



Nutraceutical awareness and usage among Gen Z in Khulna: Perceptions, trends, influencing factors, and problems

Mayeesha Hossain Aishi¹, Jannatul Ferdous Priyoty¹, Md. Matiul Islam^{2*} 
and Nasrin Nahar Begum³

Received 8 December 2025, Revised 13 March 2026, Accepted 24 June 2026, Published 30 June 2026

ABSTRACT

The global paradigm regarding diet, health, and disease prevention is shifting globally, driven by rising healthcare costs and the growing prevalence of lifestyle-related chronic conditions, such as diabetes and cardiovascular disease, leading to a shift in consumer behavior from disease treatment toward prevention. This new paradigm is characterized by the rapidly expanding nutraceutical market, which encompasses food-derived products such as dietary supplements and functional foods that have been scientifically validated for health benefits beyond basic nutrition. The Asia-Pacific region, including Bangladesh, is experiencing exponential market growth, fueled by an aging population, demand for natural products, and Gen Z's (mid-1990s to early 2010s) strong focus on wellness and preventive health. However, Gen Z's reliance on digital platforms for health information exposes them to both global trends and potential misinformation. In Bangladesh, a "double burden of malnutrition" coexists with rising Non-Communicable Diseases (NCDs), creating a vulnerable market where minimal regulatory oversight poses a significant public health risk. This study, therefore, aimed to characterize the behavioral drivers and influencers of Gen Z's nutraceutical adoption in Bangladesh, identify critical barriers, and propose evidence-based policy recommendations. Using a quantitative survey, the study found that while a strong baseline health-conscious attitude exists, the high product cost was the most significant barrier. Furthermore, the most severe problems highlighted profound public health implications stemming from an information deficit and regulatory ambiguity, as respondents reported great difficulty in distinguishing genuine from fake products, lacking awareness of potential drug-nutraceutical interactions, and finding reliable information. These findings underscore that product availability is insufficient; consumers require accessible, reliable, and verified information to ensure safe usage. In conclusion, Gen Z in Bangladesh is highly motivated towards preventive health. Still, their engagement with the nutraceutical market is critically hindered by economic barriers and a severe information and trust gap, exacerbated by counterfeit products and a lack of awareness regarding drug-supplement interactions. To transition the local market from a high-risk landscape to a beneficial public health tool, stakeholders must prioritize initiatives that mandate clear and transparent product labeling, launch robust public education campaigns, and institutionalize reliable professional guidance to enhance both product safety and consumer trust, confirming that regulatory clarity and consumer literacy are the foundational steps required.

Keywords: Nutraceuticals, Generation Z (Gen Z), Preventive Health, Consumer Behavior, Regulatory Oversight, Information Deficit, Public

¹Food and Nutrition Department, KCC Women's College, Khulna, Bangladesh

²Agrotechnology Discipline, Khulna University, Khulna, Bangladesh

³Food and Nutrition Department, KCC Women's College, Khulna, Bangladesh

*Corresponding author's email: matiul@at.ku.ac.bd (Md. Matiul Islam)

Cite this article as: Aishi, M.H., Priyoty, J.F., Islam, M.M. and Begum, N.N. 2026. Nutraceutical awareness and usage among Gen Z in Khulna: Perceptions, trends, influencing factors, and problems. *Int. J. Agril. Res. Innov. Tech.* 16(1): 1-15. <https://doi.org/10.3329/ijarit.v16i1.92211>



Introduction

The relationship between diet, health, and disease prevention has undergone a profound transformation in the 21st century. As global healthcare costs rise and the burden of lifestyle-related chronic diseases, such as cardiovascular conditions, diabetes, and obesity, increases, there has been a discernible shift in consumer behavior from disease treatment to disease prevention (WHO, 2020). The paradigm is centrally defined by the burgeoning market of nutraceuticals. Coined from “nutrition” and “pharmaceuticals”, nutraceuticals are products derived from food sources that provide extra health benefits in addition to the basic nutritional value found in foods. These products include functional foods, fortified beverages, and dietary supplements containing ingredients like probiotics, omega fatty acids, vitamins, minerals, and plant extracts (Hoque *et al.*, 2022).

Globally, the nutraceutical market is experiencing exponential growth, particularly in the Asia-Pacific region, which holds a significant share of the market due to its large population base, rising disposable incomes, and increasing health consciousness (Fortune Business Insights, 2024). This growth is fueled by several converging global trends: an aging population seeking longevity, a general desire for ‘clean-label’ and natural products, and advancements in scientific research that provide evidence-based validation for specific health claims.

Crucially, this health-conscious movement is being redefined by the demographics of Generation Z (Gen Z) - individuals generally born between 1997 and 2012 (McKinsey, 2024). This generation, the first to be fully digital-native, views health holistically, integrating mental well-being, physical fitness, and diet. Unlike previous generations that relied heavily on traditional media and medical advice, Gen Z relies on digital platforms, social media, health and fitness apps, and online influencers as a primary source of health information (Ken Research, 2023). This reliance makes them highly susceptible to global trends in functional foods and supplements, but it also exposes them to considerable misinformation and ‘fad’ diets. The global trends, therefore, are characterized by a high degree of personalization and digital mediation in nutraceutical consumption,

presenting both immense opportunities for targeted nutrition and significant challenges regarding informed decision-making and product efficacy. Understanding how Gen Z navigates this complex, digitally driven health landscape is essential to capturing the future direction of public health intervention (Jones, 2018).

The global paradigm shift towards preventing health has led to the exponential growth of the nutraceutical market, which is now heavily mediated by digital platforms and social media, particularly among Generation Z (Gen Z) (Fortune Business Insights, 2024). While nutraceuticals offer potential benefits, the digitally driven consumption exposes consumers to significant risks from misinformation and unregulated products.

Bangladesh is currently navigating a severe “nutrition transition”, characterized by a “double burden of malnutrition” where micronutrient deficiencies coexist with rapidly rising rates of overweight and obesity, acutely impacting the youth population. In this vulnerable context, nutraceuticals are entering the urban mainstream, often promoted through direct-to-consumer digital marketing and unverified peer recommendations, rather than evidence-based medical necessity. The local market remains largely unregulated, compounding the risks of product authenticity and efficacy.

