One Health 17 (2023) 100612

Contents lists available at ScienceDirect

One Health

journal homepage: www.elsevier.com/locate/onehlt

The effect of a One Health message intervention on willingness to pay for antibiotic-free animal foods: A randomized controlled trial among Chinese college students

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A R T I C L E I N F O

Keywords:
One Health
Willingness to pay
Randomized controlled trial
Antibiotic-free animal foods
Antimicrobial resistance

A B S T R A C T

Routine use of antibiotics in livestock for prophylactic purposes is a main driver of antimicrobial resistance, posing a significant threat to the health of humans, animals, and the environment. Ways to motivate farmers to voluntarily reduce antibiotics use need to be explored. Promoting antibiotic-free animal foods is one of the promising strategies. A three-arm double-blind randomized controlled trial was conducted online to explore the impact of a One Health message intervention on Chinese college students' willingness to pay for antibiotic-free animal foods. A total of 389 individuals participated in this study and were randomly assigned to one of the One Health message group, the food nutrition and safety message group, and the no message group. Each participant read a message from the corresponding group and answered a self-report questionnaire. Participants' willingness to pay (WTP) and willingness to buy (WTB) for antibiotic-free pork, eggs, and milk were measured before and after viewing the One Health message, and the results were compared to the other two groups using the Kruskal-Wallis rank sum test and the Bonferroni correction. In the One Health message group, 30.2% (39/129) reported improved WTP for all three foods, compared to 6.2% (8/130) and 13.6% (17/125) in the food nutrition and safety message group and the no message group, respectively. The One Health message intervention had a significant effect on increasing participants' WTP ($p < 0.001$) and WTB ($p < 0.05$) for antibiotic-free pork, eggs, and milk. The One Health message intervention is effective in raising participants' WTP for antibiotic-free animal foods. It is hopeful to motivate farmers and producers to voluntarily reduce prophylactic antibiotic use through market demand and consumer choice, leading to a potential decrease in total antibiotics use in livestock. Additionally, integrated approaches based on One Health principles need to be found in the future.

1. Introduction

In modern animal production practices, antibiotics are routinely used for growth promotion or to prevent disease in healthy animals, rather than just for disease treatment [1,2]. Inappropriate use of antibiotics in livestock is considered a main driver of antimicrobial resistance (AMR), posing a significant threat to the health of humans, animals, and the environment [3]. Using excess antibiotics increases bacterial selection pressure and promotes the emergence and spread of antimicrobial-resistant bacteria (ARBs) and antimicrobial-resistant genes (ARGs) in animals [4]. In addition, antimicrobial residues can contaminate the environment with animal manure via drainage courses or soil fertilization [5,6]. Humans, especially farmers, can be exposed to AMR through the environment, food chain, or direct contact, which adds to the medical risk of antibiotic treatment failure [7,8].

The World Health Organization (WHO) has proposed guidelines on

Abbreviations: AMR, Antimicrobial resistance; ARBs, Antimicrobial-resistant bacteria; ARGs, Antimicrobial-resistant genes; BBS, Bulletin Board System; CDC, Centers for Disease Control and Prevention; FAO, Food and Agriculture Organization of the United Nations; NRDC, Natural Resources Defense Council; UK, United Kingdom; USA, United States of America; WHO, World Health Organization; WTB, Willingness to buy; WTP, Willingness to pay; WTPD, Difference in willingness to pay; ZJU, Zhejiang University.

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https://doi.org/10.1016/j.onehlt.2023.100612
Received 11 May 2023; Received in revised form 3 August 2023; Accepted 4 August 2023
Available online 5 August 2023

the use of medically important antimicrobials in food-producing animals, recommending that farmers and the food industry stop routinely using antibiotics to promote growth and prevent disease in healthy animals [9]. However, the measures for implementing these two guidelines vary across countries. Mandatory growth promoter bans have been introduced in most countries [10], while regulation of prophylactic antibiotic use relies on voluntary actions in some countries (e.g., UK, USA, and China) [11–13]. In the absence of strict regulations and monitoring systems, the rising prophylactic use of antibiotics as a sort of compensation gradually replaced the use of growth promotion. Consequently, antibiotic use continued to soar [11,14].

