

Unveiling food safety perceptions: a study on consumer behavior and trust in Malaysia

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Abstract

Food safety is a critical public health issue in Malaysia, where concerns have been raised by recent high-profile incidents. This study evaluates Malaysian consumers' knowledge, attitudes, and practices concerning food safety and examines the influence of social norms and trust in food safety governance. A cross-sectional survey of 1,416 Malaysian consumers was conducted using a structured online questionnaire, which assessed consumer knowledge, risk perception, preventive measures, and trust in food safety governance. Findings revealed substantial knowledge gaps among Malaysian consumers, particularly regarding food additives, contamination, and safe handling practices. While basic hygiene practices were generally followed, moderate concern existed about genetically modified foods and food irradiation, reflecting consumer skepticism toward these technologies. Social norms significantly influenced food safety behaviors, and trust in expert opinions and certification labels proved crucial in shaping practices. These findings highlight the need for targeted educational interventions to address knowledge gaps, enhance consumer confidence in food safety, and emphasize the importance of leveraging social norms and expert opinions in public health campaigns to improve food safety behaviors. The study provides valuable insights for policymakers and public health authorities in refining food safety communication strategies and regulatory frameworks in Malaysia.

Keywords: food safety practices; risk perception; subjective norms; theory of planned behavior

Introduction

Food safety is a critical global issue, with foodborne illnesses posing significant risks to public health. The World Health Organization (WHO) reports that 1 in 10 people fall ill each year due to unsafe food, and foodborne diseases cause 330 million lives lost annually (WHO, 2025). In Malaysia, the situation reflects global

concerns, with several high-profile food contamination incidents intensifying consumer fears and underscoring the need for robust food safety measures (Soon, Singh, & Baines, 2011).

Consumer perceptions of food safety play a crucial role in shaping both food safety practices and policies. These perceptions are influenced by various factors, including

personal experiences, media coverage, and the perceived reliability of regulatory authorities (Verbeke, 2005; Caputo *et al.*, 2013; Boccia *et al.*, 2023). The complexity of food safety regulations can sometimes lead to confusion among consumers, highlighting the importance of clear and effective communication from regulatory bodies.

The advent of emerging food technologies, such as genetically modified foods (GMFs) and food irradiation, adds another layer of complexity to food safety perceptions. Despite their potential to enhance food security and safety, these technologies frequently face public resistance due to perceived health risks and a lack of understanding regarding their benefits (Bredahl, 2001; Frewer *et al.*, 2003). The gap in consumer knowledge is a significant barrier to the broader acceptance of modern food safety practices, particularly in Malaysia, where traditional food quality attributes such as freshness, presentation, and taste are highly valued (Shaharudin, Wan Mansor, & Elias, 2011).

Addressing challenges such as public resistance to emerging food technologies (e.g., genetically modified food, food irradiation) (Jadhav and Choudhary, 2024), cultural and traditional preferences (Lee *et al.*, 2022), consumer knowledge gaps (van Leeuwen *et al.*, 2024), the adoption of modern food practices (Evans *et al.*, 2010), and consumers' willingness to pay for product attributes (Boccia *et al.*, 2023) is essential not only for improving public health outcomes but also for advancing broader sustainability goals. The United Nations' Sustainable Development Goals (SDGs), specifically Goal 3 (Good Health and Well-being) and Goal 12 (Responsible Consumption and Production), emphasize the importance of ensuring food safety as a cornerstone of sustainable development (United Nations, 2015). Ensuring that consumers are well-informed and confident in the safety of their food is critical for promoting sustainable consumption patterns and mitigating food-related health risks.

Unlike previous studies (Chaudhary *et al.*, 2023; Wan Nawawi *et al.*, 2022), this study addresses the gap by providing a comprehensive analysis of consumer perceptions and behaviors related to food safety by incorporating feedback, governance, and trust, and examining how consumers interact with misinformation, including fake news and pseudo-science, in Malaysia. By examining the factors that shape consumer attitudes towards food safety, this research seeks to contribute to the development of more effective risk communication strategies and policy interventions that align with both public health objectives and the SDGs. The findings are expected to inform food safety authorities in Malaysia and contribute to the global discourse on food safety and sustainability.

Materials and Methods

Study design and participants

This study employed a cross-sectional design and the theory of planned behavior (Ajzen, 1991; Ajzen, 2020) to assess consumer attitude, subjective norms, risk perception, and behavior related to food safety in Malaysia. The calculation of the sample size was based on voluntary snowball sampling using an online sample size calculator by Survey Monkey (Daniel, 1999), considering Malaysia's finite population from the Department of Statistics, Malaysia (DOSM, 2020). The sample size was calculated using a single proportion (50%), with a significance level of 0.05 and a confidence level of 95%. The total number of samples was proportionate to the population in each state in Malaysia (DOSM, 2020).

A total of 1,416 respondents participated in this study, recruited through voluntary snowball sampling across various states in Malaysia (Table 1). The participants were diverse in terms of demographic backgrounds, including age, gender, income level, education, and geographic location, providing a comprehensive overview of consumer perceptions across different segments of the population.

Questionnaire development

The survey instrument was meticulously developed based on the Theory of Planned Behaviour (Ajzen, 1991; Ajzen, 2020), with constructs comprising eight sections designed to capture a wide range of variables related to food safety using a 5-point Likert scale. A 5-point Likert scale was selected as it offers a practical and reliable option to ensure scale consistency (Russo *et al.*, 2021). The sections included:

1. **Demographic Profile:** Captured information on respondents' origin, age, gender, income level, race, education level, occupation, household size, and involvement in food-related businesses.
2. **Food Safety Knowledge:** Assessed respondents' understanding of food safety regulations, hazards, and safe food handling practices. This section used a three-option response format (correct, incorrect, and "don't know") to gauge knowledge levels.
3. **Subjective Norms:** Measured the influence of societal norms on individual food safety behaviors using a 5-point Likert scale.
4. **Risk Perception:** Evaluated how likely respondents believed different food items were to cause food poisoning, using a scale from 1 (very likely) to 5 (very unlikely).

Table 1. Demographic characteristics and socioeconomic profile of respondents.

Profile	Category	Frequency (n)	Percentage (%)
State	Perlis	21	1.50%
	Kedah	95	6.70%
	Pulau Pinang	154	10.90%
	Perak	91	6.40%
	Selangor	397	28.00%
	Kuala Lumpur	156	11.00%
	Putrajaya	79	5.60%
	Negeri Sembilan	56	4.00%
	Melaka	50	3.50%
	Johor	110	7.80%
	Pahang	39	2.80%
	Terengganu	50	3.50%
	Kelantan	29	2.00%
	Sarawak	16	1.10%
	Labuan	9	0.60%
Gender	Sabah	64	4.50%
	Male	498	35.20%
	Female	908	64.10%
Age	Prefer not to state	10	0.70%
	18–30 years old	438	30.90%
	31–60 years old	965	68.10%
Race	> 61 years old	13	0.90%
	Malay	945	66.80%
	Chinese	340	24.00%
	Indian	65	4.60%
	Orang Asli	1	0.10%
	Bumiputera Sabah	39	2.80%
	Bumiputera Sarawak	10	0.70%
Level of Education	Others	15	1.10%
	Primary education	2	0.10%
	Secondary education	90	6.40%
	Tertiary education	1027	72.60%
Children in Household	Postgraduate	294	20.80%
	No child	614	38.60%
	(< 2 years old)	210	12.60%
	(3–12 years old)	598	36.10%
Family Members Needing Special Care	(13–17 years old)	234	14.10%
	Yes	243	17.20%
Gross Household Income	No	1173	82.80%
	Less than RM 2,500	176	12.50%
	RM 2,501 – RM 3,169	134	9.50%
	RM 3,170 – RM 3,969	91	6.40%
	RM 3,970 – RM 4,849	113	8.00%

(continues)

Table 1. Continued.

