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Consumer Perceptions, Preferences, and Attitudes Regarding Broiler Chicken Catching Methods

ABSTRACT

Pre-slaughter phases of broiler chickens can significantly compromise animal welfare, as conventional catching methods often raise ethical, physical, and moral concerns. Mechanized catching has been emerging as a viable alternative with potential to reduce these issues and improve animal treatment. This study aimed to assess the Brazilian population's perception of broiler chicken welfare and identify factors influencing preferences for manual or mechanized catching methods, focusing on socioeconomic, demographic, and cultural aspects. A structured questionnaire was administered to a sample of 508 individuals. Variables examined included socioeconomic class, demographic profile, diet type, involvement in poultry farming, and willingness to pay more for products with certified animal welfare. Data were analyzed using Chi-square tests to assess associations between categorical variables. The findings revealed a strong preference for mechanized catching, which was perceived as more comfortable and less physically harmful to chickens. However, it was also associated with perceptions of increased fear and emotional distress. Concerns related to animal welfare and confidence in preserving bird health during and after catching were significantly affected by the place of residence, but not by diet. Although animal welfare is not a primary factor for most consumers at the time of purchase, many respondents (62%) expressed a willingness to pay more for products with certified animal welfare. Mechanized catching remains relatively unfamiliar to Brazilian consumers, but the study suggests that increasing awareness of its benefits could enhance understanding and support the development of public policies and communication strategies to promote better welfare practices in the poultry industry.

INTRODUCTION

There are various reasons why individuals choose not to consume meat. These include the availability of alternative ingredients on the market, the environmental impact associated with animal production (Vasconcelos *et al.*, 2018; Shafiullah *et al.*, 2021), and ethical concerns related to animal suffering in the meat industry (Anil *et al.* 2002; Thomsen *et al.*, 2012; Norring *et al.* 2014; Randler *et al.*, 2021a, b). These factors, among others, influence the growing trend of consuming plant-based products as an alternative to animal meat (Godfray *et al.*, 2018).

In the poultry production agroindustry, animal welfare has become a prominent issue. Specifically, the handling of broilers during pre-slaughter phases, particularly during the catching process, has received considerable attention due to the stress it imposes on birds (Monleón, 2013; Lima *et al.*, 2019; Mellor *et al.*, 2020).



Mechanized catching as a replacement for traditional manual procedures has the potential to reduce the negative impacts on the birds' integrity and address ethical concerns in poultry production (Delezie *et al.*, 2006; Monleón, 2013; Wolff *et al.*, 2019).

While the adoption of mechanized catching may have implications for production costs, it could help mitigate criticisms related to animal welfare in the agroindustry (Broom, 2019; Tonsor & Wolf, 2019). Such criticisms not only influence public perception but also affect the acceptability and consumption of meat and meat products (Alonso *et al.*, 2020).

The shift from human-animal interaction in handling procedures to machine-based methods often evokes varying concerns among the public (Clifton *et al.*, 2020). For instance, research suggests that certain demographics, particularly women of specific ages and educational levels, may feel more vulnerable and anxious about replacing manual labor with machinery (Millington, 2017; Lordan & Neumark, 2018). A pertinent question remains: what is the response of male participants in these surveys?

This study is guided by the following research questions:

- a) How do Brazilian citizens perceive animal welfare in manual versus mechanized broiler harvesting?
- b) What is the preferred method of collection among Brazilian citizens?
- c) Do Brazilians consider animal welfare when purchasing poultry products?
- d) Are Brazilians willing to pay more for products that ensure better animal welfare?

Filling this knowledge gap is crucial for stakeholders in poultry production chains, as it can reduce uncertainties, facilitate decision-making, support marketing strategies, and enhance consumer purchase intentions. Additionally, it could encourage the adoption of technological alternatives that improve animal welfare both upstream and downstream of the farm (Cornish *et al.*, 2020; Alonso *et al.*, 2020). Despite the growing interest in animal welfare, this area of research remains underexplored, highlighting a significant gap in the literature (Ahmad *et al.*, 2006; Danielson, 2010).

The aim of this research is to evaluate Brazilian citizens' perceptions of animal welfare in broiler chicken production, with a focus on how these perceptions and preferences vary across different demographic and socioeconomic groups. The study also seeks to understand how these factors relate to consumers' willingness to pay more (WPM) and the consideration of animal welfare at the time of purchase.

