

1 **Too Close to Eat? Solidarity with Animals, Animal Welfare and Meat Consumption**

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40 **Abstract**

41 Meat consumption is influenced by a variety of factors including of empathy and feelings on
42 affinity towards farm animals. The goal of this study was to examine the role of solidarity with
43 animals on meat consumption and attitudes towards the treatment of animals. Data was drawn
44 from a sample of 265 respondents in the US. Correlation and mediation analyses were performed.
45 The results of the correlation analysis indicate a moderate but positive correlation between
46 solidarity with animals and proecological beliefs. The association between attitudes towards the
47 treatment of farm animals and antibiotic use and solidarity with animals was also positive. Relative
48 to meat consumption, the results indicate that proecological beliefs and concerns about the
49 treatment of farm animals negatively influenced consumption. The effect of attitudes towards
50 antibiotic use and solidarity with animals on consumption were however fully mediated by
51 proecological beliefs. The results indicate that social identification with animals can play a
52 significant role in food choice. However, its relationship with proecological beliefs implies that
53 holistic approaches are required to address current livestock production practices that are
54 considered unnatural.

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65 **Introduction**

66 Animal welfare appears to be increasingly important in many countries and it even has become an
67 official part of Schwartz's well-known theory of human values [1]. Concerns about farm animals
68 relate to how animals are treated and kept. These concerns differ across species and can elicit
69 different responses (such as meat avoidance) from consumers. In general, reductions in the
70 consumption of meat are mostly driven by consumers' personal health and ethical motives [2,3,
71 4]. In relation to animal welfare, consumers may reduce meat consumption to avoid causing harm
72 to farm animals or as a result of concerns about practices considered unnatural [5]. Animal and
73 human welfare attitudes also influence behaviors such as support for animal rights and causes [2,
74 6]. These attitudes are underpinned by different values and motivations including the extent to
75 which consumers feel connected to farm animals [7]. Human-animal relations are multi-faced in
76 nature and aspects such as affinity with animals have been linked with a number of behaviors:
77 attribution of a higher cognitive ability, anthropomorphism and anti-consumption [8, 9, 10]. The
78 pathways through which these attitudes influence consumer behavior in relation livestock
79 production and consumption are however less understood. This paper focuses on a different
80 aspect of human-animal relation i.e., the concept of solidarity with animals. Solidarity with
81 animals is the sense of connectedness to animals as part of the same social group [11, 12]. This
82 psychological bond with farm animals can have significant implications for public attitudes
83 towards different treatment and farm practices, and meat consumption behavior. It is conceivable
84 that solidarity with animals is linked to a broader connection to nature and a proecological
85 orientation. This notwithstanding, not much has been done to examine the links between solidarity
86 with animals and these important aspects of meat production and consumption. This is partly due

87 to the absence of a well-validated metric to measure solidarity with animals. A solidarity with
88 animals' scale with good psychometric properties has recently been introduced [11]. In this study,
89 we investigate the relationship between solidarity with animals, proecological beliefs, treatment
90 of farm animals and pork consumption using data from a sample of participants in the United
91 States. Our interest in the role of solidarity is informed by evidence from previous studies [6, 2]
92 which suggests that solidarity with animals can influence socially consequential actions.
93 Amongst the current litany farm animal welfare issues, the use of antibiotics in livestock
94 production presents a unique case because of its ethical and human health impacts. The latter is
95 in relation to the public health risks posed by the veterinary overuse of antimicrobials and the
96 possibility of animal-human transfer of antimicrobial resistance [13, 14]. The Food and
97 Agricultural Organization (FAO) estimates substantial economic and health consequences¹
98 resulting from antimicrobial resistance (AMR) if current trends continue [15]. In contrast to the
99 negative human health impacts, the use of antibiotics can enhance animal welfare by reducing or
100 eliminating the pain associated with disease. Inherent in the dual impacts of antibiotic use is the
101 conundrum faced by consumers who may be concerned about the treatment of animals on farms
102 and the possible negative health impacts. It is obvious that feelings of connectedness to animals
103 further complexifies these relationships. Further, we focus on the hog production in the US for two
104 reasons. First, available estimates indicate that antibiotics are significantly overused in pig
105 production in US - 27.1% of all medically sold antibiotics is used in pigs as compared to the 27.6%
106 is used in human medicine [16]. Second, these high levels of antibiotic use are linked to production
107 and husbandry practices such as the high degree of concentration [16]. For the pork industry,
108 insights from this study is particularly relevance given the current changes in the consumption, the