Profile	Category	Frequency (n)	Percentage (%)
	RM 4,850 – RM 5,879	160	11.30%
	RM 5,880 – RM 7,099	156	11.00%
	RM 7,110 – RM 8,699	133	9.40%
	RM 8,700 – RM 10,959	165	11.70%
	RM 10,960 – RM 15,099	176	12.50%
	More than RM 15,099	109	7.70%
	Occupation	Public Service	825
Private		289	20.50%
Self-employed (Business)		87	6.20%
Pensioner/Retired		22	1.60%
Unemployed		76	5.40%
Housewife/Husband (Homemaker)		27	1.90%
Others		83	5.90%
Involvement in Food-Related Business	Yes	446	31.50%
	No	970	68.50%
Attended Basic Food Safety Handling Course*	Yes	376	26.60%
	No	1040	73.40%

*The course is a basic food safety program that complies with Food Act 1983. And Food Hygiene Regulations 2009 in Malaysia.

5. **Personal Risk Preventive Behavior:** Assessed actions taken by respondents to avoid food safety risks, such as avoiding foods with chemical additives or practicing safe food handling at home.
6. **Source of Food Safety Information:** Identified preferred sources of food safety information among respondents, using a six-point scale ranging from 1 (never) to 6 (always).
7. **Trust in Food Safety Information:** Measured the level of trust respondents had in various sources of food safety information, ranging from 1 (extremely low trust) to 5 (extremely high trust).
8. **Risk Governance:** Captured perceptions of the effectiveness and sufficiency of food safety governance in Malaysia.

Questionnaire validation and translation

To ensure content validity, the questionnaire was reviewed by a panel of experts in food safety, psychology, and public health (Martuza, 1977). Following the expert review, a pilot study was conducted with 20 Malaysian residents to test the internal reliability of the questionnaire. The Cronbach's alpha values for all sections

exceeded 0.70, indicating a high level of internal consistency (Jaspreet *et al.*, 2018).

The questionnaire was translated into Malay, Mandarin, and Tamil to accommodate linguistic diversity among the respondents, using the back-to-back translation method to mitigate refusal and language barriers (Sousa and Rojjanasrirat, 2011). The translation process followed a rigorous back-translation method to ensure accuracy and consistency across languages.

Ethical considerations

The study was registered with the National Medical Research Registry of the Ministry of Health Malaysia (Research ID: RSCH ID-21-00332-1RS) and received ethical approval from the Universiti Malaya Ethics Committee (Reference Number: UM.TNC2/UMREC_1643). Participants were assured of their anonymity and confidentiality, and informed consent was obtained from all respondents prior to their participation in the survey.

Data collection

Data collection was conducted over a three-month period from January to March 2021. The survey was

distributed via the online platform Survey Monkey (<https://www.surveymonkey.com>), leveraging social networks and community groups to reach a broad audience. Respondents were incentivized with a RM10 e-wallet as a token of appreciation for their participation.

Data analysis

The collected data were analyzed using IBM SPSS Statistics Version 28. Descriptive statistics were utilized to summarize the demographic characteristics of the respondents and their responses to the survey items. To explore the relationships between demographic factors and food safety perceptions, inferential statistical techniques, including t-tests and One-Way ANOVA, were employed. Levene's Test for Equality of Variance was used in the t-tests to ensure the robustness of the results, and Tukey's Honestly Significant Difference (HSD) post-hoc test was applied following the ANOVA to control for Type I error. Although the Theory of Planned Behaviour theoretical framework was adopted in the survey design, the statistical analysis described in this study is limited to descriptive and basic inferential analysis rather than Structural Equation Modelling or Partial Least Squares Structural Equation Modeling. Hence, this study would not be a full Theory of Planned Behaviour (TPB) study in the sense of testing its predictive framework, but it serves as a TPB-informed study providing valuable insights based on TPB constructs.

Additionally, the study examined significant differences in risk perception based on gender, household income, and attendance at food safety handling courses. These analyses provided insights into the varying perceptions and behaviors among different demographic groups in Malaysia.

Results and Discussion

Food safety knowledge

The assessment of consumer food safety knowledge revealed significant gaps, particularly in understanding food additives, proper handling techniques, and awareness of food safety regulations. Overall, approximately 15.5% of the respondents scored between 80 and 100 points, 46.5% scored between 60 and 70 points, and 38% scored below 60 points. The survey results highlighted considerable gaps in consumer knowledge regarding food safety, especially in areas concerning food additives, contamination, handling, and storage practices. A significant portion of respondents demonstrated misconceptions that could lead to unsafe food practices and increased health risks (Table 2).

For instance, 83.6% of respondents incorrectly believed that rotten fruits with visible fungus can be safely consumed if the moldy part is removed. This is a particularly dangerous misconception, as mycotoxins produced by fungi can permeate beyond the visible mold and remain toxic even after the moldy portion is removed. This finding aligns with a similar study conducted in Bangladesh, where nearly 80% of respondents believed that washing, sun exposure, or cooking could eliminate the risks associated with fungal contamination (Islam *et al.*, 2022). Such misconceptions highlight the urgent need for public education on the risks of mycotoxins and other contaminants that are not eliminated by conventional food preparation methods (Moss, 2008).

In the area of food handling, 61.2% of respondents incorrectly assumed that using the same cutting board to prepare vegetables after cutting raw meat or poultry is safe, provided the board is cleaned with detergent (Table 2). This misconception overlooks the risks of cross-contamination, which can occur even with thorough cleaning (Lim *et al.*, 2017; Sekoai *et al.*, 2020). Additionally, 42.3% of respondents believed that frozen meat and poultry can be safely thawed at room temperature, a practice that significantly increases the risk of bacterial growth (Ersoy, Aksan, & Ozeren, 2008; Javadian *et al.*, 2013). According to Roccatto *et al.* (2015), leaving raw chicken meat to thaw overnight at room temperature led to a significant increase in Salmonella Typhimurium levels compared to thawing it overnight in the refrigerator.

The survey also revealed gaps in knowledge regarding food storage and reheating practices. A striking 78.5% of respondents mistakenly believed that leftover fried rice, regardless of how many times it has been reheated and refrigerated, is safe to consume as long as it is heated to the appropriate temperature. This overlooks the cumulative risk of bacterial growth and toxin production, particularly *Bacillus cereus*, that can occur with repeated reheating and improper storage (Navaneethan and Effarizah, 2021).

Further, 72.0% of respondents were unaware that the sale of genetically modified foods (GMF) is allowed in Malaysia, and 63.7% did not know that food irradiation is also permitted. These findings indicate a lack of awareness about food safety regulations and practices, which could contribute to poor decision-making in food purchases and consumption.

The data suggest a critical need for comprehensive food safety education programs that address these misconceptions and provide consumers with accurate information on safe food handling, storage, and preparation practices. Food safety education programs should also consider socio-demographic factors, education levels, and the level

Table 2. Categorization of food safety knowledge items by topic and percentage of incorrect responses.