MATERIALS AND METHODS

Construction and application of the research instrument

To identify and scale perceptions of animal welfare, the following indicators were used: pain, fear, injury, comfort, and preference for a catching method (manual or mechanized). These indicators were derived from Duncan's (2004) welfare framework and further validated by Mellor *et al.* (2020). The research instrument was developed by incorporating questions based on these frameworks, with a focus on human-animal and machine-animal interactions. Additionally, some questions were created to assess respondents' opinions on the subjective experiences faced by birds during both catching methods.

A total of 508 people watched the video. The respondents were not identified, thus the questionnaire included questions to categorize them according to their social profile, which includes gender, age group, education, family income, place of residence, and diet adopted. For the place of residence, the questions were prepared to allow a categorization of respondents according to three criteria: a) residence in rural or urban areas, b) capital, metropolitan region, and countryside, and c) geographic regions of Brazil (south, southeast, Midwest, north, and northeast).

An audiovisual tool (a 5-minute video) was edited and integrated into the questionnaire to allow a comparison of both catching methods at the stage preceding the shipment of birds destined for slaughter. The video did not contain narration or emotional music, focusing solely on a visual comparison of the catching methods. It is available at the following web address: <https://youtu.be/e6ulXh82xRc>.

Data analysis

For a general analysis of the results, the percentages indicated by the majority of respondents were analyzed. The statistical test used was the association test (Chi-square) at 5% significance, which can be used to verify



significant deviations from the observed and expected frequency of a sample, or to compare the distribution of several events from different samples with the objective of evaluating deviations in proportion between the analyzed groups.

In this test, the null hypothesis (H0) represents to equality in the proportions of responses between categories of respondents (i.e., the category does not matter; $p>0.05$). For the null hypothesis, the observed frequencies do not differ from the expected frequencies; therefore, the groups are not associated. Regarding the alternative hypothesis (H1), there are differences in the proportions of responses between the categories of respondents, meaning that the observed frequencies differ from the expected frequency; thereby indicating an association between groups (Callegari-Jacques, 2009).

The calculation of divergence between the observed and expected values is given by the following formula:

$$Chi-quadrado = \sum \frac{(O-E)^2}{E} \sim X^2_{(R-1)(C-1)}$$

Σ (sigma) represents the sum of all cells in the table (categories or groups). O is the observed frequency. E is the expected frequency if the null hypothesis (H0) is true (e.g., independence between variables or a specific distribution). R is the number of columns. C is the number of rows. Degrees of freedom are calculated based on R (number of rows) and C (number of columns).

Thus, in each question, the response options were considered nominal with a polynomial distribution, and the analysis tested whether the variability in response proportions (e.g., level of pain, level of fear, attitude of considering animal welfare, willingness to pay more) between categories of respondents had a random pattern ($p>0.05$), or whether responses varied depending on socioeconomic, demographic, degree of involvement, and diet of respondents.

During the data quality control stages (checking values and responses across different questions - spreadsheet columns), the categories for age group and income were combined based on the number of respondents. The age groups were divided into: Young (up to 24 years), Middle-aged (25 to 39 years), and Older (over 40 years). The income categories were: Low (up to R\$2,200), Medium (from R\$2,201 to R\$11,000), and High (over R\$11,001). All analyses were conducted using Jamovi software, version 2.2.5, which is available for free.

RESULTS

The results are presented below according to the study's hypotheses, categorized by perception, preference, willingness to pay more (WPM), and attitudes regarding animal welfare in purchasing decisions. A total of 508 Brazilian citizens participated in the questionnaire. Table 1 presents the main socioeconomic and demographic variables.

Table 1 – Socioeconomic and demographic information of the sample.