109 need to provide an appropriate level of animal welfare and the emergence of new products such as
110 lab-grown meat often marketed as animal welfare friendly [17].

111 **Literature review**

112 The subject of the effect of human-animal relationship on consumer behavior has been of long-
113 standing interest because of its influence on a number of attitudes and behaviors [6, 9]. These
114 attitudes can also serve as a motivation for ethical food choice [4]. It has been shown that
115 associating humanlike attributes such as perceived intelligence and appearance to animals
116 influences disgust at the thought of eating meat which leads to meat avoidance [18, 9, 5].
117 However, the extent to which animals are considered similar humans can dampen or exacerbate these
118 responses [7]. Other studies have looked at the role of psychological commitments to groups such
119 as solidarity with animals, as a determinant of attitudes towards animals [11]. The authors found
120 that solidarity with animals, was negatively associated with meat eating frequency, higher moral
121 concerns for animals, and a greater likelihood to donate to animal charities. This social identity
122 dimension of attitudes towards animals influences other consumer response (such as activism for
123 animal rights) in so-called factory farms which are often considered unnatural [6]. Perceptions
124 about animal welfare are also influenced by both objective and normative judgements [19]. The
125 authors found that animals experiencing negative emotions but living in their natural setting were
126 perceived as experiencing a higher animal welfare standard [19]. This is in comparison to animals
127 in unnatural settings experiencing positive emotions. This may be indicative of linkages between
128 perceived FAW and proecological attitudes and by extension meat consumption. Other studies
129 have examined the effect of proecological attitudes (as measured by the New Ecological Paradigm
130 (NEP) scale) [20], on meat consumption, however, the evidence appear inconclusive [21]. In this
131 study, we explore the relationship between attitudes towards antibiotic use, the treatment of
132 animals, proecological beliefs and solidarity with farm animals. We also model the relationship

133 between these variables and their influence on pork consumption using mediation analysis. The
134 use of mediation models to address similar problems have been reported in the literature [14, 22,].
135 In this study, the effect of solidarity with animals, attitude towards antibiotic use on meat
136 consumption is assumed to be mediated by proecological beliefs.

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138 **Methods**

139 An online survey instrument designed in Qualtrics was used to collect data used in the study in
140 February and March of 2019. The study adhered to the ethical guidelines and was approved by the
141 Institutional Review Board (IRB) of the University of Wisconsin – River Falls (approval number:
142 H2018 KO10). In total 265 responses were obtained from random of 1,000 adult respondents who
143 provided their email address to the Survey Research Center (SRC) at the University of Wisconsin-
144 River Falls and received an email with a hyperlink to the survey. Out of the total returned, 207
145 questionnaires were answered completely and were therefore considered usable. Incomplete
146 surveys were considered invalid. The sample included 83% (n=171) females and 17% (n=36) male.
147 The latter is lower than the share of males in Wisconsin which is about 50% (US Census Bureau,
148 2019). The mean age of participants in this study was 34.4 (SD=16.45), lower than the 38.92
149 reported in the 2017 US census. The average household income of \$68,852 (SD=\$3,3283),
150 reported in our survey was however higher than the average income of \$56,769 in Wisconsin in
151 2017 [23]. In general, the differences between the sample and the general population are expected
152 given that most of our respondents were in the River Falls area.

153 The questionnaire was divided into three subsections. In the first part, respondents were asked to
154 provide information on their pork purchase frequency and their preferences for different pork
155 attributes. The second part of the questionnaire included scale items that measured respondents'
156 attitude towards farm animals, the use of antibiotics in livestock , the environment etc. This section

157 also included the solidarity with animals scale. The last section of the questionnaire measured
158 respondents' socio-demographic characteristics. Below is an overview of selected questions
159 included in the present analysis.

