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FOOD SAFETY KNOWLEDGE, ATTITUDE AND PRACTICES AMONG URBAN AND PERI-URBAN CONSUMERS IN FAISALABAD DISTRICT, PAKISTAN

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ABSTRACT

Food safety is an essential aspect of food security, which includes supply chain management and consumer-related concerns. In Pakistan, poor food safety poses a significant problem, harming consumer health, causing financial losses, and damaging the reputation of food businesses. The present study assesses consumers' knowledge, attitudes, and behaviors regarding food safety in urban and peri-urban areas of Faisalabad. Data were gathered through a structured questionnaire, which was used to collect information from a total of 150 respondents, with 75 chosen from each of the urban and peri-urban areas of the Faisalabad district, employing a stratified random sampling technique. Descriptive statistics were employed for data analysis, and Structural Equation Modelling (SEM) was used to explore the relationships among food safety knowledge, attitudes, and practices of urban and peri-urban respondents in STATA (version 14). The findings revealed a significant knowledge gap regarding food safety among the surveyed consumers. This knowledge gap is reflected in consumers' attitudes and food safety practices. The results further revealed a negative but statistically significant relationship between knowledge and practices (H1 = -0.56, $p < 0.05$), a positive relationship between attitude and practices among the respondents (H2 = 0.79, $p < 0.05$), and a positive correlation between knowledge and attitude (H3 = 0.28, $p < 0.05$). To promote food safety, it is recommended to enhance knowledge on the subject while ensuring careful attention is given to each step in the process.

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INTRODUCTION

Food safety is a fundamental concept that entails a series of meticulous measures aimed at ensuring that food remains free from harmful contaminants, such as microorganisms like bacteria and viruses, which have the potential to cause illness or health issues (WHO, 2003). The Food and Agriculture Organization of the United Nations (FAO) defines food safety as "handling, storing and preparing food to prevent infection and help to make sure that our food keeps enough nutrients for us to have a healthy diet." Access to nutritious food is a critical component in achieving the Sustainable Development Goals (SDGs). In 2019, the significance of the SDGs was underscored during the International Conference on Food Safety, held in Addis Ababa, Ethiopia's capital, and the International Forum on Food Safety and Trade in Geneva (WHO, 2022). Researchers from across the globe are diligently striving to enhance food safety protocols due to the severe consequences of foodborne illness on public health, economies, and the

stability of the food supply (Havelaar et al., 2010; Sharma et al., 2022; Mazumdera et al., 2022).

The Knowledge, Attitudes, and Practices (KAP) model is a commonly used theoretical framework for describing and analyzing Food Safety Practices (FSP). This model highlights the factors that contribute to maintaining food safety (Zanin et al., 2017). The KAP model evaluates and analyzes the knowledge, attitudes, and practices of a population concerning a particular subject (Liao et al., 2022). KAP data holds significance in the planning, execution, and assessment of initiatives because it provides insights into the dynamics of social behavioural changes and allows for their analysis. This information enables the making of informed decisions and the tailoring of interventions effectively (Xie et al., 2017). Over the past decade, numerous studies have been conducted to assess KAP related to food safety in various industries. These studies aim to gain a deeper understanding of how different sectors approach factors or origins (Mclntyre et al., 2020; Soon et al., 2020; Öztürk, 2022; Marklinder et al., 2022).

Consumers often face challenges in adequately achieving food safety. They lack the necessary knowledge, resources, or tools to ensure food safety at every step, from purchasing to preparation and consumption (Röhr et al., 2005; McCarthy et al., 2007). Yarrow et al. (2009) argued that educational involvements can indeed have a substantial impact on people's knowledge, attitudes, concerns, and practices related to food safety. Individuals with varying levels of education often exhibit different perspectives and behaviours when it comes to their understanding and implementation of food safety measures. Education can enhance awareness, promote better hygiene practices, and improve decision-making regarding food safety (Unusan, 2007). Pakistan faces challenges related to basic food safety, which present potential problems. Lack of proper health knowledge among individuals in both their personal lives and workplace environment is leading to suboptimal practices and potentially risky behaviours in handling food. Addressing these issues through education and awareness campaigns is crucial for achieving food safety and minimizing associated risks in Pakistan (Ali et al., 2022).