Variable	Description	Percentage
Gender	Male	48%
	Female	52%
Age group	Young	21.3%
	Middle-age	34.8%
	Elderly	43.9%
Income	Low	44.7%
	Medium	48.2%
	High	7%
Education level	Elementary	6.1%
	High school	31.5%
	Technician	6.5%
	Higher education	38.6%
	Postgraduation	17.3%
Place of residence (a)	Urban	92.7%
	Rural	7.3%
Place of residence (b)	Capitals	40.9%
	Metropolises	30.1%
	Countryside	28.9%
Place of residence (c)	Southeast	43.3%
	Northeast	25.8%
	South	15.6%
	Midwest	8.3%
	North	7.1%
	Omnivores	93.9%
Diet	Non-omnivores	6.1%
	Low	55.8%
Involvement with poultry sector	High	44.2%

Upon analyzing the perception of animal welfare, several significant associations ($p<0.05$) were identified between welfare indicators and respondents' socioeconomic or gender categories (Table 1). For instance, respondents with higher education levels perceived lower levels of pain during manual catching. In contrast, female and lower-income respondents reported higher perceived pain during mechanized catching. The level of fear during manual catching was perceived as more intense among respondents with lower education, while mechanized catching elicited higher fear responses, particularly among female respondents and those with lower education



Additionally, women tended to report lower levels of perceived comfort during catching procedures. Although effect sizes varied, these associations suggest consistent patterns where gender and education influence the perception of welfare risks. For other animal welfare indicators, variations in response percentages were random ($p>0.05$) in relation to socioeconomic and demographic aspects.

For most respondents, both catching methods were perceived to cause “little” pain and “little” fear. Regarding pain levels, the “little” pain option was marked more frequently than expected among men for both manual and mechanized catching ($p<0.05$). Men also marked the options “no” fear and “little” fear more often than expected for mechanized catching ($p<0.05$). Low-income respondents more frequently selected “no pain,” while high-income respondents more frequently selected “little pain” for both catching methods (Tables 2 and 3).

Overall, pain and fear perceptions were low, but the majority of respondents indicated that mechanized catching caused more pain and fear, though the differences between the two techniques were small. When asked which method results in fewer injuries and greater comfort for birds, most respondents favored mechanized catching.

Table 2 – Perception of level of pain during catching among residents of urban and rural areas.

		Manual			Mechanized		
		Urban	Rural	Total	Urban	Rural	Total
None	Observed	75	7	82	83	12	95
	Expected	76	5.97	82.0	88.1	6.92	95.0
	%	15.9%	18.9%	16.1%	17.6%	32.4%	18.7%
Few	Observed	262	23	285	236	17	253
	Expected	264.2	20.76	285.0	234.6	17.43	252.0
	%	55.6%	62.2%	56.1%	50.1%	45.9%	49.8%
Much	Observed	96	1	97	115	4	119
	Expected	89.9	7.06	97.0	110.3	8.67	119.0
	%	20.4%	2.7%	19.1%	24.4%	10.8%	23.4%
I don't know	Observed	38	6	44	37	4	41
	Expected	40.8	3.2	44	38	2.99	40.99
	%	8.1%	16.2%	8.7%	7.9%	10.8%	8.1%
Total	Observed	471	37	508	471	37	508
	Expected	471	37	508	471	37	508
	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

χ^2 test			
	Value	df	p
Manual	8.70	3	0.034
Mechanized	7.22	3	0.065
N	508		

Caption: N is the number of respondents who answered this question

Regarding comfort, men rated ‘mechanized’ above expectations and ‘manual’ below expectations, while women were more likely to select ‘I don’t know’ above expectations. This may be due to a higher level of risk aversion or unfamiliarity with mechanized catching methods. Women, particularly in rural areas, may have had less exposure to mechanized farming techniques, making them more uncertain when evaluating the comfort and welfare of the birds in this context. This uncertainty may reflect a general lack of familiarity with the technology, which has been shown to influence perceptions in other agricultural settings.

Regardless of their place of residence, most respondents considered the level of pain and fear to be “little” for both catching methods. Significant differences ($p<0.05$) were observed in Tables 2 and 3, showing that rural residents indicated “little pain” and “little fear” more frequently than expected. For both manual and mechanized catching, rural respondents reported “a lot of pain” and “very afraid” less often than expected, and more frequently selected “no pain” and “no fear” (Tables 2 and 3). Notably, the difference in perception of pain between manual (33.9%) and mechanized catching (33.5%) was minimal, suggesting no clear dominance in perceived discomfort between the methods.