160 To measure the frequency of pork consumption, participants were asked, "How often do you
161 consume pork". Responses were rated on an eight-point scale with end points: 0=never, to 7=daily.
162 Three measures of animal welfare attitudes and perceptions were included in the survey: attitude
163 towards the treatment of animals [24] and attitudes towards antibiotic use [25]. A five-point Likert
164 scales with end points, 5=strongly agree to 1= strongly disagree, was used in the animal treatment
165 and antibiotic use scales. Proecological attitudes were measured with a reduced version of the
166 New Ecological Paradigm (NEP) scale, comprising 6 items rated on a 5-point scale (1= strongly
167 disagree; 5=strongly agree) [20]. Three of the six items capture the pro-anthropocentric dominant
168 social paradigm (DSP) whilst the remaining statements capture a proecological orientation (See
169 Table 4).

170 Following [11], a five-item scale was used to measure solidarity with animals. The scale comprised
171 of the following items each rated on a seven-point scale with endpoints, 1=strongly
172 agree;7=strongly disagree: "I feel a strong bond toward other animals"; "I feel solidarity toward
173 animals"; "I feel close to other animals"; "I feel a strong connection to other animals"; and, "I feel
174 committed toward animals".

175 **Statistical Analyses**

176 Multiple approaches were used to analyze the data. These include principal components analysis
177 (PCA), independent sample t-tests and mediation analysis. The PCA approach was used to extract
178 factors from the multi-items. Pearson correlation coefficient between the solidarity with animals
179 scale and the: attitudes towards the treatment animals, antibiotics use in livestock statements and
180 and proecological were also estimated. The PCA and correlation analysis were performed in

181 performed using IBM SPSS software (version 24). Mediation analyses were conducted to assess
 182 the total effect of solidarity with animals on meat consumption frequency in addition to the extent
 183 to which this effect is mediated by proecological beliefs. We also estimated the mediated
 184 moderation pathway (indirect effect of attitudes towards antibiotics use and the treatment of
 185 animals) on consumption via proecological beliefs.

186 Results

187 The analysis is preceded by a descriptive analysis of the scales included in the study. From Table
 188 1, the mean scores (M), factor loadings and standard deviations of scale items of the solidarity
 189 with animals scale were comparable to the original application of the scale. The estimates in this
 190 study were however marginally lower. The alpha coefficients were high (>0.90) in both cases
 191 suggesting that the items have a high internal consistency. Consistent with the findings of [11], the
 192 mean scores of female participants (4.10) was significantly higher ($t=2.36$; P -value 0.02) than those
 193 of male participants (3.68). This supports the identified gender differences in solidarity with
 194 animals reported in [11].

Table 1. Descriptive Statistics and Factor Loadings for Items of Solidarity with Animals Scale

Items	This study			Amiot and Bastian (2017)		
	M	SD	Factor loading	M	SD	Factor loading
I feel a strong bond toward other animals (Strong bond)	4.19	0.92	0.65	4.97	1.54	0.90
I feel solidarity toward animals (Solidarity)	3.70	1.02	0.95	4.84	1.57	0.88
I feel close to other animals (Closeness)	4.03	0.95	0.80	4.57	1.83	0.93
I feel a strong connection to other animals (Connection)	4.04	0.93	0.95	4.17	1.89	0.94
I feel committed toward animals (Commitment)	4.14	0.95	0.82	4.35	1.84	0.85
Cronbach's alpha	0.92			0.94		

195 Note: M=Mean; SD Standard Deviation

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197 Most respondents (53%) strongly agreed with the statement that the use of antibiotics is a better
198 strategy than destroying the affected animals (Fig 1). In contrast, most respondents (23%) were in
199 strong disagreement with that statement that, overall, the use of animal antibiotics delivers more
200 benefit than harm. Respondents were somewhat adverse (16% strongly disagree) to regulated use
201 of antibiotics for serious bacterial disease. However, they seem to recognize the need for antibiotics
202 use in livestock and believed that the process of development and testing of antibiotics was
203 generally effective and safe (77% agree and strongly agree).

