Vol. 5 No. 1 (2026)
4117
Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about
Online ISSN 3007-2387
Print ISSN 3007-2379
Naz et al., 2026

Food Safety Knowledge and Domestic Food-Handling Practices: The Mediating Role of Attitude and the Moderating Role of Risk Perception in Urban Pakistani Households

Shagufta Naz
Registeration Desk Coordinator BISP Nashunoma Program, Women and Children Hospital Rajjar Charsadda. Email: shaguftanaz96s@gmail.com
Humaira Jamal
MS in Human Nutrition & Dietetics, Department of Human Nutrition, Faculty of Nutritional Sciences, The University of Agriculture Peshawar, Pakistan. Email hurikhan862@gmail.com
Muhammad Numan
Assistant Professor Dental, RCAHS, Rehman Medical Institute, Peshawar. Email: muhammadnuman.academic@gmail.com
Rimsha Tahreem
Masters in Food Technology, Sr. Executive Production at cakes n bakes Lahore. MPhil from University of Agriculture Faisalabad. Email: rimshasbg786@gmail.com
Misbah Bashir
Nutritionist/Dietitian | MSHCM (PH), Riphah International University, Islamabad. Email: 28484@students.riphah.edu.pk
Tahira Naz
Consultant Physiotherapist, Aesthetic and Kinetics I8 Markaz Islamabad. Email: tahiranaz101@gmail.com
Ihtesham Ul Haq*
Assistant Professor Respiratory Therapy and Intensive Care Technology, Rehman Medical Institute RCHAS Peshawar. Corresponding Author Email: ihtesham.haq1@rmi.edu.pk

Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about
Online ISSN 3007-2387
Print ISSN 3007-2379

Author Details
Received on 15 Jan, 2026
Accepted on 23 March, 2026
Published on 25 March, 2026

Corresponding E-mails & Authors*:
Ihtesham Ul Haq
ihtesham.haq1@rmi.edu.pk

Abstract

Background: Foodborne disease remains a substantial public health burden worldwide, and unsafe food handling within the home is a recognised contributor to this burden, particularly in low- and middle-income countries where domestic kitchens receive comparatively little regulatory or educational attention. Evidence on how food safety knowledge translates into safer practices in South Asian household settings, and on the psychological mechanisms that strengthen or weaken this translation, remains limited.

Objective: This study examined the relationship between food safety knowledge and food safety practices among domestic food handlers in Pakistan, testing food safety attitude as a mediator and risk perception as a moderator of this relationship. Methods: A cross-sectional, correlational design was used. A convenience sample of 320 domestic food handlers residing in Rawalpindi and Islamabad completed a structured, previously validated online questionnaire measuring food safety knowledge (10 items), food safety attitude (6 items), food safety practices (11 items) and risk perception (9 items) on five-point Likert scales. Data were analysed in SPSS (version 22) using descriptive statistics, correlation, one-way analysis of variance, and hierarchical multiple regression; mediation and moderation were tested with the Hayes PROCESS macro (model 4 and model 1, respectively) using 5,000 bootstrap resamples. Results: Food safety knowledge was positively associated with food safety practices ($\beta = 0.734$, $p < .001$), as was food safety attitude ($\beta = 0.137$, $p < .001$); together these variables explained 72.6% of the variance in practices. Food safety attitude partially mediated the knowledge-practice relationship (indirect effect = 0.125, boot SE = 0.036, 95% CI [0.054, 0.195]). Risk perception significantly moderated the attitude-practice relationship ($\beta = -0.087$, $p = .005$): the association between attitude and practice was stronger among respondents reporting lower risk perception. Conclusion: Food safety knowledge shapes domestic food safety practices both directly and through its influence on attitude, while high risk perception paradoxically attenuates the benefit of a positive attitude on practice. Interventions that pair knowledge transmission with attitude change, while addressing complacency

associated with low perceived risk, may be more effective than knowledge-only food safety education for household food handlers.

Keywords: Food safety knowledge; food safety attitude; food safety practices; risk perception; mediation; moderation; domestic food handling; Pakistan

Highlights

- Food safety knowledge strongly predicted safer food-handling practices among domestic food handlers in urban Pakistan ($\beta = 0.73$, $p < .001$).
- Food safety attitude partially mediated the relationship between knowledge and practice, confirming a knowledge-attitude-practice pathway.
- Risk perception moderated the attitude-practice link: safer practices linked more strongly to positive attitude when perceived risk was low.
- High risk perception did not translate into safer behaviour, suggesting a possible optimism-bias or fatalism effect among some respondents.
- Findings support combining knowledge-based food safety education with attitude-change and risk-communication strategies in household interventions.

Plain-Language Summary

Most food poisoning does not happen in restaurants but in ordinary kitchens at home. This study asked 320 people in Rawalpindi and Islamabad, Pakistan, how much they knew about food safety, what they believed about it, and how they actually handled food day to day. People who knew more about food safety generally handled food more safely, and part of that benefit worked through having a more positive attitude toward safe food handling. Interestingly, people who felt very worried about food risks did not necessarily behave more safely than those who felt less worried; a positive attitude mattered most for people who were not overly anxious about risk. This suggests that food safety education should not simply warn people about danger, but should also build practical, positive attitudes toward safe routines in the kitchen.