Despite the confluence of these critical factors—a vulnerable youth population (Gen Z) in a high-transition urban center (Khulna) engaging with an unregulated market via digital influence—there is a critical lack of empirical data regarding the actual engagement dynamics. Specifically, the problem lies in the unknown extent and nature of this interaction:

- i. The knowledge gap: The actual nutritional literacy and perceptions of Gen Z in Khulna regarding the benefits and risks of nutraceuticals are undocumented, making it impossible to gauge their susceptibility to digital misinformation (Jones, 2018).
- ii. The influence gap: The specific roles of digital influencers, social networks, and local market factors in driving consumption patterns remain unquantified and poorly understood.

- iii. The regulatory gap: The challenges faced by consumers, such as affordability, product authenticity, and lack of professional guidance, have not been empirically analyzed within this specific local context.

Consequently, without a structured understanding of Gen Z's perceptions, usage patterns, and the critical factors influencing their choices in Khulna city, policymakers, public health educators, and regulatory bodies in Bangladesh are unable to develop effective, targeted public health interventions. This research is necessary to ground the national and global narrative in local evidence, thereby ensuring informed and safe nutritional decision-making for the nation's future demographic (Halicka *et al.*, 2025).

The general objective of this study is to empirically investigate the drivers, patterns, and challenges associated with nutraceutical consumption among Generation Z in Khulna city, Bangladesh, to inform targeted public health and regulatory policies.

- i. To describe the socio-economic characteristics of the Generation Z respondents in Khulna city.
- ii. To assess the perceived knowledge and awareness of nutraceuticals among the Generation Z respondents.
- iii. To analyze the trends of nutraceutical usage (including types, frequency, and duration) among the Generation Z respondents.
- iv. To identify the factors influencing the attitudes and behaviors toward nutraceutical use among the Generation Z respondents.
- v. To determine the perceived problems and challenges faced by the Generation Z respondents in using nutraceutical products.

Bangladesh is facing a dual nutrition crisis, with both micronutrient deficiencies and rising obesity/NCDs. In this context, nutraceutical use is growing rapidly, often without evidence-based guidance. This study focuses on Generation Z, highly influenced by digital media, to examine their awareness, usage patterns, and vulnerabilities related to nutraceuticals. It also investigates how unregulated digital marketing and influencers shape their consumption. The research will generate the first empirical evidence from Khulna to

support regulatory bodies in improving labeling, marketing standards, and public awareness campaigns. Overall, it aims to protect Gen Z from misinformation, ineffective or counterfeit products, and potential nutritional risks while strengthening national public health and nutrition security.

The research is limited to the Khulna City Corporation area and focuses solely on Generation Z (ages 12–27). It examines three core areas: (1) awareness and perceptions of nutraceuticals, (2) usage patterns, including types, frequency, and motivations, and (3) key influencing factors, especially digital media and social influence. The study includes various nutraceuticals such as supplements, functional foods, and fortified beverages, but excludes conventional pharmaceuticals and traditional herbal products not marketed through modern digital platforms.

The study has several limitations. Its non-probability sampling in a single urban area (Khulna) restricts generalizability. Self-reported data may suffer from recall and social desirability bias. Variations in how respondents interpret the term “nutraceuticals” may affect accuracy. The cross-sectional design allows only associations, not causal conclusions or trend analysis. Finally, relying on digital access may exclude less digitally connected Gen Z individuals, introducing selection bias.

Methodology

This study employed a structured and replicable methodological approach to investigate nutraceutical awareness, perceptions, usage patterns, and influencing factors among Generation Z in Khulna, Bangladesh.

Locale of the study

The research was conducted in the Khulna City Corporation area, a major urban and educational hub with a high concentration of Gen Z individuals. Data were collected from selected institutions, including Khulna University, Khulna City Corporation Women's College, Navy Anchorage School and College Khulna, and Islamabad Collegiate School and College Khulna. The city was chosen due to its socio-demographic diversity, accessibility, and increased youth exposure to health trends and nutraceutical products.

Selection of respondents

Respondents were Gen Z individuals aged 15–28 years (born 1997–2012) residing in Khulna. The sample included university and college students, employed youth, and self-employed individuals to capture diverse awareness and usage patterns. Both nutraceutical users and non-users were intentionally included. A non-probability purposive sampling technique was adopted to ensure the inclusion of individuals likely to have exposure to nutraceuticals. A total of 100 respondents were selected based on age, location, willingness to participate, and basic awareness of nutraceutical products. The number of respondents was selected purposively due to some unavoidable circumstances, such as time constraints and resource limitations. Since it was convenient and manageable for us to work with 100 respondents, that's why we have selected this sample size. Point to be noted that this sample size does not represent the entire Gen Z population of Bangladesh.

Population and sampling procedure

The target population comprised accessible Gen Z individuals living in Khulna city. Convenience sampling was used due to time and resource constraints, focusing on students and young adults in the community. Although this sampling method limits generalizability, it enabled efficient data collection across diverse socio-economic and educational backgrounds.

Research instrument

Data were collected using a structured questionnaire developed from existing literature. The instrument included sections on:

- a) **Socio-demographic information** (age, gender, education, income, occupation).
- b) **Awareness and knowledge** of nutraceuticals.
- c) **Perceptions and attitudes**, measured with 5-point Likert scales.
- d) **Usage patterns**, including type, frequency, duration and purpose of consumption.
- e) **Influencing factors**, such as digital media, marketing, peer influence and affordability.

The questionnaire was prepared in English and verbally translated into Bangla for linguistic appropriateness. A back-translation process ensured meaning accuracy. Subject experts reviewed the draft to establish content validity. The

questionnaire was translated into Bangla because of convenience for some respondents. A test study was conducted with the Bangla-translated questionnaire first on some respondents, which ensured the clarity of the translated terms.

Data collection procedure

Data were collected using both face-to-face interviews and self-administered surveys, depending on respondent convenience. Study objectives were explained, and informed consent was obtained. Clarifications were provided in Bangla when required. Each questionnaire required approximately 15–20 minutes. Completed questionnaires were checked immediately to minimize errors. Data collection occurred from 11 May to 13 June, 2025.