Researchers employ attitude scales to assess outcomes related to food safety practices and appraise the effectiveness of food safety education (Medeiros et al., 2004; Jiang et al., 2024). Most of them believed that government actions would improve the quality of safe food (Gurudasani and Sheth, 2009; Sharma et al., 2022). In this regard, governments have a primary responsibility in ensuring food safety through the implementation of policies, laws, and regulations. However, it is crucial not to overlook the role of consumers in maintaining food safety, as studies indicate that 60% to 80% of food poisoning cases originate from home settings (Redmond and Griffith, 2003). To assess the food safety attitudes of households, it is essential to grasp their knowledge and viewpoints. Therefore, it is widely recommended to introduce educational initiatives, promote awareness via campaigns, offer training, and organize workshops in Pakistan (Naeem et al., 2018).

A substantial portion of the population is at an elevated risk of acquiring foodborne illnesses, particularly in the United States, where susceptibility to such infections can lead to severe consequences (Kunisaki and Janoff, 2009). The primary concern regarding foodborne illnesses often stems from within one's household, which can be attributed to various factors. A substantial portion of our meals is typically cooked at home, which in turn heightens the probability of errors in food handling. Regrettably, this aspect often goes unnoticed, as the focus tends to be on how frequently one dines out (Carlson et al., 2002). Households can present potential hazards from a variety of foodborne pathogens, yet these dangers have not received sufficient attention.

A comprehensive understanding of best food safety practices plays a pivotal role in averting outbreaks of foodborne illnesses (Young and Waddell, 2016). Numerous sociodemographic factors, including age, gender, educational attainment, and place of residence, have been identified as pivotal in shaping individuals' knowledge and attitudes toward food safety (Moreb et al., 2017). Demographics, particularly young adults, frequently partake in risky food consumption habits and exhibit unsafe food handling behaviors (Abbot et al., 2012). Given their tendency toward risky food choices and relatively limited knowledge in this domain, young people represent a significant focal point for food safety education efforts (Nesbitt et al., 2009). In addition to the individual risks they face, young individuals also handle food intended for the general public. In Ontario, Canada, approximately 20% of high school students engage in work or volunteer activities that involve food handling for public consumption (Majowicz et al., 2015). It is of paramount importance to minimize food contamination,

which necessitates the adoption of exemplary practices in both food production and household settings (Langiano et al., 2012). Equally important is the role of training and knowledge in ensuring adherence to proper food handling practices and compliance with safety regulations (Martins et al., 2012). Merely retaining knowledge does not guarantee the implementation of FSP (Baş et al., 2006). An intriguing observation is the inverse relationship between knowledge and actual practices, as well as between attitude and practices in the context of food safety (Ansari-Lari et al., 2010). Pakistan faces a clear requirement for enhanced education regarding FSP and heightened awareness of this issue. The improved food safety measures, which should be adopted by all food service establishments (Aslam et al., 2021). Studies show that contaminants in Fruits and Vegetables (F&Vs), such as tomatoes, apples, melons, mangoes, grapes, and plums, exceed FAO and WHO limits (Syed et al., 2014). Pakistan's economy heavily relies on agriculture, contributing 19.2% to its GDP and supporting 38.5% of the rural population. Agriculture, particularly Fruits and Vegetables, is crucial for the diet of most Pakistani citizens (Government of Pakistan, 2021). Urgent adherence to WHO standards for national environmental quality is necessary for food crops in local markets. Regular monitoring of contaminants in food crops is crucial to safeguard human health and the environment in Pakistan (Khan et al., 2015).