Category	Knowledge item	% Wrong answer
Food additives and chemical safety	Chemical preservatives are not allowed to be used in foods.	65.40%
	Milk must not contain Melamine.	40.00%
Food contamination and foodborne pathogens	Rotten fruits with fungus can be safely eaten if the mouldy portion is removed.	83.60%
	Hepatitis A virus is commonly found in undercooked seafood.	45.60%
	Salmonella is a bacterium commonly found in chicken.	26.50%
	It is not safe to consume the food in a bloated can.	11.80%
	Eating bacteria-contaminated food may cause death.	9.90%
Food handling and preparation	Using the same cutting board to cut vegetables after cutting raw meat or poultry is safe as long as you clean the cutting board with detergent.	61.20%
	Frozen meat and poultry can be safely thawed in room temperature.	42.30%
	Poultry must be fully cooked for safe consumption.	2.30%
	Food handler must wear apron and cap when handling food in kitchen.	1.70%
Safe food storage and reheating	As long as the leftover fried rice is heated at appropriate temperature long enough, it does not matter if the fried rice has been reheated and refrigerated repeatedly in the past 6 hours.	78.50%
	Eating this bread after best before date will cause food poisoning.	35.50%
	Food should be reheated with temperature more than 60°C for safe consumption.	34.60%
Food safety regulations and practices	Selling of genetically modified foods (GMF) is prohibited in Malaysia.	72.00%
	Food irradiation is not allowed in Malaysia.	63.70%

of scientific knowledge (Castell-Perez and Moreira, 2020). Public health campaigns should focus on correcting these misunderstandings to reduce the risk of foodborne illnesses and improve overall food safety awareness.

Personal attitudes

To understand consumer attitudes towards food safety, Figure 1 presents descriptive data showing agreement levels on various factors using a five-point scale. The highest mean score (4.67) was observed for the practice of washing hands before and after meals, a behavior likely reinforced by public health campaigns, particularly those related to the COVID-19 pandemic (Soon *et al.*, 2021). This strong adherence to hand hygiene reflects the effectiveness of these campaigns, which emphasized hand washing as a critical preventive measure against the transmission of infectious diseases (WHO, 2022).

Respondents also showed a negative attitude towards genetically modified foods (GMF) and food irradiation, with mean disagreement scores of 2.44 and 2.34, respectively. This indicates a lack of confidence in the safety of these technologies, consistent with previous findings in Malaysia (Bashir, 2013). These attitudes suggest that food safety authorities need to enhance public awareness of the risks and benefits associated with these technologies to improve consumer acceptance.

Subjective norms

To further explore food safety behavior among Malaysian consumers, Figure 1 illustrates the subjective norms influencing respondents. Subjective norms refer to the perceived social pressures to engage in or avoid certain behaviors, based on the approval or disapproval of significant social groups (Ajzen, 2020). These norms play a critical role in shaping consumer behavior, as individuals are often motivated to align their actions with the expectations of their social circles (Therault, Young, & Barrett, 2021).

The data reveal that subjective norms play a crucial role in shaping food safety practices, with varying degrees of influence across different behaviors. The highest mean scores were observed for statements related to responsibility and assurance, such as “most people around me will wash or clean their hands before having a meal” and “most people around me think that food safety is important,” both with mean scores approaching 5. This suggests a strong social consensus on the importance of basic hygiene practices and the overall significance of food safety.

Moderate agreement was found regarding the importance of buying food products with quality and safety certifications, as well as the responsibility to report unsafe food practices. These findings suggest that while

such behaviors are socially endorsed, they are not universally practiced. This reflects the concept of injunctive norms, where individuals are influenced by the perceived approval or disapproval of their peers (Chung & Rimal, 2016).

In contrast, lower mean scores were observed for subjective norms related to more controversial or less understood food safety issues, such as concerns about genetically modified foods (GMFs) and food irradiation, with scores around 3. According to the Theory of Normative Social Behavior (TNSB), norms are more likely to influence behavior when individuals anticipate positive outcomes or strongly identify with the relevant social group (Chung & Rimal, 2016). This suggests that targeted public education efforts should focus on enhancing perceived benefits and fostering group identification around these issues, as the currently weaker social norms may contribute to uncertainty and inconsistent behaviors.

Additionally, the relatively low level of agreement with the statement “Most people around me think that food poisoning is not a serious problem,” with a mean score below 3, indicates the presence of social pressure to take food safety seriously. However, the variability in responses suggests that this perception is not uniformly held across all respondents, reflecting diverse views within the community.

The findings underscore the significant role that subjective norms play in shaping food safety behaviors. A strong social consensus around basic hygiene practices likely reinforces positive behaviors, such as hand washing before meals. However, the lower levels of agreement on issues such as genetically modified foods (GMFs), food irradiation, and the perceived seriousness of food poisoning highlight the need for more targeted public education and communication efforts. By understanding and leveraging these social norms, public health authorities can design more effective interventions that reinforce positive behaviors and address areas where social consensus is weak. For example, campaigns that promote the social approval of reporting unsafe food practices or encourage widespread adoption of food safety certifications could help strengthen these behaviors across the population.

While subjective norms strongly support certain food safety practices, there remain areas where social consensus is weaker, potentially contributing to inconsistent food safety behaviors. Addressing these gaps through targeted education and the promotion of clear, consistent messages within social networks could play a crucial role in enhancing overall food safety in Malaysia.

Risk perception

Consumers perceived seafood as the most likely food to cause food poisoning (mean = 1.933), a perception likely influenced by frequent reports of contamination and the inherent risks associated with improper handling and storage (Abdul-Mutalib *et al.*, 2015). This was followed by high perceived risks associated with street foods (mean = 2.00), dairy products (mean = 2.00), and chicken (mean = 2.17), all of which have been commonly linked to past foodborne illness outbreaks (Soon *et al.*, 2011) (Figure 2). These perceptions highlight key areas where public health education could focus to correct misconceptions and promote safer food handling and consumption practices (Grunert, 2005).

T-test analysis revealed significant gender differences ($p < 0.05$) in the perceived risk of game meats, fast food, street food, and supermarket-prepared foods (Table 3). Men generally perceived these foods as safer than women, which may be attributed to differences in food preparation responsibilities or varying exposure to food safety information (Tucker *et al.*, 2006; Niewiadomska *et al.*, 2021). These gender-based differences highlight the importance of tailoring food safety interventions to address the specific concerns, perceptions, and knowledge gaps of different demographic groups (Tomazic *et al.*, 2002).

The One-Way ANOVA analysis revealed that the M40 income group (middle-income group) exhibited the highest risk perception for chicken and seafood, while the B40 group (low-income group) showed the highest risk perception for vegetables and fruits (Table 3). These findings align with existing literature suggesting that individuals with higher incomes tend to have greater tolerance for food safety risks, largely due to better access to information and superior food handling practices. As Slovic (1987) notes, individuals who perceive themselves as knowledgeable about specific risks often feel more confident in managing them, which can lead to increased tolerance. This suggests that the M40 group's higher perceived competence in managing food safety risks may explain their relatively lower risk perception for certain food categories compared to the B40 group.

