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Communication Channels for Food Safety Awareness: A Cross-Generational Analysis of Seafood Consumer Perceptions

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Abstract

This study explores generational differences in perceived trust and preferred communication channels for seafood safety information among consumers in Kerala, India. A cross-sectional online survey was distributed via social media using convenience sampling and a structured questionnaire from March to December 2023, yielding 2,079 valid responses across four generational cohorts: Generation Z (32.9%), Millennials (33.0%), Generation X (22.0%), and Baby Boomers (12.1%). The survey assessed seafood purchasing behaviour, self-rated knowledge, perceived importance of safety information, and information-seeking preferences. Using ANOVA and Kruskal-Wallis tests, significant generational differences were identified in trust and communication preferences ($P<0.005$). Gen Z exhibited highest trust in digital platforms such as social media and television, while older cohorts—especially Gen X and Baby Boomers—favoured blogs and informational websites. Millennials and Gen X were more inclined toward product-specific sources like certifications and QR codes. In terms of communication preferences, Gen Z preferred digital formats and community outreach, whereas older generations leaned toward print media and in-store materials. These findings underscore the necessity of generationally tailored strategies. By aligning messages with trust patterns and media habits of each cohort, public health agencies and seafood stakeholders can enhance awareness, promote safe consumption, and reduce foodborne illness.

Introduction

Seafood, particularly fish, plays a critical role in ensuring food security in developing countries, contributing significantly to dietary protein intake. It serves as a vital source of nutrition for millions, offering essential nutrients like omega-3 fatty acids, vitamins, and minerals. However, the rising incidence of foodborne illnesses over the past two decades has generated substantial public health and economic concerns globally (United Nations, 2014; WHO, 2024). Safety issues related to seafood—such as microbial contamination, the use of harmful preservatives and additives, improper handling practices, and the growing influence of climate change—have further intensified these risks. These challenges not only pose health threats but also erode consumer trust underscoring the need for improved food safety measures (Maiti & Saha, 2022; Ryder et al., 2014).

The inherent complexity of the seafood supply chain, involving actors from fishers and processors to retailers and consumers, further compounds these risks (Ryder et al., 2014). Inadequate traceability and transparency within these networks often exacerbate safety concerns and reduce consumer awareness regarding proper handling practices. Recent research from India emphasizes that while traceability adoption can significantly improve safety and recall efficiency, small and medium-sized enterprises (SMEs) often face infrastructural and awareness-related constraints (Jose, 2023). In light of these gaps, effective risk communication becomes essential to bridge the knowledge divide and support consumers in making safe purchasing and consumption decisions. Previous studies have shown that increased awareness influences both food safety and sustainability-driven purchase decisions. Targeted communication strategies—especially those tailored to demographic profiles—have

emerged as effective tools for disseminating seafood safety information. Variables such as trust in information sources, individual health motivations, and demographic characteristics strongly influence how consumers access, interpret, and act on seafood safety information (Baptista et al., 2020; Lawley et al., 2019; Tediosi et al., 2015).

A critical element in designing such interventions is understanding how different consumer groups perceive trustworthiness across various information sources and how they prefer to receive messages. Trust in food labels, certifications, and traceability systems can reinforce consumer confidence, particularly for credence attributes that are not directly observable (Wu et al., 2021). Furthermore, the increasing reliance on digital media and the use of generational segmentation techniques have transformed both public health and commercial communication landscapes. Recent studies stress the value of aligning message design with the age-specific characteristics, values, and media behaviours of different generational cohorts (Chen et al., 2024; Sak & Petruk, 2024). Marketing strategies in the digital era increasingly leverage personalized content, social media, and multimedia tools to drive engagement and influence consumer decision-making (Muharam et al., 2024; Nurfatoni & Subhan, 2024).

In this context, digital marketing has evolved beyond generic outreach to embrace targeted and personalized messaging approaches. Research highlights that a strong online presence, coupled with tailored content and interactive platforms, significantly enhances consumer engagement (Hermayanto, 2023). Understanding generational differences in behaviours, preferences, and media use has become indispensable for effective marketing and public health communication. Notably, recent interventions targeting food safety education, particularly among younger populations, have shown promise. Mobile-based campaigns have demonstrated efficacy in improving safety practices, especially when message framing aligns with consumer motivations (Vezzoli et al., 2025). However, despite their potential, generation-sensitive communication strategies remain underutilized in seafood safety awareness initiatives—particularly in the Indian context.

Trust in information sources plays a vital role in shaping consumer behaviour. Studies have shown that credibility from authoritative or familiar sources significantly influences decision-making, especially during food safety incidents (Chen, 2013; Dierks & Hanf, 2006; Yang & Baker, 2024). Kornelis et al. (2007) identified consumer segments based on preferred information channels, sociodemographic characteristics, and trust levels, while Connelly et al. (2022) demonstrated that gain-framed, audience-tailored messages can enhance the effectiveness of seafood consumption guidance among vulnerable populations, such as pregnant women. Although communication is increasingly recognized as a critical component of seafood safety management, limited empirical research exists on how Indian consumers—particularly across generations—trust various information sources and prefer to receive seafood safety information. This gap is particularly relevant in Kerala, where seafood consumption is high, yet localized studies remain scarce. This study addresses this gap by examining generational differences in perceived trust and communication channel preferences related to seafood safety among consumers in Kerala. Specifically, it investigates (a) how trust in seafood safety information sources differs among Generation Z, Millennials, Generation X, and Baby Boomers, and (b) the preferred communication formats for each group. The study's insights aim to assist public health authorities, government agencies, and seafood industry stakeholders in designing generation-sensitive outreach strategies that promote safer seafood handling, informed consumer decision-making, and a reduction in foodborne illness risk.

