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EVALUATION OF FOOD SAFETY KNOWLEDGE AND ATTITUDES AMONG FOOD TECHNOLOGY STUDENTS

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Abstract: Food safety has evolved from a basic requirement for human survival into a complex, multidisciplinary field essential to global public health, sustainable development, and modern food systems. As food remains inherently vulnerable to microbiological, chemical, physical, and allergenic contamination, ensuring its safety requires robust regulatory frameworks, advanced detection technologies, and coordinated international action. Contemporary challenges—including globalization, emerging pathogens, antimicrobial resistance, demographic shifts, and environmental pressures—intensify the burden of foodborne diseases, which affect nearly 600 million people annually. The present study aims to assess student awareness, knowledge, and attitudes toward food safety, highlighting the importance of education and informed behaviour in reducing foodborne risks and strengthening the resilience of food systems

Keywords: food sustainability, environment, waste management, grain food waste

INTRODUCTION

Since antiquity, food has played a fundamental role in the development of human societies and the formation of early states. In the modern context, food safety has evolved into a multidisciplinary scientific field concerned with the production, processing, and distribution of food under conditions that prevent the occurrence of foodborne illnesses. It encompasses a range of standardized procedures and preventive measures designed to minimize risks and protect public health from potential hazards arising throughout the food chain.

The free movement of products, participation in the global market and a high level of health protection led to increased responsibility of operators and require more flexible control by institutions and higher levels of standardization compared to the systems of the past.

According article 14 of Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002. “Food safety requirements:

1. Food shall not be placed on the market if it is unsafe.
2. Food shall be deemed to be unsafe if it is considered to be:
 - (a) injurious to health;
 - (b) unfit for human consumption.” (European Parliament and Council, 2002)

In this article are explained all safety requirements for food as when assessing whether a food is unsafe (European Parliament and Council, 2002).

Unsafe food containing harmful levels of bacteria, viruses, parasites, chemical or physical substances makes people sick, causing acute or chronic illnesses resulting from more than 200 diseases, ranging from diarrhoea to cancers to permanent disability or death (World Health Organization, 2020). Globally, approximately 600 million people—nearly one in ten—become ill each year from consuming contaminated food, resulting in an estimated 33 million disability-adjusted life years (DALYs) lost and around 420,000 premature deaths (World Health Organization, 2015; World Health Organization, 2016). The burden of unsafe food falls disproportionately on vulnerable populations, including infants, young children, the elderly, and individuals with weakened immune systems. Low- and middle-income countries experience the greatest impact (Jaffee, S., et al., 2019). Increasing globalization of the food supply further amplifies exposure to emerging hazards, such as antimicrobial resistance (AMR) in foodborne pathogens, driven by the misuse and overuse of antimicrobials in human, animal, and plant health. Without effective

interventions, AMR could claim up to 10 million lives annually and cause a cumulative global economic loss of US\$100 trillion by 2050 (M.E. Wagenlehner, F. & Dittmar, F., 2022). Nutrition and food safety are closely interlinked and are essential for achieving positive health outcomes from food systems. Food must be safe, available, accessible, nutritious, culturally acceptable and ingested regularly for growth, health and well-being (Food and Agriculture Organization, 2020)

According to the WHO, food safety includes a number of routine procedures that must be followed to avoid potential serious health hazards. Thus, food safety often overlaps with food hygiene to prevent harm to consumers. (World Health Organization, 2015)

While hygiene plays a critical role in maintaining food safety, inadequate hygienic practices do not necessarily imply that food is unsafe. Food contamination can be broadly categorized into four principal types. Microbiological contamination arises from the presence of pathogenic microorganisms such as bacteria, viruses, and molds. Physical contamination involves the unintended introduction of foreign materials—such as glass, metal, plastic fragments, hair, or small stones—into food products. Chemical contamination occurs when food comes into contact with hazardous substances including pesticides, cleaning agents, or other chemical residues (Chen, Z. et al., 2023; Dougherty, C.P., et al., 2000; Duan, K., et al., 2025 Gao, P., et al., 2022; Pakdel, M., et al., 2023; Sprenger, R.A., 2004). In recent years, allergenic contamination has been increasingly recognized as an important category of food safety concern, encompassing the unintentional presence of allergenic ingredients such as peanuts, sesame seeds, eggs, and similar substances that can trigger adverse immune responses in sensitive individuals. (Chen, Z. et al., 2023).

Key factors currently shaping and expected to increasingly influence food safety include growing safety demands, global and environmental challenges, societal and demographic changes, security threats, and the rise of new technologies. (World Health Organization, 2022).