Personal preventive measures

The survey results, summarized in Table 4, indicate that Malaysian consumers demonstrate strong personal preventive behaviors related to food safety. The highest mean scores were observed for behaviors such as checking the safety of food products during purchase and practicing safe food handling at home, both with mean scores of 4.5. These findings suggest a high level of consumer

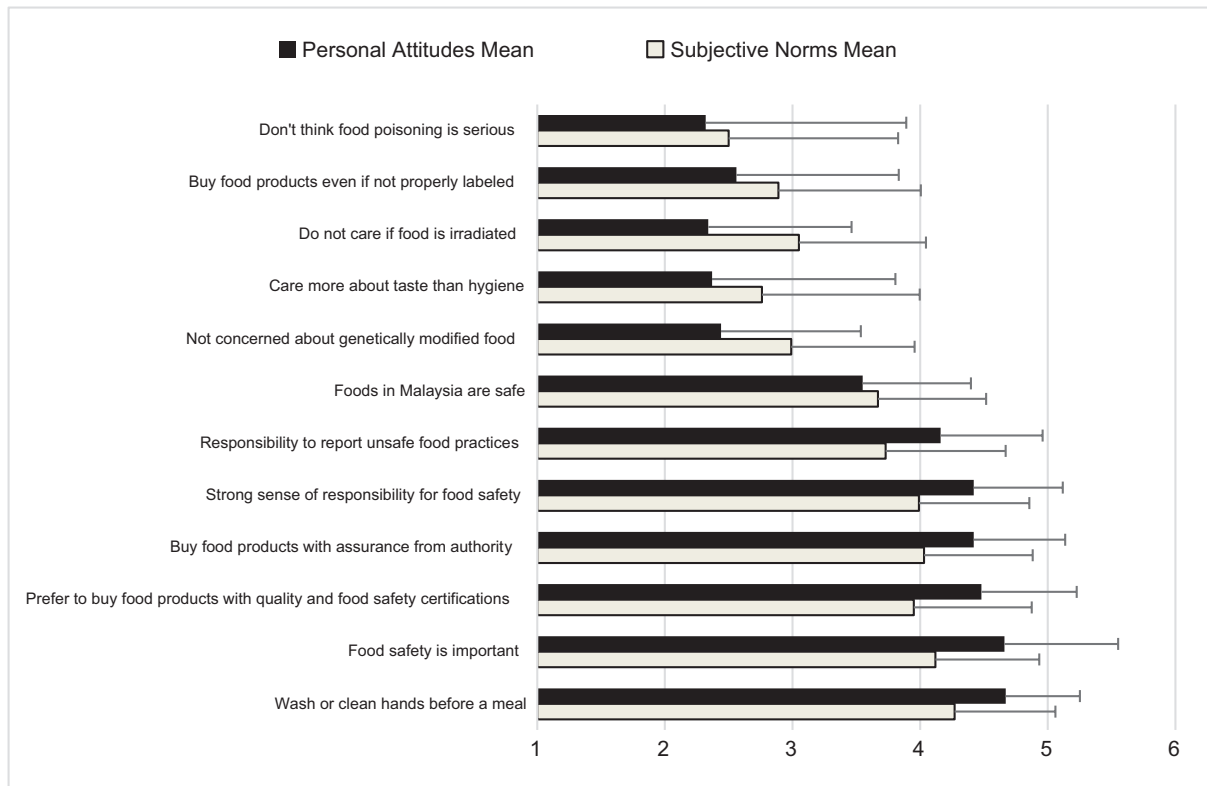


Figure 1. Comparison of Personal attitudes (represented by black bars) and subjective norms (represented by grey bars) regarding food safety. The items are arranged from top to bottom based on the theme they address, with error bars representing the standard deviation of responses. The mean scores range from 1 (Strongly Disagree) to 5 (Strongly Agree). Higher mean scores indicate stronger agreement with the statement, while lower scores suggest disagreement or neutrality.

awareness and proactive efforts to prevent foodborne illnesses, underscoring the effectiveness of existing food safety education and awareness campaigns.

One particularly notable finding is the strong preference for purchasing food products with certified quality and safety assurances, reflected by a mean score of 4.4. This highlights the critical role that certifications such as MeSTI, GMP, HACCP, and ISO play in consumer decision-making, as these certifications serve as trusted indicators of food safety. The reliance on certified products reflects a significant level of trust in regulatory bodies and underscores the importance of official endorsements in guiding consumer choices.

Conversely, there is a moderate level of concern regarding genetically modified foods (GMFs) and irradiated foods, with mean scores of 3.5 and 3.7, respectively. These concerns may arise from safety apprehensions as well as a lack of comprehensive information and trust in these technologies. For instance, Bashir (2013) found that consumers in Klang Valley, Malaysia, express significant worries about the risks associated with GM foods, including potential health effects and long-term consequences

of GM planting. Similarly, Boccia *et al.* (2018) reported that limited information, low educational awareness, and emotional factors negatively influence consumer perceptions of GM foods. Additionally, D'Souza *et al.* (2021) highlight that a lack of information is a key driver behind consumer reluctance to accept irradiated products. Although increasing the availability of information may not entirely dispel concerns, it can help consumers make more informed decisions grounded in facts rather than mistrust and confusion.

These findings suggest that while Malaysian consumers are generally vigilant about food safety and consistently engage in practices that minimize risks—such as verifying food safety at the point of purchase and relying on certified products—there remain notable gaps in understanding and confidence regarding certain food technologies. The moderate levels of concern about genetically modified foods (GMFs) and irradiated foods present a valuable opportunity for targeted education and communication initiatives. Public health authorities should prioritize reinforcing the safety of approved food processing methods while actively addressing consumer concerns to further strengthen food safety practices in Malaysia. Additionally,

