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RESEARCH ARTICLE

Knowledge, Awareness, and Perceived Risk in Sugar-Sweetened Beverage Purchasing Behavior Among Indonesian Gen Z Students

Megawati Simanjuntak[1*], Elsyahra Rieskiza Martha[2]

[1]Study Program of Family and Consumer Sciences, Faculty of Social Sciences and Human Ecology, IPB University, Bogor, Jawa Barat, Indonesia

[2]Study Program of Family and Consumer Sciences, Faculty of Social Sciences and Human Ecology, IPB University, Bogor, Jawa Barat, Indonesia

Correspondence: Megawati Simanjuntak. Email: mega_juntak@apps.ipb.ac.id

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ABSTRACT

Introduction: Sugar-sweetened beverages (SSBs) are widely consumed by Gen Z despite their well-documented health risks, including obesity, metabolic disorders, and other non-communicable diseases. The increasing availability and attractiveness of contemporary sweetened beverages may contribute to higher consumption among young consumers. Understanding the associations between psychological and cognitive factors and purchasing behaviour is important for supporting effective health promotion strategies. This study aimed to analyse the associations between knowledge, awareness, perceived risk, and SSB purchasing behaviour among Gen Z.

Methods: This quantitative cross-sectional study involved 272 Gen Z university students in Indonesia who had consumed sweetened beverages within the past month. Respondents were recruited through a voluntary, non-probability sampling technique, and data were collected via an online structured questionnaire from mid-February to early March 2025. The questionnaire measured knowledge, awareness, perceived risk, and sweetened beverage purchasing behaviour. Data were analysed using descriptive statistics and Structural Equation Modelling (SEM) to examine associations among the variables.

Results: Knowledge was not significantly associated with awareness ($\beta = -0.118$; $t = 1.763$; $p = 0.078$). Knowledge was significantly associated with perceived risk ($\beta = 0.133$; $t = 2.309$; $p = 0.021$) and with beverage purchasing behaviour ($\beta = -0.189$; $t = 3.000$; $p = 0.003$). Awareness was significantly associated with perceived risk ($\beta = 0.190$; $t = 3.004$; $p = 0.003$) and with beverage purchasing behaviour ($\beta = -0.153$; $t = 2.077$; $p = 0.038$). Perceived risk was significantly associated with beverage purchasing behaviour ($\beta = -0.377$; $t = 5.392$; $p < 0.001$), showing the strongest association among the paths tested.

Conclusion: Knowledge, awareness, and perceived risk were significantly associated with SSB purchasing behaviour among Gen Z. Higher levels of knowledge, awareness, and perceived risk tended to be associated with lower SSB purchasing behaviour. These findings highlight the importance of health promotion efforts related to sugar intake and the health risks associated with excessive SSB consumption.

Keywords: Awareness; Cross-Sectional Study; Knowledge; Perceived Risk; Sugar-Sweetened Beverages

INTRODUCTION

Sugar-sweetened beverages (SSBs) are drinks that contain added sugars, such as sucrose, high-fructose corn syrup, or other sweetening agents, which contribute to energy intake while providing minimal nutritional value (1). Owing to their widespread consumption and role in increasing sugar intake, SSBs have become a significant public health concern, particularly among adolescents (2). These beverages are commonly consumed by different population groups (3). In recent years, contemporary sweetened beverages have emerged as a popular category, characterised by varied flavours, appealing packaging, and visually attractive presentation, which enhance consumer interest and influence purchasing behaviour (4).

Contemporary sweetened beverages are popular among Gen Z because of their unique taste and appeal (4). This generation tends to follow trends, including popular drink brands such as Es Teh Indonesia, Starbucks, Janji Djiwa, Teh Poci, Menantea, Xi Boba, Chatime, Kopi Kenangan, and Hop Hop (5). Globally, sugar-sweetened beverages are consumed at fairly high levels. Based on the U.S. Health Interview Survey, 49.5% of US adults reported that they consumed sweetened beverages at least once daily (6). In line with this, studies conducted in Asian countries have reported an even higher prevalence, with over 99% of adolescents consuming sugar-sweetened beverages within a week, with sweetened tea being the predominant type (7).

According to the World Health Organization (8), daily intake of free sugars should not exceed 10% of total energy intake, with an additional recommendation to reduce it to below 5% or approximately 25 g/day. Excessive SSB consumption has been linked to an increased risk of obesity, type 2 diabetes, and cardiovascular disease (9). In Indonesia, the sugar content in SSBs, both commercially produced beverages and trendy drinks prepared on-site, is reported to range from 23–70 g per serving (10), while packaged beverages contain approximately 37–54 g of sugar per 300–500 mL (11). These amounts exceed both the WHO recommendations and the daily sugar intake limit stipulated in Regulation of the Minister of Health of the Republic of Indonesia No. 30 of 2013 (12), which sets a maximum of 50 g/day. This situation indicates that the consumption of sweetened beverages can significantly contribute to high daily sugar intake, particularly among Gen Z, who have a strong preference for such products (3,5).