Ways to motivate farmers to voluntarily reduce the large-scale use of prophylactic antibiotics need to be explored. Understandably, farmers are reluctant to take the initiative to reduce antibiotic use due to concerns about reduced productivity or increased farming costs [15]. Efforts to address the financial concerns can be alleviated by promoting market demand. Promoting antibiotic-free animal foods, produced with minimal antibiotic usage, as a marketable feature holds potential as an alternative strategy to reduce antibiotic use in livestock. This approach aims to investigate the feasibility of leveraging consumer preferences to influence market demand and drive changes in production behaviors [16].

Consumer preferences and needs are key factors shaping market demand. Willingness to pay (WTP), an indicator to estimate the maximum price that consumers would consider paying for products or services with various attributes, is often used to reflect consumer acceptance and preferences [17]. Willingness to buy (WTB) is another indicator commonly used to reflect a consumer's inclination to purchase a product or service [18,19]. Information interventions based on the knowledge deficit theory are commonly used to exert an impact on consumers' WTP or WTB [20]. A few studies focused on the demand side of the food market have shown that providing additional information or claims to consumers can lead to greater understanding and acceptance, thus increasing their willingness to try out or purchase goods, which has been proven in cultured meat [21], organic food [22,23], and foods with functional attributes [24,25].

Previous studies have often focused only on consumers' WTP for human health, animal welfare, or environmental benefits [21,26]. Human health is closely linked to animal and environmental health, so it is reasonable and critical to take each of the benefits gained from tackling AMR as a whole [27]. One Health approach interventions have been encouraged and called for to address problems of AMR [28]. However, interventions to change consumers' WTP and WTB through raising awareness and understanding of One Health dimensions of AMR are relatively rare. Fewer studies have confirmed the impact of informational interventions on antibiotic-free animal foods, especially in China, the world's largest producer and user of antibiotics and the largest producer and exporter of animal foods [13].

This study aimed to explore the impact of the One Health message intervention on WTP for antibiotic-free animal foods among Chinese college students through a randomized controlled trial. College students, as opinion leaders of the younger generation, are more receptive to novel foods and are the most plausible target for future consumers [21]. This study may also help lay the foundation for future intervention studies and potentially extend to the general public.

2. Material and methods

2.1. Study design and participants

The three-arm double-blind randomized controlled trial was conducted online among students at the Zhejiang University (ZJU). Participants were recruited from the ZJU's Bulletin Board System (BBS), which is open to students of all majors. Recruitment posters claiming to collect students' views on food safety and WTP for animal foods were posted on the BBS. Interested individuals could apply through clicking the registration and eligibility assessment link provided on the posters. Potential participants who were non-ZJU-enrolled students or vegetarians were excluded during the assessment. All eligible participants provided electronic informed consent and were then formally enrolled in the study. Recruitment was stopped when the predetermined sample size was achieved. The enrolled participants were randomized into one of the three groups: the no-message group, the food nutrition and safety message group, and the One Health message group. All included participants received a questionnaire for the corresponding group. In the questionnaire, they were asked to provide sociodemographic information, complete pre-intervention outcome measures, read the corresponding message, and then complete post-intervention outcome measures. This study was approved by the Ethics Committee of the School of Public Health, ZJU (ZGL202205–1).

2.2. Randomization and blinding

Participants were randomly assigned to one of three groups with equal probability by Wen Juan Xing [29], an independent randomization and data collection platform that provides functions equivalent to SurveyMonkey. Participants were blinded to the study design. Although participants were required to read their assigned message, they were unaware of the existence of another message or groups. The statistician (XX) was not involved in the randomization process and had no contact with any participant.

2.3. Intervention

Textual messages were given to the One Health message and food nutrition and safety message groups (Table 1). The food nutrition and safety message group and the no message group were designed as control groups.