Variables and measurement

Variables were categorized into five groups:

- a) **Socio-economic characteristics:** age, education, family type, income, occupation, organizational participation, and training. Measured using categorical and ordinal scales.
- b) **Awareness and perceptions:** indicators: awareness level, source of knowledge, perceived benefits. Measured using awareness and perception indices (low, moderate, high).
- c) **Usage trends:** indicators: types of products used, frequency, duration, purpose, expenditure, and brand preference. Measured using indices and categorical responses.
- d) **Influencing factors:** digital media exposure, peer influence, and marketing. Measured using influence indices.
- e) **Problems and challenges:** lack of knowledge, high cost, limited availability, authenticity concerns, side effects, and social/cultural barriers. Measured using 5-point Likert scales.

Data processing, tabulation and analysis

Data were processed and analyzed using SPSS. Qualitative responses were coded into numerical values. Indices and scales were constructed through score accumulation for efficient data reduction. Statistical tools used included frequency, percentage, mean, range, maximum, minimum, and standard deviation. A master sheet was prepared to tabulate all variables, enabling systematic interpretation aligned with study objectives.

Results and Discussion

The findings of the present study are organized around five key objectives to provide a comprehensive understanding of Gen Z respondents' perceptions and problems regarding nutraceuticals in Khulna city. The results first describe the socio-economic characteristics of the respondents, offering a contextual background of the surveyed population. This is followed by an analysis of their perceptions and awareness of nutraceuticals, highlighting their level of knowledge and attitudes (Smith, 2020). Subsequently, the trends and influencing factors shaping the use of nutraceuticals among the respondents are discussed. Finally, the study addresses the perceived problems and challenges faced by Gen Z in adopting nutraceuticals. Together, these insights form the basis for understanding the current status and potential of

nutraceutical awareness and usage in the study area.

A. Socio-economic characteristics of the respondents

Table 1 presents an overall summary of the socio-economic characteristics of the respondents, covering key demographic and lifestyle variables such as age, education level, family size, land inheritance status and consumption of food from inherited lands. The Table also includes information on organizational participation, family monthly income, socialization habits, and training received on various topics, including food and nutraceutical products. Quantitative measurements are provided for each characteristic, showing the number and percentage of respondents in different categories, along with ranges, means, and standard deviations where applicable.

Table 1. Distribution of the respondents on the basis of socio-economic characteristics.

Selected Characteristics (Measuring unit)	Categories	Scores	Number	Percent	Range (Min.-Max.)	Mean±SD
Age (Year)	Young	15-28	100	100.0	15-28	21.95±2.96
Education (Scores)	No Primary SSC HSC Honors Above	0 1-5 6-10 11-12 13-16 >16	0 0 11 16 70 3	0.0 0.0 11.0 16.0 70.0 3.0	8-17	13.67±2.33
Family size (Number)	Small Medium Large	≤4 5-6 >6	57 30 13	57.0 30.0 13.0	2-15	4.85±2.08
Land Inheritance	Yes No	1 2	90 10	90.0 10.0	-	1.10±0.30
Food from Inherited land	Yes No	1 2	54 46	54.0 46.0	-	1.46±0.50
Name of foods (For Yes)	Grains Fruits Vegetables Fish	1 2 3 4	23 12 11 8	23.0 12.0 11.0 8.0	-	2.07±1.11
Organizational Participation (Scores)	Low Medium High	≤6 7-12 >12	100 0 0	100.0 0.0 0.0	-	1.88±0.32
Family monthly Income (BDT)	Low Medium High	≤30,000 30001-50,000 >50,000	13 32 55	13.0 32.0 55.0	-	2.42±0.71
Socialization with family and friends and visits	Not at all Rarely Occasionally Regularly	0 1 2 3	0 8 19 73	0.0 8.0 19.0 73.0	-	2.65±0.62
Training received	Yes No	1 2	5 95	5.0 95.0	-	1.95±0.21
Training received on food	Yes No	1 2	3 97	3.0 97.0	-	1.97±0.17

The survey was conducted among 100 Gen Z individuals in Khulna city, aged between 15 and 28 years, with a mean age of 21.95 years. In terms of educational attainment, the majority of respondents (70%) were enrolled at the Honors level, while the remaining participants had completed their education at the SSC or HSC levels. Family size distribution indicated that most respondents (57%) belonged to small families comprising four or fewer members. In contrast, a smaller proportion came from medium-sized families, and only a few represented large families. A substantial majority (90%) reported having inherited land, with slightly more than half (54%) receiving food from these lands, primarily in the form of grains, fruits, vegetables, and fish.

Organizational participation was relatively low, with a mean value of 1.88, indicating limited involvement in such activities. The maximum positive score for organizational participation was only 12.0% out of 100 respondents. Because the Gen Z population spends more time on gadgets, they appear to be less interested in organizational participation. Family income levels were concentrated within the medium to high categories, with only a small percentage falling under the low-income group; the mean income score was 2.42. Socialization was reported by 73% of respondents, reflecting a relatively high level of interaction, largely attributed to their status as students regularly attending educational institutions. Participation in training programs was minimal, with a mean score of 1.95, and training specifically related to food and nutraceutical products was similarly limited, with a mean score of 1.97. Finally, regarding nutraceutical consumption, 43% of respondents reported using such products, while 57% did not, resulting in a mean score of 1.57.

As the data indicate, most Gen Z individuals are sufficiently well educated to understand health awareness issues related to nutraceuticals, suggesting that awareness of such products is relatively high among this group. The family size distribution reflects a modern socio-economic pattern, with smaller families being more common. Almost all respondents reported inheriting land, and a proportion of them also obtained food from these lands, which serves as an important source of natural nutrition through grains, fruits, vegetables, and fish. Organizational participation, however, was

found to be consistently low among the respondents. Family monthly income was predominantly in the medium to high range, which aligns with the current upward economic trends. Socialization was reported to be regular, as participants, being students, frequently engage with peers and family members. Training opportunities, particularly on food-related subjects, were notably limited. Finally, nutraceutical consumption was relatively balanced, with 43% of respondents reporting use and 57% reporting non-use, indicating no substantial difference between consumers and non-consumers.