Material and Methods

Participants

The study investigates perceptions of trust in seafood safety information sources and preferences for communication channels among generational cohorts of seafood consumers in Kerala, a costal state in southern India. The target population comprised seafood consumers aged 18 years and above who consumed seafood at least once a week. Participants were classified into generational cohorts based on age: Generation Z (18–26 years), Generation Y or Millennials (27–42 years), Generation X (43–58 years), and Baby Boomers (59+ years). To ensure adequate representation of each cohort, convenience sampling was employed with deliberate consideration for gender, education, occupation, and residential background. The survey was distributed using institutional networks, social media platforms (e.g., WhatsApp, Facebook, Telegram), university mailing lists, and seafood consumer forums to enhance reach across age groups and demographic profiles. A total of 3000 respondents were invited to participate in the survey, and 2484 participants completed the survey. Responses were screened for completeness and consistency and after excluding incomplete and duplicate submissions, a final sample of 2079 valid responses were retained for analysis.

Research Design

The study followed an exploratory, cross-sectional survey design using a semi-structured, self-administered questionnaire to collect data between March and December 2023. The questionnaire was administered online through social media platforms using Google Forms and Microsoft Forms, ensuring accessibility for

individuals with internet access while capturing diverse demographics. The survey instrument was designed and adapted from validated studies (Kornelis et al., 2007; Liu et al., 2014; Minnens et al., 2020; Mirosa et al., 2020; Pieniak et al., 2007, 2013; Redmond & Griffith, 2005; Tiozzo et al., 2018; Verbeke, 2008; Wang et al., 2013), and refined with insights from field interactions and expert consultation to ensure its relevance and comprehensiveness for seafood consumers in Kerala. Minor adaptations were made to reflect local seafood consumption and media access patterns in Kerala. The questionnaire development did not consider communication theories and frameworks, since the seafood consumers in Kerala are highly impulsive in their seafood purchase, consumption behaviour, and in the selection of communication channels for food safety awareness (Rejula et al., 2021; Sajeev & Joshy, 2024).

The questionnaire consisted of four sections. The first section collected demographic data through six questions on participants age, gender, education level, occupation, residence type, and frequency of seafood consumption. The second section assessed subjective knowledge and perception of seafood safety, including the importance of seafood safety awareness, and the frequency of seeking related information (Tiozzo et al., 2018; Verbeke, 2008). The third section examined trust in seafood safety information sources by asking respondents to rate their trust in eleven distinct information sources commonly assessed by consumers in Kerala. These sources were identified through literature and expert input (Ekanem et al., 2008; Liu et al., 2014; Pieniak et al., 2007). Responses were rated on a 5-point Likert scale ranging from 1 = Not at all trustworthy to 5 = Completely trustworthy and were recoded into broader categorical variables to facilitate group-wise comparisons and improve interpretability. The analysis considered the proportion of respondents indicating low trust (ratings of 1 or 2) and high trust (ratings of 4 or 5) (Table 1). The fourth section focused on preferred communication channels for receiving seafood safety information. Nine communication channels were identified based on existing literature (Lam et al., 2020; Mirosa et al., 2020; Wang et al., 2013). Participants rated their preference using a 5-point scale ranging from 1 = Strongly prefer to 5 = Do not prefer. High (1 and 2) and low (4 and 5) preference scores were used to determine the most and least preferred channels (Table 2).

To ensure face validity and cultural relevance, the draft questionnaire was reviewed by experts in food safety and consumer behaviour. The questionnaire was translated into Malayalam, the regional language of Kerala, and validated using a back-translation method to ensure accuracy and comprehension. Participation was voluntary, anonymous, and without incentives. Upon completing the survey, participants received a thank-you message and were encouraged to share the survey within their networks to increase reach. To ensure reliability and clarity, the questionnaire was pilot tested among 52 seafood consumers for face validity, and feedback was used to revise the instrument. The final questionnaire required approximately 10 minutes to

Table 1. Perceived trust in seafood safety information sources (Cronbach's alpha= 0.743)

Information source	*1 = Not at all trustworthy source, 5 = Complete trustworthy source*						
	n	Proportion of respondents who stated values 1 & 2	Proportion of respondents who stated values 4 & 5	Mean ranked values	Median ranked value	SD	
Traditional sources (TV, radio, magazines, newspapers)	2058	18.4	79.5	4.16	5	1.418	***Most trust worthy source***
Government organisations (Food Safety Department, Kerala Fisheries Department, FSSAI)	2066	22.7	71.8	3.84	5	1.511	
Health authorities and professionals (Doctors & Nutritionists)	2068	21.0	71.1	3.80	4	1.402	
Social media (Facebook, Instagram, WhatsApp, YouTube)	2058	27.7	65.4	3.64	4	1.511	
Educational and research institutions (CMFRI, CIFT)	2063	60.1	34.6	2.73	2	1.348	
Print media (books/ pamphlets/ brochures)	2062	63.2	29.7	2.68	2	1.344	
Product labels with certifications (FSSAI, FSSC, BRC, HACCP)	2051	64.3	31.4	2.43	2	1.612	
Local community events, (conferences or workshops)	2063	61.2	31.8	2.37	2	1.528	
Inter personnel networks (Family & friends)	2067	69.5	21.7	2.34	2	1.276	
Consumer advocacy groups (associations)	2061	66.8	25.6	2.30	2	1.524	
Online resources (websites, blogs, articles)	2055	85.3	12.2	1.92	2	1.083	***Least trust worthy source***
Local Seafood Retailers/ Markets	2065	78.2	14.4	1.89	1	1.275	

complete. While online distribution facilitated broad reach, it also introduced limitations. The study acknowledges potential self-selection bias, and the underrepresentation of digitally disconnected populations, especially older consumers or those from rural areas. These limitations are considered when interpreting the generalizability of findings. The reliability of the questionnaire was confirmed through Cronbach's alpha values ranging from 0.749 to 0.829, indicating good internal consistency. Validity was ensured through expert review and pilot testing.

Statistical Analysis

Data were analysed using SPSS (version 26.0). Descriptive statistics used to summarise the demographic characteristics of participants responses across survey sections. Chi-square tests and Cramer's V were applied to explore associations between categorical variables. To assess differences in trust in seafood safety information sources across generational cohorts, one-way ANOVA was conducted, followed by Tukey's Honest Significant Difference (HSD) test for post hoc pairwise comparisons between mean scores. Mean values were used to rank the sources from most to least trusted for interpretation.

