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Consumers' Knowledge, Attitudes, Practices, and Trust on Food Safety in Pork Value Chains in Vietnam

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Abstract

Consumer demand for safe food has been shaping the development of pork value chains, influenced by consumer knowledge, attitudes, and practices (KAP) and trust in the value chain, among other factors. This study aimed to explore consumer KAP and trust regarding food safety across different pork value chains in Vietnam. Data were collected through interviews with 170 consumers from Hanoi, Hung Yen, and Nghe An provinces. The results showed misconceptions about food safety in all three of the prevalent types of pork value chains, particularly low awareness of microbial contamination and heightened concerns over chemical residues. Many consumers demonstrated appropriate attitudes towards foodborne illness and reported applying good hygiene practices at home, although these practices varied among value chains, especially the rural GAHP value chain. Consumers overall reported low trust in the value chain actors, especially the modern and urban traditional value chains. Pig producers and government authorities were highly ranked as primary responsibility for food safety. Among communication channels, higher trust was placed in television news from the government. To improve food safety in pork value chains, the actors should focus on product differentiation, such as signaling good agricultural practices and organizing shorter, traceable value chains through cooperative models. The government could support these developments by implementing effective communication, and education and training programs on food safety for consumers and all value chain actors.

Keywords

Smallholder value chain, food safety, KAP, intervention

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Introduction

In developing countries, food value chains are typically characterized by informality, a large number of small-scale actors, heterogeneity with low traceability, and information asymmetry (Minarelli *et al.*, 2016). Increasing incomes is one of the key drivers for value chain upgrading, as consumer demand becomes more discerning and diverse (Kaplinsky, 2000; Trienekens, 2011). In Vietnam, the pig sector accounted for more than 60% of the country's total meat production during the period of 2018-2023 (Department of Livestock Production, Ministry of Agriculture and Rural Development, 2024). Several studies have shown that increased consumer awareness of food safety is associated with higher levels of education and income, and can lead to a greater willingness to pay for higher-quality, safer products (Zhanga *et al.*, 2018; Ragasa *et al.*, 2019). Among various food attributes, food safety has become an increasingly pressing concern in Vietnam, especially for meat products (Kaplinsky, 2000; Dang-Xuan *et al.*, 2016; Pham *et al.*, 2019). Unfortunately, perceived food quality and safety in Vietnam are declining, and consumer distrust towards food safety is growing (Figuié *et al.*, 2019).

GTZ (2007) defines a value chain as "a sequence of related business activities (functions) from the provision of specific inputs for a particular product to primary production, transformation, and marketing, up to the final sale of the particular product to the consumer". Various types of pork value chains in Vietnam have been described in recent literature (Ngo *et al.*, 2021). In this study, three value chains were selected due to their potential to supply safe pork at scale, along with the traditional system that supplies most consumers. These three types were categorized based on the product characteristics and marketing systems: (1) Traditional: This system is characterized by limited common product standards along the chain, i.e., conventional pork, no formal contracts or agreements among value chain actors, and no leading actor. It is common across all regions of Vietnam, in both rural and urban areas, with distribution primarily through wet markets, where almost 99% of consumers purchase pork (Nga *et al.*, 2015); (2) Rural (GAHP): The VietGAHP (Vietnam Good Animal Husbandry Practices) system was introduced under the Livestock Competitiveness and Food Safety Project (LIFSAP) in 2010 as a large-scale value chain development program to upgrade the smallholder pork value chain. In this value chain, pigs are raised in conditions complying with VietGAHP protocols, then slaughtered and marketed in rural areas; and (3) Urban modern pork value chain: This value chain is characterized by modern retail outlets, including supermarkets, convenience stores, and boutique shops, that sell higher-quality pork products at premium prices.