Table 3 – Perception of level of fear during catching among residents of urban and rural areas

		Manual			Mechanized		
		Urban	Rural	Total	Urban	Rural	Total
None	Observed	34	6	40	41	8	49
	Expected	37.1	2.91	40.0	45.4	3.57	49.0
	%	7.2%	16.2%	7.9%	8.7%	21.6%	9.6%
Few	Observed	237	15	252	215	16	231
	Expected	233.6	18.35	252.0	214.2	16.82	231.0
	%	50.3%	40.5%	49.6%	45.6%	43.2%	45.5%
Much	Observed	172	11	183	188	9	197
	Expected	169.7	13.33	183.0	182.7	14.35	197.1
	%	36.5%	29.7%	36.0%	39.9%	24.3%	38.8%
I don't know	Observed	28	5	33	27	4	31
	Expected	30.6	2.4	33	28.7	2.26	30.96
	%	5.9%	13.5%	6.5%	5.7%	10.8%	6.1%
Total	Observed	471	37	508	471	37	508
	Expected	471	37	508	471	37	508
	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

χ^2 test			
	Value	df	p
Manual	7.65	3	0.054
Mechanized	9.58	3	0.023
N	508		

Caption: N is the number of respondents who answered this question



Variability in responses regarding the preference for the catching method was not associated with dietary preferences (omnivores vs. non-omnivores) ($\chi^2=1.28$; $p>0.05$). Among both omnivores and non-omnivores, preference for mechanized catching prevailed.

The willingness to pay more for animal welfare products was statistically significant across gender ($\chi^2=14.10$; $p<0.05$), age group ($\chi^2=16.10$; $p<0.05$), education level ($\chi^2=39.30$; $p<0.05$), and income ($\chi^2=24.10$; $p<0.05$). No statistical difference was found for geographic region ($\chi^2=23.10$; $p>0.05$) or between residents of capitals, metropolitan areas, and rural areas ($\chi^2=4.01$; $p>0.05$) or between urban and rural residents ($\chi^2=4.48$; $p>0.05$).

Regardless of gender, most respondents indicated a willingness to pay up to 5% more (28.3%), followed by “unwilling” (26.3%), with fewer respondents willing to pay up to 10% (15.5%) or more than 10% (8.0%). Differences between men and women ($p<0.05$) were explained by contrasting frequencies (fe vs. fo) for most response options.

In terms of age, regardless of group, the predominant responses were WPM of up to 5% or less, including unwillingness to pay more. Among younger respondents, WPM of up to 1% (31.5%) was most frequent, followed by 5% (29.6%). Among middle-aged respondents, WPM options for up to 5%, “unwilling,” and up to 1% were predominant. Older respondents were the only group where “unwilling” and “more than 10%” were marked more frequently than expected.

Regarding income, the majority of low-income respondents (29.5%) were unwilling to pay more for animal welfare products. Among respondents with intermediate income, 27.8% were willing to pay up to 5% more, while 33.3% of high-income respondents were willing to pay up to 10% more.

Among respondents with primary and secondary education (45.2% and 29.4%, respectively), the majority indicated they were unwilling to pay more for animal welfare products. Respondents with technical education (30.3%) were willing to pay up to 1% more, while individuals with higher and postgraduate education (28.1% and 34.1%, respectively) were more willing to pay up to 5% more. Regarding place of residence, the most common responses for WPM were up to 5%, 1%, or unwillingness to pay more.

DISCUSSION

There is a global trend toward the consumption of meat produced with greater attention to animal welfare, a trend influenced by socioeconomic and demographic factors, familiarity with production methods, lifestyles, and information on product labels (Cornish *et al.*, 2020; Randler *et al.*, 2021b).

There is substantial skepticism toward certification among Brazilian consumers. However, a contrast with countries where such labeling has proven effective would strengthen this point. In Brazil, however, studies have documented resistance and skepticism even when labeling and certification stamps are present. This skepticism may be attributed to insufficient knowledge about production methods and animal welfare practices, suggesting that Brazilian consumers require more time to trust and assimilate practices that ensure higher animal welfare standards. It is important to consider that this situation differs from countries where such certifications have been more widely accepted and effective in shaping consumer behavior (Toni *et al.*, 2015; Hötzel & Vandresen, 2022).

In this context, it is crucial to develop reliable communication channels and conduct effective information campaigns about farm animal welfare (Miranda-De La Lama *et al.*, 2019; Neves *et al.*, 2020). Such campaigns could help foster a well-informed public that makes purchasing decisions aligned with animal welfare principles (Cornish *et al.*, 2020).