For variables where data did not meet normality assumptions (tested using the Shapiro-Wilk test and visual inspection of histograms), non-parametric tests including Mann-Whitney and Kruskal-Wallis were applied to examine differences in preferred communication channels across generational groups (Kornelis et al., 2007; McKnight & Najab, 2010; Yang & Baker, 2024). Bonferroni Correction was applied to adjust for multiple comparisons, maintaining a significance threshold of $\alpha = 0.05$ (5%). Survey responses were categorized and transformed as required to enable appropriate statistical analysis and interpretation. As an exploratory study, the analysis did not employ multivariate regression or structural equation modelling approaches that require parameter estimation or model fit indices (e.g., RMSEA, CFI, TLI). Therefore, model fit measures are not reported. This decision was based on the nature of the research objectives and the structure of the data collected. The focus remained on cross-sectional group comparisons and identification of generational patterns rather than predictive modelling or latent structure testing.

Results

Respondent Demographics and Behavioural Characteristics

A total of 2,079 responses were analysed, with representation across generational cohorts, gender, education levels, occupations, and residential areas. The sample was distributed across generational groups as follows: Generation Z (32.9%), Generation Y (33.0%), Generation X (22.0%), and Baby Boomers (12.1%) (Figure 1). Gender distribution displayed the predominance of females (53.6%), with males constituting 46.3% and a small proportion of respondents identified as other (0.1%) in gender. Educational qualification ranged from secondary education (16.5%) to postgraduate degrees (26.0% master's, 24.4% PhD/equivalent professional). Students (37.4%) comprised the largest occupational group, followed by private employees (20.3%) and government servants (20.1%). Respondents from suburban areas formed (42.5%) of the respondent sample and urban areas (33.6%), followed by 23.9% residing in rural areas. Regarding the seafood purchase frequency, alternate-day buyers formed the largest group (42.8%), followed

Table 2. Preferred communication channels to be informed about seafood safety (Cronbach's alpha= 0.829)

Communication channels	n	0 = Ye, I prefer, 1 = No, I don't prefer				
		Proportion of respondents who stated values 1 & 2	Proportion of respondents who stated values 4 & 5	Mean ranked values	Median ranked value	SD
Mass media (TV & Radio)	2047	84.2	15.7	4.35	5	1.453
Social media platforms (Facebook, Instagram, and WhatsApp)	2062	68.4	29.4	3.73	5	1.678
Health professionals (doctors, nutritionists)	2066	64.4	32.9	3.57	4	1.676
Internet resources (websites, apps)	2065	62.9	35.1	3.53	4	1.779
Government and Educational resources (FSSAI, CMFRI, and CIFT)	2062	61.1	38.8	3.50	4	1.709
Retail Communication (Posters, pamphlets, and labels)	2061	51.3	47.1	2.87	4	1.727
Community Outreach Programs (Seminars, workshops, and health awareness)	2057	47.8	48.9	2.87	3	1.739
Product related channels (product labels/certifications/QR codes)	2064	40.7	53.7	2.72	2	1.720
Print media (Newspapers & magazines)	2071	27.2	71.4	2.25	1	1.675

Most preferred channel

Least preferred channel

by weekly buyers (34.4%) and daily buyers (22.8%). Nearly half (49.5%) of the respondents rated their "Knowledge of seafood safety" as very poor, and 47.2% rated the "Importance of seafood safety awareness" as slightly important. Most respondents (43.8%) reported that they "Rarely sought seafood safety information" while 28.6% stated they "Never sought such information".

Behavioural Characteristics of Seafood Consumer across Generations

Table 3 presents the socio-demographic analysis of seafood consumers in Kerala, highlighting relationships among generational cohorts (Gen Z, Millennials, Gen X, and Baby Boomers) and key behavioural variables. Significant behavioural differences were observed in purchase frequency, self-rated knowledge, importance of information, and frequency of seeking seafood safety information ($P<0.005$). Baby Boomers reported the highest proportion of daily purchases (36.3%), while Gen Z and Millennials predominantly engaged in alternate-day purchases (56.4% and 39.9%, respectively). 51.8% of Gen Z and 48.2% of Millennials rated their knowledge as 'Very poor', whereas Gen X and Baby Boomers had showed the highest proportions of "Good" knowledge on seafood safety (20.7% each). Most generations considered "seafood safety information", slightly important. The highest proportions of Millennials (17.8%) and Gen X (14.8%) considered seafood safety information to be 'very important.' Baby Boomers were most likely to report seeking seafood safety information as 'Rarely' (46.6%), while Millennials had the highest proportion of respondents seeking information "Often" (9.0%).

Perceived Trust in Seafood Safety Information Sources and Preferred Communication Channels

The analysis revealed statistically significant generational differences in perceived trust toward various seafood safety information sources. Respondents generally rated traditional media outlets—including television, newspapers, magazines, and radio—as the most trusted sources, with 79.5% of participants rating these as trustworthy (scores 4 & 5 on a 5-point scale), and a mean trust score of 4.16 (Table 2). This was followed by government organisations (71.8%), and health authorities and professionals (71.1%). Social media platforms such as Facebook, Instagram, WhatsApp, and YouTube were also notably trusted by a large share of respondents (65.4%), particularly among younger cohorts ($P<0.001$). Meanwhile, educational and research institutions, print media, and product certifications received moderate trust levels, with less than 35% of participants rating them highly. The least trusted sources were online resources like blogs and informal websites (12.2%), followed by local seafood vendors or markets (14.4%), and interpersonal networks such as family and friends (21.7%). These findings reflect a broader consumer tendency to prioritize institutional and regulated sources over informal or commercially involved actors in the seafood value chain.