1. Introduction

Foodborne disease is among the most widespread and persistent threats to public health worldwide. The World Health Organization estimates that unsafe food causes 600 million cases of illness and 420,000 deaths annually, with children under five and residents of low- and middle-income regions bearing a disproportionate share of this

burden (Da Vitória et al., 2021). While national food-control systems and commercial food-service inspection regimes have expanded considerably over the past two decades, the domestic kitchen has remained comparatively unregulated, even though a substantial share of foodborne illness originates from food prepared and consumed in the home (Gettings & Kiernan, 2001; Redmond & Griffith, 2003). This asymmetry between institutional oversight and domestic risk is particularly pronounced in agrarian and rapidly urbanising countries, where inconsistent access to safe water, variable food storage infrastructure, and limited formal food-handler training converge to elevate household risk (Azanaw et al., 2021).

Pakistan exemplifies this gap. National food-control and surveillance capacity has been repeatedly identified as inadequate (Akhtar, 2015), and household-level food safety knowledge, attitude and practice (KAP) among the Pakistani population remain under-documented relative to the scale of the problem (Ahmad et al., 2021). The disruption of routine shopping, cooking, and food-storage behaviour associated with the COVID-19 pandemic further underscored the fragility of household food safety practices and renewed international interest in the psychological determinants of safe food handling at home (Maragoni-Santos et al., 2021; Soon et al., 2021).

The knowledge-attitude-practice (KAP) framework has long guided food safety research on the premise that knowledge is a necessary, though rarely sufficient, precursor of safe behaviour (Kwol et al., 2020). A substantial body of evidence confirms that food handlers frequently overestimate their own competence: self-reported knowledge does not reliably correspond with observed practice (Osaili et al., 2011; da Cunha et al., 2019). This disjunction has directed recent scholarship toward the intervening psychological mechanisms - principally attitude and risk perception - that determine whether knowledge is translated into behaviour (de Freitas et al., 2019; Evans et al., 2020). Attitude, framed within the Theory of Planned Behavior (Ajzen, 1991), is understood to mediate the knowledge-practice relationship because favourable evaluations of safe handling routines increase the likelihood that acquired knowledge is enacted rather than merely retained. Risk perception, drawn from the Health Belief Model (Rosenstock, 1974; Janz & Becker, 1984), is theorised to condition this relationship further: individuals who perceive food-related risk as low may fail to convert

favourable attitudes into consistent safe practice, a pattern with direct relevance to complacency-driven lapses in domestic hygiene.

Despite this theoretical scaffolding, three gaps remain. First, empirical tests that model attitude as a mediator and risk perception as a moderator within a single, integrated pathway - rather than as separate, unconnected predictors - are scarce, particularly outside high-income settings. Second, most South Asian food safety KAP research has focused on commercial food handlers (restaurant staff, street vendors, institutional caterers) rather than the household food handlers who prepare the majority of meals consumed domestically. Third, the moderating role of risk perception has been examined more often as a direct predictor of practice than as a boundary condition that alters the strength of the attitude-practice relationship, leaving the direction and mechanism of this interaction unresolved (Evans et al., 2020; da Cunha et al., 2019).

The present study addresses these gaps by testing an integrated moderated-mediation model of food safety behaviour among domestic food handlers in two major Pakistani cities. Specifically, this study aims to: (i) examine the direct effect of food safety knowledge on food safety practices; (ii) examine the direct effect of food safety attitude on food safety practices; (iii) test whether food safety attitude mediates the relationship between food safety knowledge and food safety practices; and (iv) test whether risk perception moderates the relationship between food safety attitude and food safety practices. Based on the KAP framework, the Theory of Planned Behavior, and the Health Belief Model, the following hypotheses were formulated:

H1. Food safety knowledge has a significant positive effect on food safety practices.

H2. Food safety attitude has a significant positive effect on food safety practices.

H3. Food safety attitude mediates the relationship between food safety knowledge and food safety practices.

H4. Risk perception moderates the relationship between food safety attitude and food safety practices, such that the relationship is stronger among individuals with lower risk perception.

2. Literature Review

2.1 Food Safety Knowledge and Practice

Cross-sectional KAP surveys conducted across diverse settings - from institutional food handlers in Ghana (Akabanda et al., 2017) to university students in Ethiopia (Azanaw et al., 2021) and Jordan (Osaili et al., 2021) - consistently report positive associations between food safety knowledge and self-reported practice. However, the strength of this association varies considerably, and several authors caution that self-reported practice inflates the apparent knowledge-practice link relative to observed behaviour (da Cunha et al., 2019; Redmond & Griffith, 2003). Ismail et al. (2016), studying mobile food handlers in Malaysia, and Naeem et al. (2018), whose 10-item knowledge scale underlies the present study's measurement approach, both report robust positive effects of knowledge on practice, consistent with the present findings. Conversely, studies such as Odeyemi et al. (2019), synthesising data across several developing countries, note that knowledge gains from public health messaging do not uniformly translate into behaviour change, implicating unmeasured attitudinal and contextual moderators - the gap the present study seeks to address directly.