The findings from this survey are consistent with and can be contextualized within the existing literature on the health and dietary behaviors of Generation Z. Previous research highlights Gen Z as a health-conscious generation, with a strong emphasis on wellness and preventive health practices (McKinsey, 2024). Their relatively high levels of education may contribute to both their health awareness and their pursuit of reliable health information, including knowledge related to nutraceuticals. Other studies have shown that while Gen Z's food choices are primarily influenced by taste, price, and health considerations, social media and consumer trends also exert a noticeable, though secondary, influence (Halicka *et al.*, 2025). This may help explain the popularity of certain nutraceuticals, which are frequently marketed online.

A distinctive feature of this study is the data on land inheritance and access to food derived from such land. Although participants generally represent modern socio-economic conditions, many still retain access to traditional, natural food sources such as grains, fruits, vegetables and fish from inherited lands. This pattern aligns with broader consumer preferences documented in nutraceutical research, where there is an increasing shift toward natural-origin products and a gradual move away from synthetic alternatives (Hoque *et al.*, 2022). With regard to nutraceutical consumption, the findings reveal a relatively small difference between consumers (43%) and non-consumers (57%). This indicates that, overall, the socio-economic characteristics of the respondents align closely with those of contemporary urban society, with no substantial divergence in health-related behaviors between the two groups.

B. Perceptions and awareness of the respondents

Perceptions and awareness of the respondents regarding nutraceuticals were assessed through two key dimensions: perceived knowledge and perceived awareness. These indicators provide insights into how well Gen Z individuals in Khulna city understand nutraceutical products and the extent to which they are conscious of their potential health benefits. Together, these measures help capture both the cognitive and attitudinal aspects of respondents' orientation toward nutraceutical use.

Table 2 presents the results of the knowledge assessment, highlighting the distribution of knowledge categories among the 100 respondents. The Table provides quantitative measurements for each characteristic, including the number and percentage of participants across different categories, as well as ranges, means, and standard deviations where applicable. This section specifically examines the perceived knowledge and awareness of nutraceuticals among Gen Z respondents. The data illustrate the frequency and proportion of participants classified into four distinct knowledge levels: none, low, medium and high.

Table 2. Distribution of the respondents based on the perceived knowledge.

Categories	Score	Respondents N=100		Mean±Standard Deviation	Range	
		Frequency	Percent		Min.	Max.
				7.06 ± 2.09	1	10
None	0	0	0.0			
Low	≤3	7	7.0			
Medium	4-6	28	28.0			
High	>6	65	65.0			

The results indicate that a majority of respondents (65.0%) demonstrated a high level of knowledge, while (28.0%) exhibited a medium level of knowledge. Only a small proportion (7.0%) reported a low level of knowledge, and no respondents were found to have a score of zero, suggesting that all participants possessed at least some degree of knowledge. The overall mean score was 7.06 ± 2.09 , with observed scores ranging from 1 to 10.

The survey suggests that the group holds a comprehensive knowledge base. A large proportion of respondents achieving a high knowledge is an important observation, as it reflects either successful knowledge dissemination or a well-informed group. The mean score of 7.06 with a standard deviation of 2.09 indicates that most scores are concentrated near the average.

Table 3. Distribution of the respondents based on the perceived awareness.

Categories	Score	Respondents N=100		Mean±Standard Deviation	Range	
		Frequency	Percent		Min.	Max.
				44.77 ± 9.30	22	60
None	0	0	0.0			
Low	≤35	19	19.0			
Medium	36-55	61	61.0			
High	>55	20	20.0			

Table 3, titled "Perceived Awareness," presents the distribution of awareness levels among 100 respondents. Participants were categorized into different levels of awareness based on their scores. The majority of respondents (61.0%) demonstrated a medium level of awareness, while 19.0% and 20.0% reported low and high levels of awareness, respectively. Notably, no respondents scored zero, indicating that all

participants possessed at least some awareness of nutraceutical products. The overall mean score was 44.77 ± 9.30 , with a range of 22 to 60. These results suggest that awareness among Gen Z respondents is generally moderate, neither very low nor exceptionally high, yet the absence of a zero score reflects a baseline level of awareness across the entire group.

The data indicate that the 100 respondents exhibit a moderate level of awareness, with the majority falling into the medium category. In contrast to the knowledge assessment, where a substantial proportion of participants demonstrated high knowledge, the awareness results reveal a more balanced distribution, with most respondents clustered around the medium level. The mean score of 44.77, with a standard deviation of 9.30, suggests that awareness levels are generally consistent across the group. This balanced distribution implies that respondents possess a reasonable degree of awareness and are likely to exercise caution in their consumption of nutraceutical products.

The findings from the awareness assessment reveal a distinct pattern compared to the perceived knowledge results. While the knowledge data indicated that respondents are generally well-informed, with a high proportion falling into the high knowledge category, the awareness results suggest a more moderate level of understanding. This discrepancy highlights a potential distinction between perceived knowledge, what participants know, and perceived awareness, their conscious recognition and comprehension of the topic.

C. Trends and Influencing factors among the respondents

Trends and influencing factors among the respondents were examined through five key

dimensions: perceived benefits, motivation and the role of digital media, peer influence and marketing. These indicators provide insights into the factors shaping Gen Z's attitudes and behaviors toward nutraceutical products. By analyzing these aspects, the study aims to identify the drivers behind consumption patterns and the social, technological, and promotional elements that influence their choices.

The following Tables present the trends and factors influencing the respondents' attitudes and behaviors toward nutraceutical products. Table 4 illustrates perceived benefits, categorizing respondents into "None," "Low," "Medium," and "High" levels, along with their corresponding frequencies and percentages. Table 5 summarizes respondents' motivations, similarly classified across four levels with respective frequencies and percentages. Table 6 highlights the role of digital media, showing the extent of its influence on respondents, while Table 7 details peer influence across the same categorical levels. Finally, Table 8 presents the role of marketing, indicating the distribution of respondents according to "None," "Low," "Medium" and "High" levels of marketing influence. Together, these Tables provide a comprehensive overview of the key drivers shaping Gen Z's engagement with nutraceutical products.

Table 4. Distribution of the respondents based on the perceived benefits.