Table 3 highlights respondents' preferences for communication channels to receive seafood safety information. Mass media (TV & Radio) was the most preferred channel, with 84.2% indicating strong preference. Despite its popularity, no significant generational difference was observed ($P=0.874$), suggesting broad acceptance across age groups. Social

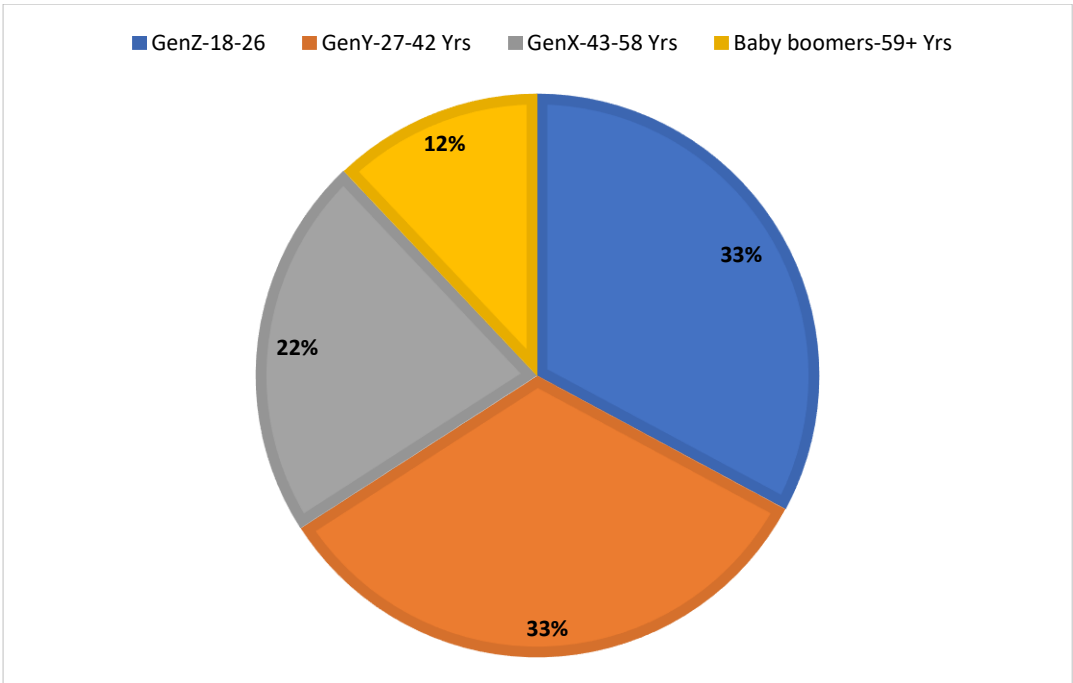

Figure 1. The identified generational cohorts.

media platforms (Facebook, Instagram, WhatsApp) ranked second, preferred by 68.4% of respondents, with significant generational variation (P<0.001), reflecting higher engagement among younger consumers. Health professionals were strongly preferred by 64.4% of respondents, with no significant generational differences (P=0.442), indicating consistent trust across cohorts. Internet resources (websites, apps) were preferred by 62.9%, showing significant variation across age groups (P<0.001), suggesting digital familiarity influenced preference. Similarly, government and educational sources (FSSAI, CMFRI, CIFT) were moderately preferred (61.1%), with no significant differences (P=0.486). Lower preference was seen for retail communication (51.3%) and community outreach programs (47.8%), both showing significant generational variation (P<0.001), indicating declining engagement among younger consumers. Product-related channels (labels, certifications, QR codes) received low preference (40.7%) and varied significantly by generation (P=0.001), possibly due to reduced attention to static packaging information. Print media was the least preferred (27.2%), with 71.4% expressing low preference and significant generational differences (P<0.001), indicating a decline in traditional print media relevance.

Impact of Generational Cohorts on Perceived Trust in Seafood Safety Information Sources

To examine differences in perceived trust toward various seafood safety information sources across generational cohorts, a one-way analysis of variance (ANOVA) was conducted (Table 4). The results revealed statistically significant generational differences in trust levels for all examined information sources. Television and radio emerged as the most trusted information sources overall, with a mean trust score of 4.16 (*SD=1.418*). The ANOVA results indicated a statistically significant difference across age groups (F=13.523, P<0.001, partial η^2=0.01956), with Gen Z (18–26 years) reporting significantly higher trust compared to Millennials (27–42 years), Gen X (43–58 years), and Baby Boomers (59+ years). Health professionals, including doctors and nutritionists, ranked second in terms of trust (M=3.80, SD=1.402). Gen Z exhibited significantly higher trust compared to Gen X and Baby Boomers (F=4.116, p=0.006, partial η^2=0.00595). Social media platforms (Facebook, Instagram, WhatsApp, YouTube) followed closely with a mean score of 3.64 (SD=1.511). The ANOVA revealed a highly significant difference across generations (F=21.250, P<0.001, partial η^2=0.03063), with Gen Z reporting markedly higher trust compared to all other age groups. Traditional print-based sources, such as food and science magazines, flyers, and leaflets, received comparatively lower trust ratings overall (M=2.68, SD=1.344).

However, Gen Z still rated these sources significantly higher than Gen X (F=4.281, P=0.005, partial η^2=0.00623). Community-based sources such as events and workshops were also rated low in trust (M=2.37, SD=1.528), with Gen Z expressing significantly higher trust than Gen X (F=3.492, P=0.015, partial η^2=0.00507), although the overall differences were less pronounced. Online resources—including websites, blogs, and online articles—were the least trusted sources across the board, with a mean trust score of 1.92 (SD=1.083). In contrast to the trend observed for most other sources, older cohorts (Gen X and Baby Boomers) showed significantly higher trust in online resources than Gen Z and Millennials (F=27.250, P<0.001, partial η^2=0.03888), suggesting a unique reversal in trust dynamics for this

Table 3. Percentage of distribution of the behavioural variables among the generational cohorts of respondents (contingency tables and chi-square test) [a]