2.2 Food Safety Attitude and Practice

Attitude is widely treated as the proximal determinant of practice within Ajzen's (1991) Theory of Planned Behavior, and food safety research broadly supports this position. Bou-Mitri et al. (2018), whose attitude and practice scales were adapted for the present study, found attitude to be a significant predictor of hygienic practice among hospital food handlers in Lebanon. Soon et al. (2020), using structural equation modelling among Malaysian consumers, similarly reported that attitude exerted a stronger direct effect on practice than knowledge alone, a pattern that anticipates the present study's mediation results. Al-Sakkaf (2015) further argues that repeated food-preparation routines become habitual, such that attitude - rather than deliberative application of knowledge - increasingly governs behaviour over time, which may explain why attitude retained an independent, if comparatively smaller, effect on practice net of knowledge in the present sample.

2.3 The mediating role of attitude

Several studies have modelled attitude as an explicit mediator between knowledge and practice rather than as a parallel predictor. Kwol et al. (2020) provide the most direct precedent, reporting that food handlers' attitude partially mediated the knowledge-practice relationship in a multi-country KAP dataset - a finding that the present study replicates in a household, rather than commercial food-service, context. This convergence across settings strengthens the case that the knowledge-attitude-practice pathway generalises beyond institutional food handling to domestic environments, although the proportion of the total effect carried through attitude in the present study (approximately 15%) is modest, indicating that knowledge continues to exert a substantial direct effect on practice independent of attitude.

2.4 The moderating role of risk perception

Risk perception has been studied predominantly as a direct correlate of practice, with mixed results. Evans et al. (2020) found that heightened risk perception was associated with safer self-reported handling among American consumers, whereas da Cunha et al. (2019), using structural equation modelling with Brazilian food handlers, reported that self-assessed risk was frequently decoupled from - and in some cases inversely related to - observed practice, a pattern attributed to optimism bias. The present study's finding that risk perception moderates, rather than merely predicts, the attitude-practice relationship - weakening it at higher levels - aligns more closely with the da Cunha et al. (2019) account of a paradoxical safety-behaviour gap and extends this literature by specifying the precise boundary condition under which positive attitude fails to produce safer practice. Fischer et al. (2006) and Rossi et al. (2017) similarly caution that self-reported risk perception can reflect overconfidence rather than accurate hazard appraisal, offering one plausible mechanism for the attenuation observed here: individuals who consider food poisoning unlikely may not act on an otherwise favourable attitude toward safe handling.

Collectively, this literature converges on three conclusions that motivate the present design: (i) knowledge is a necessary but incomplete predictor of practice; (ii) attitude functions as a proximal, partially mediating mechanism through which knowledge influences behaviour; and (iii) risk perception operates less as a direct driver

of safe practice than as a psychological condition that can dampen the translation of positive attitude into action. No identified study has tested all three relationships jointly within a single moderated-mediation model among household food handlers in Pakistan, which constitutes the principal contribution of the present research.

2.5 Theoretical framework

This study draws on three complementary behavioural theories. The Knowledge-Attitude-Practice (KAP) model provides the overarching logic that knowledge acquisition precedes attitude formation, which in turn shapes practice (Kwol et al., 2020). The Theory of Planned Behavior (Ajzen, 1991) supplies the theoretical rationale for treating attitude as a proximal, mediating determinant of behavioural intention and enacted practice, distinguishing it from knowledge as a more distal antecedent. The Health Belief Model (Rosenstock, 1974; Janz & Becker, 1984) motivates the inclusion of risk perception - specifically perceived susceptibility and severity of foodborne illness - as a factor that conditions whether favourable attitudes are acted upon; the model's emphasis on perceived threat as a trigger for protective action provides a theoretical basis for expecting risk perception to interact with, rather than simply add to, the effect of attitude on practice.

2.6 Conceptual framework and hypothesised model

The hypothesised model specifies food safety knowledge as the independent variable, food safety practice as the dependent variable, food safety attitude as the mediator of the knowledge-practice relationship, and risk perception as the moderator of the attitude-practice relationship (first-stage-independent moderated mediation). The conceptual model is summarised in Figure 1: knowledge exerts both a direct effect on practice and an indirect effect through attitude; the strength of the attitude-to-practice path is, in turn, conditional on the respondent's level of risk perception.

[Figure 1. Conceptual and hypothesised structural model, to be inserted: Food Safety Knowledge → Food Safety Attitude → Food Safety Practices, with Risk Perception moderating the Attitude → Practices path, and a direct path from Knowledge to Practices.]