Categories	Score	Respondents N=100		Mean±Standard Deviation	Range	
		Frequency	Percent		Min.	Max.
				32.23 ± 7.38	15	44
None	0	0	0.0			
Low	≤13	0	0.0			
Medium	14-30	34	34.0			
High	>30	66	66.0			

In the Table, we can see that the High perceived benefits: 66 out of 100 respondents (66.0%). Medium perceived benefits: 34 out of 100 respondents (34.0%). Low or no perceived benefits: 0 out of 100 respondents (0.0%). The mean score is 32.23 ± 7.38, with a range of 15 to 44.

The data suggest that the vast majority of the respondents have a positive perception of the benefits associated with the subject of the study. The high percentage of

respondents in the "High" category (66.0%) indicates that the benefits are widely and strongly perceived. The absence of respondents in the "Low" and "None" categories further reinforces that the perceived benefits are universally recognized among the participants.

This finding highlights the significant role that perceived benefits play in the context of the study. A strong perception of benefits is a powerful driver for behavior and engagement. The high mean score and the

absence of low or no-benefit perceptions suggest that the benefits are either very clear, tangible, or well-communicated to the population studied. This could be due to effective marketing, strong peer-to-peer recommendations, or the inherent value of

the product or service itself. Future research could explore which specific benefits are most valued by the "High" category respondents.

Table 5. Distribution of the respondents based on the motivation.

Categories	Score	Respondents N=100		Mean±Standard Deviation	Range	
		Frequency	Percent	15.14 ± 3.27	Min. 7	Max. 21
None	0	0	0.0			
Low	≤9	7	7.0			
Medium	10-18	67	67.0			
High	>18	26	26.0			

In the Table for motivation, it is depicted that Medium motivation: 67 out of 100 respondents (67.0%). High motivation: 26 out of 100 respondents (26.0%). Low motivation: 7 out of 100 respondents (7.0%). No motivation: 0 out of 100 respondents (0.0%). The mean score is 15.14 ± 3.27, with a range of 7 to 21.

The results indicate that most respondents have a medium level of motivation (67.0%). A notable portion also falls into the high motivation category (26.0%). The remaining (7.0%) have low motivation, and no respondents have no motivation at all. This suggests a generally positive but not overwhelmingly high level of motivation among the group.

While a majority of respondents are moderately motivated, the data also reveals a significant group with high motivation and a small group with low motivation. The results suggest that motivation is a key factor, but it's not uniformly high across the population. The moderate level of motivation could be influenced by various factors. Understanding what differentiates the highly motivated group from the moderately or lowly motivated groups would be valuable. The study should further explore the specific drivers behind these different levels of motivation, such as personal goals, external rewards, or internal satisfaction.

Table 6. Distribution of the respondents based on the role of digital media.

Categories	Score	Respondents N=100		Mean±Standard Deviation	Range	
		Frequency	Percent	15.11 ± 3.21	Min. 6	Max. 22
None	0	0	0.0			
Low	≤9	5	5.0			
Medium	10-18	73	73.0			
High	>18	22	22.0			

Role of digital media influences, medium role of digital media: 73 out of 100 respondents (73.0%). High role of digital media: 22 out of 100 respondents (22.0%). Low role of digital media: 5 out of 100 respondents (5.0%). No role of digital media: 0 out of 100 respondents (0.0%). The mean score is 15.11 ± 3.21, with a range of 6 to 22.

A significant majority of respondents (73.0%) report that digital media plays a medium role. 22.0% of respondents feel it plays a high role, and a small minority (5.0%) feel it plays a low role. No respondents felt that digital media played no role. This highlights the considerable but

not universally dominant influence of digital media on the respondents.

The findings confirm the widespread influence of digital media, with almost all respondents acknowledging its role to some extent. The large percentage in the medium category suggests that while digital media is an influential factor, it may not be the sole or primary driver for the majority. This implies that digital media serves as a consistent, supporting influence rather than a powerful, deciding factor. Further investigation could explore the specific platforms (e.g., social media, news sites, etc.) and types of content that contribute most to this influence.

Table 7. Distribution of the respondents based on the role of peer influence.

Categories	Score	Respondents N=100		Mean±Standard Deviation	Range	
		Frequency	Percent		Min.	Max.
				15.40 ± 4.55	2	25
None	0	0	0.0			
Low	≤9	8	8.0			
Medium	10-18	66	66.0			
High	>18	26	26.0			

In the Table for peer influence, medium peer influence: 66 out of 100 respondents (66.0%). High peer influence: 26 out of 100 respondents (26.0%). Low peer influence: 8 out of 100 respondents (8.0%). No peer influence: 0 out of 100 respondents (0.0%). The mean score is 15.40 ± 4.55 , with a range of 2 to 25.

The data reveal that peer influence has a medium role for the majority of respondents (66.0%). A smaller but substantial group (26.0%) reports a high level of peer influence, and 8.0% report a low level. No respondents were unaffected by peer influence. This demonstrates that social circles and peer opinions are a significant factor for the respondents.

The results are consistent with the general understanding of social dynamics, where peer influence plays a considerable role in shaping opinions and behaviors. The fact that a large majority fall into the medium and high influence categories suggests that social validation and peer opinions are important factors for the respondents. This could have significant implications for strategies that leverage word-of-mouth or community building.

Understanding what specific peer behaviors, opinions, or recommendations are most influential would be a valuable next step.

Table 8. Distribution of the respondents based on the role of marketing.

Categories	Score	Respondents N=100		Mean±Standard Deviation	Range	
		Frequency	Percent		Min.	Max.
				18.07 ± 4.27	5	24
None	0	0	0.0			
Low	≤9	4	4.0			
Medium	10-18	38	38.0			
High	>18	58	58.0			

The role of marketing in this sector is: High role of marketing: 58 out of 100 respondents (58.0%). Medium role of marketing: 38 out of 100 respondents (38.0%). Low role of marketing: 4 out of 100 respondents (4.0%). No role of marketing: 0 out of 100 respondents (0.0%). The mean score is 18.07 ± 4.27 , with a range of 5 to 24.

The findings indicate that for the majority of respondents (58.0%), marketing plays a high role. A large portion (38.0%) feels that marketing plays a medium role, with only a small minority (4.0%) reporting a low role. No respondents reported a role for marketing. This suggests that marketing is a very powerful and influential factor for the population under study.