The results of a systematic literature review of K. Duan et al. in 2025 on the topic “Current research development on food contaminants, future risks, regulatory regime and detection technologies” indicates significant variability in the understanding of contaminants of emerging concern, their future drivers, and their effects on the food system, environment, and human health. This underscores the need for further research aimed at systematically identifying and evaluating regional differences in food contamination prevention strategies, as well as determining how these variations influence the efficiency of prevention, mitigation, and control measures. Moreover, the findings emphasize the importance of enhancing international collaboration in food contamination research and engaging technological partners to promote the adoption of advanced technologies for the detection and management of food contaminants. (Dougherty, C.P., et al., 2000)

In 2020, the 73rd World Health Assembly called on the World Health Organization (WHO) to revise its 2002 Global Strategy for Food Safety to better address contemporary and emerging challenges, embrace technological advances, and apply innovative methods to reinforce national food safety systems (World Health Organization, 2020).

The process also incorporated existing regional action plans and strategic frameworks, along with the principles of the Codex Alimentarius and the Food and Agriculture Organization’s (FAO) draft Strategic Priorities for Food Safety 2022–2031 (World Health Organization, 2022).

Food safety is identified as essential to food security and closely tied to achieving SDGs related to health, sustainability, and economic growth, particularly SDGs 2, 3, and 8, as well as 1, 6, 12, and 17. The strategy emphasizes that safe and nutritious food is vital for progress toward these goals, especially in low- and middle-income countries. It also highlights key “drivers of change” — environmental, social, and technological — that shape food safety systems. Recognizing and integrating these factors is crucial for resilience, adaptability, and effective public health protection in a changing global food landscape (World Health Organization, 2022).

Within the framework of the EU’s precautionary “from farm to fork” and “One Health” approach to food safety, there is a growing need for rapid and reliable methods to detect, monitor, and characterize emerging threats and factors contributing to the emergence and spread of new food safety hazards. Such a comprehensive approach enables accurate risk assessment, the development of effective mitigation measures, and the anticipation, prevention, and control of future foodborne risks to public health. This

section focuses on emerging pathogens, antimicrobial resistance, and food-related allergies (World Health Organization, 2022).

“One Health” approach is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. It recognizes the health of humans, domestic and wild animals, plants and the wider environment (including ecosystems) are closely linked and inter-dependent (Food and Agriculture Organization, 2021).

Many surveys have been conducted to reveal consumer behaviors related to food safety (Bolek, 2020; Burke, Young, & Papadopoulos, 2016; Fontes, Giraud-Héraud, & Pinto, 2015; Golian, Nagyová, Andocsová, Zajác, & Palkovič, 2018; Lange, Göranson, & Marklinder, 2016; Liu & Niyongira, 2017; Sani & Siow, 2014; Yu, Gibson, Wright, Neal, & Sirsat, 2017; Zhllima, Imami, & Canavari, 2015).

EXPOSITION

The primary objective is to emphasize the global public health significance of food safety by raising student awareness and evaluating their knowledge and attitudes toward the topic. The study, designed as a survey comprising 20 questions, aims to address key aspects of food safety, including incidents of safety breaches, public perceptions of control system effectiveness, awareness of proper food storage and preparation practices, understanding of the main causes of safety violations, recognition of allergen-related risks, identification of high-risk food products, and individual tendencies to engage in behaviours that compromise food safety.

The assessment is based on the results of a survey conducted among 120 students enrolled in the full-time “Food Technology” program. The study was carried out over an eight-year period—from 2017 to 2025 - and involved third-year students.

The questionnaire, entitled “Food Safety,” was administered electronically and included optional fields for respondents to indicate their age group and gender. The questions were designed not only to assess students’ knowledge related to food safety, but also to encourage deeper engagement with the topic.

A total of 117 participants provided information about their age and gender, with the largest proportion being individuals aged 21-30 years. Of those who responded, 91 (77.8%) were women and 26 (22.2%) were men. Three participants submitted the questionnaire without answering any of the items; therefore, their responses were included in the total number of participants but excluded from the analysis of individual questions. Additionally, some respondents did not answer all questions, resulting in a number of valid responses ranging between 113 and 117 for the individual survey items.