A multiphase message development process was implemented to prepare the message. A preliminary message pool was prepared based on literature reviews and health education materials from websites (i.e., Centers for Disease Control and Prevention [CDC], WHO, and Food and Agriculture Organization of the United Nations [FAO]). The message pool was vetted by a multidisciplinary team of experts including experts in antimicrobial resistance, health education, and economics. Ten sentences were selected from the message pool and rewritten into an initial version of the intervention message. Finally, the research team pretested these messages among 12 college students through qualitative interviews. Modifications were made based on the feedback of the pretest.

2.4. Procedures

The enrolled participants received a link to a self-reported questionnaire specific to the group they were assigned to. The questionnaire could be completed on a smartphone, computer, or tablet. Intervention messages corresponding to each group were embedded within the questionnaires.

In the first step, participants' sociodemographic information and responses on frequency of purchasing animal foods and familiarity with antibiotic-free animal foods were collected.

In the second step, participants were informed of the definition of antibiotic-free animal foods. [30–32] Participants were then asked about their WTP and WTB for antibiotic-free animal foods. WTP for pork, eggs, and milk were measured respectively. A trap question was set after this part to identify participants who may not be fully attentive or engaged in the study.

In the third step, participants read the message corresponding to their assigned group. Participants in the no message group saw a blank page. The food nutrition and safety message group and the One Health message group were each presented with a message. Participants in each group were prompted to ensure that they stayed on this page for at least ten seconds before answering subsequent questions.

Table 1
Textual messages given to three groups.

Group	Full message
No message group (1)	(No textual message was given but participants would receive a note: "Please hold on this page for ten seconds and continue to answer the next questions.")
Food nutrition and safety message group (2)	Access to adequate safe and nutritious food is essential to sustain life and promote good health. Animal foods provide humans with a large amount of energy, dietary protein, and bioavailable minerals and vitamins such as vitamin B12, riboflavin, vitamin A, vitamin E, vitamin D, iron, zinc, and calcium. Some nutrients cannot be synthesized by the body itself and must be obtained from food. For example, vitamin B12 are only found in animal foods. Deficiency of the above nutrients may lead to blood disorders and neurological disorders. Unsafe foods create a vicious cycle of disease and malnutrition that particularly affects infants, young children, the elderly and the sick. With harmful bacteria, viruses, parasites or chemicals, unsafe foods cause >200 diseases ranging from diarrhea to cancer. It is estimated that 600 million people (almost 1 in 10) become ill, resulting in 42 million deaths each year due to eating unsafe food.
One Health message group (3)	Inappropriate use of antibiotics as growth promoters or prophylactic drugs by farmers can lead to residues of antibiotics, resistant bacteria or drug-resistant genes in animal food. These residues can enter the body through food intake or contact, accelerating the emergence and spread of antimicrobial resistance in the human body. Antimicrobial resistance renders antibiotics ineffective, thus infectious diseases (pneumonia, tuberculosis, etc.) become more difficult to treat. The risk of infection in cancer chemotherapy and surgery increases, which means longer hospital stays, costly treatment with side effects, and even death. Studies estimate that 10 million people will die each year (almost 1 every 3 s) due to antimicrobial resistance by 2050. In addition, excessive antibiotics are difficult to be absorbed and metabolized by the animal's intestinal tract. The vast majority is excreted directly into the environment through feces, thereby contaminating water and soil. It is a huge threat to the ecosystem and food chain.

In the fourth step, participants responded again to WTB and WTP for antibiotic-free animal foods as the post-intervention measure. Additionally, participants in the food safety and One Health message groups were asked about their reflections on the message they had read. Participants in all three groups were asked three single items about their attitudes towards antibiotic-free animal foods labeling.

In the final step, all questions were answered, the One Health message was shown as additional health education for the no message group and the food nutrition and safety message group.

All steps of the trial were completed within the same session. Once participants progressed to the next step, they could not return to the previous step to modify their answers. Upon completion of participation, each participant received ¥5 ($0.70) as compensation for their time.