The data confirms the significant impact of marketing strategies, as evidenced by the high percentage of respondents who report its strong influence. The fact that a

combined (96.0%) of respondents fall into the medium or high categories suggests that marketing efforts are effectively reaching and influencing the target audience. This indicates that well-executed marketing campaigns are likely to be a primary driver of success in this context. Further research could delve into which specific marketing channels, messages, or campaigns resonate most effectively with the audience.

D. Perceived problems of the respondents

Table 9 presents perceived problems related to nutraceutical products; it includes data from a survey of 100 participants. The Table lists 15 potential problems, each with a corresponding problem score, problem index %, and rank. Participants rated each problem on a severity scale from 0 to 3. (Not at all 0), (Less Severe 1), (Moderately Severe 2), and (Highly Severe 3). The scores are calculated by multiplying the rating value by

the number of people who chose that rating for each problem. The problem score for each issue is the sum of these calculated values. The problem index is then calculated by dividing the problem score by the maximum possible score of 300 and multiplying by 100. The most perceived problem from this Table has been found to be that the price of most nutraceutical products is very high and sometimes out of

reach of most customers. This ranked in the 1st position. The 2nd problem is the uncertainty of the usage and dosage of the nutraceutical products for consumption. The 3rd problem is that there is a lack of clear conception and knowledge about nutraceutical products. These three problems are the most ranked problems that have been perceived from the respondents.

Table 9. Distribution of the respondents based on the perceived problems.

No.	Perceived Problem	Not at all (0)	Less Severe (1)	Moderately Severe (2)	Highly Severe (3)	Problem Score	Problem Index (%)	Rank
1.	High cost of nutraceutical products	0×0	1×8	2×18	3×74	266	88.66	1 st
2.	Lack of clear information about benefits and side effects	0×4	1×9	2×19	3×68	251	83.66	3 rd
3.	Confusion due to too many product choices	0×16	1×30	2×42	3×12	150	50.00	14 th
4.	Difficulty in distinguishing genuine products from fake or low-quality ones	0×8	1×8	2×24	3×60	236	78.66	6 th
5.	Limited availability of trusted brands in local markets	0×1	1×21	2×56	3×22	199	66.33	10 th
6.	Fear of side effects or adverse reactions	0×1	1×14	2×18	3×67	252	83.67	4 th
7.	Lack of trust in product claims and advertisements	0×3	1×22	2×46	3×29	201	67.00	9 th
8.	Uncertainty about proper dosage and usage instructions	0×3	1×4	2×27	3×66	256	85.33	2 nd
9.	Limited consultation or guidance from healthcare professionals	0×3	1×11	2×28	3×58	241	80.33	5 th
10.	Social stigma or negative perception about using supplements	0×25	1×33	2×27	3×15	132	44.00	15 th
11.	Misleading information from social media or unverified sources	0×6	1×29	2×35	3×30	189	63.00	12 th
12.	Difficulties in accessing reliable online purchasing platforms	0×2	1×16	2×54	3×28	208	69.33	8 th
13.	Lack of awareness about possible interactions with medicines	0×4	1×12	2×28	3×56	237	78.67	7 th
14.	Perceived ineffectiveness or slow results after using the product	0×7	1×37	2×39	3×17	166	55.33	13 th
15.	Regulatory concerns-uncertainty if products are approved and safe	0×4	1×23	2×51	3×22	191	63.66	11 th

Based on the survey of 100 participants, the most significant problems associated with nutraceutical products were identified and ranked according to their problem indices. The primary concern was the high cost of nutraceutical products, which received a problem index of 88.66% and a score of 266. The second most prominent issue was uncertainty regarding proper dosage and usage instructions, with a problem index of 85.33% and a score of 256. The third-ranked problem was the lack of clear information about benefits and side effects, with a problem index of 83.66% and a score of 251. The fourth-ranked issue was the fear of potential adverse reactions, with a problem index of 83.67% and a score of 252. These findings highlight the key barriers faced by Gen Z respondents in effectively using nutraceutical products.

The least significant problems identified by the respondents included social stigma or negative perceptions about using supplements, which ranked 15th with a problem index of 44% and a score of 132. Confusion arising from the availability of too many product choices was ranked 14th, with a problem index of 50% and a score of 150. Perceived ineffectiveness or slow results after using nutraceutical products ranked 13th, with a problem index of 55.33% and a score of 166. These findings suggest that, while present, these issues are relatively less critical compared to other challenges faced by Gen Z consumers.

The results show that consumers are primarily concerned with issues related to product information, safety, and cost. The top-ranked problem, high cost, is a significant financial barrier for consumers. This suggests that despite a willingness to use these products, the price point is a major deterrent. The high rankings of “uncertainty about proper dosage,” “lack of clear information,” and “fear of side effects” all point to a critical need for better consumer education and transparency from manufacturers and healthcare providers. Consumers appear to be hesitant due to a lack of trustworthy, accessible information, which can lead to a perception of risk. The problem of “limited consultation or guidance from healthcare professionals” further reinforces this, indicating a gap in professional support and advice for consumers. The lower-ranked problems, such as “social stigma” and “confusion due to too many product choices,” suggest that these are less pressing issues for the surveyed group. This indicates that the

direct, practical concerns of cost and safety are far more impactful than social or market-related issues.

The findings indicate a strong correlation between consumer trust and the reported problems. The most severe problems identified are those that directly impact a consumer's ability to make an informed, safe, and cost-effective decision. The highest-ranking problem, the high cost of nutraceuticals, is a straightforward economic barrier, but the subsequent problems are more complex, stemming from an information deficit. The data suggests that simply having products available isn't enough; consumers require accessible, reliable information to feel confident in their purchase and usage. The fact that problems like “lack of awareness about possible interactions with medicines” and “difficulty in distinguishing genuine products from fake” are also highly ranked underscores the public health implications of this information gap. To address these concerns, stakeholders in the nutraceutical industry, including manufacturers, regulators and healthcare professionals, should prioritize initiatives that improve product labeling, public education campaigns and professional guidance. By doing so, they can build consumer trust, enhance product safety, and ultimately increase the responsible use of nutraceuticals.