Respondents (n)	n	Gen Z (32.9%)	Gen Y (33.0%)	Gen X (22.0%)	Baby boomers (12.1%)	p
Purchase frequency	2079					0.000
Daily		9.1	28.4	27.5	36.3	
Alternately		56.4	39.9	33.6	30.3	
Weekly		34.6	31.7	38.9	33.5	
Self-rated knowledge	2079					0.001
Very poor		51.8	48.2	49.3	47.4	
Poor		19.5	22.7	19.9	18.7	
Average		7.6	8.7	5.6	5.6	
Good		17.3	12.7	20.7	20.7	
Excellent		3.8	7.7	7.6	7.6	
Importance of information	2079					0.002
Not important		29.9	19.7	22.1	25.5	
Slightly important		46.1	48.0	47.6	47.4	
Moderately important		4.4	5.1	4.8	6.0	
Very important		10.7	17.8	14.8	12.7	
Extremely important		8.9	9.5	10.7	8.4	
Frequency of Seeking Information	2079					0.000
Never		35.0	26.5	24.7	23.9	
Rarely		45.1	43.1	41.5	46.6	
Sometimes		3.2	4.7	6.3	6.4	
Often		3.7	9.0	12.4	8.4	
Always		13.0	16.7	15.1	14.7	

Gen z= 18-26years, Gen y (Millennials)= 27-42 years, Gen x= 43-58 years, Baby boomers= 59 years and more, P>0.05, 0.001

particular medium. These findings highlight distinct generational patterns in trust toward seafood safety information sources. Younger cohorts, particularly Gen Z, tend to place greater trust in digital and interpersonal sources such as social media, health professionals, and even community events. In contrast, older cohorts demonstrate greater trust in more traditional or static formats, such as online articles and official websites.

Generational Differences in Preferred Communication Channels

The preferred communication channels for different generational cohorts were influenced by statistically significant differences in their responses, as revealed through the Kruskal–Wallis H test (Table 5). These findings underscore the heterogeneity in communication preferences shaped by age-related media consumption habits and digital literacy levels. Among the various communication channels, social media platforms exhibited marked generational variation. Significant differences were observed between Gen Z and Gen X (U=125159.500, P<0.05), as well as between Millennials and Gen X (U=121943.000, P<0.05). A similar pattern was noted between Gen X and Baby Boomers (U=48799.500, P<0.05), indicating that older cohorts were significantly less inclined to prefer social media compared to younger ones. These U-values reflect a consistent decline in preference scores among older generations, reaffirming that younger cohorts demonstrate a stronger engagement with social platforms as trusted sources for seafood safety information.

Internet-based resources—including websites, apps, and live chats—also showed robust generational disparities. Statistically significant pairwise differences were recorded between Gen Z and Gen X (U=100685.000, P<0.05), Gen Z and Baby Boomers (U=61877.500, P<0.05), and Millennials versus Gen X (U=98611.500, P<0.05). These results point to a generational digital divide, with younger consumers—particularly Gen Z—exhibiting higher comfort and trust in web-based sources for seafood safety content. The lower U-values in comparisons involving Baby Boomers reflect their relatively minimal engagement with such digital platforms. Print media (newspapers and magazines), often assumed to appeal to older audiences, also revealed significant generational differences. Contrary to common expectations, younger participants displayed notable preference levels. Significant pairwise differences were found between Gen Z and Gen X (U=118162.000, P<0.05), Gen Z and Baby Boomers (U=62963.000, P<0.05), and Millennials versus both Gen X (U=120754.000, P<0.05) and Baby Boomers (U=64413.000, P<0.05). These findings may reflect a nuanced shift among younger cohorts valuing credible, structured formats of information, especially in health and safety contexts.

Retail communication channels, including posters, pamphlets, and in-store displays, showed generational differences in several pairwise comparisons. Notable differences were identified between Gen Z and Millennials (U=170592.500, P<0.05), Gen Z and Gen X (U=121077.500, P<0.05), and Gen Z and Baby Boomers (U=58193.500, P<0.05). The direction of these U-values suggests that younger respondents, especially Gen Z, were more receptive to visual and point-of-sale information, possibly due to their stronger exposure to curated messaging in retail and commercial environments. In the case of product-related communication channels, which include product labels, certifications, and QR codes, generational variation was moderate but statistically significant. Significant pairwise differences were observed between Millennials and Gen X (U=137216.500, P<0.05), and between Millennials and Baby Boomers (U=77519.500, P<0.05). These results highlight Millennials' inclination toward traceability and informed decision-making, often enabled through technology-embedded packaging. Community outreach programs—such as seminars, webinars, and workshops—demonstrated considerable variation across generations. Significant differences were identified between Gen Z and Millennials (U=196355.500, P<0.05), Gen Z and Baby Boomers (U=69948.500, P<0.05), and Millennials versus Gen X (U=133491.000, P<0.05). Gen X and Baby Boomers also differed significantly (U=47543.500, P<0.05). The overall trend suggests that younger generations are more participatory in interactive and knowledge-sharing events, potentially due to higher educational exposure and social networking tendencies.

Table 4. Mean scores (1-5 Likert scale) and ranking of trust in seafood safety information sources across generational cohorts

Information source	n	Mean[a]	SD	Effect size[b]	F	p	Significant differences[c]
TV & radio	2058	4.16	1.418	0.01956	13.523	0.000	18-26>27-42, 43-58, and 59+
Health professionals (Doctors & Nutritionists)	2068	3.80	1.402	0.00595	4.116	0.006	18-26>43-58 and 59+
Social media (Facebook, Instagram, WhatsApp, YouTube)	2058	3.64	1.511	0.03063	21.250	0.000	18-26> All other cohorts
Food & science magazines/ Flyers/ Leaflets	2062	2.68	1.344	0.00623	4.281	0.005	18-26>43-58
Community events or workshops	2063	2.37	1.528	0.00507	3.492	0.015	18-26>43-58
Online resources (websites, blogs, articles)	2055	1.92	1.083	0.03888	27.250	0.000	43-58 and 59+>18-26 and 27-42

[a]Mean: all cohorts, [b]Effect size: Partial η^2, [c]Significant differences: Post Hoc results

Discussion

This study explored the associations between generational cohorts, trust in seafood safety information sources, and preference for communication channels to receive seafood safety awareness. By outlining the profile of seafood consumers in Kerala across generational cohorts, the findings provide actionable insights to inform seafood safety communication strategies.