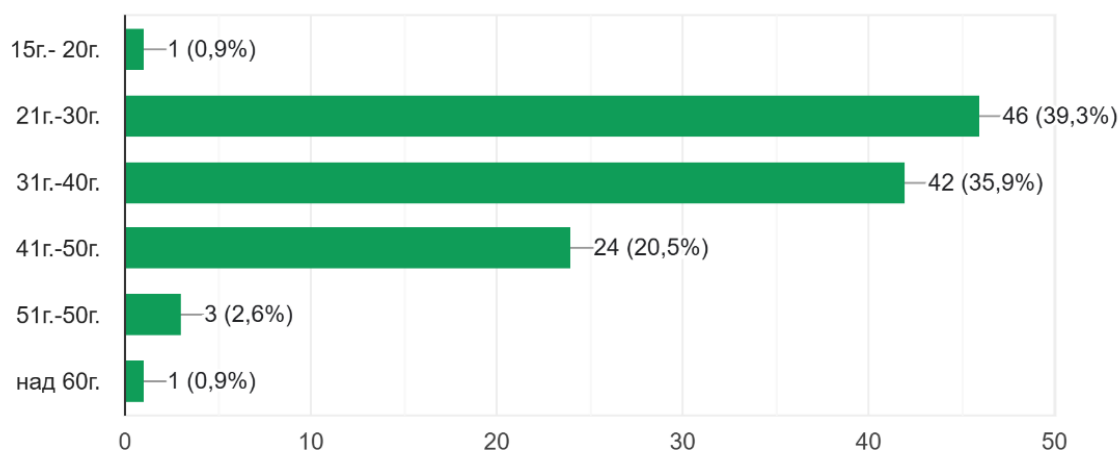


Fig. 1 Data on the age groups of the study participants

The questions cover the most important topics in food safety and aim not only to check social opinion, but also to encourage respondents to become more informed on certain issues, which in turn can protect them and improve their quality of life.

Questions and objective

1. Have you ever suffered from food poisoning? It shows the importance of the problem.
2. Have you ever witnessed a situation in which food was offered or produced under conditions that did not comply with food safety and hygiene standards? It shows the frequency of food safety problems, even in cases where food poisoning does not occur.
3. Do you think that safety and hygiene standards are strictly observed by producers and traders offering food products? It shows the public's opinion on compliance with safety standards.
4. Do you think that the control exercised by the competent authorities over food safety is sufficiently effective? It shows the public's view of the control system.
5. Do you know where to report if you find an irregularity regarding food safety? It shows the awareness of the population about the legal representatives responsible for safety.
6. Would you report to the competent authorities if you found any irregularity regarding food safety? It shows the willingness of the population to participate in the control process.
7. Did you know that food poisoning is most often caused by pathogenic microorganisms? It shows the awareness of the population regarding the most common causes of food safety violations.
8. Have you heard of Norovirus? It shows the awareness of the public about the causes of contamination, beyond microbiological, chemical and physical agents.
9. Is 7°C a good temperature for refrigerated storage? It shows the awareness of the public about the safe storage of food.
10. Are some pathogenic microorganisms destroyed when storing food in refrigerated conditions? It shows the awareness of the public about the safe storage of food.
11. Does freezing in a freezer (below -18°C) guarantee 100% destruction of microorganisms? Shows public awareness of safe food storage.
12. Is 100°C the minimum temperature that the coldest point of cooking should reach to ensure that pathogenic microorganisms are destroyed? Shows public awareness of temperature processing and how it affects safety.
13. Can the consumption of foods containing allergens lead to conditions requiring hospital treatment? Shows public awareness of the importance of increased attention to allergens in the content of food products.
14. Is milk (of animal origin) an allergen? Shows people's knowledge of the representatives of the main group of allergens.
15. Do you think that poultry products pose a greater health risk than other meat products? Shows public awareness of the difference between the structure of poultry and other types and the risks it poses.
16. Does eating raw or undercooked meat pose a risk of food poisoning? It shows people's opinions about the heat treatment of meat and its relationship to safety.
17. Does eating fresh unwashed fruits and vegetables pose a risk of food poisoning? It shows people's opinions about the hygiene of products and its relationship to safety.
18. Do you wash your hands with soap and water before eating? It shows people's tendency to expose themselves to safety risks.
19. Do you wash fruits and vegetables before eating? It shows people's tendency to expose themselves to safety risks.
20. Do you check the expiration date of every product you buy? It shows people's tendency to expose themselves to safety risks.

RESULTS AND DISCUSSIONS

The results indicate that 20.5% of respondents answered affirmatively to question 1, which demonstrates the frequency of problems arising from compromised food safety.

A total of 44% reported having witnessed a situation in which food was offered or produced under conditions that did not meet food safety and hygiene standards. This shows that the frequency of situations involving potential risk is more than 20% higher than the proportion of individuals who have actually experienced food poisoning. In practice, every second person has been exposed to such a risk.

