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Analysis of Public Knowledge, Attitudes, and Practices in Food and Drug Selection in Indonesia

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Abstract

As consumers, the public plays a vital role in ensuring the safe and appropriate use of products. This study aimed to assess awareness of food and drug safety and quality among the Indonesian population. Using a cross-sectional survey, the authors measured public awareness across three key dimensions: knowledge, attitudes, and practices. Data were collected from 20,610 respondents aged 17–65 years from 34 provinces in Indonesia. The survey approach employed a three-stage stratified sampling design. Data were collected through structured face-to-face interviews, and the results were presented as an index ranging from 0 to 100 (low to high awareness). The respondents demonstrated good knowledge (92.85), attitudes (90.46), and practices (80.97). The average overall Awareness Index was 88.09. The authors observed significant variations by region, age, education, and occupation, but not by sex. The gap between knowledge and attitudes, and practices can be regarded as a public health concern. Awareness of food and drug safety and quality that does not manifest in behavioral practices does not protect consumers from harm.

Keywords: attitudes, drug safety, food safety, knowledge, practice

Introduction

Due to its vast geography, sociocultural diversity, and inconsistent regulatory enforcement, Indonesia faces an ongoing challenge in ensuring drug and food safety. Although the Indonesian Food and Drug Authority (FDA) has aligned its framework with global standards, gaps in information access, public awareness, and compliance persist. According to Statistics Indonesia (2022), about 50% of household spending goes on food and beverages,[1] highlighting their economic importance. While healthcare expenditure is lower, it remains crucial, as it influences drug access and use. Therefore, ensuring the safety and quality of food and pharmaceutical products is essential for consumer protection and public health.

In Indonesia, ingestible products are regulated by the Indonesian FDA, which ensures product safety, efficacy, and quality through pre- and postmarket control.[2] National postmarket surveillance between 2019 and 2022 identified thousands of noncompliant and unregistered products, including 4,140 cosmetics, 1,788 traditional medicines, and 1,624 pharmaceuticals.[3] The continued availability of such products poses health risks and erodes public trust in the regulatory system. In 2023, public spending in Indonesia on over-the-counter drugs (42%) nearly matched that on prescription drugs (39%).[4] This is indicative of a high rate of self-medication and a corresponding need for consumer vigilance in choosing safe, high-quality products. Such products comply with national quality and safety standards, ensuring their efficacy and avoiding health risks. They undergo premarket evaluation and postmarket surveillance by the Indonesian FDA and are granted marketing authorization prior to distribution. The World Health Organization (2021) emphasizes that product safety and quality assurance require compliance with technical specifications, the absence of contaminants, and appropriate use by consumers according to approved indications.[5]

Safe, high-quality drug and food products are fundamental to public health and the overall well-being of society. Inadequate quality control and exposure to unsafe products can lead to severe health consequences and a decline in public trust.[6] Therefore, effective regulatory oversight is essential to ensure that products comply with regulations and to maintain public confidence in health systems.

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Indonesia's challenges reflect global issues relating to consumer protection. Unsafe, counterfeit, and substandard products pose major public health risks, especially in low- and middle-income countries. Studies show that public awareness is crucial to reducing these risks and strengthening regulatory systems. Despite ongoing communication and education by the Indonesian FDA, systematic evaluation of public understanding and practices on drug and food safety remains limited. In China, Ding *et al.* found that while consumers had a good understanding of the reasons for antimicrobial use and its importance, and had positive attitudes toward it, their behaviors did not fully align with these attitudes.[7] Liu *et al.* reported that Chinese consumers place a high value on safety labels and are willing to pay more for reliable product information.[8] Similarly, in Saudi Arabia, Almaghrabi found that consumers trust information from national authorities over influencers, with higher education linked to greater awareness and critical judgment.[9]

Public awareness is a cornerstone of consumer protection. Public knowledge, attitudes, and practices (KAP) significantly influence how individuals identify, select, and use ingestible products. A well-informed public is better able to detect unsafe or counterfeit products, adhere to usage instructions, and report violations to authorities.[10,11] Numerous studies have demonstrated that the KAP framework is an effective means of evaluating community engagement with drug and food safety and identifying areas that need targeted interventions.[10,11] For instance, individuals with higher awareness of food hygiene practices are less likely to engage in risky behaviors that lead to contamination and foodborne diseases.[12] Moreover, consumer education improves rational drug use, enhances adherence to medication guidelines, and reduces the circulation of unregulated generics and unregistered drugs.[13] However, in Indonesia, empirical national data on public awareness of drug and food safety are scarce.