Pakistan faces a critical food safety (FS) issue that demands immediate attention, and a scientific approach is imperative to address this concern effectively. (Akhtar, 2015). The relationship between KAP may vary among communities due to demographic differences. Understanding FS in KAP, among F&V consumers, is crucial for the local economy. For this purpose, this study investigates the food safety knowledge, attitudes, and practices of urban and peri-urban consumers in the Faisalabad district of Pakistan. The objectives of the study were to evaluate knowledge about food safety among consumers, understand their attitudes and practices regarding food safety, and suggest policy implications for food safety based on KAP analysis, in relation to food consumption patterns.

METHODOLOGY

Study Area and Sampling Structure

The research was conducted in the Faisalabad district due to its unique blend of urban and peri-urban areas. Faisalabad is also the second-largest city in the Punjab region, following Lahore. Faisalabad covers an area of 5,856 square kilometers and is home to a population exceeding 3.2 million people. Our study focused on urban and peri-urban consumers. Peri-urban are those transitional zones between rural and urban areas which often experiences pressure from urban expansion and faces unique challenges related to governance, planning, and service delivery. Households located in geographic areas that are administratively outside the core urban boundaries but are adjacent to or within close proximity of the urban city limits, exhibiting both urban and rural characteristics in terms of infrastructure, services, and livelihood activities were selected from peri-urban areas for the present study. Primary data were collected through a structured questionnaire from a total of 150 respondents, with 75 selected each from urban and peri-urban areas of the district, using stratified random sampling.

Questionnaire Design

A structured questionnaire was developed to assess the knowledge, Attitude, and Practices (KAP) of the participants. The questionnaire was organized into four distinct sections, which included demographic information, the frequency and types of foods consumed, the amount spent on food, and the level of knowledge and concern regarding food safety. The first section aimed to collect information about the respondents' backgrounds and included questions such as age, gender, profession, household income, number of people in the household, number of children, and frequency of food preparation at the household level. The second section of the questionnaire focused on inquiries related to the participants' habits and practices regarding food consumption and purchasing. The third section was designed to assess the participants' understanding and attitudes concerning food safety. The last section was designed to determine the participants' perspectives and actual practices regarding food safety.

Pilot Study

The primary experiment was preceded by a preliminary pilot study, involving 30 individuals responsible for food preparation within their households. Notably, these 30 individuals did not participate in the final experiment. The purpose of this pilot study was dual: Firstly, the questionnaire designed for the survey was administered

to the pilot group. The objective was to evaluate the effectiveness of the questionnaire and identify any necessary improvements. Secondly, based on the feedback and responses gathered from the pilot study participants, the questionnaire was refined and adjusted as needed. This adaptation was crucial to ensure that the questionnaire was well-suited and culturally appropriate for the specific community under investigation.

Modelling Strategy

Structural Equation Modeling (SEM) is an effective instrument used for analysis of the interrelationship among latent variables (Marklinder et al., 2022). It was employed to examine the intricate relationships between FSK (Food Safety Knowledge), FSA (Food Safety Attitude), and FSP (Food Safety Practices). SEM enables a comprehensive examination of the interrelationship between FSK, FSA, and FSP, providing insights into the complex dynamics and associations between knowledge, attitude, and behavior regarding food safety.

H1; FSK is directly related to practices

H2; FSA directly related to practices

H3; FSK and FSA are correlated with each other

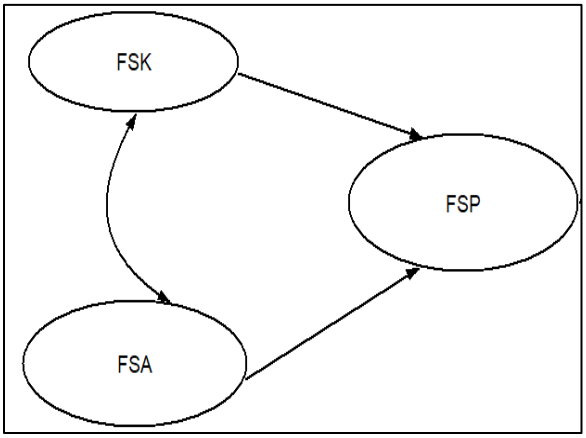

Figure 1. Relationship between KAP

Statistical Analysis

Statistical Packages for Social Sciences (SPSS) version 21, STATA version 14 was used for descriptive analysis such as frequency, percentages, mean and standard deviations and to conduct Structural Equation Modeling (SEM) to study the relationship between FSK, FSA and FSP among urban and peri-urban respondents in the Faisalabad district.