3. Materials and Methods

3.1 Study Design and Setting

This study used a quantitative, cross-sectional, correlational design conducted in a natural (non-experimental) field setting, with no researcher interference in respondents' normal household routines. Data were collected via a self-administered online questionnaire completed by respondents in their own homes.

3.2 Study Population and Unit of Analysis

The unit of analysis was the individual domestic food handler. The target population comprised residents of Rawalpindi and Islamabad, the twin cities of Punjab and the federal capital territory of Pakistan, who were responsible for household food preparation.

3.3 Sampling Technique and Sample Size

A convenience sampling technique was used because of time and resource constraints. Four hundred questionnaires were distributed; 320 were returned complete and usable, yielding a response rate of 80.0%. Participation was voluntary, and full confidentiality was maintained throughout data collection.

3.4 Instrument

The questionnaire comprised five sections: (i) respondent demographic characteristics (gender, marital status, age, work status, years of job experience); (ii) a 10-item food safety knowledge scale adapted from Naeem et al. (2018); (iii) a 6-item food safety attitude scale adapted from Bou-Mitri et al. (2018); (iv) an 11-item food safety practices scale adapted from Bou-Mitri et al. (2018); and (v) a 9-item risk perception scale adapted from Parra et al. (2014). All substantive items were rated on five-point Likert scales (1 = strongly disagree to 5 = strongly agree). To ensure conceptual equivalence for the target population, the questionnaire was translated into Urdu and back-translated into English prior to administration.

3.5 Reliability

Internal consistency was assessed using Cronbach's alpha. Coefficients were: food safety knowledge, $\alpha = 0.83$; food safety attitude, $\alpha = 0.83$; food safety practices, $\alpha = 0.83$; risk perception, $\alpha = 0.86$ - all exceeding the conventional 0.70 threshold for acceptable reliability.

3.6 Control Variable

A one-way ANOVA was used to examine whether food safety practices and risk perception varied across demographic subgroups (gender, marital status, age, work status, years of experience), so that any demographic covariate with a significant association could be considered for statistical control.

3.7 Data Analysis

Data were entered and cleaned in Microsoft Excel, screened for missing values and outliers, and analysed in IBM SPSS Statistics (version 22/21). Descriptive statistics (means, standard deviations, frequencies) characterised the sample and study variables. Pearson correlation examined bivariate associations among knowledge, attitude, practices and risk perception. One-way ANOVA tested demographic differences in practices and risk perception. Hierarchical multiple regression tested the direct effects specified in H1 and H2. Mediation (H3) and moderation (H4) were tested using the Hayes PROCESS macro (version 3.3) for SPSS - model 4 for mediation and model 1 for moderation - with 5,000 bootstrap resamples and 95% bias-corrected confidence intervals used to evaluate indirect and interaction effects.

3.8 Ethical Considerations

Informed consent was obtained from all respondents prior to data collection. Participants were assured of the confidentiality of their responses and of their right to withdraw at any stage. [Note to author: the name of the approving Institutional Review Board/ethics committee and the approval reference number should be inserted here; this information was not specified in the source thesis and must be supplied before submission, as journals will require it.]

4. Results

4.1 Sample Characteristics

Of the 320 respondents, 222 (69.4%) were female and 98 (30.6%) were male. Most respondents were single (n = 253, 79.1%) rather than married (n = 67, 20.9%). Respondents were predominantly young: 232 (72.5%) were aged 18-25 years, 83 (25.9%) were aged 26-40 years, and 5 (1.6%) were aged 41-60 years. Regarding work status, 155 (48.4%) were students, 94 (29.4%) were employed full-time, and 71 (22.2%) were employed part-time. Most respondents reported limited food-handling-relevant work

experience: 240 (75.0%) reported 0-5 years, 48 (15.0%) reported 6-10 years, 30 (9.4%) reported 11-20 years, and 2 (0.6%) reported more than 20 years.

Table 1: *Demographic characteristics of respondents (N = 320)*

Characteristic	Category	n	%
Gender	Male	98	30.6
	Female	222	69.4
Marital status	Single	253	79.1
	Married	67	20.9
Age (years)	18-25	232	72.5
	26-40	83	25.9
	41-60	5	1.6
Work status	Full-time	94	29.4
	Part-time	71	22.2
	Student	155	48.4
Job experience (years)	0-5	240	75.0
	6-10	48	15.0
	11-20	30	9.4
	>20	2	0.6

Note. Percentages may not sum to exactly 100% due to rounding.

4.2 Demographic variation in practices and risk perception

One-way ANOVA indicated a statistically significant difference in food safety practices across age groups ($F = 6.48$, $p = .02$). No other demographic subgroup comparisons reached significance for either food safety practices or risk perception (all $p > .05$; Table 2).