The Indonesian FDA has implemented various initiatives to ensure the safety of these consumables, including public education and outreach. However, their effectiveness has not been systematically evaluated. There is also limited evidence on how public awareness varies between regions and the relationship between levels of public awareness and regulatory and educational interventions. Therefore, this study aimed to assess the awareness, knowledge, and practices of the Indonesian population regarding the safety and quality of ingestible products. It is the first of its kind in Indonesia, providing nationwide quantitative data on public awareness using a standardized index. It offered evidence-based insights and reflects the efficacy of regulatory and communication programs. The findings were expected to inform policymakers, particularly the Indonesian FDA, and to contribute to the design of segmented communication strategies and public health interventions that strengthen consumer protection and improve population health outcomes.

Method

This study employed a quantitative, cross-sectional design. Primary data were drawn from a nationally representative household survey conducted between July and September 2024. Enumerators visited respondents' households and conducted face-to-face interviews using a structured questionnaire. Data collection was implemented using computer-assisted personal interviewing (CAPI) to ensure standardized administration and minimize data entry errors. The target population for this study was the Indonesians. Eligible respondents were aged 17–65 years, in good physical and mental health, and users of drug and food products, including pharmaceuticals, traditional medicines, health supplements, cosmetics, and processed foods.

A stratified three-stage random sampling approach was used to ensure that the sample was representative of Indonesia's heterogeneous population. In the first stage, census blocks were stratified by province and urban–rural classification. In the second stage, households were systematically selected within each census block. In the third stage, one eligible respondent per household was randomly chosen. The sampling frame covered all 34 provinces, 509 districts/cities, 1,770 subdistricts, and 2,055 villages or urban neighborhoods in Indonesia. A total of 20,610 respondents were surveyed, providing representative estimates at the national (±1% margin of error) and provincial (±7% margin of error) levels.

The questionnaire was developed using the KAP framework[14] and drawing on the *Cek KLIK* (check packaging, label, distribution permit, and expiration date) variables, representing the key practices recommended by the Indonesian FDA communication, information, and education (CIE) program.[15] The questionnaire was validated and deemed appropriate for research use. It consists of 23 validated items with good internal consistency (Cronbach's alpha = 0.83). A Cronbach's Alpha value ranging from 0.80 to 0.89 indicates good internal consistency, demonstrating that the instrument is reliable and the items measure the construct consistently.[16] The data gathered comprised demographic characteristics (region, sex, age, marital status, education level, and occupation), knowledge of the Indonesian FDA, and KAP related to the selection, purchase, and consumption of five categories of the Indonesian FDA-regulated products.[17]

The collected data were analyzed using R, an open-source statistical software package, version 4.4.0. Descriptive statistics (mean) were used to summarize respondents' demographic characteristics (region, sex, age, marital status, education level, and occupation) and awareness levels. Inferential analyses, including one-way analyses of variance (ANOVA) and Pearson correlation tests, were performed to examine the relationships between demographic factors and awareness indicators. The resulting scores were used to create the National Awareness Index, which was calculated using several systematic steps. First, the mean and standard deviation for each question were determined, and the responses were standardized to z-scores. These standardized values were then weighted and averaged by aspect for each product category. The mean scores were normalized to a 0–100 scale and adjusted using respondent weights to ensure representativeness. Aspect scores were then obtained by dividing the total normalized values by the sum of respondent weights. Aspect indices were derived from the weighted averages of commodity scores. Finally, the National Awareness Index was derived from the aggregated KAP scores for each product type. Each KAP component was weighted according to question importance, population proportion, and product weight. Scores were then categorized into five ranges: very poor (≤45.00), poor (45.01–60.00), fair (60.01–75.00), good (75.01–90.00), and excellent (≥90.01). These ranges were based on the frequency distribution of the survey data on a normal distribution curve.[18]

Results

A total of 20,610 respondents aged 17–65 years, representative of Indonesia's adult population, participated in the survey. The response rate was 99.95%. Of the respondents, 60.19% resided in urban areas and 39.81% in rural areas; 50.57% were male and 49.43% female. The largest age group was 36–50 years (34.46%), and the most common educational level was senior high school or equivalent (45.07%). The predominant occupations were homemaker (29.65%), employee/worker (23.45%), and entrepreneur (21.82%). The high proportion of homemakers aligns with established national demographic data and typical respondent availability in household surveys.[19] Statistics Indonesia parameters were used for weighted analyses to adjust for demographic imbalances and ensure representativeness across genders, ages, occupations, and regions. The demographic profile of the respondents is presented in Table 1.