2.5. Outcomes

The primary outcome of this study was the difference in willingness to pay (WTPD) for pork, eggs, and milk between pre- and post-intervention in the One Health message, the food nutrition and safety message, and the no-message groups. Pigs, chickens, and cows were selected to represent the three main sources of animal foods (i.e., pork, eggs, and milk). Secondary outcomes were WTB antibiotic-free animal foods and the extent to which the One Health message influenced the next purchase of antibiotic-free animal foods. Other outcomes were participants' reflections on the message and attitudes towards labeling antibiotic-free animal foods.

2.6. Statistical analysis

According to the sample size calculation formula for multiple comparisons and the results of our pilot study, 324 individuals (i.e., 108 in each group) were required to detect a ¥3 ($0.42) difference in the primary outcome between multiple groups. The sample size provided 80% power at a two-sided 5% significance level. With a 15% potential withdrawal rate, the sample size was adjusted to 381 (i.e., 127 in each group).

Statistical analyses were conducted in R version 4.2.1. The main results analysis was based on the whole dataset. Descriptive statistics were used to explore any imbalances among groups at baseline. The Wilcox rank sum test was used to compare pre- and post-intervention outcomes within each group. The Kruskal-Wallis rank sum test was used to compare outcomes among the three groups. The Bonferroni correction was used for multiple comparisons.

Sensitivity analyses were performed to ensure the stability of the main results. We stratified all the cases by gender and redid comparisons. After removing cases with any WTPD less than zero, comparisons within groups and among groups were repeated. Tobit regressions were also conducted to control confounding factors.

Comparisons with non-parametric tests were done with the package "PMCMRplus". Tobit regressions in sensitivity analyses were done with the package "VGAM". All analysis results were considered statistically significant when $p < 0.05$. This trial was prospectively registered with the ChiCTR registry (ChiCTR2200062050).

3. Results

3.1. Characteristics of participants

The study was carried out from July 25 to August 15, 2022. A total of 389 participants enrolled and completed the questionnaires in the study as planned. Five questionnaires were excluded prior to statistical analysis due to incorrect answers to the trap question (Fig. 1).

The majority of participants were female (58.6%), Han (97.1%), undergraduate (47.1%), not majoring in a One Health-related discipline (61.5%), and had an average monthly household income of less than ¥5000. Most participants (69.9%) purchased animal food five to six times per week or every day. Prior to this study, 80.5% of participants had heard of or purchased antibiotic-free animal foods (Table 2).

3.2. The primary outcome

The distribution of WTP for pork, eggs, and milk in three groups is shown in Table 3 and Fig. S1. The proportion of participants who stated WTPD of zero for the three foods in the One Health message group (30.2%) was much lower than those in the no message group (70.8%) and the food nutrition and safety message group (57.6%). Among participants in the One Health message group, 30.2% stated increased WTP for all three foods, compared to 6.2% and 13.6% in the no message group and the food nutrition and safety message group, respectively. However, 9.4% of participants stated at least one negative WTPD (Table 4).

Comparisons among groups showed a significant effect of the One Health message intervention on improving participants' WTP, whether compared to the no message ($p < 0.001$) or the food nutrition and safety message ($p < 0.001$) (Table 5). The results of the three sensitivity analyses we performed were similar to the main analysis (Tables S1, S2, S3, S4).

The results of the within-groups comparisons showed that the post-intervention WTP measures were higher than the pre-intervention, regardless of the groups or foods (Table 5).