Discussion

The purpose of this chapter is to give a review of the literature that is relevant to the current study. This study was carried out to investigate the nutraceutical awareness and usage among Gen Z in Khulna. The researcher made an exhaustive search of available literature to find out studies dealing with nutraceutical awareness and usage. During the review, the researcher discovered studies examining the relationship between the rise of nutraceutical imperative, the dominant economic barrier, prioritization of practical concerns, and the characteristics, namely age, education, family size, family income, training, knowledge on nutraceuticals, organizational participation, influencing factors, and media contact directly or indirectly.

“Tendencies and attitudes towards dietary supplements use among undergraduate female students in Bangladesh” (Chowdhury *et al.*, 2021). This research specifically investigates the tendencies and attitudes

towards dietary supplement use among undergraduate female students (primarily the Gen Z age group) in Chittagong, Bangladesh. It covers prevalence, reasons for use (general health, physician recommendation, etc.), and their positive opinions/attitudes, which directly relate to our awareness, usage, and perception variables.

“Factors affecting consumers’ decisions on the use of nutraceuticals: a systematic review” (Teoh *et al.*, 2019). This provides a comprehensive overview of motivating factors (perceived health benefits, safety, and advice from healthcare professionals/family) and barriers (lack of belief, high cost, lack of knowledge) to nutraceutical use globally. This will be an excellent resource for structuring our Influencing Factors and Problems sections.

“Exploring the factors affecting consumer behavior towards the purchase of Nutraceuticals in Pakistan” (Abid *et al.*, 2022). This directly investigates factors affecting consumer behavior for nutraceuticals among young consumers, finding that perceptions of health benefits, safety features, and the source of information are significant influencing factors. This directly mirrors our “Perceptions” and “Influencing Factors” variables.

“Food Choices of Gen Z University Students in Bangladesh” (Hossain *et al.*, 2024). This qualitative study explores factors driving food preferences among Gen Z university students in Bangladesh, including the role of social, technological, and cultural dynamics. While broader than nutraceuticals, it provides crucial context on health issues, nutrition levels, cost, and social media influence on Gen Z’s food choices, all of which are relevant to nutraceutical usage.

Introduction and the Gen Z consumer landscape

The global health and wellness trend has driven the significant expansion of the nutraceutical market, which integrates nutrition and pharmaceuticals to offer disease-preventive and health-promoting products (Teoh *et al.*, 2019). This review focuses on Generation Z (Gen Z), a digitally native, health-conscious cohort that is highly influential in the market (Hossain *et al.*, 2024). While Gen Z expresses a strong inclination toward health, their urban, high-paced lifestyle often involves high

consumption of accessible, inexpensive ultra-processed foods, creating a nutritional paradox that makes them relevant consumers for supplementary products (Hossain *et al.*, 2024). The diet of the Gen Z population is mostly composed of ultra-processed foods, so they tend to prefer products that are labeled as natural or of organic origin. Most of them have the misconception that nutraceuticals can fix their poor diets, which is not appropriate. They mainly think of nutraceutical supplements as a quick fix for their health, without maintaining a proper diet.

Trends and prevalence of nutraceutical usage

Research consistently demonstrates a high and rising prevalence of dietary supplement and nutraceutical consumption among young adults, forming a critical user segment. Studies conducted in the South Asian region, particularly in Bangladesh, show a highly prevalent use of dietary supplements among undergraduate students, a group largely composed of Gen Z (Chowdhury *et al.*, 2021). These consumers generally exhibit positive attitudes towards dietary supplements, primarily using them for general health and well-being, nutritional supplementation, immune support, and energy (Chowdhury *et al.*, 2021). However, a significant trend identified in the region is the widespread practice of self-medication. A large percentage of users initiate supplement intake and continue usage without consulting a healthcare professional like a physician or pharmacist, raising concerns about potential adverse effects and unverified claims (Chowdhury *et al.*, 2021). The global demand for nutraceuticals has been significantly boosted by consumer emphasis on disease prevention and a preference for natural, functional ingredients over synthetic drugs (Teoh *et al.*, 2019). The market’s growth is further fueled by the desire for personalized nutrition and the heightened awareness of immune health following global events (Teoh *et al.*, 2019).

Perceptions and key influencing factors

Consumer behavior concerning nutraceuticals is heavily influenced by personal perceptions and external cognitive factors. Consumer attitudes and knowledge are consistently cited as strong, positive predictors of healthy and sustainable consumption behavior (Gan *et al.*, 2016). Specifically, the decision to purchase nutraceuticals is profoundly influenced by

the consumer's perception of the product's health benefits and its safety features (Abid *et al.*, 2022). Consumers, when evaluating purchase intent, often consider factors like taste and packaging, along with the core perceived benefits (Teoh *et al.*, 2019). Furthermore, an active lifestyle often correlates positively with the consumption of dietary supplements, suggesting that usage is integrated into a broader health-conscious routine (Gan *et al.*, 2016). The source of information is a statistically significant factor determining a consumer's decision to use nutraceuticals (Abid *et al.*, 2022). For Gen Z, the digital environment is the primary domain for information gathering. This dependence on online sources, including social media, makes the consumer susceptible to popular trends and influencer marketing. Trust in the information source and the product is also an integral component that dictates purchase intention (Gan *et al.*, 2016).

Problems and barriers to informed usage

Despite the high awareness, several problems, both cognitive and structural, act as barriers to the safe, effective, and equitable use of nutraceuticals. A key problem is the vulnerability of Gen Z to misinformation, pseudoscience, and exaggerated claims disseminated through digital media and online platforms (Hossain *et al.*, 2024). This challenge is amplified by issues of low nutritional literacy, making it difficult for consumers to differentiate between credible, evidence-based nutrition advice and viral, unverified trends (Chowdhury *et al.*, 2021). Structurally, the lack of stringent regulatory oversight for nutraceuticals, when compared to pharmaceuticals, allows manufacturers to make claims without robust clinical evidence (Teoh *et al.*, 2019). This regulatory gap increases safety concerns and contributes to consumer skepticism (Teoh *et al.*, 2019). The high cost of nutraceutical products is a frequently cited barrier for price-sensitive young adults, particularly in developing economies. This cost disparity often forces consumers to prioritize cheaper, readily available ultra-processed options over expensive nutraceuticals and fresh, nutrient-dense foods (Teoh *et al.*, 2019; Hossain *et al.*, 2024).