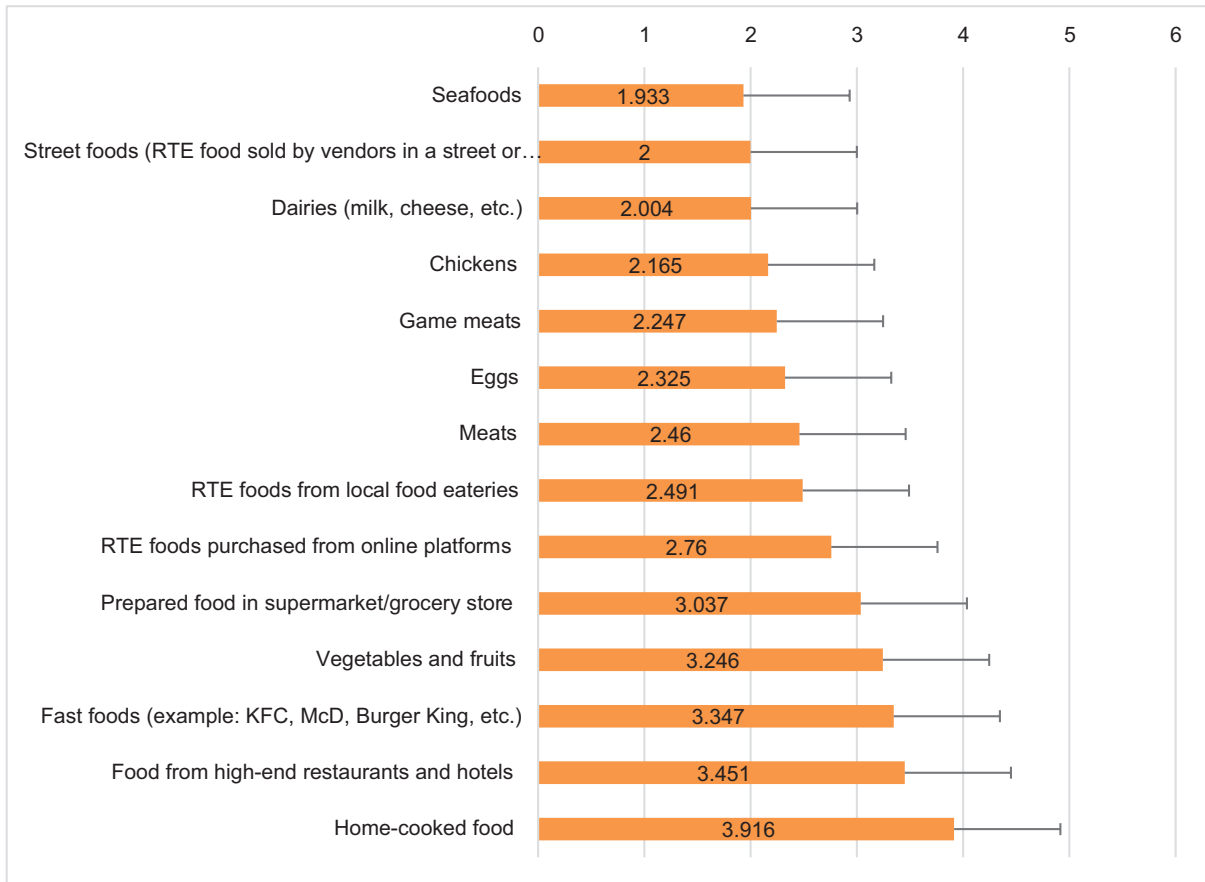


Figure 2. Mean perception of food safety risk associated with various food categories, as assessed by respondents. The mean scores range from 1 (highest perceived risk) to 5 (lowest perceived risk). Error bars represent the standard deviation of the responses, indicating the variability in perceived risk among the participants. Foods with lower mean scores are perceived as riskier, while those with higher mean scores are perceived as safer.

information shared by credible sources—such as government agencies, food safety experts, and scientific organizations—on social media platforms should be carefully assessed and tailored to the age and educational level of the target audience to ensure dissemination of accurate, evidence-based knowledge. This approach can help bridge existing knowledge gaps (Zhang *et al.*, 2022). By continuing to promote preventive measures and directly tackling areas of consumer uncertainty, public health authorities can bolster consumer confidence and contribute to safer food practices nationwide.

Trust and communication

The survey results, illustrated in Figure 3 (A) and (B), highlight the significant role of social media and internet resources as primary channels for disseminating food safety information. Platforms such as Facebook, YouTube,

and Instagram, along with general internet searches, are among the most frequently used and trusted sources by consumers. This trend underscores the need for food safety authorities to maintain a strong presence on these platforms, ensuring that accurate and reliable information is readily accessible where consumers are most likely to seek it.

Interestingly, while social media platforms are highly trusted, consumers also place considerable confidence in food experts, scientists, and medical professionals. This aligns with findings from Tonkin *et al.* (2015) and Rupprecht *et al.* (2020), which demonstrated that expert labels, particularly those supported by rigorous scientific testing and analysis, significantly enhance consumer trust. Therefore, integrating expert insights into social media and internet content could boost the credibility of the information shared, combining the wide reach of these platforms with the authoritative voice of trusted experts.

Table 3. Risk perception of consumers based on gender, income categories and attendance of safe food handling course.

Food category	Gender			Household Income Category*					Attendance to Safe Food Handling Course				
	Male	Female	F- value	p-value	B40	M40	T20	F- value	p-value	Attended	Not-attended	F- value	p-value
Meats	2.554	2.41	1.551	0.213	2.525	2.425	2.425	1.445	0.236	2.311	2.514	0.875	0.35
Chickens	2.243	2.12	2.31	0.129	2.28	2.06	2.186	5.939	0.003*	1.915	2.256	3.886	0.049*
Eggs	2.412	2.278	0.214	0.644	2.393	2.249	2.365	2.453	0.086	2.064	2.419	7.518	0.006*
Vegetables and fruits	3.267	3.237	1.962	0.161	3.156	3.239	3.425	5.739	0.003*	3.128	3.289	0.004	0.948
Seafoods	1.954	1.92	0.04	0.842	2.018	1.879	1.888	3.204	0.041*	1.83	1.97	0.584	0.445
Dairies (milk, cheese, etc.)	2.074	1.96	2.719	0.099	2.023	1.99	2.004	0.146	0.864	1.923	2.033	2.776	0.096
Game meats	2.373	2.177	3.979	0.046*	2.305	2.259	2.123	2.154	0.116	2.285	2.234	5.31	0.021*
Street foods	2.082	1.952	4.921	0.027*	2.035	2.002	1.94	1.012	0.364	1.902	2.036	0.484	0.487
Fast foods	3.516	3.26	5.1	0.024*	3.44	3.53	3.347	18.221	<.001*	3.314	3.359	1.409	0.235
RTE foods from local food eateries	2.552	2.458	3.336	0.068	2.471	2.503	2.505	0.201	0.818	2.378	2.532	0.82	0.365
Food from high-end restaurants and hotels	3.534	3.411	0.515	0.473	3.329	3.476	3.621	8.135	<.001*	3.298	3.507	0.63	0.427
RTE foods purchased from online platforms	2.783	2.749	0.187	0.666	2.737	2.759	2.804	0.46	0.631	2.66	2.796	0.147	0.702
Home-cooked food	3.966	3.896	0.07	0.791	3.827	3.932	4.035	3.772	0.023*	3.702	3.993	19.798	<.001*
Prepared food by supermarket/grocery store	3.12	2.992	7.042	0.008*	2.969	3.044	3.144	3.107	0.045	3.013	3.046	0.112	0.738

* According to the Department of Statistics Malaysia (DOSM) recently released Household Income & Basic Amenities Survey Report 2022, the mean (average) income across the household groups are: B40- RM3,401 (<RM2,499); M40 – RM7,971 (RM3,170-RM3,969); T20 – RM19,752 (>RM3,170).

Table 4. Personal preventive measures and associated mean scores and standard deviations.

Category	Personal Preventive Measures	Mean	Standard Deviation
Avoidance of Potentially Unsafe Food Products	I will avoid eating food added with chemical additive even though it is allowed in regulation.	3.4	1.0
	I avoid consuming Genetically Modified Food (GMF).	3.5	1.0
	I do not buy irradiated food.	3.7	0.9
	If I buy food that is expired, spoiled, moldy or poisonous, I will learn from experience and will be more cautious or avoid buying from the same source again.	4.5	0.7
Avoidance of Unhygienic Food Sources	I avoid eating at food eatery that is not hygienic.	4.5	0.6
Reliance on Trusted Sources and Certifications	I buy from trustable sources and manufacturers.	4.3	0.6
	I will make sure to buy food products from manufacturers that have certified quality and food safety assurance (e.g. MESTI, GMP, HACCP, ISO, etc.).	4.4	0.7
Safe Food Handling Practices	I practice safe food handling at home to prevent food poisoning.	4.5	0.6
Staying Informed About Food Safety	I follow food safety news and to ensure I avoid food fraud (buying fake or inferior food).	4.2	0.8
Vigilance in Food Safety During Purchase	When buying food, I will check the safety of food product by checking expiry date, color and taste.	4.5	0.6

Note: Level of agreement among respondents on a scale from 1 (Strongly Disagree) to 5 (Strongly Agree).

However, the data also reveal lower trust levels in politicians and social media influencers, indicating that despite their broad reach, these figures are not perceived as reliable sources of food safety information. This finding aligns with Rupperecht *et al.* (2020), who reported that non-expert sources, including politicians, typically receive lower trust ratings. Furthermore, consumer trust can be undermined by such non-expert sources, especially regarding sustainability labeling (Cook *et al.*, 2023). These insights suggest that food safety campaigns involving politicians or influencers should be strategically managed—perhaps by pairing them with trusted experts or limiting their role to raising general awareness rather than delivering detailed food safety messages.

Overall, the findings emphasize the critical importance of strategically leveraging both digital platforms and expert opinions to effectively communicate food safety information. The strong trust consumers place in expert labels underscores the need for food safety authorities to incorporate expert insights into their online communication strategies. By understanding where consumers direct their trust, authorities can more precisely target their messaging, ensuring that vital information reaches and resonates with the intended audience. Additionally, campaigns that promote social approval for reporting unsafe food practices or encourage the widespread adoption of food safety certifications could further reinforce positive behaviors throughout the population.