Table 2: *One-way ANOVA: demographic variation in risk perception and food safety practices*

Demographic variable	Risk perception F	Risk perception p	Food safety practices F	Food safety practices p
Gender	0.73	.40	0.56	.45
Marital status	7.23	.08	2.84	.92
Age	5.25	.06	6.48	.02*
Work status	3.23	.41	1.77	.17
Job experience	0.44	.72	3.58	.14

*Note. *p < .05. Values as reported in the source dataset; authors should re-verify degrees of freedom and exact F/p pairings against the original SPSS output before submission, as ANOVA cell values for marital status and work status warrant a consistency check.*

4.3 Descriptive Statistics, Reliability and Correlations

Descriptive statistics and bivariate Pearson correlations for the four study variables are presented in Table 3. Food safety knowledge (M = 3.92, SD = 0.43), food safety attitude (M = 3.90, SD = 0.54), risk perception (M = 3.95, SD = 0.40) and food safety practices (M = 4.00, SD = 0.44) all clustered toward the upper end of the five-point scale, indicating generally favourable knowledge, attitude and self-reported practice in this sample. All bivariate correlations were positive and statistically significant (p < .05). Food safety knowledge correlated most strongly with food safety practices (r = .84), followed by the knowledge-attitude correlation (r = .72) and the attitude-practices correlation (r = .69). Risk perception showed moderate correlations with the remaining variables (r = .47 to .54).

Table 3: *Means, Standard Deviations, Reliability Coefficients And Inter-Correlations Of Study Variables*

Variable	M	SD	1	2	3	4
1. Food safety knowledge	3.92	0.43	(.83)			

Variable	M	SD	1	2	3	4
2. Food safety attitude	3.90	0.54	.72*	(.83)		
3. Risk perception	3.95	0.40	.47*	.54*	(.83)	
4. Food safety practices	4.00	0.44	.84*	.69*	.54*	(.86)

*Note. N = 320. Cronbach's alpha reliabilities are shown in parentheses on the diagonal. *p < .05. The narrative reliability figures reported in the Methods (α = .83 knowledge, attitude and practices; α = .86 risk perception) and the diagonal values in this correlation matrix should be cross-checked against the original SPSS reliability output before submission, as the source materials contained a minor labelling inconsistency between the two.*

4.4 Direct effects: hierarchical multiple regression (H1, H2)

Hierarchical multiple regression was used to test the direct effects of food safety knowledge and food safety attitude on food safety practices. Both predictors were significant: food safety knowledge (β = 0.734, p < .001) and food safety attitude (β = 0.137, p < .001) together explained 72.6% of the variance in food safety practices (R^2 = .726). These results support H1 and H2.

Table 4: *Hierarchical Multiple Regression Predicting Food Safety Practices*

Predictor	β	R^2	ΔR^2
Food safety knowledge	0.734***		
Food safety attitude	0.137***	.726	.726

*Note. N = 320. ***p < .001. Dependent variable: food safety practices.*

4.5 Mediation Analysis (H3)

Mediation was tested using the Hayes PROCESS macro (model 4, 5,000 bootstrap samples). The direct effect of food safety knowledge on food safety practices, controlling for attitude, remained significant (β = 0.734, SE = 0.043, t = 16.93, p < .001), as did the effect of knowledge on the proposed mediator, attitude (β = 0.137, SE = 0.035, t = 3.97, p < .001). The indirect effect of food safety knowledge on food safety practices through food safety attitude was significant, as the 95% bootstrap confidence interval did not contain zero (indirect effect = 0.125, boot SE = 0.036, 95% CI [0.054,

0.195]). This indicates that food safety attitude partially mediates the relationship between knowledge and practice, supporting H3.

Table 5: *Mediation Analysis: Food Safety Attitude As Mediator Of The Knowledge-Practices Relationship*

Path	Effect	SE	t	p	95% Boot CI
Knowledge → Practices (direct, c')	0.734	0.043	16.93	< .001	-
Knowledge → Attitude (a path)	0.137	0.035	3.97	< .001	-
Knowledge → Attitude → Practices (indirect, ab)	0.125	0.036	-	-	[0.054, 0.195]

Note. N = 320. Bootstrap results based on 5,000 resamples with bias-corrected 95% confidence intervals. An indirect effect is considered significant when the confidence interval excludes zero.

4.6 Moderation Analysis (H4)

Moderation was tested using the Hayes PROCESS macro (model 1, 5,000 bootstrap samples), with food safety attitude as the focal predictor, risk perception as the moderator, and food safety practices as the outcome. In step 1, the demographic control variable accounted for a small but non-trivial share of variance (β = -0.102, R^2 = .009). In step 2, both food safety attitude (β = 0.781, $p < .001$) and risk perception (β = 0.548, $p < .001$) were significant predictors of practices. In step 3, the interaction term (attitude × risk perception) was significant and negative (β = -0.087, p = .005), and the addition of the interaction term improved model fit (R^2 = .528, ΔR^2 = .012). This indicates that risk perception moderates the attitude-practices relationship: the positive effect of attitude on practice was stronger among respondents with lower risk perception and weaker among those with higher risk perception, supporting H4.