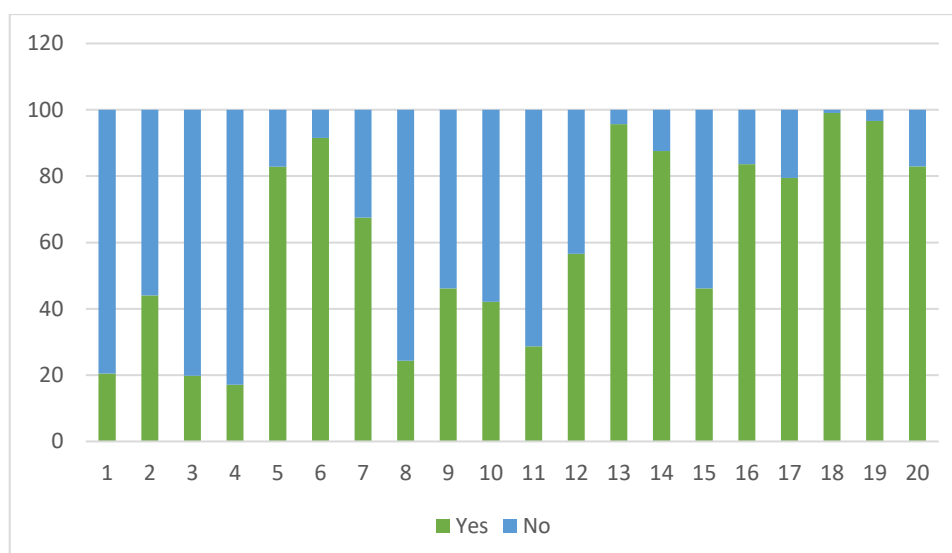


Fig. 2 Data on positive and negative responses to each of the survey questions

For question 3, concerning safety and hygiene standards among food producers and retailers, 80.2% responded negatively, and for question 4, concerning competent authorities, 82.9% also responded negatively. These questions address perceptions of the effectiveness of food safety management and control systems, and the results indicate that respondents generally consider these systems insufficiently effective.

Questions 5 and 6 relate to the awareness of organizations responsible for food safety control and the willingness of respondents to participate in the control process. Here, more than 80% and more than 90%, respectively, answered positively, indicating a high level of engagement.

A total of 67.5% responded positively to question 7, showing that more than half of the participants understand the major role of microbiological contamination in food safety.

In contrast, results differ for other sources of food-related hazards. For question 8, only 23.3% responded affirmatively, despite the fact that it is one of the most common causes of gastrointestinal illnesses during the winter months.

Question 9, is based on the widely accepted danger zone for food storage of 5–63°C. For this question, 53% of students responded negatively, indicating good awareness of correct storage temperatures.

This finding is reinforced by responses to question 10, 57.9% responded negatively.

Similarly, for question 11 regarding the destruction of microorganisms by freezing, the majority-71.3%-responded negatively.

Question 12, shows divided opinions: 56.6% answered “yes” and 43.4% answered “no.” According to international food safety standards, a temperature of 75°C is generally sufficient to ensure food safety, with an appropriate holding time depending on the nature and volume of the product.

For question 13, 95.7% answered positively, suggesting that respondents are well informed about the risks posed by allergens in food products.

Regarding question 14, 87.6% answered positively and 12.4% negatively. Although the percentage of incorrect answers is small, the results indicate a need for greater awareness of major food allergens, the risks they pose, and the importance of proper labelling.

Questions 15 and 16 concern the safety of meat products. For question 15, the majority (53.8%) answered “no,” indicating that students are not sufficiently aware of the elevated risks associated with poultry. For question 16, 83.6% answered positively, suggesting that participants are well informed about the importance of adequate thermal processing. Although various culinary traditions include raw or rare meat dishes (e.g., steak tartare, rare steaks, burgers), these foods can be safe if all other food safety requirements concerning the product and food preparation environment are strictly met.

For question 17, 79.5% responded affirmatively. Further down, question 19, received 96.6% positive responses. This suggests that some participants do not perceive unwashed produce as risky, yet still wash it before eating.

Questions 18 and 20 - provide insight into personal tendencies to expose oneself to food safety risks. A total of 99.1% responded affirmatively to question 18, and 82.9% to question 20. Although the results are generally satisfactory, they indicate that some food safety issues may arise due to personal choices and behaviors.

CONCLUSION

Food safety has been a critical concern since the earliest stages of human civilization, transcending geographical, demographic, and social boundaries. The findings of the study allow for several key conclusions. Despite technological advancements in the food industry and improved access to information, food safety continues to present significant challenges. Effective safety management strategies and regulatory frameworks shows positive outcomes only when rigorously implemented. Continuous improvement of control systems is essential to minimize instances of food safety violations. Furthermore, enhancing public awareness of the causes and mechanisms of food contamination, the necessary conditions for safe food storage and preparation, and the potential health consequences of consuming unsafe food could substantially reduce the incidence of foodborne illnesses.

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