Consumers' knowledge, attitudes, and trust are the key drivers influencing their attention to and concern for food safety. Vietnamese consumers place high importance on organoleptic properties when buying pork, with texture (firmness, viscosity, and coolness), odor, and cleanliness being the most important criteria (Nga *et al.*, 2015). Therefore, there is a need for both the private and public sectors to be involved in addressing these issues, and enhancing food safety is considered as one of the Government's roles in managing market failures. However, the interdisciplinary literature on consumers' attitudes and behaviors towards food safety in different agri-food value chains has been scant. Previous studies, such as those by Trang *et al.* (2022) and Dang-Xuan *et al.* (2016), have focused on consumer knowledge, information needs, and trust regarding pork safety in different retail types in Northern Vietnam, or on specific actors within a pork value chain. To date, no study has surveyed consumers' KAP and trust regarding food safety across multiple pork value chains, which are representative of the broader Vietnam context. In practice, a number of food poisoning outbreaks related to Salmonella have been reported in Vietnam (Nguyen Van Phuc *et al.*, 2024; Thanh Binh, 2024), raising central questions about the underlying reasons of consumer behaviors when choosing food with food safety in mind. This study aimed to describe the knowledge, attitudes, practices, and trust of consumers on food safety in different pork value

chains, and to provide implications for improving food safety in pork value chains in Vietnam.

Methodology

The KAP theory

Knowledge is defined as the understanding of any given topic (Kaliyaperumal, 2004). Attitudes are emotional, motivational, perceptive, and cognitive beliefs that positively or negatively influence the behavior or practice of an individual (FAO, 1994). According to FAO (2014), "practices" are the observable actions of an individual that may affect their own or others' nutrition, such as eating, feeding, handwashing, cooking, and selecting foods. This study employed the KAP framework (K - knowledge, A - attitudes, P – practices). According to Zanin et al. (2017), KAP is one of the most widely used theories to study food safety practices. Badran (1995) proposed an influence diagram describing how knowledge positively influences attitudes, which in turn affects practices (Kwol *et al.*, 2020). In addition, this study adopted the definition of trust from Robbins (2016): "Trust is a belief about another person's trustworthiness with respect to a particular matter at hand that emerges under conditions of unknown outcomes". In this context, the particular matter is food safety.

Study design and location

This cross-sectional study was conducted from September 2018 to March 2019. It was a part of a larger survey using the food safety performance tool (FSPT) developed, tested, and refined by the International Livestock Research Institute (ILRI). The tool was used to access the knowledge, attitudes, practices, and trust of various actors in the pig value chain, such as farmers, slaughterhouses owners, retailers, and consumers. Three provinces selected by the ACIAR Project "Safe Pork: Market based approaches to improving the safety of pork in Vietnam" were also used for the study: Hanoi, Hung Yen, and Nghe An. The rural VietGAHP pork value chain was investigated in Hung Yen and Nghe An, while both the traditional and modern urban pork value chains were investigated in Hanoi.

Sample size and participant selection

The sample size was calculated using the formula for comparing two proportions. The calculation was based on the following assumptions: a 95% confidence level, and an expected 30% difference in the response rate to specific knowledge questions, such as "If pork is fully cooked then it is safe", between consumer groups purchasing pork from traditional retailers (expected 30-40% correct) and modern retail outlets (expected 60-70% correct). Based on these assumptions, a minimum of 35 consumers per value chain was targeted. From the proportion of available consumers across the three value chains, we invited and selected a total of 170 consumers, namely 36 from the rural VietGAHP, 55 from the modern urban, and 79 from the traditional urban value chains.

The snowball sampling and convenient sampling techniques were applied. Consumer participants were selected through retailer introductions or intercept approaches following the method described by Graham et al. (2014). Selection was also based on the participants' willingness to participate and their identification with specific pork value chains, as defined earlier in this study.

Participant interviews

The face-to-face interviews were carried out using a FSPT, which included a combination of both structured and open-ended questions. The contents of the questionnaire covered the following key aspects: (i) basic demographic information, (ii) food safety knowledge, attitudes, and practices, (iii) behaviors and incentives, (iv) trust and governance, and (v) communication and interventions related to food safety.

Data management and analysis

Collected data were encoded, managed, and double-checked in Excel (Microsoft Corporation, Redmond, USA). Descriptive and comparative statistics were performed using the Chi-square test or Fisher's exact test, where appropriate (to test differences in proportions between groups), and the F-test (to assess differences in group means). Data analysis was

carried out using SPSS 22.0 (IMB, USA) statistical software. The significance level of the tests was set at a maximum of 10% (P <0.1).