High consumption of sweetened beverages also aligns with the rising burden of diabetes in Indonesia. According to a report by the International Diabetes Federation (13), Indonesia ranked fifth globally by number of adults aged 20–79 years with diabetes in 2024, following China, India, the United States, and Pakistan. The number was estimated at 20.4 million in 2024 and is projected to rise to 28.6 million by 2050 (13).

Knowledge, awareness, and risk perception are three constructs that are conceptually distinct but sequentially interrelated. In this study, knowledge means objective knowledge: the verifiable, factual information a person holds about a product or category (14). For sweetened beverage purchases, it captures what consumers actually know, not what they assume they know. This knowledge may inform awareness, which is the consumer's ability to recognise and evaluate whether a product has positive or negative effects on health (15). Awareness may, in turn, relate to risk perception, which is defined as consumers' subjective assessment of the level of uncertainty and the potential negative consequences that may arise from a purchasing decision (16). Various studies indicate that this sequence of processes may ultimately be associated with purchasing behaviour, a process that encompasses information search, intention formation, and purchasing decision-making (17,18).

Previous studies have examined knowledge (19), awareness (20), and risk perception (21,22), and purchasing behaviour related to sugar-sweetened beverages (SSBs) (23,24). However, studies that integrate these four variables into a sequential model within the same population remain limited. Gen Z was selected as the study population not merely for ease of access, but because of its theoretical relevance. As the largest demographic group in Indonesia, accounting for approximately 27.94% of the total population, or about 70 million people (25), and as a generation that has grown up in the digital age with health information-seeking behaviours distinct from those of previous generations (26), the process of health belief formation among Gen Z is presumed to have characteristics distinct from those of older age groups, which have traditionally been the primary focus of SSB research based on the Health Belief Model (HBM).

This study uses the Health Belief Model (HBM) as a heuristic for the cognitive sequence leading to health-related purchasing behaviour (27,28). We did not operationalize each HBM construct directly. Knowledge and awareness function as early cognitive inputs: they shape how consumers evaluate potential consequences of sweetened beverage consumption. Perceived risk captures consumers' overall assessment of possible negative consequences from a purchasing decision, spanning health, financial, time, and social domains. We did not measure perceived susceptibility, perceived severity, or perceived barriers as separate constructs. The model therefore reflects the HBM's sequential logic, not a strict test of its individual components.

Based on the above discussion, this study proposes and tests a model in which knowledge is associated with awareness (H1) and perceived risk (H2), awareness is associated with perceived risk (H3), and knowledge, awareness, and perceived risk are each associated with sugar-sweetened beverage (SSB) purchasing behaviour among Gen Z consumers in Indonesia (H4–H6). Figure 1 shows the conceptual framework for this study.

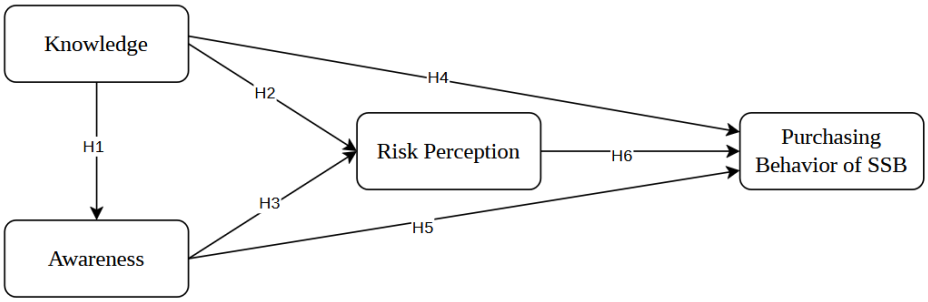


Figure 1. Conceptual framework. SSB, sugar-sweetened beverage.

This integrated model, grounded in the HBM, offers two main contributions. Theoretically, this study extends the application of the Health Belief Model, which has traditionally been used in clinical and disease prevention contexts, such as vaccination and cancer screening, to the context of routine, non-clinical consumption behaviour. Specifically, it examines whether the cognitive sequence proposed by the HBM remains applicable when the perceived health threat is cumulative and results from individuals' own behaviour, such as excessive sugar consumption, rather than being acute or externally imposed. Furthermore, this study clarifies the conceptual distinctions among knowledge, awareness, and perceived risk, constructs that have often been used interchangeably or examined separately in previous studies on SSBs, by testing them as distinct yet sequentially related constructs within a single research model.