204 **Fig 1. Participants perceptions about the use of antibiotics in livestock**

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206 Fig 2 shows the participants agreement with various attitudes towards the treatment of animals
207 statements. The first three statements relate to ethical aspects of the treatment of animals whilst
208 the remaining two assesses the role of animal welfare in food choice [24]. In general, respondents
209 expressed higher levels of agreement with the latter statements as compared to the former three.
210 Most respondents strongly agreed (53%) and agreed (35%) that the animal products they consumed
211 are produced by animals that have experienced as little paid as possible. Another 77% strongly
212 agreed (39%) and agreed (38%) with the statement that it was important to them that the products
213 they consumed were sourced from animals whose rights have been respected. In contrast, a lower
214 proportion of respondents agreed and strongly agreed with statements: humans have little respect
215 for animals (46%); increased regulation of the treatment of animals is needed (49%); and, the
216 treatment of animals raises serious ethical questions (55%). These trends are generally consistent
217 with a estimates in Canada although the magnitudes differ (for example see [26]).

218 **Fig 2. Participants perceptions about the treatment of farm animals**

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220 **Correlation analysis**

221 The Pearson correlation analysis to assess the relationship between the solidarity with animals
222 scale and attitudes towards the treatment of animals and the use of antibiotics are reported in Tables
223 2 and 3 respectively. The results indicate that there is positive significant correlation between the
224 solidarity with animals and various items in the animal attitudes scale (Table 2). The correlations
225 are however moderate to weak depending on the item. The stronger correlation was between the
226 ethical treatment of animals statements, “It is important to me that animal products I eat have been
227 produced in a way that the animal’s rights have been respected” ($r=0.28$); and, “It is important to
228 me that the animal products I eat have been produced in a way that the animals have experienced
229 as little pain as possible” ($r=0.32$). In contrast, correlations when positive was weaker for
230 statements that assess perceptions towards animal welfare in food choice: increased regulation of
231 the treatment of animals in farming is needed” ($r=0.17$); and, “In general, humans have too little
232 respect for the quality of life of farm animals” ($r=0.15$). These results suggest a positive
233 relationship between solidarity with the animals and perceptions about farm husbandry practices.
234 The relationship is stronger for the ethical treatment issues as compare to the role of animal welfare
235 in food choice.

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237 From Table 3, relationship between solidarity with animals and attitudes towards the use of
238 antibiotics shows marked differences across the various items of the latter scale. Out of the seven
239 items of the antibiotics use scale, two items, i.e. “We live in such a hygienic environment that the
240 use of animal antibiotics is redundant” and “There is a good reason why the use of certain animal
241 antibiotics is recommended”, were not significantly correlated solidarity with animals scale.
242 statements on the trust in in regulation of antibiotic use, relative net benefit of antibiotic use and
243 need for the mandated use of antibiotics to treat serious disease were all positively correlated with

244 the attitudes towards the use of antibiotics. Overall, these results suggest a positive but weak
 245 association between solidarity with animals and support for the use of antibiotics in livestock

Table 2. Results of Correlation Analysis: Solidarity with Animals and Attitudes Towards the Treatment of Animals

	It is important to me that animal products I eat have been produced in a way that the animal's rights have been respected	It is important to me that the animal products I eat have been produced in a way that the animals have experienced as little pain as possible	The treatment of animals in livestock farming raises serious ethical questions	Increased regulation of the treatment of animals in farming is needed	In general, humans have too little respect for the quality of life of farm animals	solidarity with animals scale
It is important to me that animal products I eat have been produced in a way that the animal's rights have been respected	1					
It is important to me that the animal products I eat have been produced in a way that the animals have experienced as little pain as possible	0.59**	1				
The treatment of animals in livestock farming raises serious ethical questions	0.15*	0.18**	1			
Increased regulation of the treatment of animals in farming is needed	0.23**	0.26**	0.75**	1		
In general, humans have too little respect for the quality of life of farm animals	0.21**	0.15*	0.72**	0.67**	1	
solidarity with animals scale	0.28**	0.32**		0.17*	0.15*	1

246 Notes: ***Correlation is significant at the 0.01 level; **Correlation is significant at the 0.05 level;
 247 *Correlation is significant at the 0.10; insignificant estimates not reported
 248 .