Table 1. Frequency Distribution of Respondent Characteristics (n = 20,610)

Category	Frequency	Percentage (%)
Region		
Urban	11,835	60.2
Rural	8,775	39.8
Sex		
Male	8,703	50.6
Female	11,907	49.4
Age (years)		
>50	5,388	20.5
36–50	8,123	34.4
25–35	4,747	28.0
<25	2,352	17.1
Marital Status		
Married	15,924	75.1
Single	3,119	20.4
Divorced	1,567	4.5
Education Level		
Higher education	2,312	8.6
Senior high school or equivalent	8,929	45.1
Junior high school or equivalent	4,140	21.9
Elementary school or uneducated	5,229	24.4
Occupation		
Housewives	7,094	29.7
Employee/ staff	4,423	23.5
Self-employed	3,778	21.8
Farmer or fisher	3,247	14.0
Student	872	5.0
Unemployed	933	5.0
Other (i.e., retiree, freelancer)	263	1.1

Table 2 presents the Public Awareness Index and the average scores of respondents on each component across the five product categories: pharmaceuticals, traditional medicines, health supplements, cosmetics, and processed foods. The results showed an overall Public Awareness Index regarding drug and food product quality and safety of 88.09, which falls into the "good" category. The average score for the knowledge component was 92.85 ("very good"). For the attitude component, the average score was 90.46 ("very good"), both of which were higher than that for the practice component, which was 80.97 ("good"). Within the five categorical score levels, the current national score on the Awareness Index falls within the "good" category.

Table 2. Indonesian Public Knowledge, Attitudes, and Practices of Products by Type (n = 20,610)

Aspect	Score					Index
	Pharmaceuticals	Traditional Medicines	Health Supplements	Cosmetics	Processed Food	
Knowledge	95.14	91.03	90.31	91.36	94.71	92.85
Attitudes	91.60	89.90	89.80	89.63	90.51	90.46
Practices	84.57	79.46	78.02	80.87	80.54	80.97
Awareness	**90.44**	**86.80**	**86.04**	**87.29**	**88.59**	**88.09**

An ANOVA was conducted to compare the Public Awareness Index across various demographic categories (Table 3) and to examine scores for knowledge, attitude, and practice across different demographic groups (Table 4). The ANOVA results indicated that the Public Awareness Index differed significantly (p-value <0.05) across the following demographic groups: region, age, education level, and occupation. More highly educated respondents demonstrated greater awareness than those with lower levels of education. This pattern suggested that education exerts a meaningful influence on public awareness, likely through enhanced access to credible information sources and better capacity to interpret safety-related messages. The ANOVA results also identified significant differences in knowledge and attitudes according to the region, age, education level, and occupation. There were significant differences in practices according to respondents' region, age, sex, education level, and occupation. This study found that respondents with lower educational attainment were predominantly located in rural areas. A correlation analysis was conducted to evaluate the relationships between knowledge, attitudes, and practices as components of public awareness. The findings are summarized in Table 5.

Table 3. Analysis of Public Awareness Index Scores by Demographic Characteristics (n = 20,610)

Variable	Awareness Index	Analysis of Variance	
		F	p-value
Region**			
Urban	89.35	25.44	<0.001
Rural	86.20		
Age**			
<25-year-olds	89.50		
25–35-year-olds	89.64	33.09	<0.001
36–50-year-olds	88.46		
>50-year-olds	84.21		
Sex*			
Male	87.83		
Female	88.37	2.92	0.088
Education Level**			
Elementary school or uneducated	82.17		
Junior high school or equivalent	87.42	80.55	<0.001
Senior high school or equivalent	90.57		
Higher education	93.64		
Occupation**			
Unemployed	87.05		
Student	88.65		
Housewives	88.44		
Employee/staff	89.42	14.59	<0.001
Self-employed	89.61		
Farmer or fisher	82.66		
Other (i.e., retiree, freelancer)	91.76		

Notes: * = not significant, ** = significant, significance level: 95%

Table 4. Analysis of Public Knowledge, Attitude, and Practice Scores of Survey Respondents by Demographic Characteristics (n = 20,610)