Practically, this study's findings are expected to provide a foundation for developing more effective sugar consumption education strategies targeting Gen Z. In addition, the findings are intended to provide empirical evidence that policymakers and stakeholders in the sugar-sweetened beverage industry may consider when reviewing existing food-labelling policies and sugar-consumption regulations, including Regulation of the Minister of Health of the Republic of Indonesia No. 30 of 2013, by considering the levels of consumer knowledge, awareness, and perceived risk within this demographic group.

METHODS

Study Design

This study employed a quantitative approach with a cross-sectional design to examine the associations between knowledge, awareness, perceived risk, and sweetened beverage purchasing behaviour among Gen Z. Data were collected through an online survey using a structured questionnaire distributed via Google Forms. Because a cross-sectional design captures data at only one point in time, the observed relationships are associations and cannot establish causality or temporal ordering. Accordingly, the structural paths are interpreted as hypothesised associations rather than causal pathways.

Participants and Sample

The target population consisted of Gen Z college students in Indonesia who had consumed sweetened beverages within the past month. Gen Z refers to individuals born between 1997 and 2012 (29). The inclusion criteria were Gen Z university students in Indonesia who had consumed sugar-sweetened beverages within the past month and were willing to participate in the study. The exclusion criteria included incomplete questionnaire responses and duplicate submissions.

The criterion of consuming sugar-sweetened beverages within the past month was applied because the main variables of this study, namely knowledge, awareness, perceived risk, and purchasing behaviour, are conceptually relevant only to individuals with actual consumption experience. Therefore, non-consumers were excluded to ensure that the measured constructs, particularly purchasing behaviour, had direct relevance for all respondents. Nevertheless, the authors acknowledge that this criterion may limit variability in the outcome variable and introduce selection bias related to the modelled behaviour. Consequently, the estimated associations in this study should be interpreted within the context of the active consumer population.

This study applied a non-probability sampling method using a voluntary sampling technique in which respondents were selected based on their availability and willingness to participate (30). Because recruitment was conducted online and voluntarily through social media networks and university student networks, this study did not have a probabilistically defined population sampling frame. Accordingly, the accessible population in this study consisted of Gen Z university students in Indonesia who consume sugar-sweetened beverages and are active on social media platforms (WhatsApp, Instagram, Discord, and X), as well as university student networks through which the questionnaire was distributed. This study estimated associations among variables within this population. The generalisability of the findings is therefore limited to this group and is not intended to represent all Gen Z university students in Indonesia at the national level.

The minimum sample size was determined through an *a priori* power analysis for multiple regression on the endogenous construct with the largest number of direct predictors in the structural model, following Cohen's (31) approach as implemented in G*Power 3.1 software (32). In the proposed research model, the purchasing behaviour construct had the largest number of direct predictors, namely three constructs consisting of knowledge, awareness, and perceived risk. Assuming a medium effect size ($f^2 = 0.15$), a significance level (α) of 0.05, and a statistical power of 0.80, the required minimum sample size was 77 respondents. During data collection, we obtained 310 responses. After screening based on the eligibility criteria, 272 responses were considered valid and included in the analysis. This sample size substantially exceeded the minimum sample

size recommended by the power analysis (n = 77) and therefore exceeded the prespecified minimum sample-size requirement for the structural analysis.

Setting and Study Period

This study was conducted online, with respondents completing the questionnaire from their respective places of residence throughout Indonesia. The distribution of respondents' regions of origin showed a high concentration on Java Island, with respondents from West Java (25.7%), East Java (15.1%), DKI Jakarta (14.2%), Central Java (14.2%), and the Special Region of Yogyakarta (7.4%) cumulatively accounting for 76.8% of the total sample (209 of 272 respondents). The remaining respondents were distributed across ten other provinces outside Java with substantially smaller proportions, including Banten (4.0%), Riau (2.9%), Bengkulu (2.6%), North Sumatra (2.2%), East Kalimantan (2.2%), Lampung (1.8%), Bali (1.5%), South Sumatra (1.5%), West Sumatra (1.1%), and other provinces (3.6%). Therefore, although this study included respondents from various regions of Indonesia, the sample more strongly reflects Gen Z university students in Java than those in other regions, and the findings should be generalised to the national level with caution.

Variables and Measurement Instruments

The research instrument was a structured questionnaire adapted from previous studies to ensure clarity and relevance for the respondents. This study examined four variables: knowledge, awareness, perceived risk, and sweetened beverage purchasing behaviour.