Risk governance

The survey data, summarized in Table 5, offers a nuanced perspective on consumer perceptions of risk governance in Malaysia. Overall, consumers demonstrate moderate confidence in the effectiveness of government and regulatory bodies in managing food safety, with mean scores ranging from 3.3 to 3.7. Of particular concern is the relatively low score for the implementation and enforcement of food safety regulations (3.3 ± 1.0), highlighting perceived shortcomings in regulatory enforcement. This suggests that although food safety regulations exist, improvements are needed in their practical application and oversight to bolster consumer confidence.

Consumers also express a relatively high level of confidence in their ability to report food safety issues, as reflected by a mean score of 3.8 for the accessibility of complaint channels. This suggests that consumers generally feel empowered to raise concerns. However, the somewhat lower score for authorities' responsiveness (3.4 ± 0.9) indicates that, despite the availability of reporting mechanisms, there may be inconsistencies or delays in how complaints are handled.

Interestingly, the prioritization of food safety by the government received a moderate score of 3.4, suggesting that a portion of consumers perceive food safety as insufficiently prioritized. This perception underscores the need for more visible and sustained government efforts to clearly demonstrate that food safety remains a top national priority.

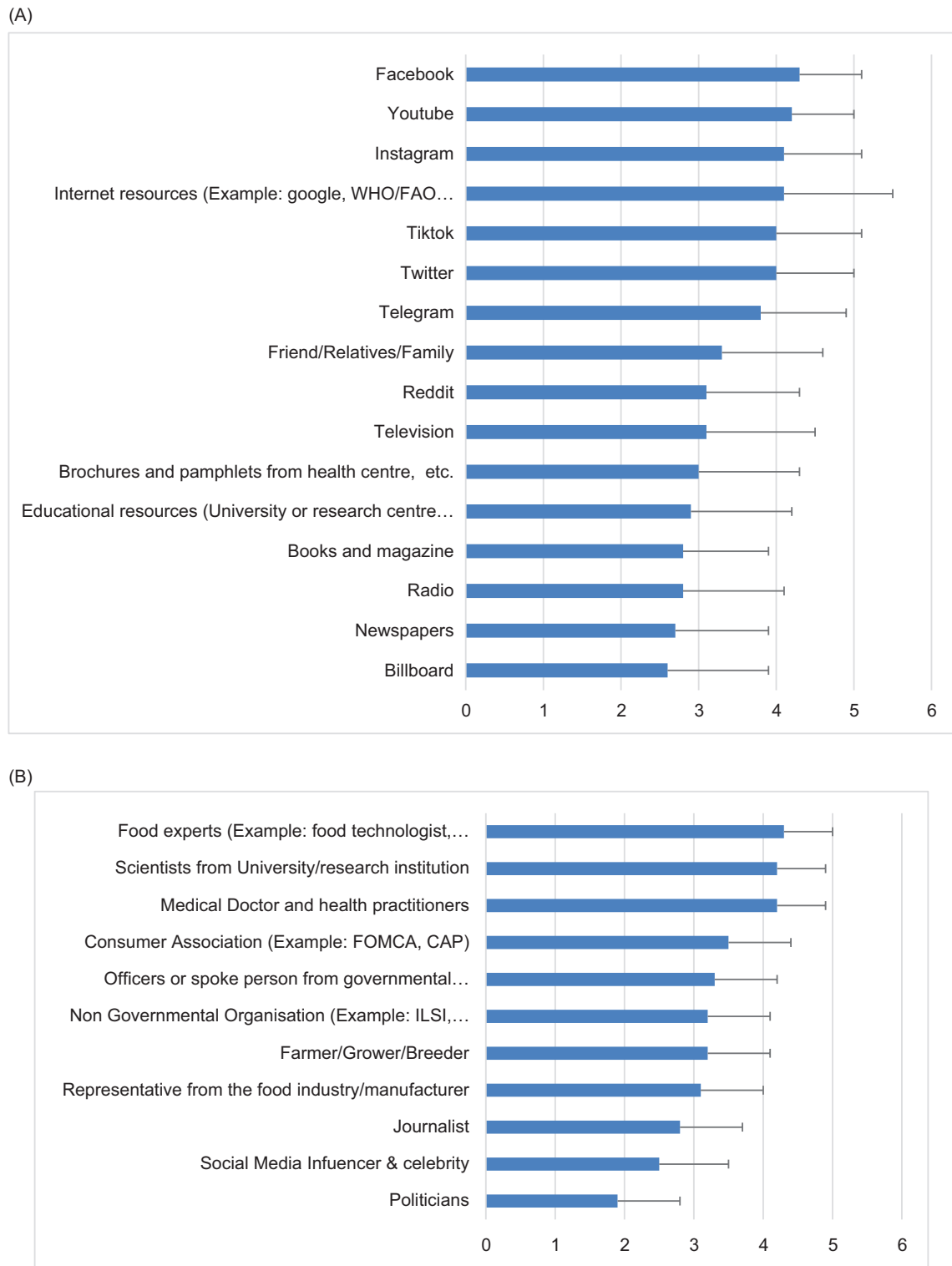


Figure 3. Consumer trust and communication channels for food safety information with (A) shows the mean levels of trust consumers place in various communication channels for obtaining food safety information; and (B) illustrates consumer trust in different authorities and individuals providing food safety information. The mean trust ratings are displayed on a scale from 1 (no trust) to 5 (high trust), with error bars representing the standard deviation of the data.

Table 5. Consumer Perceptions regarding the efficiency and effectiveness of risk governance in Malaysia.

Category	Risk Governance	Mean	Standard Deviation
Perception of Government and Regulatory Efficiency	The national food safety authority is competent in handling and managing food safety and health in Malaysia.	3.7	0.9
	The Ministry of Health Malaysia give appropriate punishment to food business operators who violates the food safety regulation.	3.6	1
	Food safety system handled by the government in Malaysia is efficient	3.5	0.9
	The regulation in Malaysia is sufficient to ensure food safety throughout the food supply chain in Malaysia.	3.5	1
	The implementation and enforcement of law and regulation related to food safety in Malaysia is sufficient.	3.3	1
Accessibility and Responsiveness of Authorities	The consumers have an accessible channel to complain and report about food safety incidence to the authorities (Example: MOH, KPDNHEP, MOA, Local Authority and others).	3.8	0.9
	The authorities provide timely and fair response to food safety complains and reports from the consumers.	3.4	0.9
Prioritization of Food Safety	Malaysian government puts food safety as a priority in the country.	3.4	1.1
Communication and Education	The Ministry of Health Malaysia shares enough food safety information with the consumer for consumer to make consumption decision.	3.6	1
	Food safety education and awareness programs to improve food safety knowledge in consumers are insufficient.	2.5	1.1
Responsibility of Food Industry and Consumers	The food industry in Malaysia is responsible to produce food products that are safe for consumption.	4	1
	Malaysian consumers can help food regulators to monitor food safety by reporting it is concern.	4	0.8

Each item is rated on a Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree), with the mean scores and standard deviations provided for each item.

While there is a generally positive perception of risk governance in Malaysia, the data highlights several areas requiring improvement, particularly in regulatory enforcement, the prioritization of food safety, and consumer education. Addressing these gaps could significantly boost consumer confidence and strengthen overall food safety nationwide. These findings offer valuable insights for policymakers to refine food safety communication strategies and public health interventions in Malaysia.