Table 3. Results of Correlation Analysis: Attitudes Towards the Use of Antibiotics and Solidarity with Animals

	The process of developing and testing antibiotics for use in livestock production proves their effectiveness and safety	The use of antibiotics is a better strategy than destroying the affected animals	For serious animal bacterial diseases, requirements for farmers to use antibiotics should be in place	We live in such a hygienic environment that the use of animal antibiotics is redundant	Overall, the use of animal antibiotics delivers more benefits than harm	Use of antibiotics in livestock cannot be seriously harmful; otherwise, authorities would ban the use	There is a good reason why the use of certain animal antibiotics is recommended	solidarity with animals scale
The process of developing and testing antibiotics for use in livestock production proves their effectiveness and safety	1							
The use of antibiotics is a better strategy than destroying the affected animals	0.60**	1						
For serious animal bacterial diseases, requirements for farmers to use antibiotics should be in place	0.41**	0.48**	1					
We live in such a hygienic environment that the use of animal antibiotics is redundant		-0.20**	-0.16*	1				
Overall, the use of animal antibiotics delivers more benefits than harm	0.53**	0.48**	0.35**		1			
Use of antibiotics in livestock cannot be seriously harmful; otherwise, authorities would ban the use	0.63**	0.58**	0.51**	-0.21**	0.53**	1		
There is a good reason why the use of certain animal antibiotics is recommended	0.60**	0.49**	0.44**		0.50**	0.52**	1	
solidarity with animals scale			0.17*		0.16*	0.19**		1

252 We also assessed the correlation between the solidarity with animals and environmental beliefs
 253 (Table 4). The results indicate that solidarity with animals is positively associated with selected
 254 proecological beliefs and negatively correlated with anthropocentric beliefs. This is evident from
 255 the positive correlation between the solidarity scale the proecological statement, “ Animals and
 256 plants have a right to exist”, and the negative correlation with the anthropocentric statement, “The
 257 ecological crises is exaggerated”. The association was stronger ($r=+2.27$) in the case of the former
 258 than the latter ($r=-0.17$).

259 **Table 4. Results of Correlation Analysis: NEP Scale and Solidarity with Animal**

	Plants and Animals Have a Right to Exist	Humans Have the Right to Modify Natural Environments	Interference with Nature	Nature Can Cope with Industrial Nations	Humans Abuse Environment	Ecological Crisis is Exaggerated	solidarity with animals scale
Plants and Animals Have a Right to Exist	1						
Humans Have the Right to Modify Natural Environments	-0.20**	1					
Interference with Nature	0.33**	-0.30**	1				
Nature Can Cope with Industrial Nations	-0.19**	0.35**	-0.26**	1			
Humans Abuse Environment	0.31**	-0.26**	0.47**	-0.39**	1		
Ecological Crisis is Exaggerated	-0.34**	0.17*	-0.26**	0.48**	-0.53**	1	
solidarity with animals scale	0.27**					-0.17*	1

260 Notes: ***Correlation is significant at the 0.01 level; **Correlation is significant at the 0.05 level;
 261 *Correlation is significant at the 0.10; insignificant estimates not reported

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264 **Mediation Analysis**

265 The mediation analysis is preceded by an overview of self-reported pork consumption behavior
 266 amongst survey participants. Most participants (37%) reported consuming pork 3-4 times a week.
 267 A smaller proportion (3%) of participants reported eating pork daily or never (4%). Table 5 is a
 268 summary of the results of the mediation model estimated.