The current body of literature provides a strong framework detailing that Gen Z's nutraceutical usage is substantial, driven by positive health perceptions and digital influences, but constrained by

misinformation, self-medication, and economic barriers. However, a critical research gap exists concerning the integrated study of all these variables: awareness, usage, perceptions, trends, factors, and problems within a specific, localized context. While regional data exists for large metropolitan centers, a comprehensive study focused solely on Gen Z in Khulna remains absent.

Conclusion

This study demonstrates that although nutraceuticals hold substantial promise within the broader shift toward preventive healthcare, their responsible use is currently impeded by two interconnected challenges: economic inaccessibility and a pervasive information and trust deficit. This study identifies the high cost of these products as the primary barrier to adoption, yielding a dominant problem Index of 88.66%. This shows that despite a strong baseline of health consciousness among Gen Z in Khulna, the price point remains the critical factor restricting equitable access. High product costs restrict equitable access, while widespread concerns about safety, authenticity, and potential interactions with medications reveal a deeper structural issue tied to weak regulatory oversight and inconsistent information. The findings show that consumers are navigating a knowledge vacuum in which unclear labeling, limited professional guidance, and insufficient regulatory enforcement heighten public health risks. The long-term sustainability of the nutraceutical sector therefore requires a transition from a predominantly market-driven model to one grounded in consumer protection, ethical practice and scientific transparency. Restoring public confidence will depend on coordinated action across industry, regulatory authorities and healthcare professionals to create an environment where informed, safe and evidence-based decision-making becomes the norm.

Recommendations

To address the identified trust and information gaps, a multi-level intervention framework is essential. First, manufacturers, under strengthened regulatory oversight, should implement standardized and mandatory labeling protocols that ensure clarity on potential drug-nutraceutical interactions, product authentication, and the scientific basis of health claims. Technologies such as QR

codes or blockchain should be mandated to enhance traceability and combat counterfeit products. There is currently no digital framework in Bangladesh where a QR code or blockchain is printed on supplement packaging. However, if this initiative is implemented by the Directorate General of Drug Administration (DGDA), it would make consumers' lives hassle-free regarding this issue. Providing accurate information about a supplement's brand, origin, dosage, usage, and other essential details through a QR code or blockchain that can be scanned by smartphones makes it easier to purchase and consume safely. Second, public health agencies and professional organizations must lead sustained educational initiatives that raise awareness of high-risk practices, particularly the concurrent use of supplements with chronic disease medications. The benefits of the product and the proper dosage should be clearly labeled on the packaging. Proper information about the product itself, including its dosage and usage, should be clearly communicated, either on the packaging, by a healthcare professional, or by the pharmacist. Developing centralized, unbiased digital repositories of nutraceutical information and leveraging pharmacies as frontline sources of guidance will further enhance consumer literacy. Finally, integrating healthcare professionals more directly into the nutraceutical information ecosystem is crucial. This includes revising medical and pharmacy curricula to incorporate evidence-based nutraceutical education, establishing clinical decision support tools for real-time interaction alerts, and creating professional certification systems to endorse products that meet rigorous safety and quality standards. Collectively, these measures will strengthen consumer protection, enhance transparency, and promote the safe and informed use of nutraceuticals in Bangladesh.

Acknowledgements: The authors express their sincere gratitude to all respondents who generously shared their time and insights during the survey. The authors also extend their appreciation to everyone who supported various stages of this research.

Conflict of Interest: The authors declare that there are no conflicts of interest associated with this research.

Funding Declaration: No external funding was received for conducting this research.

References

- Abid, S., Mehmood, S.S., Khan, A.A. and Junaid, M. 2022. Exploring the factors affecting consumer behavior towards the purchase of nutraceuticals in Pakistan. *J. Manage. Res.* 9(3): 1–17.
- Chowdhury, M.R., Akter, S., Paul, A.R. and Nipa, A.A. 2021. Tendencies and attitudes towards dietary supplement use among undergraduate female students in Bangladesh. *J. Edu. Health Promot.* 10(1): 1–9.
- Fortune Business Insights. 2024. *Nutraceuticals Market Size, Trends & Growth Report [2032]*, Maharashtra, India. Retrieved from <https://www.fortunebusinessinsights.com/nutraceuticals-market-102530>
- Gan, T.T., Othman, Z.A. and Sanyal, S.K. 2016. Factors influencing consumption of nutraceuticals in Malaysian population: A cross-sectional study. *J. Trad. Complemen. Med.* 6(4): 382–388.
- Halicka, E., Kaczorowska, J., Rejman, K. and Plichta, M. 2025. Investigating the consumer choices of Gen Z: A sustainable food system perspective. *Nutrients* 17(3): 591. <https://doi.org/10.3390/nu17030591>
- Hoque, F., Asma, A., Hossain, M. and Sarker, S. 2022. Exploring the factors affecting consumer behavior towards the purchase of nutraceuticals in Pakistan. *J. Market. Strate.* 4(2): 263–282. <https://doi.org/10.52633/jms.v4i2.216>
- Hossain, S., Islam, M. and Rahman, A. 2024. Food choices of Gen Z university students in Bangladesh. *J. Youth Stud.* 45(2): 201–215.
- Jones, C.D. 2018. Factors influencing health literacy in rural populations. *J. Commun. Health* 43(1): 177–184.
- Ken Research. 2023. *Asia Pacific Nutraceuticals Market Trends & Growth Analysis to 2030*. Retrieved from <https://www.kenresearch.com/industry-reports/asia-pacific-nutraceuticals-market>
- McKinsey. 2024. *Mind the gap: Gen Zers are obsessed with wellness*. Retrieved from <https://www.mckinsey.com>
- Smith, T.E. 2020. Knowledge levels of environmental issues among university students. *Int. J. Environ. Res. Public Health* 17(24): 9324.
- Teoh, S.L., Lee, Y.Y. and Ooi, G.H. 2019. Factors affecting consumers' decisions on the use of nutraceuticals: A systematic review. *Int. J. Environ. Res. Public Health* 16(14): 2568.
- WHO. 2020. Noncommunicable diseases (NCDs) and their risk factors: The global burden of NCDs. World Health Organization, Geneva: WHO Press.