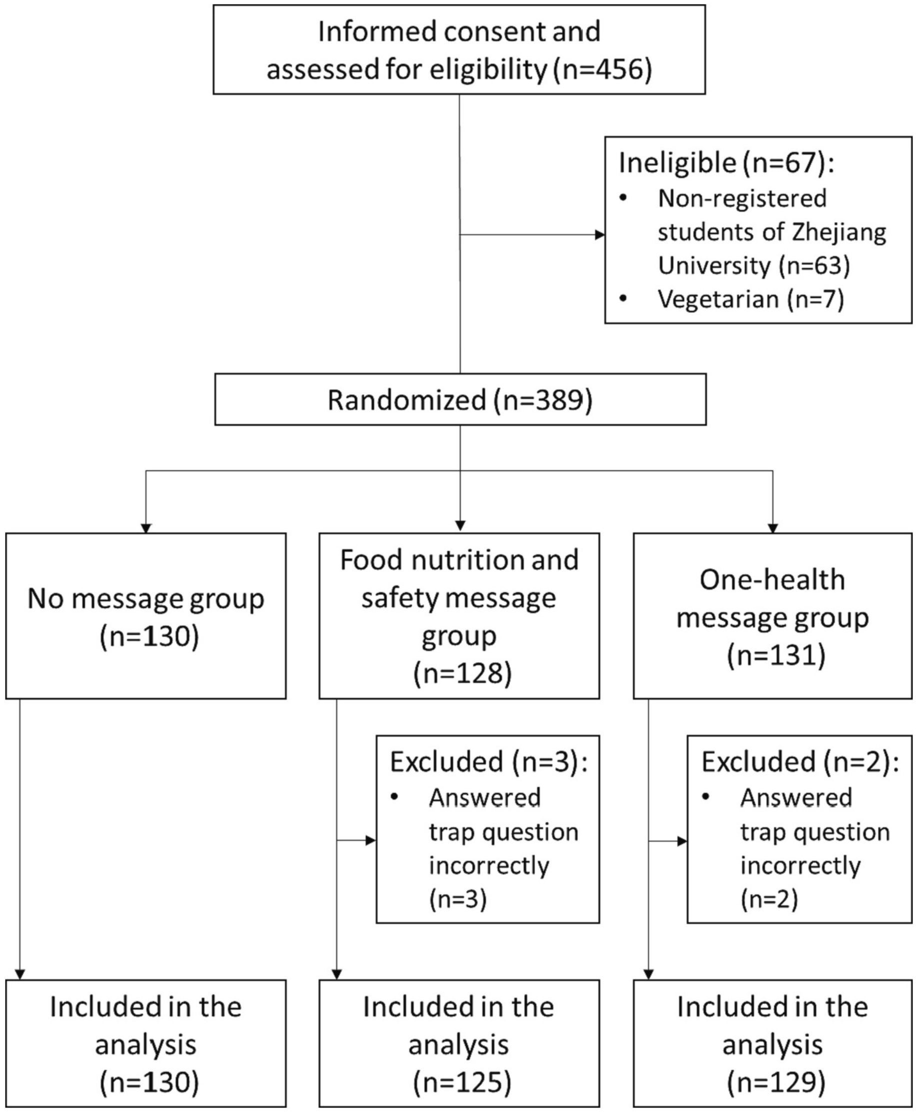

Fig. 1. Trial flowchart.

3.3. Secondary outcomes

Compared to the no message group and the food nutrition and safety message group, the One Health message group had a significantly higher WTB ($p < 0.05$) (Table S5). About 63.6% (82/129) of participants reported that they would consider "antibiotic-free" for their next time animal food purchase, which was highly correlated with their WTP ($p < 0.05$) (Table S6).

3.4. Other outcomes

Of the participants in the One Health message group, 105 of 129 (84.5%) reported being prompted to think about possible health risks to humans from consuming animal foods that may contain antibiotics or from their production processes. About 58.9% (76/129) and 72.9% (94/129) of participants reported that they thought about risks to animals and the environment due to overuse of antibiotics after reading the One Health message.

When asked about their attitude towards "antibiotic-free" food labels, participants in the One Health group showed a significantly higher level of support than the other two groups ($p < 0.001$). When informed that farmers might be inclined to reduce antibiotic use in farming if the market for antibiotic-free animal food expanded, participants in the intervention group indicated that this would influence their purchasing choices to a greater extent ($p < 0.001$) (Table S7). Participants reported that additional messages related to human health benefits (51/120, 42.5%), antibiotic resistance hazards (19/120, 15.8%), and national regulatory standards (10/120, 8.3%) were most likely to increase their WTB or WTP (Table S8).