Table 6; *Moderated Regression: Risk Perception As Moderator Of The Attitude-Practices Relationship*

Step / Predictor	β	R^2	ΔR^2
Step 1: control variable	-0.102	.009	.009
Step 2: food safety attitude	0.781***		

Step / Predictor	β	R^2	ΔR^2
Step 2: risk perception	0.548***		
Step 3: attitude × risk perception	-0.087**	.528	.012

*Note. N = 320. **p < .01, ***p < .001. Dependent variable: food safety practices.*

[Figure 2. Interaction plot, to be inserted: simple slopes of food safety attitude on food safety practices at low and high levels of risk perception, illustrating a steeper (stronger) slope for respondents with low risk perception and an attenuated slope for respondents with high risk perception.]

4.7 Summary of Hypothesis Testing

Table 7: *Summary Of Hypothesis Testing*

Hypothesis	Statement	Result
H1	Food safety knowledge → food safety practices (positive)	Supported
H2	Food safety attitude → food safety practices (positive)	Supported
H3	Food safety attitude mediates knowledge → practices	Supported (partial mediation)
H4	Risk perception moderates attitude → practices (weaker at high risk perception)	Supported

5. Discussion

5.1 Food Safety Knowledge and Practice

Consistent with H1, food safety knowledge exerted a strong, direct, positive effect on food safety practices (β = 0.734, p < .001), corroborating earlier work among mobile food handlers (Ismail et al., 2016) and household women (Naeem et al., 2018). A large majority of respondents correctly identified core hazards - for instance, 81% recognised that direct hand contact with ready-to-eat food risks bacterial contamination, and 74.5% correctly identified undercooked meat and eggs as a contamination risk - suggesting that the foundational knowledge base required for safe handling is reasonably well established in this urban sample. Nonetheless, specific unsafe behaviours persisted

alongside this knowledge: notably, 78% of respondents reported thawing raw food at room temperature, a practice inconsistent with recommended cold-chain handling and one that illustrates the well-documented gap between possessing knowledge and consistently enacting it (Osaili et al., 2011; da Cunha et al., 2019).

5.2 Food Safety Attitude and Practice

Attitude also exerted a significant, if comparatively modest, direct effect on practice ($\beta = 0.137$, $p < .001$), consistent with the Theory of Planned Behavior (Ajzen, 1991) and with prior findings from Bou-Mitri et al. (2018) and Soon et al. (2020). Most respondents expressed favourable attitudes toward core hygienic principles, including separating raw and cooked food and avoiding the refreezing of defrosted items. The relatively modest size of the direct attitude effect, set against the much larger direct effect of knowledge, suggests that in this household sample behaviour was driven primarily by what respondents knew rather than by generalised favourable sentiment toward safe handling - a pattern that differs somewhat from institutional food-service settings, where attitude has sometimes emerged as the stronger predictor (Soon et al., 2020).

5.3 The Mediating Role of Attitude

Food safety attitude partially mediated the knowledge-practice relationship, with the indirect path accounting for a modest but statistically robust share of the total effect. This finding is consistent with Kwol et al. (2020) and supports the broader KAP premise that knowledge shapes practice partly by first shaping attitude. Practically, this implies that food safety education limited to fact transmission is likely to leave some of its potential impact on the table: interventions that additionally cultivate favourable attitudes toward specific safe-handling routines - for example, framing hand hygiene and cross-contamination avoidance as achievable, low-effort habits rather than abstract risks - may yield larger downstream gains in practice than knowledge transmission alone.

5.4 The Moderating Role of Risk Perception

The moderation result constitutes the most novel contribution of this study. Risk perception weakened, rather than strengthened, the positive association between attitude and practice at higher levels, indicating that respondents who felt more vulnerable to foodborne illness did not necessarily convert favourable attitudes into safer behaviour more readily than those who felt less vulnerable. This pattern echoes da

Cunha et al. (2019), who documented a comparable disjunction between perceived risk and observed practice attributable to optimism bias, and is broadly consistent with Fischer et al. (2006), who cautioned that self-reported risk perception often reflects overconfidence rather than calibrated hazard appraisal. One plausible explanation is that a subset of high-risk-perception respondents experience anxiety without a corresponding sense of self-efficacy, a combination that the Health Belief Model identifies as insufficient to produce protective action in the absence of perceived response efficacy (Rosenstock, 1974). An alternative explanation is habituation: respondents who have long perceived food handling as risky may have adapted psychologically to that risk without altering behaviour accordingly. Distinguishing between these mechanisms is an important direction for future research.

6. Practical Implications

Government and policy makers: Findings support extending national food safety strategy beyond commercial food-service regulation to include household-level food safety education, given that domestic practice, not only commercial handling, materially affects population-level foodborne illness risk.

Food industry and retailers: Point-of-sale labelling and consumer guidance on safe storage and thawing (a domain in which unsafe practice persisted despite adequate knowledge) may help close the knowledge-practice gap identified here.

Public health and educational institutions: Because attitude only partially explains why knowledge translates into practice, and because high risk perception did not enhance practice, food safety curricula should pair factual content with attitude-shaping techniques and realistic, non-alarmist risk communication rather than fear-based messaging alone.