Conclusions

This study provided an in-depth analysis of consumer perceptions and behaviors concerning food safety in Malaysia. The findings reveal significant knowledge gaps among consumers, particularly regarding food additives, contamination, and safe handling practices. Notably, there is limited understanding of technologies used to prolong food shelf life, such as genetically modified foods (GMF) and food irradiation. This highlights an urgent need for targeted educational initiatives by food safety authorities to effectively inform the public about the risks and benefits associated with these technologies.

Moreover, the study revealed that while consumers generally demonstrate positive attitudes toward food safety practices, these attitudes require ongoing reinforcement through continuous engagement and motivation. Social norms, identified as key drivers shaping consumer risk perceptions and preventive behaviors, should be strategically addressed in public health initiatives to promote safer food handling and consumption practices.

The moderate perception of food safety governance indicates that consumers expect greater efficiency and transparency from food safety authorities. Encouraging active consumer involvement—through public consultations or collaborative policymaking—in food safety decision-making processes is essential to enhance fairness and transparency, ultimately fostering stronger public trust.

Trust in information sources—particularly expert opinions and certification labels—emerged as a critical finding. Consumers showed a strong preference for experts with scientific or medical backgrounds and tended to seek information through both social and traditional media. Food safety authorities can leverage this trust to effectively manage consumer perceptions of food safety risks by ensuring that accurate and reliable information,

especially regarding genetically modified foods and food irradiation, is disseminated through these trusted channels. Tailoring communication strategies to account for demographic differences and education levels will further enhance the effectiveness of these interventions.

However, the study has certain limitations that should be taken into account when interpreting the findings. The use of voluntary snowball sampling and an online survey method resulted in the underrepresentation of elderly respondents and potentially other demographic groups. Future research should aim to incorporate more diverse sampling methods to capture a broader demographic spectrum, thereby enhancing the generalizability and robustness of the results.

Data Availability Statement

The datasets produced in this study can be obtained from corresponding authors upon reasonable request.

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Author Contributions

Y.S.T, L.C.C and M.H.L. Conceptualization; Investigation; Supervision; Validation; and Writing - review & editing. Y.S.T, L.C.C Funding acquisition; M.N.H.M Investigation; Formal analysis; Roles/Writing - original draft.

Conflicts of Interest

The authors declare no conflict of interest.

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References

Abdul-Mutalib, N.A., Syafinaz, A.N., Sakai, K., & Shirai, Y. (2015). An overview of foodborne illness and food safety in Malaysia. *International Food Research Journal*, 22(3), 896–901.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)

Ajzen, I. (2020). The theory of planned behavior: Frequently asked questions. *Human Behavior and Emerging Technologies*, 2(4), 314–324. <https://doi.org/10.1002/hbe2.195>

Bashir, I. M. (2013). Consumer perceptions of genetically modified food in Klang Valley, Malaysia (Unpublished master's thesis). Universiti Putra Malaysia, Selangor, Malaysia.

Bredahl, L. (2001). Determinants of consumer attitudes and purchase intentions with regard to genetically modified food – Results of a cross-national survey. *Journal of Consumer Policy*, 24(1), 23–61. <https://doi.org/10.1023/A:1010950406128>

Boccia, F., Covino, D., & Sarnacchiaro, P. (2018). Genetically modified food versus knowledge and fear: A noumenic approach for consumer behaviour. *Food Research International*, 111, 682–688. <https://doi.org/10.1016/j.foodres.2018.06.013>

Boccia, F., Alvino, L., & Covino, D. (2023). This is not my jam: An Italian choice experiment on the influence of typical product attributes on consumers' willingness to pay. *Nutrition & Food Science*, 54(1), 13–32. <https://doi.org/10.1108/NFS-04-2023-0076>

Castell-Perez, M. E., & Moreira, R. G. (2020). Irradiation and consumers acceptance. In *Innovative food processing technologies* (Vol. 1, pp. 122–135). <https://doi.org/10.1016/B978-0-12-815781-7.00015-9>

Caputo, V., Nayga Jr., R. M., & Scarpa, R. (2013). Food miles or carbon emissions? Exploring labelling preference for food transport with a stated choice study. *Australian Journal of Agricultural and Resource Economics*, 57(4), 465–482.

Chaudhary, M. A., Lim, V.-C., Sahimin, N., Faller, E. M., Regmi, P., Aryal, N., & Azman, A. S. (2023). Assessing the knowledge of, attitudes towards, and practices in, food safety among migrant workers in Klang Valley, Malaysia. *Travel Medicine and Infectious Diseases*, 54, 102620. <https://doi.org/10.1016/j.tmaid.2023.102620>

Chung, A., & Rimal, R. N. (2016). Social norms: A review. *Review of Communication Research*, 4, 1–29. <https://doi.org/10.12840/issn.2255-4165.2016.04.01.008>

Cook, B., Leite, J. C., Rayner, M., Stoffel, S., van Rijn, E., & Wollgast, J. (2023). Consumer interaction with sustainability labelling on food products: A narrative literature review. *Nutrients*, 15(17), 3837. <https://doi.org/10.3390/nu15173837>

Daniel, W. W. (1999). *Biostatistics: A foundation for analysis in the health sciences* (7th ed.). John Wiley & Sons.

Department of Statistics Malaysia (DOSM). (2020). Report on the key findings population and housing census of Malaysia. <https://www.dosm.gov.my/v1/index.php?r=column/pdfPrev&id=akliVWdIa2g3Y2VubTVSMkxmYXp1UT09>

D'Souza, C., Apaolaza, V., Hartmann, P., Brouwer, A. R., & Nguyen, N. (2021). Consumer acceptance of irradiated food and information disclosure – A retail imperative. *Journal of Retailing and Consumer Services*, 63, 102699. <https://doi.org/10.1016/j.jretconser.2021.102699>

Ersoy, B., Aksan, E., & Özeren, A. (2008). The effect of thawing methods on the quality of eels (*Anguilla anguilla*). *Food Chemistry*, 111(2), 377–380. <https://doi.org/10.1016/j.foodchem.2008.03.081>

Evans, G., de Challemaison, B., & Cox, D. N. (2010). Consumers' ratings of the natural and unnatural quality. *Appetite*, 54(3), 557–563. <https://doi.org/10.1016/j.appet.2010.02.014>