Variable	Knowledge	Analysis of Variance		Attitude	Analysis of Variance		Practice	Analysis of Variance	
		F	p-value		F	p-value		F	p-value
Region									
Urban	94.21	25.28	<0.001	91.04	6.51	0.011	82.78	24.02	<0.001
Rural	90.80			89.58			78.22		
Age (years)									
<25	95.26	35.81	<0.001	91.39	11.69	<0.001	81.86	28.83	<0.001
25–35	94.59			90.84			83.48		
36–50	93.17			90.75			81.46		
>50	87.96			88.70			75.97		
Sex									
Male	92.92	0.1	0.752	90.42	0.09	0.768	80.14	12.03	<0.001
Female	92.79			90.51			81.81		
Education Level									
Elementary school or uneducated	85.90	66.69	<0.001	87.42	36.68	<0.001	73.19	75.82	<0.001
Junior high school or equivalent	92.82			90.07			79.37		
Senior high school or equivalent	95.72			91.61			84.38		
Higher education	97.66			94.07			89.18		
Occupation									
Unemployed	92.25	13.86	<0.001	90.44	9.26	<0.001	78.45	10.42	<0.001
Student	95.15			90.16			80.64		
Homemaker	92.69			90.65			81.99		
Employee/ staff	94.35			91.31			82.59		
Self-employed	94.77			91.37			82.69		
Farmer or fisher	86.88			87.05			74.04		
Other (i.e., retiree, freelancer)	95.58			94.10			85.61		

Table 5. Analysis of the Correlations Between Respondents' Knowledge, Attitude, and Practice Scores on the Public Awareness Index

Correlation	Practice score	Knowledge score	Attitude score
Practice score	1	-	-
Knowledge score	0.599**	1	-
Attitude score	0.521**	0.382**	1

Notes: **p-values <0.01 (two-tailed) were considered statistically significant

Discussion

This study highlighted meaningful variations in public awareness of product safety and quality considerations across sociodemographic groups, suggesting that awareness was shaped not only by individual factors such as education and occupation, but also by contextual factors, including urban or rural residence. The higher awareness scores among urban and highly educated respondents might reflect greater exposure to digital information channels and public campaigns. In contrast, lower awareness in rural and less educated respondents might be attributable to reduced access to information and lower exposure to regulatory messages.

The sex distribution of respondents was roughly equal; however, the largest occupation group was housewives. This result reflected the pivotal role of women as primary decision-makers in household consumption of ingestible products. Lim *et al.* argue that the higher proportion of women in similar surveys across Asia reflects their responsibility for food purchases rather than a sampling imbalance.[20] Sariyev *et al.* found that women's participation in household decision-making significantly improves diet quality and food security.[21]

Similarly, Nurhayani *et al.* found that housewives' education and knowledge are closely associated with household self-medication practices, indicating that their decisions strongly influence household health behaviors.[22] Toneu *et al.* showed that women in Marrakech, Morocco, possess three times as much knowledge about medicinal plants as men. This is linked to their responsibility for cooking and caring for the family, placing them in the decision-making role regarding household food use and traditional medicine.[23] Therefore, the high proportion of housewives among the study population reflected sociocultural reality rather than selection bias. The largest age group in this study was 36–50-year-olds (34.46%), and the education level was senior high school (45.07%). Statistics Indonesia stated that the general educational profile of Indonesians is senior high school (30.85%).[24]

This study provided an overview of the Indonesian population's Awareness Index regarding the selection of safe, high-quality drugs and food. It further examined differences within and between participants in scores on the KAP components that comprise the index. This study found that, while scores for knowledge about (92.85) and attitudes toward (90.46) drug and food safety were very good, those for related behavioral practices (80.97) were slightly lower. This incongruity suggested that, although people understand and value product safety, their translation into behavioral implementation is inconsistent. Such knowledge-practice discrepancies are common in public health. Previous studies

have also found that knowledge alone is insufficient to modify behavior. There must also be motivation, a supportive environment, and reinforcement. Information dissemination must be complemented by behavioral interventions.[25,26] A previous study noted that behavioral change does not automatically occur simply because individuals have adequate knowledge, as evidenced by hygiene education programs that have failed to produce significant behavioral changes.[27] A high level of knowledge about food safety will have little impact if the individual has a careless attitude, hindering the proper implementation of food-handling practices.[28]

Overall, the national Public Awareness Index stood at 88.09, indicating strong awareness of the requirements for selecting safe, high-quality consumables. By product category, awareness was highest for pharmaceuticals (90.44; very good), followed by processed foods (88.59; good). Awareness of safe purchasing practices for cosmetics (87.29), traditional medicines (86.80), and health supplements (86.04) was also good, but there was room for behavioral improvement. These results indicated that, while awareness levels were encouraging, maintaining consistent reflective practices remained a challenge. Moreover, there were disparities among demographic groups that need to be addressed. ANOVA results revealed statistically significant differences in awareness levels across region, age, education level, and occupation. This study found no significant difference between males and females, suggesting that health communication campaigns have been equally accessible to both sexes. Nonetheless, ensuring sex-neutral communication that remains sensitive to cultural norms is essential to maintaining balanced engagement.