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Table 5: Results of Mediation Analysis

Outcome [Consumption]	<i>Direct effect (DE)</i>		<i>Total effect (TE)</i>	
	Coefficient	SE	Coefficient	SE
NEP	-0.27***	0.10	-0.27***	0.10
solidarity with animals	0.04	0.10	0.01	0.10
attitudes towards antibiotics use	0.02	0.10	0.06	0.10
attitude towards the treatment of animals	-0.23**	0.11	-0.36***	0.10

Outcome [NEP]	<i>Direct effect (TE)</i>		<i>Total effect (TE)</i>	
	Coefficient	SE	Coefficient	SE
solidarity with animals	0.11*	0.06	0.11*	0.06
attitudes towards antibiotics use	-0.13**	0.06	-0.13**	0.06
attitude towards the treatment of animals	0.46***	0.07	0.46***	0.67

Note: ***, **, * denote significance at 1%, 5% and 10% respectively; SE is standard error

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272 Attitudes towards the treatment of animals and proecological beliefs. (NEP) have a negative effect
 273 on consumption. The direct effect and total effect of the former were -0.23 and -0.36 respectively.
 274 This suggests that part of the effect of attitudes towards the treatment of animals on consumption
 275 is mediated by proecological beliefs. Solidarity with animals did not have a direct effect on
 276 consumption. However, its effect on proecological beliefs was positive (0.11). This suggests that
 277 effect of solidarity with animals on pork consumption is fully mediated by proecological beliefs.
 278 Attitudes towards antibiotic use in livestock had no direct effect on meat consumption. It was
 279 negatively associated (-0.13) with proecological beliefs. Considering that the use of antibiotics
 280 may be considered unnatural, this result is unsurprising.
 281 In sum, the mediation analyses suggest attitudes concerns about livestock husbandry practices and
 282 proecological beliefs reduce the tendency to consume meat. The effect of solidarity and attitudes
 283 towards antibiotic on meat consumption is fully mediated by proecological beliefs.

284 **Discussion**

285 In this study we set out to investigate relationship between solidarity with animals, meat
286 consumption and attitudes towards production practices. Specifically, we focused on attitudes
287 towards the treatment of animals and the use of antibiotics. We found a positive but moderate
288 association between solidarity with animals and these attitudes. This suggests individual with a
289 stronger sense of social identification with farm animals may be more receptive to the use of
290 antibiotics in livestock and proper care of farm animals. Solidarity with animals was also positively
291 associated with proecological beliefs. The results further suggest the effect of solidarity with
292 animals and attitudes towards antibiotic use on consumption is mediated by proecological beliefs.
293 The indirect effect of solidarity with animals on consumption corroborates evidence from previous
294 studies on the impact of human-animal on meat consumption [5, 22,28] The additional insights
295 provided in this study is that, the effect of feelings of connection to animals is perhaps subsumed
296 under a broader feeling of connectedness to nature. This outcome seems consistent with the
297 relationship between solidarity with animals and speciesism reported in [11] and the role of animal
298 welfare and ecological concerns in food choice [6, 27]. An important implication is that while
299 solidarity with animals may invoke a higher degree of acceptance for practices that ameliorate the
300 pain of farm animals, meat consumption may reduce their consumption of meat if these practices
301 (e.g. the use of antibiotics) are considered unnatural. Given that the respondents in our sample are
302 mostly non-vegetarian, the effect of proecological beliefs and attitudes towards the treatment of
303 animals on consumption is indicative of possible conscientious omnivore behavior [29]. Where,
304 respondents may not completely shift away from meat production but may purchase meat from
305 ethical sources. For the conventional pork industry, potential negative impacts of these attitudes
306 on consumption can be attenuated by addressing the concerns about antibiotics use as part of a
307 broader range of ethical considerations (environmental and animal welfare). Partial approaches

308 may be less successful given the higher order linkages identified in the present study. Our results
309 should be interpreted with a few caveats in mind. Our sample overrepresents female respondents
310 (80%) and this can be a source of bias. We also did not consider other meat consumption
311 behaviors-vegetarians, flexitarian, omnivores It is plausible that the role of solidarity with animals
312 across the different consumption behavior and other livestock species [10, 19] may be different.
313 These limitations are avenues for future research.