The results discussed here are organized according to the study's hypotheses and are divided into four main sections: perception, preference, willingness to pay more (WPM), and attitudes toward considering animal welfare when purchasing.

Despite small percentage differences, most respondents perceived mechanized catching as causing more pain and fear, yet also viewed it as leading to fewer injuries. This suggests that, in line with prior research, pain, fear, comfort, and physical injuries are perceived and weighted differently by individuals. These variations contribute to the broader understanding of how perceptions of animal welfare can differ among consumers (Ahmad *et al.*, 2006; Danielson, 2010; Weary & Robbins, 2019).

Age was not a significant factor in the variability of perceptions regarding animal welfare. Similarly, income, except for the perception of pain in mechanized catching, did not influence how respondents perceived



animal welfare. Thus, neither age nor income appear to be critical factors in determining marketing strategies for promoting animal welfare in the Brazilian market.

While a trend in the literature suggests that older individuals tend to show less concern for animal welfare (Binngiesser *et al.*, 2013), there is no clear consensus on this relationship (Martens & Hansart, 2019). Other factors such as local culture, geographic specificity, or sample size may have more influence than age alone (Randler *et al.*, 2021a). In contrast, schooling and gender were more strongly linked to variability in perceptions.

Gender, in particular, has long been recognized as an important demographic factor influencing attitudes toward animal welfare. Studies have consistently demonstrated a tendency for greater concern among women; however, the extent and manifestation of this concern can be shaped by cultural factors, as evidenced across diverse literature (Herzog, 2007; Mazas & Fernández-Manzanal, 2019).

Among respondents, the perception of “little” pain predominated for both catching methods. In manual catching, the perception of “no pain” was most common among individuals with lower education levels, whereas respondents with higher education tended to acknowledge some level of pain. This suggests that education influences perceptions of animal welfare, likely because higher education provides individuals with the tools to develop a more critical view. Public awareness campaigns could leverage educational strategies to foster more critical views on animal welfare, potentially influencing consumer purchasing decisions and supporting welfare standards (Toma *et al.*, 2012).

In line with Boaitay & Minegishi (2020), international studies have shown a positive association between education levels and awareness of animal welfare issues. They note that in lower-income countries, lower levels of education are often associated with reduced concern for animal welfare, likely due to lower purchasing power and less awareness of animal welfare regulations.

The greater fear associated with mechanized catching may be due to the images respondents saw in a video during the survey, which showed birds being captured and moved using rotors and mats. The perception of increased fear in mechanized catching may also stem from a lack of awareness that manual catching, which takes longer, could result in heightened fear for the birds (Duncan *et al.*, 1986).

Regarding respondents’ perceptions based on place of residence, the study revealed that, generally speaking, location did not significantly influence animal welfare perceptions, with two exceptions. For most respondents, mechanized catching was associated with higher levels of bird comfort and fewer injuries. In these cases, the level of pain and fear was perceived as low for both methods. This suggests that promoting mechanized harvesting in advertising could enhance consumer perceptions of animal welfare, rather than negatively affecting them.

The two exceptions to this pattern were rural respondents, who tended to perceive both pain and fear as low or even nonexistent. This could be attributed to the rural population’s closer ties to agricultural practices and a greater familiarity with production systems, including the stages leading to pre-slaughter (Kendall *et al.*, 2006). Urban populations, on the other hand, may have become less familiar with the reality of agricultural production systems, which could explain their different perceptions of animal welfare.

The literature shows that dietary preferences such as vegetarianism and veganism influence perceptions of animal welfare, particularly when animals are anthropomorphized (Díaz, 2016; Plante *et al.*, 2019), which is supported by the results of this study. Among those who choose not to consume meat, concerns about animal suffering (Randler *et al.*, 2021a), the availability of plant-based food alternatives (Kahn, 2020), and the environmental impact of livestock production (Vasconcelos *et al.*, 2018; Shafiullah *et al.*, 2021) are significant drivers.

Social movements advocating for reduced meat consumption and better animal welfare have become influential in shaping contemporary attitudes, often driving moral considerations in purchasing decisions (Hepting *et al.*, 2014; Eat-Lancet Commission, 2019). The fact that most respondents, whether omnivores or not, perceived mechanized catching as better for reducing injury incidence and improving bird comfort suggests that transitioning to mechanized catching could positively impact both moral acceptance and meat consumption.