Urban respondents exhibited higher levels of awareness than their rural counterparts, likely due to greater access to information, digital infrastructure, and market surveillance. These findings highlighted the need to strengthen public education and outreach programs in rural and remote areas. Community-based interventions can be delivered in collaboration with village governments, local health cadres, and mobile information units to ensure equitable information access. Strengthening the Indonesian FDA's communication with the public and integrating drug and food safety education into local government, education office, and health office programs in low-access regions may further improve awareness.

This study also found that age influenced awareness levels, with younger respondents (<35 years) demonstrating higher awareness than older respondents (>35 years). This difference might be due to younger individuals' greater exposure to digital health promotion and social media campaigns. Older people were more likely to rely on traditional information sources. Accordingly, strategies to raise awareness should adopt a multichannel approach that incorporates digital promotions targeting younger audiences, traditional media campaigns, and interpersonal methods such as community meetings and education specifically for older adults. Encouraging intergenerational knowledge sharing within households may also bridge awareness gaps between age groups.

Educational level and occupation were significant factors in awareness. Respondents with higher levels of education demonstrated higher awareness scores, reflecting the influence of literacy and critical thinking skills on health-related behaviors. Educational level is known to strongly influence both reading–writing literacy and functional literacy.[29] Data from Statistics Indonesia indicated that residents in rural areas have lower literacy than their urban counterparts, particularly among older adults.[30] Future analyses should incorporate effect size estimations to quantify the magnitude of these differences and strengthen the interpretation of the practical relevance. Individuals working as employees, entrepreneurs, or retirees exhibited higher awareness than informal workers, housewives, and unemployed respondents. Previous studies also identified the education level and occupation of the consumer as key contributors to safe product choices.[31,32] Moreover, another study have demonstrated the importance of tailoring health education to the age of the target population.[33] However, demographic variables alone cannot fully explain consumer behavior, as attitudes, norms, and environmental factors also play crucial roles.[34]

To address disparities, CIE strategies should prioritize informal workers, housewives, and unemployed groups in rural areas. CIE programs should be adapted for people of varying literacy levels and tailored for use across various communication channels. Developing educational materials using simplified language, visual aids, and local dialects, where appropriate, will enhance comprehension. Furthermore, integrating the *Cek KLIK* initiative into both school curricula and adult education programs can foster early awareness of product safety and promote lifelong learning. The demographic disparities observed in this study indicated that, although general awareness was relatively high, strategies to increase equitable access, understanding, and application of information on drug and food safety are essential, particularly among those living in rural areas, those with lower education levels, older adults, and workers in the informal sector. Strengthening localized, participatory, and literacy-sensitive communication is crucial to bridging awareness gaps and fostering national behavioral change.

To enhance the practical impact of public awareness programs, policies should emphasize evidence-based, context-sensitive approaches. Integrating traceable digital tools, such as barcode scanning and cellphone-based label verification (using a cellphone application developed by the Indonesian FDA), into the Indonesian FDA's CIE initiatives could improve corporate transparency, consumer engagement, and trust in product safety systems. Concurrently, outreach to high-risk groups, such as older adults, rural residents, and informal workers, should be strengthened through visual materials, local languages, and community-driven communication. Efforts to incorporate the *Cek KLIK* campaign with digital verification platforms would modernize regulatory communication and reinforce public confidence. Collectively, these strategies can bridge the awareness–practice gap and facilitate equitable, technologically-enhanced consumer protection and safer health behaviors across Indonesia.

The correlation analysis showed strong positive relationships between knowledge and practices ($r = 0.599$, p-value <0.01), attitudes and practices ($r = 0.521$, p-value <0.01), and knowledge and attitudes ($r = 0.382$, p-value <0.01), indicating that higher knowledge and more positive attitudes are linked to better food and drug safety practices. A previous study have reported that knowledge, attitudes, and practices are interrelated and mutually influential.[35] Similarly, another study found a positive, though weaker, correlation between knowledge and food safety practices, suggesting that knowledge contributes to good practices.[36] Hossen *et al.* have assessed food safety KAP among street food vendors in the Jashore region of Bangladesh.[37] They found that the KAP food safety parameters were positively associated with one another, and practice levels increased in line with knowledge and positive attitude levels.