4. Discussion

To our knowledge, this is the first randomized controlled trial of WTP for antibiotic-free animal foods through a One Health approach. The study utilized a well-designed textual message intervention. Participants' WTP and WTB was measured before and after their viewing of the One Health message, and the results were compared to the food nutrition and safety message group and the no message group. The results showed that the One Health message intervention had a significant effect on increasing participants' WTP and WTB.

Our hypothesis that exposure to the One Health message would increase participants' WTP and WTB "from 0 to 1" and "from 1 to more" was supported by the study results. In keeping with the knowledge deficit model of consumer attitudes, informational intervention with a health education purpose was effective in increasing their acceptance of these foods [33]. Overall, these findings are consistent with previous

Table 2
Baseline characteristics of trial participants ($n = 384$).

	No message group (n = 130)	Food nutrition and safety message group (n = 125)	One Health message group (n = 129)	P value
Age, mean (SD)	22.55 (2.48)	22.69 (2.50)	22.60 (2.31)	0.906[a]
Gender				0.043[b]
Male	59 (45.4)	58 (46.4)	42 (32.6)	
Female	71 (54.6)	67 (53.6)	87 (67.4)	
Ethnicity				0.895[b]
Han ethnic group	127 (97.7)	121 (96.8)	125 (96.9)	
Others	3 (2.3)	4 (3.2)	4 (3.1)	
Education level				0.924[b]
Undergraduate	60 (46.2)	57 (45.6)	64 (49.6)	
Master student	51 (39.2)	47 (37.6)	48 (37.2)	
PhD student	19 (14.6)	21 (16.8)	17 (13.2)	
Major				0.817[b]
One Health related majors*	49 (37.7)	51 (40.8)	48 (37.2)	
Other majors	81 (62.3)	74 (59.2)	81 (62.8)	
Average monthly household income				0.415 [b]
≤¥5000	54 (41.5)	50 (40.0)	62 (48.1)	
¥5001–¥10,000	43 (33.1)	47 (37.6)	34 (26.4)	
≥¥10,001	33 (25.4)	28 (22.4)	33 (25.6)	
Frequency of purchasing animal food				0.196 [b]
0–2 times /week	17 (13.1)	17 (13.6)	8 (6.2)	
3–4 times/week	29 (22.3)	23 (18.4)	23 (17.8)	
5–6 times/week or daily	84 (64.6)	85 (68.0)	98 (76.0)	
Have heard of or purchased antibiotic-free animal food				0.825 [b]
Yes	104 (80.0)	99 (79.2)	106 (82.2)	
No	26 (20.0)	26 (20.8)	23 (17.8)	

* One Health related majors include food science, medicine, agronomy, environmental science, and biological science. Students in these majors were required to have taken at least one course on antibiotics, bacterial resistance, and antibiotic-free animal foods.
[a] ANOVA.
[b] Chi-square test.

Table 3
Pre-intervention and post-intervention WTP for pork, egg, and milk in three groups.

		Pre-intervention			Post-intervention		
		Mean(SD)	Median	Difference (%)*	Mean(SD)	Median	Difference (%)*
Pork							
	Group (1)	24.72 (3.82)	25	23.62	25.08 (4.21)	25	25.40
	Group (2)	24.99 (4.65)	25	24.94	25.63 (4.70)	25	28.15
	Group (3)	25.36 (4.91)	25	26.78	26.98 (5.94)	25	34.88
Egg							
	Group (1)	7.96 (1.88)	8	32.64	8.12 (1.94)	8	35.28
	Group (2)	7.94 (1.77)	8	32.25	8.26 (1.96)	8	37.69
	Group (3)	8.03 (1.89)	8	33.85	8.76 (1.98)	8	46.07
Milk							
	Group (1)	5.59 (1.79)	5	39.73	5.74 (1.85)	5	43.48
	Group (2)	5.47 (1.31)	5	36.70	5.78 (1.51)	5	44.50
	Group (3)	5.71 (1.38)	5	42.78	6.34 (1.64)	6	58.41