RESULTS AND DISCUSSION

Results were further discussed in following subdivisions.

Descriptive Statistics

Demographic attributes play a crucial role in shaping individuals' knowledge, attitudes, and practices (KAP) towards food safety. As an integral component of this study, understanding the diverse socio-demographic characteristics of the respondents provides valuable insights into the factors influencing food safety behavior. The respondents are categorized into two groups: Urban and Peri-urban. Each group consists of 75 households, totaling 150 consumers (Table 1).

The majority among them were females (72.7%). The proportion of female participants compared to male participants in the study demonstrated the significant role of females as the primary food preparers in Asian households. Regarding their educational background, approximately 23.3% of respondents had completed only secondary education. Additionally, a majority of the households had income levels that fell below the hardcore threshold. Statistics on poverty reveal that in the 2018-19 period, nearly 37% of Pakistan's population resided below the poverty line. Rural areas exhibited a higher prevalence, greater depth, and increased severity of poverty compared to urban regions (Jamal, 2021). Because the majority of the respondents were housewives without a source of income, they were unable to make financial contributions to their households. Additionally, a significant proportion of respondents came from larger families with a minimum of six people in the family (80%), and 20% of them had at least three children living in the house. This substantial number of people added to the household's financial responsibilities. It's noteworthy that nearly three-quarters (62.7%) of the food preparers were responsible for cooking meals at home daily.

Understanding the consumption patterns of various food groups is essential for assessing dietary diversity, identifying areas of concern, and developing strategies to promote balanced and nutritious diets among the population. Table 2 shows the consumption habits of the respondents regarding key food items, revealing distinct patterns. A significant majority of the participants reported consuming particular food categories during the week leading up to the interview. 93.3% of the respondents reported consuming vegetables, 87.3% reported consuming fruits, and 49.3% reported consuming meat and poultry.

Table 1. Demographic characteristics and daily meal frequency of households.

Variable	Items	Percentage
Location	Urban	50.0
	Peri-urban	50.0
Gender	Male	27.3
	Female	72.7
Age(years)	25-34	6.7
	35-44	27.3
	45-54	43.3
	55-64	21.3
	65 and above	1.3
Education	No schooling	8.7
	Pre- primary	5.3
	Primary	21.3
	Secondary school	23.3
	Intermediate	22.7
	Bachelors	13.3
	Master or above	5.3
Source of income	Primary source	13.3
	No secondary source	86.7
Household annual income	200,000 – 400,000	8.7
	400,000 – 600,000	20.6
	600,000 – 800,000	44.7
	800,000 and above	26
Household size	1-3	10.0
	4-6	80.7
	7-9	9.3
Meal frequency	Once a day	14.7
	Twice a day	22.6
	Three times a day	62.7

Table 2. Food Groups Consumed.

Food Group	Percentage
Vegetables	93.3
Fruits	87.3
Meat and Poultry	49.3
Fish and Seafood	11.3
Pulses/Legumes/Nuts	86.7
Dairy Products	86.0

Note: Multiple responses were allowed.

Women often play a central role in managing food-related activities, and their knowledge and awareness about food safety can influence the entire household's practices. The possible reasons for the results include easy access, household women's access, the habit of making fresh purchases, purchasing power, and daily price variations, which affect a small volume of purchasers. People buying in smaller quantities may not always have the opportunity to take advantage of bulk discounts. As a result, they might opt for food items that are more affordable but may not adhere to the highest safety standards. Table 3 presents data on the respondents' preferences for purchasing F&Vs and the factors influencing their choices. Response to "1st most important place to buy F&Vs," the majority of respondents (85%) reported local open-air retail outlets as their preferred option. The second most important place for purchasing F&Vs, after local markets, is street hawkers, preferred by 60% of the respondents, and the third most important place to buy F&Vs, after local markets and street hawkers, is supermarkets (44.67%).