Based on the KAP correlation analysis, targeted, intensive intervention programs are needed to improve public knowledge and foster positive attitudes that encourage behavioral change. Effective programs should aim to motivate people to change their practices in selecting safe, high-quality medicines and foods through persuasive education. To design such programs, an appropriate practice change strategy is essential, which includes the 4E model (education, engineering, enforcement, and empowerment).[38] KAP findings can be used to guide the development of tailored CIE strategies based on demographic analysis and audience segmentation by gender, age, education level, and local language use. CIE delivery should address the specific information needs of the community, with an emphasis on product information and the use of checklists such as *Cek KLIK*.

The analysis of respondents' knowledge in this study found the highest scores for checking expiration dates, followed by ensuring intact packaging, and the lowest for checking registration numbers. However, practice scores for reading product labels to obtain information such as registration numbers or usage instructions remained relatively low. These findings highlighted the need for interventions that strengthen label literacy and registration numbers. As with the strategies already discussed, these should be tailored to different education levels and delivered in local languages. Campaigns should emphasize the practical steps to be taken before purchasing items, such as using the *Cek KLIK* checklist. Mulyanti *et al.* found that housewives in Pontianak City, Indonesia, paid attention to product features such as expiration dates, halal certification, and packaging when selecting processed food products.[39]

Implementing these targeted interventions and communication strategies requires not only careful technical program design but also supportive policy environments and resource mobilization. Strengthening public knowledge and behavior toward drug and food safety cannot rely solely on government initiatives. There must also be collaborative engagement from multiple sectors, including nongovernmental organizations, academia, and community-based groups. Shared responsibility and coordinated resource allocation across these actors will enhance program sustainability, increase outreach to diverse populations, and ensure that behavioral change efforts are contextually appropriate and socially inclusive.

This study's strength was its large-scale, nationally representative dataset of 20,610 respondents, providing robust evidence and a comprehensive resource for informing policy and program development. The institution's collaboration with the Indonesian FDA had ensured that the findings were directly applicable to the design and implementation of national CIE programs. However, as this was a cross-sectional study, causal relationships could not be established. A further limitation was the reliance on self-reported data. This may have introduced a social desirability bias, while uneven participation across provinces could have led to minor sampling bias despite statistical weighting. Future longitudinal studies along with behavioral experiments and qualitative analyses that explore the sociocultural determinants of public awareness in more depth are needed. It should also incorporate effect size estimations to better quantify the magnitude of the observed differences and improve the interpretation of their practical relevance. Addressing these aspects will strengthen the evidence upon which the design and evaluation of effective national health communication strategies are based.

Conclusion

This study reveals significant variations in public knowledge, attitudes, and practices regarding the safe selection of drugs and food in Indonesia. While overall awareness appears adequate, positive attitudes are not consistently reflected in everyday behavior, particularly among those with lower levels of education and limited access to information, indicating the need for more inclusive, equitable, and behaviorally informed interventions, supported by strengthened CIE strategies tailored to demographic and regional characteristics. CIE strategies should consider demographic analysis and audience segmentation to focus interventions on demographic groups with lower scores on the Awareness Index, such as those >50, those with only an elementary school education or no schooling (farmers and fishers), and those conversant only in local languages. Ultimately, this study contributes a robust empirical foundation for the development of data-driven policies and sustainable public health communication strategies that increase consumer self-protection and improve population health outcomes in Indonesia.

Abbreviations

FDA: The Food and Drug Authority; KAP: knowledge, attitude, practice; CIE: communication, information, and education; ANOVA: analysis of variance.

Ethics Approval and Consent to Participate

Ethical approval was obtained from the Ethics Committee of the Research and Community Service Institute (LPPM), Atma Jaya University (No. 0005U/III/PPPE.PM.10.05/5/2024). All participants provided written informed consent after being informed of the study objectives and procedures, ensuring voluntary participation and confidentiality.

Competing Interests

The authors declare that they have no significant competing financial, professional, or personal interests.

Availability of Data and Materials

This study utilized data from the Center for Drug and Food Policy Analysis, the Indonesian FDA. The datasets are not publicly available due to institutional regulations, but may be accessed by relevant stakeholders upon reasonable request and with permission.

Authors' Contributions

TW, SA, and RUC conceptualized the study; TW, SA, and RUC created the methodology; TW, SA, SN, RUC, and ERS wrote the original draft, reviewed, and edited the manuscript.

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