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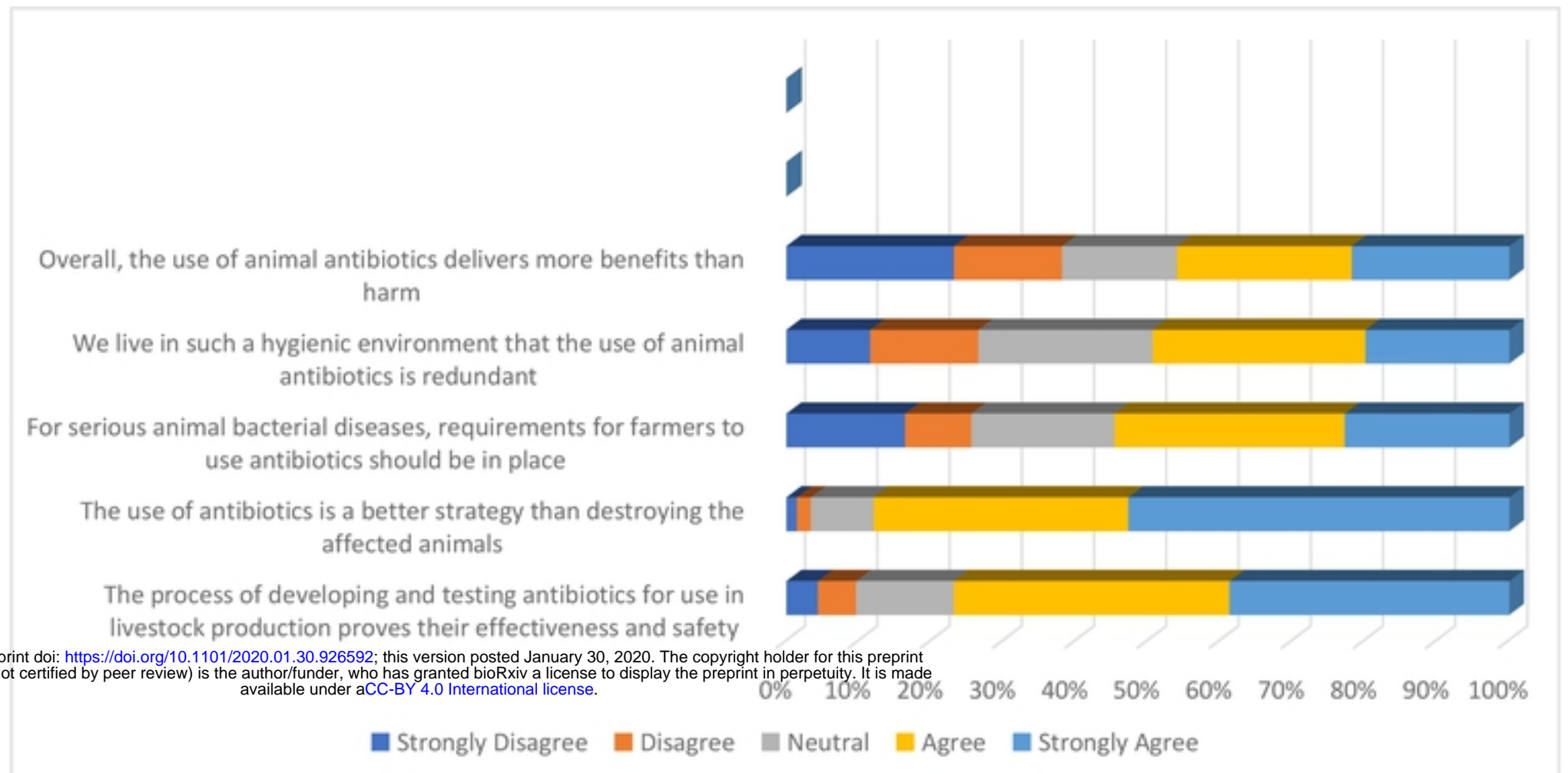