Table 3. Most preferred place to buy F&Vs.

Places	Percentage
Local open-air markets	85.33
Street hawkers	60.00
Super markets	44.67
Restaurants	18.67
Online traders	1.33
Others	12.00

Note: Multiple responses were allowed

Descriptive Statistics of KAP Items

Table 4 displays the mean scores of FSK, FSA, and FSP. Results show that the FSK of respondents was at a good level (80% of full score), as it's evident from Table 4. There was sufficient knowledge on kitchenware's hygiene and the importance of food storage in the refrigerator among respondents. FSK item K5 shows the lowest score among all FSK items, indicating that many households did not understand the importance of cooking food carefully.The findings of the FSA mean score calculations indicated that respondents appeared to show a good attitude towards hygiene of kitchen wares (A2), consumption of good quality food and vegetables (A3), and cleaning of shelves during cooking food (A5). Regarding FSP, all the items used to assess respondents' behavior revealed that they have relatively good behavior in FSA, as all mean value scores are higher than 80%.

Table 4. Food safety items used in the mean scores of KAP.

Construct	Variables	Means (S.D)
FSK	K1. Do you know washing of hands is necessary for the safety of food?	4.13(0.334)
	K2. Do you know that good quality kitchenware is necessary for food safety?	4.21(0.406)
	K3. Do you know the importance of kitchenware's hygiene for food safety?	4.37(0.485)
	K4. Do you know the importance of properly storing food in the refrigerator to prevent contamination?	4.21(0.406)
	K5. Do you know the importance of cooking food thoroughly?	4.00(0.401)
FSA	A1. Do you believe in washing hands before & after consuming food?	4.19(0.396)
	A2. Do you believe that the hygiene of kitchenware is necessary for food safety?	4.29(0.457)
	A3. Do you believe in consuming good-quality food and vegetables?	4.35(0.478)
	A4. Do you believe that washing fruits & vegetables is important?	4.19(0.396)
	A5. Do you believe in having clean shelves during cooking food?	4.26(0.440)
FSP	P1. Do you always wash your hands before every meal?	4.19(0.396)
	P2. Do you always wash cleaning utensils for safety concerns?	4.50(0.502)
	P3. Do you always perform cleaning of the refrigerator to avoid food contamination?	4.29(0.457)
	P4. Do you check the expiration dates on your food before consuming it?	4.21(0.406)
	P5. Do you always avoid consuming foods that have an unusual color, texture, or smell?	4.27(0.444)

SEM Results

Table 5 and Figure 2 present the results of the structural models' standardized path coefficients, which illustrate how strong the direct relations are between the constructs. Our results show a strong negative correlation between FSK and FSP, which is in line with the basic hypothesis that FSK significantly influences FSP (H1= -0.56, $p<0.05$), as demonstrated in Table 4. Thus, the initial hypothesis (H1) is sustained. This finding is consistent with the results of several prior studies, which have reported similar outcomes. Lim et al. (2016) found a significant negative relationship between FSK and FSP and emphasized the importance of improvement in FSK of the community. Unusan (2007) revealed that even though the respondents performed well in an FSP assessment, they lacked interest in practicing FSP. Baş et al. (2006) discovered that having good FSK might not lead to good handling practices. The evidence supporting this notion was further reinforced by Abdul-Mutalib et al. (2012), who demonstrated brilliant FSK in food handling; however, their hygiene practices fell short of equivalence. Astonishingly, 40 percent among them wore jewelry during home activities, and even some used the same cleaning utensils for various washing systems. These findings highlight the disconnect between knowledge and actual behaviour in the context of FSP among the food handlers examined.