Ethical approval for this study was obtained from the Ethical Review Board for Biomedical Research of the Hanoi School of Public Health (Approval No. 110/2018/YTCC-HD3). Informed consent was attained from each participant prior to the interview.

Results and Discussion

Consumers' characteristics and their purchased pork value chains

The interviewed consumers were predominately female (about 90%) with an average respondent age of 51. The majority had finished secondary or high school. On average, consumers in Hanoi (modern and traditional value chains) had higher education levels than those in rural areas (GAHP, **Table 1**).

The rural GAHP value chain had four main activities: providing inputs, production, slaughtering, and retailing. Collectors were not involved in this value chain as slaughterhouses bought pigs directly from farmers. The urban traditional pork value chain in Hanoi was characterized by retailers who also served as butchers. Typically, each meat stall was run by a couple (often husband and wife) who sourced pigs from farmers or slaughterhouses in the suburbs of Hanoi, then slaughtered and transported the carcasses and intestines to markets using a motorbike for retail sale. The urban traditional pork value chain in urban areas long reflects the production sites. The urban modern pork value chain was characterized by stronger linkages between actors and labelled products.

Across all the value chains, a high proportion (40-90%) of live pigs from different farm scales, including VietGAHP farms (as mentioned earlier), were brought to slaughterhouses, especially small- and medium-scale, slaughterhouses. Between 65-98% of pork from all the slaughterhouse scales was subsequently distributed to traditional retailers and wet markets, where approximately 60-85% of the peri-urban and urban consumers, and almost 100% of the rural consumers, purchased their pork. In contrast, only 10-35% of the urban and peri-urban consumers bought pork from modern retailers and boutique shops, while rural consumers rarely bought pork from modern retailers (**Figure 1**).

Table 1. Consumers' demographic characteristics by pork value chain types

Description	Rural GAHP (n = 36)	Urban modern (n = 55)	Urban traditional (n = 79)	Overall (n = 170)
Gender (%)				
Female	91.7	85.5	91.1	89.4
Male	8.3	14.5	8.9	10.6
Age (years old, *mean*)	45.4	53.0	51.8	50.8
Occupation (%)				
Farmer	80.6	0.0	0.0	17.1
Non-farm job (staff, workers, etc.)	5.6	69.1	60.7	51.8
Housewives	0.0	23.6	26.6	20.0
Other (freelancer, private business, etc.)	13.8	7.3	12.7	11.1
Education (%)				
Higher school and lower	88.9	52.7	70.9	68.8
Vocational	8.3	10.9	5.1	7.6
College and higher	2.8	36.4	24.0	23.6

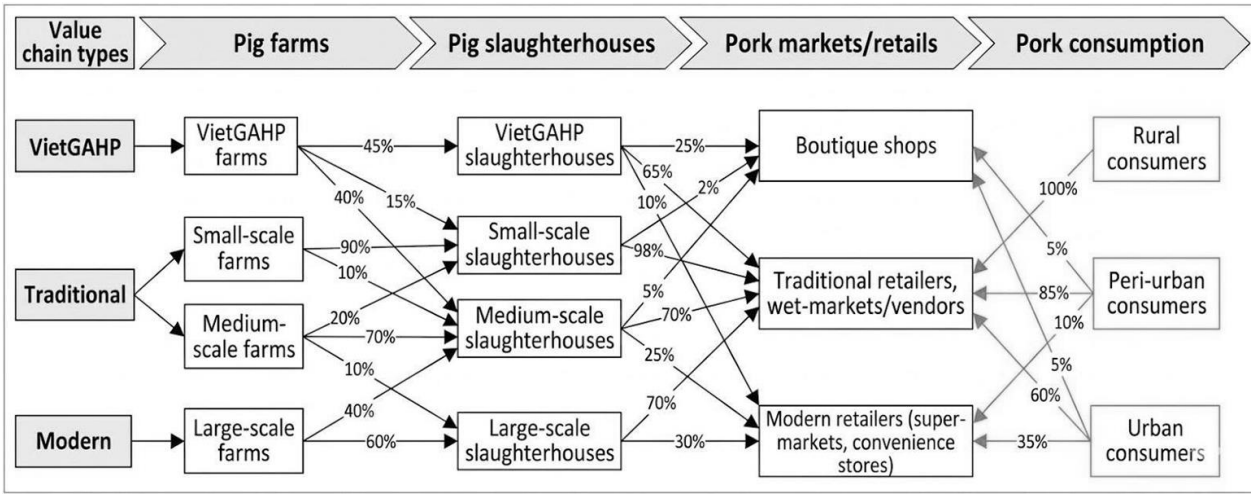

Figure 1. The generic proportions of value chains distributing pork to consumers in different areas in Vietnam (adapted from SafePORK project's annual report)