The price of regular pork, eggs, milk is set as ¥20 ($2.81) per catty (500 g), ¥6 ($0.84) per catty (500 g), ¥4 ($0.56) per carton (250 mL). All WTPs in the table are denominated in Chinese Yuan (¥).
Group (1) is the No message group, Group (2) is the Food nutrition and safety message group, and Group (3) is the One Health message group.
* Difference (%) refers to the increase in participants' mean WTP of antibiotic-free animal food compared to the price of regular food.

Table 4
Descriptive analysis for difference of willingness to pay, n (%).

	Total	No message group (n = 130)	Food nutrition and safety message group (n = 125)	One Health message group (n = 129)
Any WTPD<0	36(9.4)	13(10.0)	14(11.2)	9(7.0)
Every WTPD = 0	203(52.9)	92(70.8)	72(57.6)	39(30.2)
Every WTPD>0	64(16.7)	8(6.2)	17(13.6)	39(30.2)

studies on consumers' perceptions of antibiotic-free animal food labels [26,34,35]. However, only few of these studies provide additional information on the risks of AMR. A choice experiment in the USA found that the information given did not affect consumers' choices of pork chops, likely due to their strong prior belief that antibiotic use in livestock production could pose a human health threat [36]. Information used in this experiment focused solely on the human health risks associated with antibiotic misuse in the livestock, without addressing the impact of AMR on animals and the environment. Since the given information is new and thought-provoking to them, participants in our study had a high perception of the human, animal, and environmental risks caused by the misuse of antibiotics in farming, and then had a

Table 5
Comparison within and among groups of difference of willingness to pay (WTPD).

Comparison within groups	Pork		Eggs		Milk	
	WTPD, mean (SD)	P value	WTPD, mean (SD)	P value	WTPD, mean (SD)	P value
No message group (1)	0.36 (1.89)	0.025	0.16 (0.80)	0.032	0.15 (0.58)	0.004
Food nutrition and safety message group (2)	0.64 (2.42)	0.002	0.33 (1.08)	<0.001	0.31 (0.89)	<0.001
One Health message group (3)	1.62 (2.85)	<0.001	0.73 (1.25)	<0.001	0.63 (0.87)	<0.001

Comparison among groups	Pork		Eggs		Milk	
	X^2/ z value	P value	X^2/ z value	P value	X^2/ z value	P value
Total	37.506	<0.001	39.148	<0.001	33.51	<0.001
1–2	1.583	0.340	1.167	0.730	1.257	0.626
1–3	5.926	<0.001	5.921	<0.001	5.534	<0.001
2–3	4.287	<0.001	4.698	<0.001	4.225	<0.001

greater preference for antibiotic-free animal foods. In contrast, the food nutrition and safety message, which contained vague descriptions and interference with nutritional value of animal foods, had a weak and limited effect on participants' WTP. Therefore, more precise and focused information may be needed to stimulate participants' thinking and increase their WTP for these foods.

Our study findings provided evidence that the One Health message intervention was effective in improving participants' attitudes towards "antibiotic-free animal food" labeling. Health messages can be delivered through various ways, including food labels, advertisements, and packaging instructions, all of which serve to provide a stimulus [37]. We speculate that these alternative delivery approaches, particularly those that utilize visual aids (i.e., images and videos), could have a similarly positive impact on consumers as the textual messages in our study [38]. Our study has contributed to the development of a One Health intervention message pool for informing future interventions targeting diverse populations. This expanded pool of intervention content can enhance health messages delivered through food labeling and other channels, promoting informed consumer choices that prioritize health.