The results displayed in Figure 2 provide substantial support for Hypothesis (H2), revealing a notable and positive correlation between FSA and FSP. Notably, among all the variables investigated, food safety attitude emerges as the most pivotal factor, according to respondents, as indicated by the highest standardized path coefficient ($H2 = 0.79$, $p < 0.05$). Abdul-Mutalib et al. (2012) revealed that participants showed an encouraging attitude towards safe food storage practices, particularly concerning heat regulators and

following accurate procedures for food handling. Buccheri et al. (2010) demonstrated *a* positive attitude towards safe FSP, including the rightful handling of food using suitable gloves and clothing. However, observed that untimely beliefs and underestimating the risks of food diseases appeared to contribute to negligence in safe food handling practices. Porticella et al. (2008) found that safer food preparation and storage practices among consumers revealed reservations about the effectiveness of recommended FSP, such as using a food thermometer, in reducing foodborne diseases. A positive attitude towards FSP can only be fostered when individuals genuinely believe that using a food thermometer can effectively reduce the risk of foodborne diseases. Then, a proper FSP will be successfully functional.

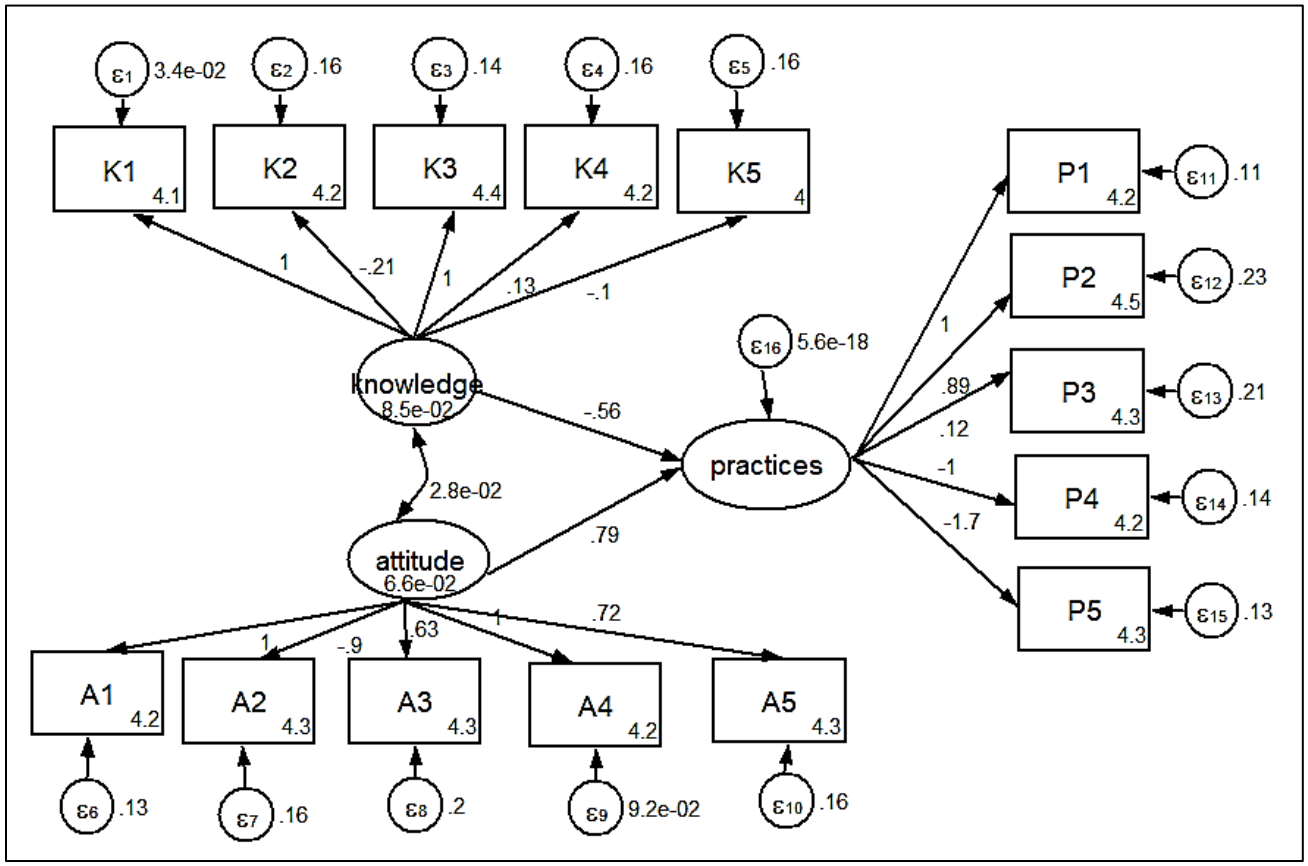

Figure 2. Results of Structural Equation Modeling Using KAP.

Table 5. Hypothesis Testing of KAP.

Hypothesis	Path	Estimate	p-value
H1	FSK → FSP	-0.56	0.003
H2	FSA → FSP	0.79	0.000
H3	FSK ↔ FSA	0.28	0.001

*p<0.005 Source: Author's calculations from the survey data 2023

The results also show a correlation between the FSK and FSA (H3=0.28, P<0.05) of the participants. These results resemble one of the relationships, where FSK and FSA independently influence behavior. However, it is worth noting that in the majority of other studies, a significant relationship, either positive or negative, was observed between FSK and FSA. This suggests that in many cases, knowledge and attitude are interconnected and can influence each other, affecting individuals' behavior regarding food safety. Ansari-Lari et al. (2010) discovered in their research that an optimistic outlook and familiarity with food hygiene were associated with

workers in a meat processing facility. Research by Abdul-Matalib et al. (2012) confirmed that respondents' attitudes towards cleanliness and sanitation improved when they had more information.

CONCLUSION