Generational Differences in Seafood Safety Awareness and Behaviour

Significant generational differences were evident in seafood purchasing behaviours, knowledge levels, perceived importance of seafood safety information, and the frequency of seeking seafood safety information. Baby Boomers exhibited the highest frequency of daily seafood purchases, reflecting traditional dietary preferences, cultural norms, and their continued involvement in household food procurement. In contrast, Gen Z and Millennials reported less frequent purchasing patterns, indicative of a shift towards convenience, dining out, and greater detachment from daily food preparation routines. This aligns with findings by Güney and Sangün (2017), which identified generational differences in seafood consumption behaviour and associated younger generations with convenience-oriented food habits.

Self-rated knowledge of seafood safety varied significantly among generational cohorts. Baby Boomers and Gen X reported higher levels of awareness, likely attributed to lifelong exposure to food safety practices, intergenerational learning, and hands-on experience with seafood preparation. Traditional household roles and proximity to fresh seafood markets likely contribute to their seafood literacy. On the other hand, Gen Z and Millennials demonstrated significantly lower awareness, potentially due to increased reliance on ready-to-eat seafood products, lack of formal education on food safety, and the delegation of seafood purchasing to older family members. These findings are consistent with Baptista et al. (2020) and Forleo and Bredice (2023), who noted that younger generations tend to have limited knowledge of seafood safety. These differences underscore the impact of generational exposure and education on food safety practices. Lawley et al. (2019) found that higher education and older age are positively associated with food safety knowledge.

The study found that Gen Z and Millennials rated seafood safety information as less important, while Baby Boomers and Gen X assigned higher importance. This discrepancy may reflect higher perceived vulnerability among older cohorts, greater food safety literacy, and stronger cultural ties to traditional food handling. For younger generations, the perception of risk may be lower due to limited firsthand exposure to foodborne illness incidents or a stronger trust in the regulatory framework of food retail environments. Previous studies (Baptista et al., 2020; Wessells et al., 1996) have identified factors influencing seafood safety perceptions, including prior experience, exposure to risk, and recreational harvesting activities. Forleo and Bredice (2023) reported that nearly half of Gen Z consumers in Italy lacked awareness or sensitivity regarding seafood safety and sustainability, despite claiming knowledge about nutritional and safety implications. These findings suggest that communication campaigns targeted at younger cohorts must move beyond factual messaging to include emotional appeals, relevance to personal health, and integration with popular formats such as videos and peer-driven content.

Generational differences also emerged in the frequency of seeking seafood safety information. Baby

Table 5. Pairwise comparison for preferred communication channels with generational cohorts

Communication channel	Kruskal-Wallis H	Pair wise age comparison	U statistics	KSAD	Z	p
Social Media Platforms (Facebook, Instagram, WhatsApp, YouTube)	49.004	18–26 vs. 43–58	125159.500	0.182	-5.854	0.000
		27–42 vs. 43–58	121943.000	0.209	-6.535	0.001
		43–58 vs. 59 <	48799.500	0.115	-3.087	0.002
Internet Resources (Websites, Apps, Live Chats)	186.064	18–26 vs. 43–58	100685.000	0.315	-10.751	<0.001
		18–26 vs. 59 <	61877.500	0.250	-7.072	<0.001
		27–42 vs. 43–58	98611.500	0.334	-11.409	<0.001
		27–42 vs. 59 <	60760.000	0.269	-7.638	<0.001
Print Media (Newspapers & Magazines)	99.216	18–26 vs. 43–58	118162.000	0.201	-7.518	0.000
		18–26 vs. 59 <	62963.000	0.260	-6.919	0.000
		27–42 vs. 43–58	120754.000	0.188	-7.023	0.000
		27–42 vs. 59 <	64413.000	0.243	-6.497	0.000
Retail Communication Channels (Posters, Pamphlets, Labels)	102.795	18–26 vs. 27-42	170592.500	0.224	-8.769	0.000
		18–26 vs. 43–58	121077.500	0.000	-6.799	0.000
		18–26 vs. 59 <	58193.500	0.274	-7.690	0.000
Product-Related Channels (Product Labels/ Certifications/ QR Codes)	13.994	27-42 vs 43-58	137216.500	0.112	-3.377	0.002
		27–42 vs. 59 <	77519.500	0.122	-2.289	0.009
Community Outreach Programs (Seminars, Webinar, Workshops)	36.453	18–26 vs. 27-42	196355.500	0.130	-4.929	0.000
		18–26 vs. 59 <	69948.500	0.122	-3.958	0.000
		27-42 vs 43-58	133491.000	0.121	-4.075	0.000
		43–58 vs. 59 <	47543.500	0.138	-3.465	0.004

Standard significance level: α (alpha) = 0.05, Bonferroni correction: Adjusted α = 0.05/6 = 0.0083, Kolmogorov-Smirnov Absolute Difference (KSAD) reflects the maximum observed discrepancy between cumulative distributions for the groups

Boomers reported the highest proportion of rarely seeking seafood safety information, relying more on ingrained knowledge and past experiences. Conversely, Millennials were more likely to actively seek information, particularly through digital platforms. This aligns with Connaway et al. (2008), who found that Millennials frequently turn to personal networks for information, while Baby Boomers are more likely to rely on personal libraries and colleagues. The active online presence of younger generations and their comfort with mobile devices and social media underscores the importance of engaging them through digital seafood safety content. This also suggests a shift from passive to interactive learning environments, where consumers increasingly seek customized, on-demand safety information.

The generational differences observed in seafood safety behaviour likely reflect broader shifts in lifestyle patterns, digital information consumption, and evolving roles in food preparation. Older cohorts, shaped by traditional food systems and firsthand experience, tend to rely on ingrained knowledge and local cues such as freshness and vendor trust. In contrast, younger generations raised in digital and fast-paced environments depend more on third-party cues like labels, reviews, and influencer content. This shift reduces direct engagement in seafood handling unless information is engaging, personalized, and easily accessible. Cultural revival strategies—such as intergenerational cooking content or storytelling by older family members—may help bridge the awareness gap and foster shared responsibility for seafood safety.

