1016/j.tifs.2017.06.010

Schnettler, B., Vidal, R., Silva, R., Vallejos, L., & Sepúlveda, N. (2008). Consumer perception of animal welfare and livestock production in the Araucania Region, Chile. *Chilean Journal of Agricultural Research, 68*(1), 80–93. http://doi.org/10.4067/S0718-58392008000100008

Sergento, E. S. G. (2018). *Epitools - Calculadoras epidemiológicas*. *Estudios epidemiológicos*. *Cálculos de tamaño de muestra*. Ausvet. http://epitools.ausvet.com.au

Serpell, J. A. (2004). Factors influencing human attitudes to animals and their welfare. *Animal Welfare, 13*, 145–151.

Spooner, J. M., Schuppli, C. A., & Fraser, D. (2014). Attitudes of Canadian citizens toward farm animal welfare: A qualitative study. *Livestock Science, 163*, 150–158. https://doi.org/10.1016/j.livsci.2014.02.011

Statistical Analysis Systems Institute. (2021). *The SAS Studio – OnDemand for Academics* (Release 3.8 Enterprise Edition). SAS Institute Inc.

Tarazona, A. M., Ceballos, M. C., & Broom, D. M. (2020). Human relationships with domestic and other animals: One health, one welfare, one biology. *Animals, 10*(1), Article 43. https://doi.org/10.3390/ani10010043

Te Velde, H., Aarts, N., & van Woerkum, C. (2002). Dealing with ambivalence: farmers' and consumers' perceptions of animal welfare in livestock breeding. *Journal of Agricultural and Environmental Ethics, 15*, 203–219. https://link.springer.com/article/10.1023/A:1015012403331

Valros, A., & Hänninen, L. (2018). Animal Ethical Views and Perception of Animal Pain in Veterinary Students. *Animals, 8*(12), Article 220. https://doi.org/10.3390/ani8120220

Van Poucke, E., Vanhonacker, F., Nijs, G., Braeckman, J., Verbeke, W., & Tuyttens, F. (2006). Defining the concept of animal welfare: integrating the opinion of citizens and other stakeholders. In M. Kaiser & M. Lien (Eds.), *Ethics and the politics of food* (pp. 555–559). Wageningen Academic Publishers.

Vanhonacker, F., Verbeke, W., Van Poucke, E., & Tuyttens, F. A. M. (2008). Do citizens and farmers interpret the concept of farm animal welfare differently? *Livestock Science, 116*(1–3), 126–136. https://doi.org/10.1016/j.livsci.2007.09.017

Ventura, B. A., von Keyserlingk, M. A. G., Wittman, H., & Weary, D. M. (2016). What Difference Does a Visit Make? Changes in Animal Welfare Perceptions after Interested Citizens Tour a Dairy Farm. *PLoS ONE, 11*(5), Article e0154733. https://doi.org/10.1371/journal.pone.0154733

Walker, M., Diez-Leon, M., & Mason, G. (2014). Animal Welfare Science: Recent Publication Trends and Future Research Priorities. *International Journal of Comparative Psychology, 27*(1), 80–100. https://escholarship.org/uc/item/1vx5q0jt

Weary, D. M., & Robbins, J. A. (2019). Understanding the multiple conceptions of animal welfare. *Animal Welfare, 28*, 33–40. https://doi.org/10.7120/09627286.28.1.033

Weary, D. M., & von Keyserlingk, M. A. G. (2017). Public concerns about dairy-cow welfare: how should the industry respond? *Animal Production Science, 57*, 1201–1209. http://doi.org/10.1071/AN16680