Fig 1. Participants attitudes towards the use of antibiotics in livestock

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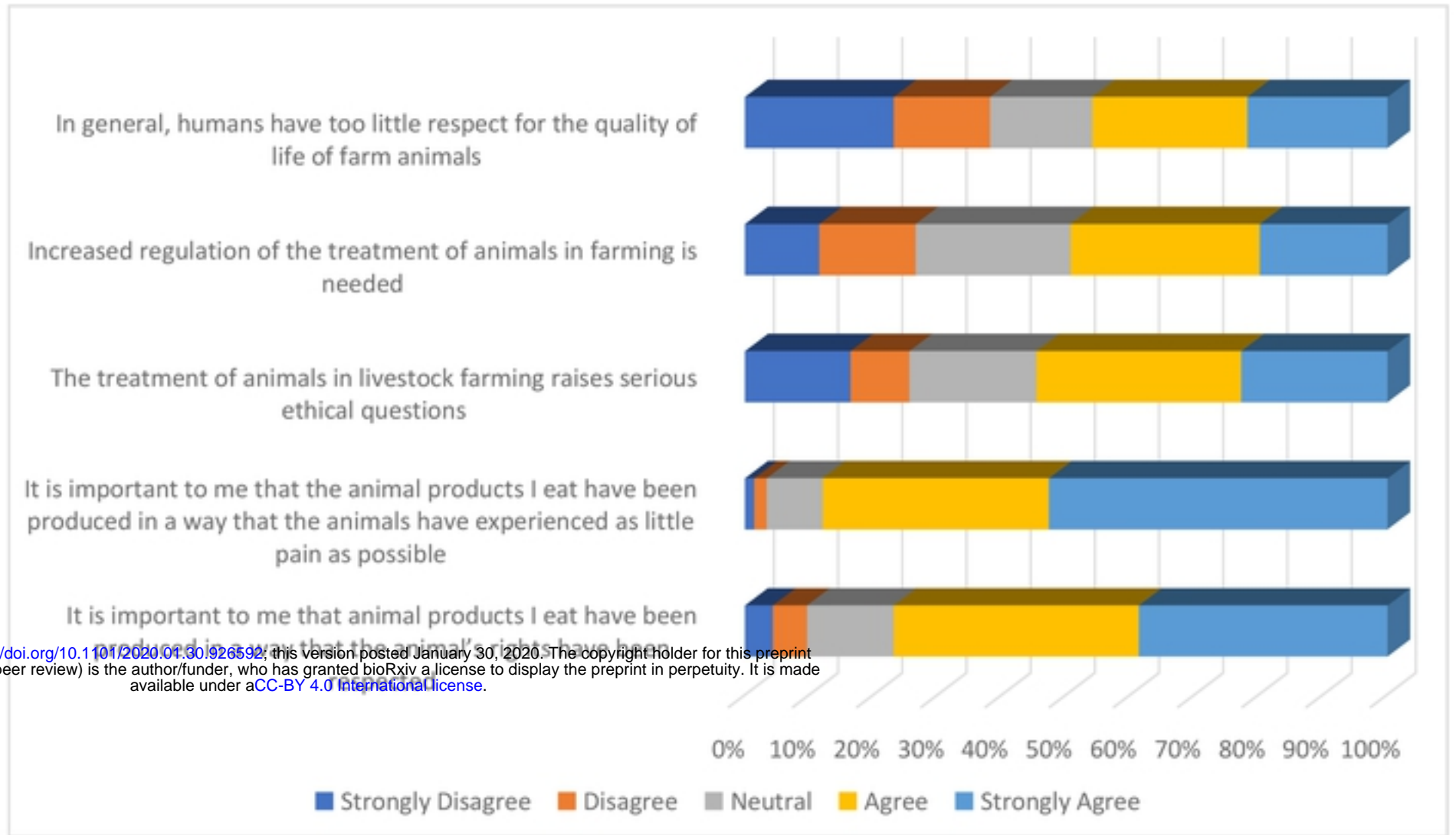


Fig 2. Participants attitudes towards the treatment of farm animals