Generational Difference in Trust in Information Sources for Seafood Safety

The findings revealed significant generational variations in trust and reliance on seafood safety information sources. Older cohorts, such as Baby Boomers and Gen X, demonstrated greater trust in traditional sources, including television and radio, government agencies, and health professionals. This is consistent with Yang and Baker (2024), who emphasised the credibility of conventional media among older demographics. In contrast, younger generations, particularly Gen Z, expressed a preference for digital platforms, including social media and user-generated content on social commerce websites. These generations were socialised in environments where institutional communication, expert guidance, and public broadcasting shaped food safety understanding, thus explaining their loyalty to authoritative sources. These findings support earlier research by Herrando et al. (2019), which observed that Gen Z tends to prioritise peer-driven content, while older cohorts favour information from institutional or company-generated sources.

Borkovich (2014) suggested that trust in online platforms is not strictly age-bound but is shaped by the perceived credibility, interactivity, and design of the source. Cabeza-Ramírez et al. (2022) further found that influencer marketing is increasingly effective for younger audiences when influencers are perceived as authentic and knowledgeable. Thus, engaging trusted digital voices and content creators with expertise in food and health can play a critical role in improving trust in seafood safety messaging. Nevertheless, the observed scepticism toward online resources by Gen Z may reflect rising digital misinformation, lack of regulation in food-related content, and limited seafood literacy, all of which can impair their ability to assess content credibility. Furthermore, this scepticism may also reflect a shifting perception of expertise, wherein traditional authorities are viewed as less relevant or out-of-touch with modern communication norms. Bridging this trust gap will require public institutions to adapt their messaging tone, adopt a more participatory approach, and collaborate with digital influencers who align with evidence-based health narratives.

Trust in food manufacturers and retailers also emerged as an important factor influencing consumer confidence in seafood safety. Consistent with Chen (2013), consumers' trust is influenced by the perceived transparency and responsiveness of these stakeholders in the aftermath of food safety issues. Older generations, influenced by past food safety events, continue to view health professionals, certified food labels, and nutrition counsellors as credible sources. These sources are often perceived as being backed by expertise and ethical responsibility. Mass media, despite its accessibility, was often seen as sensational or inconsistent, which undermines its trustworthiness. Government institutions, particularly the Food and Drug Administration (FDA) and Centre for Disease Control and Prevention (CDC), were regarded as scientifically sound and trustworthy, particularly by Baby Boomers and Gen X (Ekanem et al., 2008; Thomas & Feng, 2021).

Generational differences in communication preferences further complicate the dynamics of trust in communication channels. Younger cohorts, like Gen Z, prefer digital platforms and interactive content, while older generations, such as Baby Boomers and Gen X, rely more on traditional media or direct communication through trusted intermediaries (Herrando et al., 2019). While traditional media and institutional messaging may resonate with older audiences, younger cohorts are likely to respond more favourably to influencer-led campaigns or community-driven content. It is also important to note that while Gen Z demonstrates high digital engagement, they simultaneously show heightened concern for the authenticity and accuracy of online content. As such, misinformation mitigation strategies—such as platform verification, transparency labels, and embedded citations—can further strengthen trust in digital food safety messaging.

The decline in trust in expert advice noted by Wandel (2004) has been exacerbated by the explosion of user-generated content and shifting perceptions of

authority among younger users. To address the widening generational divide, future strategies should blend traditional and digital approaches. For younger generations, partnerships with health influencers, verified food bloggers, and interactive online campaigns could increase message penetration. At the same time, traditional media channels and community outreach should be maintained for older adults to ensure continuity and reassurance. Cross-generational trust-building can be further supported by public campaigns that promote transparency, include real-life testimonials, showcase food safety certifications, and utilise both expert and community narratives. In summary, effective seafood safety communication requires a dual approach—one that honours generational trust patterns while modernising authority structures through co-creation, credibility markers, and multi-modal storytelling.

Generational Difference in Communication Channels for Seafood Safety Information

The study revealed a clear generational divide in the preferred communication channels for receiving food safety information among seafood consumers of Kerala. Younger generations, such as Gen Z and Millennials, demonstrated a strong preference for digital communication platforms, including social media, internet resources, and online applications. This finding aligns with existing research highlighting the inclination of younger cohorts for online information sources due to their accessibility, searchability, and perceived trustworthiness (Dabija et al., 2018; Gao, 2023; Ma et al., 2017). Social media platforms like WhatsApp, Snapchat, and YouTube emerged as especially influential among these cohorts (Boulianne et al., 2024; Sultan, 2020). In contrast, older generations—particularly Baby Boomers and Gen X—exhibited a marked preference for traditional media, such as television, radio, and newspapers. These findings reinforce earlier observations that older and less digitally literate populations continue to rely heavily on conventional media due to established habits, perceived credibility, and ease of access (Tediosi et al., 2015; Tomczyk et al., 2022). This generational distinction underscores the necessity for multi-channel communication strategies that integrate both digital and traditional platforms to ensure that critical seafood safety information is disseminated effectively across the population. While younger generations value convenience and immediacy in content delivery, they also seek interactive formats—such as reels, short videos, Q&A forums, and mobile apps—that offer engaging and actionable information. This opens up an opportunity to incorporate behavioural nudges and gamified features into seafood safety education tools.

Among younger generations, social media platforms, particularly WhatsApp, Snapchat, and YouTube, emerged as favoured channels for receiving food safety information. Similar trends have been observed in other studies, which highlighted the potential of leveraging these platforms to engage younger audiences effectively (Abdulsalam & Bakarman, 2021). The preference for digital platforms among Gen Z and Millennials is largely attributed to their familiarity with technology and its role in their daily lives. This generational shift highlights the increasing reliance on digital platforms for information, contrasting with older generations who continue to favour traditional media due to established habits and ease of access. By identifying the trusted and preferred mediums for disseminating seafood safety information, the research provides insights into designing tailored messages that improve seafood handling and consumption practices and promote public health awareness related to food safety. The study seeks to reduce foodborne illness risks associated with seafood and foster informed decision-making across generational cohorts.