Health professionals: Clinicians and community health workers engaging with households, particularly those with young children, pregnant women, or elderly members, can use these findings to tailor food safety counselling toward specific high-risk behaviours (for example, unsafe thawing) rather than generic hygiene advice.

Food inspectors and researchers: The moderated-mediation pathway identified here offers a template for future household food safety assessments and highlights risk

perception, not merely knowledge, as an important variable to measure when evaluating intervention effectiveness.

7. Strengths and Limitations

7.1 Strengths

This study is among the few to model food safety attitude and risk perception jointly, as mediator and moderator respectively, within a single integrated pathway among household (rather than commercial) food handlers in a South Asian setting. The use of previously validated scales, bootstrap-based mediation and moderation testing, and a reasonably large sample (N = 320) relative to comparable household KAP studies strengthens confidence in the pattern of associations reported.

7.2 Limitations

Several limitations should be considered when interpreting these findings. The convenience sampling strategy and the concentration of respondents in two cities limit generalisability to Pakistan's wider population, and the sample skewed young and heavily toward students, who may not represent typical household food handlers. All measures were self-reported, and self-reported practice is known to diverge from observed behaviour (da Cunha et al., 2019; Redmond & Griffith, 2003), raising the possibility of social-desirability bias. The cross-sectional design precludes causal inference regarding the direction of the knowledge-attitude-practice pathway. Finally, data collection relied exclusively on an online questionnaire, which may have introduced selection effects related to internet access and digital literacy.

8. Future Research

Future studies should incorporate observed or video-recorded practice alongside self-report to quantify the extent of over-reporting identified in prior literature (da Cunha et al., 2019). Probability-based sampling across a broader range of Pakistani regions, socioeconomic strata, and age groups would strengthen external validity. Longitudinal or intervention designs are needed to test whether attitude-focused or risk-communication-focused interventions produce measurably larger gains in practice than knowledge-only interventions, and qualitative work could help clarify the psychological mechanism - overconfidence, habituation, or low self-efficacy - underlying the attenuating effect of high risk perception identified here.

9. Conclusion

This study demonstrates that food safety knowledge is a strong, direct predictor of domestic food safety practice, and that this relationship is partially transmitted through food safety attitude. Critically, risk perception does not simply add to safe behaviour; instead, it conditions the effectiveness of a favourable attitude, with the attitude-practice link weakening as perceived risk increases. These findings refine the conventional KAP model for household settings and suggest that food safety education initiatives are likely to be more effective when they combine knowledge transmission with deliberate attitude-building and calibrated, non-alarmist risk communication, rather than relying on knowledge or fear-based risk messaging in isolation.

References

Ababio, P., & Adi, D. (2012). Evaluating food safety practices among food handlers in Kumasi Metropolis. Internet Journal of Food Safety, 14, 35–43.

Ahmad, J., Javed, S., Khan, M., Shadman, S., Farooq, M., Saleem, M., ... Ilyas, N. (2021). Food safety knowledge, attitude, and practice of university students, KPK Pakistan, 2019: A cross-sectional study. Journal of Innovative Sciences, 7. https://doi.org/10.17582/journal.jis/2021/7.2.281.287

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

Akabanda, F., Hlortsi, E. H., & Owusu-Kwarteng, J. (2017). Food safety knowledge, attitudes and practices of institutional food-handlers in Ghana. BMC Public Health, 17(1), 40. https://doi.org/10.1186/s12889-016-3986-9

Akhtar, S. (2015). Food safety challenges—A Pakistan's perspective. Critical Reviews in Food Science and Nutrition, 55(2), 219–226. https://doi.org/10.1080/10408398.2011.650801

Al-Sakkaf, A. (2015). Domestic food preparation practices: A review of the reasons for poor home hygiene practices. Health Promotion International, 30(3), 427–437. https://doi.org/10.1093/heapro/dat051

Azanaw, J., Dagne, H., Andualem, Z., & Adane, T. (2021). Food safety knowledge, attitude, and practice of college students, Ethiopia, 2019: A cross-sectional study. BioMed Research International, 2021, e6686392. https://doi.org/10.1155/2021/6686392

Bou-Mitri, C., Mahmoud, D., El Gerges, N., & Jaoude, M. A. (2018). Food safety knowledge, attitudes and practices of food handlers in Lebanese hospitals: A cross-sectional study. Food Control, 94, 78–84. https://doi.org/10.1016/j.foodcont.2018.06.032

da Cunha, D. T., de Rosso, V. V., Pereira, M. B., & Stedefeldt, E. (2019). The differences between observed and self-reported food safety practices: A study with food handlers using structural equation modeling. Food Research International, 125, 108637. https://doi.org/10.1016/j.foodres.2019.108637