The findings indicate that a significant portion of the surveyed population lacks specialized food safety arrangements at the household level. However, among those who have adopted food safety measures, the most common practices reported were washing F&Vs with clean water before consumption and storing them at low temperatures, which are positive steps toward reducing potential risks. However, concerning national laws and regulations related to FS, the majority of the respondents appeared to be unaware of their existence. This lack of awareness could be a concerning factor, as it may indicate a general lack of knowledge about the legal frameworks in place to ensure food safety standards in the country. In light of these findings, there is a need for targeted educational initiatives to raise awareness about household-level food safety practices beyond simple washing, such as proper handling and storage techniques. Efforts should also be made to inform consumers about the importance of adhering to national food safety regulations and the role these regulations play in safeguarding public health. The study found that if the respondents had a good attitude towards food safety, it would have a positive impact on FSP. The fact that respondents' FSK did not lead to improved food safety procedures is an intriguing finding. The research also showed that people in the Faisalabad district need to learn more about food safety.

Educating consumers and stakeholders about the importance of FSK and best practices is crucial for raising awareness and fostering positive changes in their attitudes and behaviors. Food safety efforts should focus on increasing knowledge, adopting proper measures, and integrating safe practices into daily routines. By creating awareness about the significance of food safety, we can promote better health and establish comprehensive policies.

In addition to a command-and-control approach, promoting a market that offers premium prices for safe and organic foods can serve as an incentive for growers to register their farms and adopt safer practices. This will create a positive market signal, encouraging producers to prioritize food safety. By addressing food safety at the policy level, fostering market incentives, conducting awareness campaigns, and ensuring effective communication, the entire food production system can be transformed towards a safer and more sustainable approach.

Future research should delve into how culture influences attitudes and practices concerning food safety. Additionally, it should identify effective methods to motivate individuals and communities to adopt safe food handling behaviors. Evaluating different communication channels and messages will also be crucial to maximize their impact. Furthermore, conducting cross-cultural and cross-national studies will offer valuable insights into variations in food safety practices among diverse populations.

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