Consumers' knowledge of food safety in different pork value chains

Most of the consumers believed that unsafe food, especially pork, could be detected by physical appearance. The VietGAHP (rural) consumers seemed more confident in detecting unsafe pork by observing the pork's appearance, e.g., color, odor, or texture of the pork, compared to the urban consumers. More than 85% of the respondents believed that chemical residuals in food (pork) were a main cause of cancer. This was the main reason for their belief that well-cooked pork was still not considered safe. When asked to compare food safety risks across food types, most participants considered fish to not be riskier than mangoes. Different reasons were given, for example, some believed that mangoes are preserved with chemicals and eaten fresh, so they pose a higher health risk (**Table 2**).

Consumers' attitudes towards food safety in different pork value chains

More than 90% of the consumers from all the value chain types blamed poor hygienic practices for foodborne disease. Most (83.5%) considered foodborne disease as a usually serious illness. About 80% of the consumers were worried about foodborne diseases at least once a week, reasoning that food sold in markets is generally unsafe. Interestingly, interviewed consumers considered farmers as the most responsible for pork safety, followed by the government and ministries, and input suppliers. While other value chain actors, such as slaughterhouses, traders, and retailers, were rarely seen as responsible for food safety (**Table 3**). The consumers' concerns on chemical residues and strong beliefs that chemical residues in food are the main cause of cancers, probably led to their perception that farmers are the most responsible for food safety (**Table 2**). There were differences in attitudes towards food safety among the value chains. Consumers from the traditional value chain appeared less concerned about poor hygiene practices compared to those in the other value chains (*P*-value <0.05, Chi-square test, **Table 3**). However, consumers in the rural GAHP value chain seemed less worried about foodborne diseases, with 36% stating that such illnesses are "usually not serious" (**Table 3**).

Consumers' practices towards food safety in different pork value chains

Most of the consumers reported practicing separation of raw and cooked foods. The adoption of this practice was not significantly different among consumers across the three value chains. However, some consumers used the same cutting board for different foods in their kitchens, and there was a significantly higher proportion of rural consumers doing this practice compared to their urban counterparts. Consumers also reported that buying a lot of meat then storing it at home could lead to a decline in quality and increase the risk of bacterial contamination. Interviewed consumers also reported applying

Table 2. Consumers' knowledge on food safety across different retail types (%)

Questions items	Rural GAHP (n = 36)	Urban modern (n = 55)	Urban traditional (n = 79)	Overall (n = 170)	Chi-square Test
Unsafe food can be detected by its physical appearance					
Yes	100	92.7	86.1	91.2	
No	0	5.5	13.9	8.2	*9.2**
Don't know	0	1.8	0	0.6	
Chemicals in foods are the main cause of cancer					
Yes	86.1	87.3	86.1	86.5	
No	8.3	10.9	8.8	9.4	1.3^{ns}
Don't know	5.6	1.8	5.1	4.1	
If pork is fully cooked, then it is safe					
Yes	50.0	18.2	27.8	29.4	
No	50.0	81.8	68.4	68.8	14.3**
Don't know	0	0	3.8	1.8	
Fish are riskier than mangoes [a]					
Yes	5.6	16.4	27.8	19.4	*17.1***
No	88.8	63.6	49.4	62.4	
Don't know	5.6	20.0	22.8	18.2	

*Note: **, *: statistically different from zero at 5% and 10%, respectively; ns: non-significant difference. a: The answer "No" is correct.*

Table 3. Consumers' attitudes towards food safety (%)