- Frewer, L. J., Howard, C., & Shepherd, R. (1997). Public concerns in the United Kingdom about general and specific applications of genetic engineering: Risk, benefit, and ethics. *Science, Technology & Human Values*, 22(1), 98–124. <https://doi.org/10.1177/s016224399702200105>
- Grunert, K. G. (2005). Food quality and safety: Consumer perception and demand. *European Review of Agricultural Economics*, 32(3), 369–391. <https://doi.org/10.1093/eurrag/jbi011>
- Jadhav, H. B., & Choudhary, P. (2024). Emerging technologies for the processing of food to ensure higher food safety with enhanced food quality: A review. *Discover Food*, 4, 20. <https://doi.org/10.1007/s44187-024-00089-5>
- Islam, M. R., Prince, M., Lokman, S. M., Marzan, L. W., & Alam, S. (2022). Misconception of consumers and retailers regarding fungal spoilage of onion and prevalence of fungi in rotten onion. *Bioresearch Communications*, 8(1), 1068–1076. <https://doi.org/10.3329/brc.v8i1.57046>
- Jaspreet, K. B., Surjit, S., & Priyanka, K. (2018). How to design and validate a questionnaire: A guide. *Current Clinical Pharmacology*, 13(3), 210–215. <https://doi.org/10.2174/1574884713666180807151328>
- Javadian, S. R., Rezaei, M., Soltani, M., Kazemian, M., & Pourgholam, R. (2013). Effects of thawing methods on chemical, biochemical, and microbial quality of frozen whole rainbow trout (*Oncorhynchus mykiss*). *Journal of Aquatic Food Product Technology*, 22(2), 168–177. <https://doi.org/10.1080/10498850.2011.636865>
- Lee, J., Pelto, G. H., & Nordhagen, S. (2022). Beliefs, values, and sociocultural patterns related to food safety in low- and middle-income countries: A synthesis of the descriptive ethnographic literature. *Appetite*, 178, 106265. <https://doi.org/10.1016/j.appet.2022.106265>
- Lim, E., Lee, J., Kim, J.-S., & Koo, O. (2017). Isolation of indigenous bacteria from a cafeteria kitchen and their biofilm formation and disinfectant susceptibility. *LWT – Food Science and Technology*, 77, 376–382. <https://doi.org/10.1016/j.lwt.2016.11.060>
- Martuza, V. R. (1977). Applying norm-referenced and criterion-referenced measurement in education. Allyn and Bacon Publishers.
- Moss, M. O. (2008). Fungi, quality and safety issues in fresh fruits and vegetables. *Journal of Applied Microbiology*, 104(5), 1239–1243. <https://doi.org/10.1111/j.1365-2672.2007.03705.x>
- Niewiadomska, K., Kosicka-Gębska, M., Gębski, J., Jeżewska-Zychowicz, M., & Sulek, M. (2021). Perception of the health threats related to the consumption of wild animal meat—is eating game risky? *Foods*, 10(7), 1544. <https://doi.org/10.3390/foods10071544>
- Navaneethan, Y., & Effarizah, M. E. (2021). Prevalence, toxigenic profiles, multidrug resistance, and biofilm formation of *Bacillus cereus* isolated from ready-to-eat cooked rice in Penang, Malaysia. *Food Control*, 121, 107553. <https://doi.org/10.1016/j.foodcont.2020.107553>
- Roccato, A., Uyttendaele, M., Cibin, V., Barrucci, F., Cappa, V., & Zavanin, P. (2015). Effects of domestic storage and thawing practices on *Salmonella* in poultry-based meat preparations. *Journal of Food Protection*, 78(12), 2117–2125. <https://doi.org/10.4315/0362-028X.JFP-15-048>
- Rupprecht, C. D. D., Fujiyoshi, L., McGreevy, S. R., & Tayasu, I. (2020). Trust me? Consumer trust in expert information on food product labels. *Food and Chemical Toxicology*, 137, 111170. <https://doi.org/10.1016/j.fct.2020.111170>
- Russo, G. M., Tomei, P. A., de Campos Serra, B. P., & Mello, S. F. (2021). Differences in the use of 5- or 7-point Likert scale: An application in food safety culture. *Organizational Cultures*, 21(2), 1–17. <https://doi.org/10.18848/2327-8013/CGP/v21i02/1-17>
- Sekoai, P. T., Feng, S., Zhou, W., Ngan, W. Y., Pu, Y., Yao, Y., Pan, J., & Habimana, O. (2020). Insights into the microbiological safety of wooden cutting boards used for meat processing in Hong Kong's wet markets: A focus on food-contact surfaces, cross-contamination, and the efficacy of traditional hygiene practices. *Microorganisms*, 8(4), 579. <https://doi.org/10.3390/microorganisms8040579>
- Shaharudin, M. R., Wan Mansor, S., & Elias, S. J. (2011). Food quality attributes among Malaysia's fast food customers. *International Business and Management*, 2(1), 198–208. <http://doi.org/10.3968/j.ibm.1923842820110201015>
- Slovic, P. (1987). Perception of risk. *Science*, 236(4799), 280–285. <https://doi.org/10.1126/science.356350>
- Soon, J. M., Singh, H., & Baines, R. (2011). Foodborne diseases in Malaysia: A review. *Food Control*, 22(6), 823–830. <https://doi.org/10.1016/j.foodcont.2010.12.011>
- Soon, J. M., Vanany, I., Abdul Wahab, I. R., Hamdan, R. H., & Jamaludin, M. H. (2021). Food safety and evaluation of intention to practice safe eating out measures during COVID-19: Cross-sectional study in Indonesia and Malaysia. *Food Control*, 125, 107920. <https://doi.org/10.1016/j.foodcont.2021.107920>
- Sousa, V. D., & Rojjanasrirat, W. (2011). Translation, adaptation and validation of instruments or scales for use in cross-cultural health care research: A clear and user-friendly guideline. *Journal of Evaluation in Clinical Practice*, 17(2), 268–274. <https://doi.org/10.1111/j.1365-2753.2010.01434.x>
- Therault, J. E., Young, L., & Barrett, L. F. (2021). The sense of should: A biologically-based framework for modeling social pressure. *Physics of Life Reviews*, 36, 100–136. <https://doi.org/10.1016/j.plrev.2020.01.004>
- Tucker, M., Whaley, S. R., & Sharp, J. S. (2006). Consumer perceptions of food-related risks. *International Journal of Food Science & Technology*, 41(2), 135–146. <https://doi.org/10.1111/j.1365-2621.2005.01010.x>
- Tomazic, T. J., Katz, B. M., & Harris, C. K. (2002). Is that strawberry safe to eat? Consumer attitudes about food safety. In R. C. Wimberly, C. K. Harris, J. J. Molnar, & T. J. Tomazic (Eds.), *The social risks of agriculture* (pp. 57–74). Praeger Westport Connecticut USA.
- Tonkin, E., Wilson, A. M., Coveney, J., Webb, T., & Meyer, S. B. (2015). Trust in and through labelling – A systematic review and critique. *British Food Journal*, 117(1), 318–338. <https://doi.org/10.1108/BFJ-07-2014-0244>
- United Nations. (2015). Transforming our world: The 2030 agenda for sustainable development. <https://sustainabledevelopment.un.org/post2015/transformingourworld/publication>
- van Leeuwen, S. P. J., Verschoor, A. M., van der Fels-Klerx, H. J., van de Schans, M. G. M., & Berendsen, B. J. A. (2024). A novel

- approach to identify critical knowledge gaps for food safety in circular food systems. *NPJ Science of Food*, 8(1), 34. <https://doi.org/10.1038/s41538-024-00265-y>
- Verbeke, W. (2005). Agriculture and the food industry in the information age. *European Review of Agricultural Economics*, 32(3), 347–368. <https://doi.org/10.1093/eurrag/jbi017>
- Wan Nawawi, W.N.F. Ramoo, V., Chong, M.C., Zaini, N. H., Chui, P.L., & Abdul Mulud, Z. (2022). The food safety knowledge, attitude and practice of Malaysian food truck vendors during the Covid-19 pandemic. *Healthcare*, 10(6), 998. <https://doi.org/10.3390/healthcare10060998>
- World Health Organization (WHO). (2025). Foodborne diseases estimates. Retrieved from <https://www.who.int/data/gho/data/themes/who-estimates-of-the-global-burden-of-foodborne-diseases>. Accessed February 19 2025.
- World Health Organization (WHO). (2020). Hand hygiene for all global initiative. World Health Organization. Retrieved from <https://www.who.int/initiatives/hand-hygiene-for-all-global-initiative>. Accessed June 15 2024.
- Zhang, J., Wu, H.-C., Chen, L., & Su, Y. (2022). Effect on social media use on food safety risk perception through risk characteristics: Exploring a moderated mediation model among people with different levels of science literacy. *Frontiers in Psychology*, 13, 963863. <https://doi.org/10.3389/fpsyg.2022.963863>