Despite the growing preference for digital platforms, the role of traditional health professionals—such as doctors and nutritionists—remains highly significant, especially among older generations. These professionals are widely trusted as credible sources of food safety information, including advice on seafood consumption (Chen et al., 2019; Wandel, 2004). However, barriers such as limited time and perceived patient disinterest may hinder the effective delivery of food safety education in healthcare settings (Chen et al., 2019). Additionally, gaps in healthcare providers' knowledge about seafood risks and benefits have been identified, potentially affecting the quality of guidance offered. To improve communication efforts, it is essential to equip healthcare providers with science-based, accessible resources that enhance their ability to educate the public.

The findings underscore that a one-size-fits-all approach to seafood safety communication is unlikely to be effective. The diverse generational preferences for communication channels and media usage patterns necessitate tailored strategies to improve awareness and engagement. Furthermore, hybrid communication models that combine mass media campaigns with localised, culturally sensitive digital outreach can help bridge generational divides. For example, partnerships with local fish markets, community health workers, and regional influencers may facilitate trust-based dissemination. By aligning communication efforts with the preferences of different age groups and ensuring that healthcare professionals are adequately supported with relevant resources, seafood safety communication can be more effective across all demographics.

Implications for Public Health Communication Strategies

The findings of the study underscore the significance of generational differences in seafood safety concerns, highlighting the need for tailored

communication strategies to address these differences. Public health initiatives should emphasise the risks associated with seafood consumption, such as environmental contaminants and the importance of proper cooking practices. These initiatives must leverage diverse communication channels, including digital platforms, mass media, and community-based programs, to effectively reach various demographic groups. Importantly, multi-level messaging should be considered—targeting both household practices and systemic issues such as seafood adulteration, traceability, and market hygiene.

However, the relationship between information and behaviour is multifaceted. Providing knowledge alone does not guarantee desired behavioural changes, as factors such as cultural values, personal beliefs, and trust in information sources significantly influence behavioural outcomes. Thus, public health campaigns must integrate these elements to ensure that the information leads to effective change. Effective communication channels for seafood safety include television, radio, posters, leaflets, newspapers, cookbooks, magazines, social media, and reminder aids (Frewer, 2011). Interactive approaches, such as direct engagement through healthcare providers or tools like FishChoice and ChooseYourFish, have been shown to be more effective in building trust and promoting safer practices compared to passive methods (Dinh et al., 2023; Minnens et al., 2020). Demographic factors such as age, education, and gender influence seafood safety awareness. For instance, women and individuals with higher education levels tend to exhibit greater risk awareness and safer seafood handling practices (Baptista et al., 2020). In Kerala's context, integrating seafood safety awareness with broader community nutrition programs (such as ICDS or NRHM) may enhance reach and uptake. Combining digital education tools with on-ground demonstrations in Anganwadi's, fish markets, and schools could make interventions more inclusive.

Despite recognising fish as a nutritious food, consumers in Kerala display limited awareness of specific health benefits, and few exhibit the habit of checking packaging information for quality or safety details before purchasing. These observations highlight the critical need for targeted interventions such as awareness campaigns, educational programs, and government initiatives. Such efforts could promote informed purchasing practices, encourage consumer vigilance against adulteration, and address broader concerns including transportation methods, market cleanliness, and the lack of certification systems (Maiti & Saha, 2022; Rejula et al., 2021). The implementation of visual cues such as QR codes or smart labels that provide real-time traceability, freshness, or safety tips may enhance consumer engagement across age groups—particularly for tech-savvy younger audiences. Future research should focus on assessing the effectiveness of targeted interventions and investigating region-specific challenges in seafood safety education. Addressing barriers such as time constraints and resource limitations will be crucial in developing practical and consumer-friendly educational strategies. These efforts will contribute to a more holistic approach to improving seafood safety practices and enhancing public health outcomes.

Conclusions

This study provided critical insights into seafood safety awareness by examining generational differences in trust and preferred communication channels among seafood consumers in Kerala. It identified that while Gen Z and Millennials predominantly rely on digital platforms such as social media, websites, and online forums, older cohorts like Baby Boomers and Gen X place greater trust in traditional media sources including newspapers, television, and radio. These preferences are influenced by varying levels of technological familiarity, risk perception, and cultural practices associated with seafood consumption and food safety behaviours. The findings underscore the necessity for a diversified and inclusive communication strategy that accommodates the informational needs of all age groups. Public health authorities, seafood marketers, and policymakers should prioritize multi-channel outreach that blends traditional media with innovative digital tools. For younger consumers, interactive, visually engaging, and mobile-accessible content may improve information retention and behaviour change. Meanwhile, leveraging trusted traditional channels will ensure continued engagement with older demographics. Ultimately, the study emphasizes that generationally tailored, transparent, and trust-building communication efforts are essential to improve seafood safety awareness, reduce foodborne risks, and contribute to public health protection across Kerala. Future interventions should also consider integrating educational programs and cross-generational engagement approaches to foster shared responsibility for seafood safety within households and communities.

Ethical Statement

This study involved human participants through a survey and was conducted in accordance with the ethical principles outlined in the 1964 Declaration of Helsinki. Ethical review and approval were waived by the Ethics Committee of the School of Industrial Fisheries, Cochin University of Science and Technology (CUSAT), as the study maintained respondent anonymity and did not involve sensitive personal data. All data collection procedures followed ethical guidelines in accordance with CUSAT's ethical standards, particularly those promoted by the Centre for Integrity in Research and Ethics (ICREP). Informed consent was obtained from all participants, who were informed that their responses would remain anonymous, participation was entirely

voluntary, and confidentiality would be maintained.

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Author Contribution

A.V. (Corresponding Author) led the conceptualization, methodology, data collection, data analysis, writing, review & editing. M.S.N. contributed to conceptualization, methodology, supervision, data analysis, review & editing. All authors reviewed and approved the final manuscript.

Conflict of Interest

The authors declare that they have no conflict of interest.

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