Attitude questions	Rural GAHP (n = 36)	Urban modern (n = 55)	Urban traditional (n = 79)	Overall (n = 170)	Chi-square Test
Foodborne diseases are usually caused by poor hygiene practices					
Yes	97.2	94.5	86.1	91.2	4.97*
No	2.8	5.5	13.9	8.8	
Foodborne diseases are usually not serious illnesses					
Yes	36.1	10.9	11.4	16.5	12.81***
No	63.9	89.1	88.6	83.5	
I worry about foodborne diseases at least once a week					
Yes	83.3	80.0	79.7	80.6	2.49^{ns}
No	13.9	18.2	20.3	18.2	
Don't know	0	1.8	0	1.2	
Responsibility to ensure that food is safe belongs to					
Input suppliers	17.0	9.0	9.0	11.0	Na
Farmers	53.0	55.0	53.0	54.0	
Slaughterhouses	11.0	2.0	4.0	5.0	
Consumers	14.0	2.0	3.0	5.0	
Government	41.7	40.0	46.8	43.5	

*Note: In the same row, different superscripts (*** and *) indicate significant differences from zero at 1% and 10%, respectively. Na: not applicable.*

proper food storage techniques by cleaning meat before placing it in a fridge (**Table 4**).

Consumers' trust in their interaction frequency with different actors and stakeholders related to food safety

Respondents were asked to indicate their trust in different value chain actors, stakeholders, and communication channels in the pork chain, using a score from 1 (very low trust) to 10 (complete trust). Generally, traders, slaughterhouses, farmers, and farm input suppliers received the lowest trust ratings from consumers. Similarly, supporting actors were not highly trusted by consumers. In terms of communication channels, television and radio were the most trusted sources for information and messages related to food safety (**Table 5**). Consumers in the rural GAHP value chain gave higher trust scores across all the listed actors compared to those in the other value chains (**Table 5**).

Ranking of feasible intervention measures to improve safety of pork by consumers

Based on a list of 11 proposed interventions developed by the research team, consumers ranked these measures in order of importance for improving food safety along the pork value chains. Responses varied among consumers from different value chains (**Figure 2**). The modern and traditional value chain consumers showed similar rankings for the top three interventions: a tamper-proof label, a government campaign to educate housewives and consumers about food safety, and a government campaign to train pork value chain actors. Meanwhile, consumers in the GAHP value chain appreciated the formation of cooperatives with stronger linkages, which implies a clear product origin of products, certification (i.e., VietGAHP), and a tamper-proof label scheme. Inversely, social media groups (e.g., Facebook) where people can post feedback on food quality, newspaper postings, and displaying food safety scores (by authorities) at shops, kiosks, or restaurants were the three lowest-ranked intervention options.

Discussion

This study provides insight into the levels of knowledge, attitude, practice, and trust of consumers regarding food safety in Vietnam, using the pork value chain as an example. Responses from different consumer groups, namely VietGAHP, traditional, and modern retailers, revealed a common belief that food safety can be judged by the physical appearance of pork, especially VietGAHP consumers. Physical characteristics such as the color, firmness, flavor, and water holding capacity can be influenced by factors like breed and nutrition feeding (Janicki *et al.*, 1963; Blair, 2017). However, the majority of consumers agreed that unsafe food can be detected by physical appearance, which was also found in Nga *et al.* (2015) and Dang *et al.* (2020). However, this is a misperception because spoilage bacteria differ from those that cause illness. Food may appear to be safe and yet be unsafe to humans as microbial contamination is not always visible (Brito *et al.*, 2025). Similarly, Samapundo *et al.* (2016) found that the majority of consumers in Ho Chi Minh City either lack knowledge or gave incorrect answers regarding whether *Salmonella* or *Staphylococcus* are foodborne pathogens. Related to this, Shilpa *et al.* (2024) showed that urban participants had a higher knowledge and better food safety practices compared to rural participants.