The results also suggest that mechanized harvesting could be promoted as a positive aspect of marketing strategies within the poultry industry. This could help mitigate the moral concerns and criticisms directed at poultry farming and meat products, aligning more closely with consumers’ expectations of animal welfare.

Interestingly, respondents with a technical education stood out from those with other educational



backgrounds by showing a preference for manual catching. A possible explanation lies in this group's more pronounced perception of the risks of human labor being replaced by machinery. Professionals with a technical education may have a sharper understanding of the labor market transformations driven by technology, which could lead them to value activities requiring manual skills and that are less susceptible to automation. However, while this interpretation aligns with existing studies in labor economics (Millington, 2017; Lordan & Neumark, 2018; Clifton *et al.*, 2020), it is important to acknowledge that other factors, such as personal values or the specific labor market context, may also play a role in shaping these preferences.

Moreover, the concern around automation replacing manual labor, especially in specific demographics, has been linked to factors such as gender and education (Clifton *et al.* 2020). Studies have noted that older worker in particular may be more vulnerable to the impacts of labor automation (Lordan & Neumark, 2018). However, in the case of Brazilian respondents, age and income did not seem to influence preferences for the catching method.

Data from the Brazilian Institute of Geography and Statistics (IBGE, 2015) highlight the urban-rural divide in the sample. In 2015, 84.72% of Brazilian citizens lived in urban areas, and only 15.28% resided in rural areas. This demographic skew is reflected in the sample, particularly in terms of the rural-urban criterion.

It is difficult to pinpoint why respondents from urban areas were more uncertain about their preferred catching method, while those in rural areas displayed a clearer preference for mechanized catching. This uncertainty could be related to a lack of familiarity with agricultural production systems, especially the stages preceding slaughter, to which urban residents may be less exposed (Kendall *et al.*, 2006).

Preferences for mechanized catching were consistent across both dietary groups. In a study by Delezie *et al.* (2007), non-omnivores showed no clear preference for a particular method of catching, likely because their opposition to animal slaughter outweighed concerns about catching methods.

Regarding WPM, place of residence did not significantly influence respondents' willingness to pay more for products with better animal welfare. While no clear patterns emerged for WPM based on gender, the majority of respondents were either unwilling or only willing to pay up to 5% more. This trend was also evident across different age groups, with the highest percentages indicating a reluctance to pay more,

particularly among older respondents. This aligns with previous research suggesting that older individuals tend to show less willingness to pay for higher animal welfare standards (Clark *et al.* 2017).

Additionally, the analysis revealed that higher income and education levels were associated with a greater willingness to pay more for animal welfare (Clark *et al.* 2017). This finding can be understood in light of the Theory of Planned Behavior (Ajzen, 1991), which suggests that favorable attitudes and perceived behavioral control (influenced by economic resources and knowledge) increase the intention to act, in this case, to pay more for animal welfare-focused products. This further corroborates the idea that economic and educational factors play a significant role in consumer behavior related to animal welfare.

CONCLUSION

This study compared manual and mechanized catching methods for broiler chickens, finding that while both were perceived to cause minimal pain and fear, mechanized catching was seen as slightly more distressing, but resulting in fewer injuries and greater comfort for the animals. Despite limited awareness in Brazil, mechanized catching was preferred by respondents. These findings suggest that mechanized catching could reduce ethical concerns in poultry handling and, with better information dissemination, may gain broader public support. From a policy standpoint, promoting animal welfare practices through education and incorporating mechanized catching into welfare standards could be beneficial. Future research should focus on the long-term effects of mechanized catching on animal welfare and its economic viability in Brazil, as well as exploring how demographic factors shape perceptions of animal welfare in poultry farming.

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AUTHOR CONTRIBUTIONS

Conceptualization, Methodology, Writing – Original Draft: FMD. Data Curation, Formal Analysis, Visualization: EB, MFCB. Methodology, Data Analysis: MCS. Data Curation, Formal Analysis, Writing – Review & Editing: JKV. Writing – Review & Editing: FRC. Conceptualization, Writing – Original Draft, Validation: CMK. Data Collection, Writing – Original Draft: CCO. Supervision, Conceptualization, Project Administration, Funding Acquisition: RGG. All authors have read and agreed to the published version of the manuscript.

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DATA AVAILABILITY STATEMENT

Data will be available upon request to the corresponding author.

CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

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