Da Vitória, A. G., de Souza Couto Oliveira, J., de Almeida Pereira, L. C., de Faria, C. P., & de São José, J. F. B. (2021). Food safety knowledge, attitudes and practices of food handlers: A cross-sectional study in school kitchens in Espírito Santo, Brazil. BMC Public Health, 21(1), 349. https://doi.org/10.1186/s12889-021-10282-1

de Freitas, R. S. G., da Cunha, D. T., & Stedefeldt, E. (2019). Food safety knowledge as gateway to cognitive illusions of food handlers and the different degrees of risk perception. Food Research International, 116, 126–134. https://doi.org/10.1016/j.foodres.2018.12.058

Evans, K. S., Teisl, M. F., Lando, A. M., & Liu, S. T. (2020). Risk perceptions and food-handling practices in the home. Food Policy, 95, 101939. https://doi.org/10.1016/j.foodpol.2020.101939

Fischer, A. R. H., Frewer, L. J., & Nauta, M. J. (2006). Toward improving food safety in the domestic environment: A multi-item Rasch scale for the measurement of the safety efficacy of domestic food-handling practices. Risk Analysis, 26(5), 1323–1338. https://doi.org/10.1111/j.1539-6924.2006.00813.x

Gettings, M. A., & Kiernan, N. E. (2001). Practices and perceptions of food safety among seniors who prepare meals at home. Journal of Nutrition Education, 33(3), 148–154. https://doi.org/10.1016/S1499-4046(06)60184-X

Ismail, F. H., Chik, C. T., Muhammad, R., & Yusoff, N. M. (2016). Food safety knowledge and personal hygiene practices amongst mobile food handlers in Shah Alam,

Selangor. Procedia - Social and Behavioral Sciences, 222, 290–298. https://doi.org/10.1016/j.sbspro.2016.05.162

Janz, N. K., & Becker, M. H. (1984). The Health Belief Model: A decade later. Health Education Quarterly, 11(1), 1–47. https://doi.org/10.1177/109019818401100101

Kwol, V. S., Eluwole, K. K., Avci, T., & Lasisi, T. T. (2020). Another look into the Knowledge Attitude Practice (KAP) model for food control: An investigation of the mediating role of food handlers' attitudes. Food Control, 110, 107025. https://doi.org/10.1016/j.foodcont.2019.107025

Maragoni-Santos, C., Serrano Pinheiro de Souza, T., Matheus, J. R. V., de Brito Nogueira, T. B., Xavier-Santos, D., Miyahira, R. F., ... Fai, A. E. C. (2021). COVID-19 pandemic sheds light on the importance of food safety practices: Risks, global recommendations, and perspectives. Critical Reviews in Food Science and Nutrition, 1–13. https://doi.org/10.1080/10408398.2021.1887078

Naeem, N., Raza, S., Mubeen, H., Siddiqui, S. A., & Khokhar, R. (2018). Food safety knowledge, attitude, and food handling practices of household women in Lahore. Journal of Food Safety, 38(5), e12513. https://doi.org/10.1111/jfs.12513

Odeyemi, O. A., Sani, N. A., Obadina, A. O., Saba, C. K. S., Bamidele, F. A., Abughoush, M., ... Aberoumand, A. (2019). Food safety knowledge, attitudes and practices among consumers in developing countries: An international survey. Food Research International, 116, 1386–1390. https://doi.org/10.1016/j.foodres.2018.10.030

Osaili, T. M., Al-Nabulsi, A. A., & Taybeh, A. O. (2021). Food safety knowledge, attitudes, and practices among Jordan universities students during the COVID-19 pandemic. Frontiers in Public Health, 9. https://www.frontiersin.org/article/10.3389/fpubh.2021.729816

Osaili, T. M., Obeidat, B. A., Abu Jamous, D. O., & Bawadi, H. A. (2011). Food safety knowledge and practices among college female students in north of Jordan. Food Control, 22(2), 269–276. https://doi.org/10.1016/j.foodcont.2010.07.009

Parra, P. A., Kim, H., Shapiro, M. A., Gravani, R. B., & Bradley, S. D. (2014). Home food safety knowledge, risk perception, and practices among Mexican-Americans. Food Control, 37, 115–125. https://doi.org/10.1016/j.foodcont.2013.08.016

Redmond, E. C., & Griffith, C. J. (2003). Consumer food handling in the home: A review of food safety studies. Journal of Food Protection, 66(1), 130–161. https://doi.org/10.4315/0362-028X-66.1.130

Rosenstock, I. M. (1974). The Health Belief Model and preventive health behavior. Health Education Monographs, 2(4), 354–386. https://doi.org/10.1177/109019817400200405

Rossi, M. de S. C., Stedefeldt, E., da Cunha, D. T., & de Rosso, V. V. (2017). Food safety knowledge, optimistic bias and risk perception among food handlers in institutional food services. Food Control, 73, 681–688. https://doi.org/10.1016/j.foodcont.2016.09.016

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

Soon, J. M., Wahab, I. R. A., Hamdan, R. H., & Jamaludin, M. H. (2020). Structural equation modelling of food safety knowledge, attitude and practices among consumers in Malaysia. PLOS ONE, 15(7), e0235870. https://doi.org/10.1371/journal.pone.0235870