Overconcern about the effects of chemical hazards in food (such as antibiotic residues and growth promoters used in production) rather than biological ones remained a major issue of consumers. Consumers' concerns of chemical residues in food have been found in a number of studies, such as Jalal *et al.* (2015), Tran Thi Tuyet Hanh *et al.* (2015), and Thanh Mai Ha *et al.* (2019). However, evidence suggests that most foodborne illnesses are caused by biological rather than chemical hazards (Havelaar *et al.*, 2015). Our findings revealed a slow shift in consumer knowledge regarding food safety, particularly within the pork value chain. More than half of the respondents in a 2013 survey were more concerned about chemicals than bacteria in pork (Unger *et al.*, 2018), and this pattern remained consistent in our current study. The majority of consumers still believe that chemicals in food are the main cause of cancer. On the other hand, consumers probably do not have full, transparent information about microbial contamination in food and its health

Table 4. Practices of consumers towards food safety at home (%)

Practices questions	Rural GAHP (n = 36)	Urban modern (n = 55)	Urban traditional (n = 79)	Overall (n = 170)	Chi-square Test
Raw and cooked foods are often kept separately					
Yes	94.4	96.4	100	97.6	
No	2.8	3.6	0	1.8	6.509^{ns}
Don't know	2.8	0	0	0.6	
Use the same board for cutting different foods in my kitchen					
Yes	25.0	9.1	6.3	11.2	9.040**
No	75.0	90.9	93.7	88.8	
Buy a lot of meat to store for several days or weeks					
Yes	19.4	21.8	35.4	27.6	
No	80.6	78.2	64.6	72.4	
Clean and wash hands and kitchen utensils during preparation and cooking food					
Yes	69.4	40.0	30.4	41.8	
No	30.6	60.0	69.6	58.2	
Food is stored properly in closed boxes at cold temperatures					
Yes	47.2	56.4	55.7	54.1	
No	52.8	43.6	44.3	45.9	

*Note: ** statistically different from zero at 5%; ns: non-significant difference.*

risks. Consumers' limited knowledge is partly due to ineffective risk communication strategies employed by the mass media (Nguyen-Viet *et al.*, 2019). The question on the perceived safety of fish and mangoes further illustrated these knowledge gaps, as most consumers either did not know the answer or gave the wrong answer. These findings underscore the need for more effective communication strategies, including appropriate content and channels (e.g., TV and radio), to convey accurate food safety information to consumers and other value chain actors. Pham-Duc *et al.* (2019) also reported that pig producers in Nam Dinh (previous name) and Dong Nai provinces believed that TV is the first outlet for providing good information for them.

The study also found that most consumers, especially urban consumers, are highly aware of the risks of foodborne illness resulting from poor hygienic practices. Given the requirement of standardization and traceability in pork products, the range of activities implemented by various value chain actors has changed little compared to a decade ago (Ha *et al.*, 2014; Nga *et al.*, 2014). Consumers in developing countries, including Vietnam, are expected to become increasingly aware of food safety issues as urbanization proceeds and incomes rise (Cho *et al.*, 2014; Figuié & Bricas, 2016; Ortega & Tschirley, 2017; Roesel *et al.*, 2019). Younger consumers tend to favor modern retail systems (Nguyen & Le Do, 2012), and many are willing to pay a premium for safe pork (Khai *et al.*, 2018; Thi Nguyen *et al.*, 2019). The observed increasing trend in VietGAHP and modern pork value chains in the present study are consistent with this development. However, the smallholder VietGAHP value chain remains very limited in rural areas, while the modern pork value chain is expensive and serves only a niche market.

Various studies have shown that retailed pork in Vietnam often exceeds the allowable bacterial contamination limits and highlight *Salmonella* spp. as a major cause of foodborne illness among Vietnamese pork consumers (Dang-Xuan *et al.*, 2017; Cook & Phuc, 2019; Nguyen-Viet *et al.*, 2019). In Ciano's research in the Philippines, it was also found that "all samples (71/72) of the pork tested positive for *E. coli*, with all samples exceeding the allowable

Table 5. Consumers' trust and interaction frequency with actors and food safety stakeholders in the pork value chain