Compared with the "top-down" programs implemented by the government to reduce antibiotic use in livestock, we provided more evidence for a promising "bottom-up" approach that has the potential to shape supply-side behavior through consumer preferences and market demand. This approach may benefit both the supply side and the demand side. For farmers or animal food produces, a broad market for antibiotic-free animal foods is foreseeable. Some farmers have volunteered to curtail prophylactic antibiotics use to meet the needs of US consumers [39]. Several studies have shown that reducing prophylactic antibiotic use in livestock production did not reduce overall production or increase costs [40–42]. On the other side, antibiotic-free animal foods are more in line with consumers' expectations of healthy foods and may provide them with health benefits. Indirectly, consumers can benefit from the appropriate use of antibiotics in livestock to reduce the risk of AMR [36]. Nevertheless, several studies have shown that the way farmers use antibiotics is influenced by numerous factors (e.g., economic attributes and environmental factors) and other sectors (e.g., veterinarians and retailers) [23,33,43]. It should be acknowledged that directing changes in production practices through consumer market demand alone is insufficient, and integrated approaches based on One Health principles need to be found to align activities and to balance sometimes competing interests in various sectors.

We found differences in the WTPD for the three foods even within the three groups. Because the contingent valuation method was used in hypothetical scenarios in the questionnaire, the anchoring effect may have contributed to this situation [44]. However, the prices set in this study were based on the average daily food prices in the market, allowing the obtained WTP to reflect the actual situation to some extent.

There are several limitations in the study. First, participants' WTP in a hypothetical situation may be inflated, compared to their actual purchasing behaviors in the real world. The One Health message emphasized the population health benefits of reduced antimicrobial risk, implying that purchasing antibiotic free animal products is a socially desirable as it contributes to the public good. Thus, social desirability bias can exacerbate this phenomenon [45,46]. Although previous study has shown that placing information on the product itself will make relevant information available at the point of purchase, and it might reduce the gap between WTP and purchases [47], further research is needed to explore participants' behavior change. Second, a small proportion of participants reported a lower WTP after the intervention, but the reasons were not documented. Sensitivity analyses excluding participants with any WTPD less than zero yielded similar results to the main analyses. Third, there was a higher proportion of females in the intervention group due to the simple randomization process. However, all other sociodemographic characteristics remained balanced among the groups. Gender-stratified analyses and the Tobit regression were conducted to control confounding factors, and these showed consistent results.

5. Conclusion

This randomized controlled trial has demonstrated that a One Health-based informational intervention has the potential to increase Chinese college students' WTP and WTB for antibiotic-free animal foods. Such interventions may be a promising "bottom-up" approach to motivate farmers and producers to voluntarily reduce prophylactic antibiotic use by responding to market demand and consumer choice, ultimately leading to a potential decrease in the total use of antibiotics in livestock. Additionally, integrated approaches based on One Health principles need to be found in the future.

Ethics approval and consent to participate

The study was reviewed and approved by the Ethics Committee of the School of Public Health, Zhejiang University (ZGL202205–1). Electronic informed consent was obtained from each participant. All methods were carried out in accordance with relevant guidelines and regulations.

Consent for publication

Not applicable.

Funding

This study was supported by National Natural Science Foundation of China No. 72004194 and Key Laboratory of Pollution Exposure and Health Intervention of Zhejiang Province Grant No. 20220203.

CRediT authorship contribution statement

Xin Xu: Conceptualization, Methodology, Software, Formal analysis, Writing – original draft. **Xiaomin Wang:** Conceptualization, Methodology, Writing – review & editing, Funding acquisition. **Caoying Song:** Methodology. **Bo Yan:** Methodology, Software, Validation. **Ran Zhang:** Writing – review & editing. **Lu Li:** Conceptualization, Supervision. **Xudong Zhou:** Conceptualization, Methodology, Data curation, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no competing interests.

Data availability

The datasets generated and/or analyzed during the current study are not publicly available due to the fact that our colleagues are now analyzing this data for other papers and it is not appropriate to make the raw data publicly available but are available from the corresponding author on reasonable request.

Acknowledgements

We are grateful to all respondents for their participation in this study.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.onehlt.2023.100612.

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