Actor/people	Consumer's trust level				
	Rural GAHP (n = 36)	Urban modern (n = 55)	Urban traditional (n = 79)	Overall (n = 170)	F-test
Value chain actors					
Other consumers	7.9	7.3	7.2	7.4	2.8*
Supermarket sellers	7.7	6.9	6.6	6.9	6.6***
Boutique and convenience store staff	7.6	7.1	6.6	6.8	3.3**
Traditional market retailers	6.8	5.3	5.7	5.8	9.4***
Farm input suppliers	7.5	5.3	5.3	5.8	22.8***
Pig producers/farmers	7.8	5	5.3	5.7	28.6***
Slaughterhouse workers	7.1	4.8	4.7	5.3	20.2***
Traders/middlemen	6.1	4.8	4.7	5.0	7.5***
Supporting actors					
Veterinary staff	8.6	6.3	6.1	6.9	28.4***
Local authorities	8.3	6.7	6.3	6.8	16.8***
Health staff	8.4	6.3	6.2	6.8	19.3***
Agricultural extension staff	8.1	5.6	5.9	6.5	19.8***
Communication channels					
TV and radio	8.6	7.7	7.7	7.9	5.4***
Newspapers	6.8	6.6	6.6	6.6	0.12^{ns}
Social media (e.g., Facebook)	6.5	6.8	6.2	6.5	1.8^{ns}
Famous people	6.7	5.3	5.3	5.6	4.3**
Overall trust level	7.7	6.2	6.2	6.5	31.5***

*Note: ***, **, *: statistically different from zero at 1%, 5%, and 10%, respectively; ns: non-significant difference.*

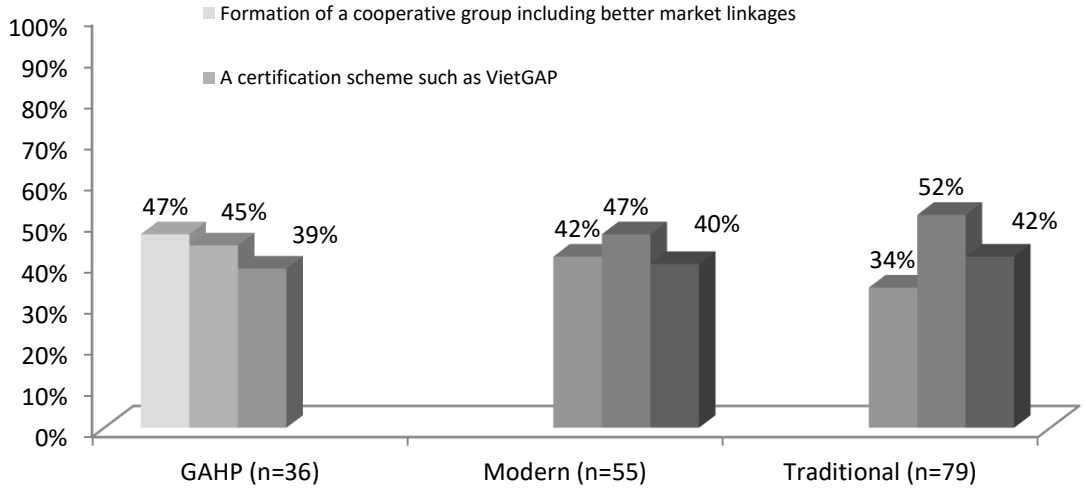

Figure 2. Consumers' opinion on key measures to improve food safety in Vietnam's pork value chains

limit" (Ciano, 2025). In our survey, consumers generally expressed concern about cross-contamination from raw to cooked food in the kitchen, and were aware of factors that reduce

food safety, such as unhygienic preparation or improper storage. Practices such as using the same cutting board or knives for both raw and cooked pork can induce bacterial cross-contamination, and consequently illness (Dang-Xuan *et al.*, 2016; Dang-Xuan *et al.*, 2017). In this study, it was a good sign that almost all the interviewed consumers reported good practices, like keeping raw and cooked food separate. Only a small number, mostly from rural areas, still used the same cutting board for different foods. This difference may be the result of economic constraints preventing enough kitchen utensils, and/or a lack of awareness of hygiene practices among rural consumers.

Unlike fully integrated meat value chains with registered product standards, smallholder value chains often lack clear product information. This information asymmetry can create uncertainty for consumers, leading them to adopt different ways to make pork "less unsafe", i.e., going back to their hometown to buy a large quantity of pork of known origin and storing it in their refrigerator for several weeks or months, or pre-steaming the pork before cooking main dishes. Information asymmetry is a market failure that needs government action along the food chain (Rama & Harvey, 2009; Nga, 2015). Probably due to the overemphasis on chemical residues in meat, our study showed that consumers put the greatest responsibility for food safety on producers, government authorities, and input suppliers, while they pay little attention to the roles of slaughterhouses and retailers, whose practices are equally important. Thus, more effective communication is needed to inform consumers and, in turn, create greater pressure across the entire value chain, especially slaughterhouses and retailers, to take responsibility and adopt better hygiene practices that fulfil the safe food demands of consumers.

Among the proposed interventions, government campaigns to train value chain actors on food safety were considered the most important by consumers in this survey. Food safety risks and proper hygiene handling practices should be prioritized in education and training programs for food value chain actors and stakeholders (Bahnson *et al.*, 2001; Dang-Xuan *et al.*, 2016; Samapundo *et al.*, 2016). Such educational and training campaigns could empower and motivate those involved in food retail and processing. These might also contribute to addressing issues such as the lack of ethical practices among certain food value chain actors (Nguyen-Viet *et al.*, 2017; Nguyen *et al.*, 2018; Nguyen-Viet *et al.*, 2019).

In the context of limited traceability of food in Vietnam (Ehlert & Faltmann, 2019), it is understandable that the consumers' demand for information about food origin was highly ranked (Dang *et al.*, 2020). This finding also aligned with studies in China, where over 90% of the interviewed consumers considered a food traceability system necessary and were willing to pay premium for it (Song *et al.*, 2008). Roesel *et al*. (2019) also reported that in Uganda a "number of urban customers trust the meat inspection stamp at purchase". The formation of cooperative groups (e.g., VietGAHP) could enable the certification of product standards and support traceability, especially in the context of small-scale and scattered pig production in Vietnam. Wider distribution of cooperative-produced food to urban and peri-urban consumers should be prioritized and strengthened to help reach the majority of consumers at the lowest cost.

Regarding other technical intervention measures, identifying and applying feasible incentives to support behavior changes among value chain actors was considered key for both adoption and scalability. Comparative studies of incentive-based, light-touch interventions in Kenya (milk and slaughter), India (milk), and Nigeria (butchers/retailers) have shown that only a little uptake can be expected without supporting incentives (Johnson *et al.*, 2015). These incentives may include food safety banners, basic equipment, or peer-to-peer monitoring systems. In our study, some suggested interventions for food safety improvement, which could also function as incentives, included training value chain actors, implementing certification schemes, or introducing labeling. However, due to the modest number of respondents and the non-representative sampling approach, the findings of this study are context-

specific and may have limited generalizability. In addition, as this study is a cross-sectional study, evidence in the study does not support any conclusion about the changes. The results only highlight the status of consumer KAP at the time of the survey.

Conclusions and Implications

Consumers' knowledge, attitudes, and practices play a critical role in food safety-related behaviors. The results from this study showed that there are misconceptions about food safety across the three pork value chains, especially the underestimation of biological risks and the overestimation of chemical risks. Many consumers believe that unsafe food could be detected by its physical appearance, or that pork is safe when fully cooked. Consumers' attitudes to foodborne diseases differed by value chains. Fewer consumers in the traditional pork value chain were concerned about poor hygiene practices, and consumers in the rural GAHP value chain showed a greater concern with foodborne disease. Yet, rural GAHP consumers showed the lowest concern about the seriousness of foodborne diseases and a higher proportion of rural GAHP consumers still used the same cutting board for raw and cooked food—again implying that positive attitudes toward food safety are not necessarily translated into practice. Although good food preparation practices were reported overall, they were less frequent among the VietGAHP consumers in rural areas. Important interventions were ranked by consumers, focusing on tamper-proof labelling, government education programs, and cooperative formation. Given the state of consumers' KAP on food safety (particularly for pork) and their priorities for interventions to improve food safety, several implications of upgrading pork value chains were drawn from the study. Food safety risk communication to consumers should be strengthened via different official channels of the government but priority given to VTV1 news programs. VietGAHP pork product development is recommended for smallholders but should be aligned in shorter chains with tamper-free labelling to build trust. A business model in which cooperatives own or sign a contract with slaughterhouses and have their distribution channel of safe pork would probably be more effective for smallholders to reach urban consumers. The government should play a key role in improving food safety through education, providing updated and transparent information and capacity-building. Future research on consumers' KAP should also extend to processed and ready-to-eat foods, which are growing in demand.

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