Knowledge was measured using ten indicators adapted from Kulsuwiponchai et al. (33) and Teng et al. (34). Awareness was measured using six indicators adapted from Bakar et al. (35), who adopted the questionnaire developed and validated by Teng et al. (34). Five items (A1–A5) were drawn from the attitude domain of this instrument, which assesses awareness of daily sugar-sweetened beverage consumption and healthy beverage selection, and for which internal consistency was reported at the domain level. One item (A6) was drawn from the practice domain because it captures the same orientation towards sugar information at the point of purchase. Consistent with the source instrument, we therefore treated awareness as a single reflective construct. The original dichotomous agree/disagree format was replaced with a five-point Likert scale, and the items were reworded as first-person statements. This specification does not allow us to identify which aspect of awareness drives the observed associations; we address this further as a limitation below. Perceived risk was measured using six indicators adapted from Khofanda and Belgiawan (23) and Sawyer et al. (36). These items reflect a general consumer risk perception construct, encompassing perceived uncertainty and potential negative consequences (health, financial, time, and social) of consuming sweetened beverages. Purchasing behaviour was measured using four indicators adapted from Dono et al. (37), Fausnacht et al. (38), and Hanifah et al. (22). Following item purification based on outer loadings, two items were removed from the perceived risk construct (PR5: "Continuous consumption of sweetened beverages will cause addiction"; PR6: "If one becomes ill from consuming sweetened beverages, relationships with family will be disrupted"), and one item was removed from the purchasing behaviour construct (PPM3: "Frequency/volume of cups consumed each time drinking a sweetened beverage," scaled from ¾ cup to 2.5 cups). The removal of PR5 and PR6 may have narrowed the content coverage of perceived risk by excluding addiction-related and family-relational risk facets; the remaining four items (PR1–PR4) continued to represent core health and financial risk perceptions. The removal of PPM3 reduced the content coverage of purchasing behaviour by excluding a volumetric consumption dimension that is conceptually distinct from purchase frequency (PPM2) and cup size/sugar level (PPM4); this is acknowledged as a limitation. All retained items were scored in a consistent positive direction (higher score = higher construct level), with no reverse-coded items.

Because the original instrument was developed in English, the items were translated into Indonesian using a machine translation tool (DeepL). The translated items were then back-translated into English by three individuals from the research team and compared item by item with the original English version to verify semantic equivalence. Discrepancies or ambiguous terms identified during this comparison were resolved through discussion to reach consensus on the final wording. The instrument did not undergo an expert/content review prior to pilot testing. This represents one of the methodological limitations of the present study, as the content validity of the instrument relied entirely on the theoretical appropriateness of the items adapted from previous studies (22,23,33,34,36–38) without additional independent evaluation of their cultural and linguistic appropriateness for the Indonesian Gen Z population. Cognitive testing was subsequently conducted with five university students who met the study's eligibility criteria, namely Gen Z university students in Indonesia who had consumed sugar-sweetened beverages within the past month. They were from five higher education institutions (four women and one man; aged 20–22 years), all originated from Java, and four were in their seventh or eighth semester. They completed the questionnaire and were then asked whether any items were difficult to understand. No major revisions were made, as they did not report substantial difficulties. The questionnaire was then pilot tested with 30 university students who met the same criteria, drawn from 26 higher education institutions in Indonesia (24 women and 6 men; aged 20–22 years). Most were in their seventh or eighth semester (n = 23) and originated from Java (n = 26). Monthly allowances were below IDR 1,000,000 (n = 7), between IDR 1,000,000 and 1,500,000 (n = 14), or above IDR 1,500,000 (n = 9). The cognitive-testing and pilot participants were different individuals, and neither group was included in the main sample. The complete questionnaire, including final item wording and scoring, is provided in Appendix 1.

Pilot-test reliability was assessed using SPSS version 26. The reliability assessment focused on internal consistency (Cronbach's alpha) and did not result in any further item revisions because language refinement and item readability had already been addressed during cognitive testing. The pilot reliability results showed Cronbach's alpha values of 0.824 for awareness and 0.721 for purchasing behaviour, indicating acceptable internal consistency, whereas knowledge (α = 0.549)

and perceived risk (α = 0.575) showed relatively lower values. The Guttman scale (39) was used to measure knowledge (0 = incorrect, 1 = correct), whereas a five-point Likert scale (1 = strongly disagree to 5 = strongly agree) was used to measure awareness, perceived risk, and purchasing behaviour.

Alpha values between 0.50 and 0.60 at the pilot stage may be considered acceptable in the context of exploratory research, particularly when the items are adapted from well-established instruments with strong theoretical foundations and content validity (40). Nevertheless, because pilot-stage reliability (n = 30) may not reflect reliability in the main sample, we recalculated the reliability of the reflectively measured variables and the knowledge score using the main study data (n = 272). For the knowledge variable, represented as a ten-item composite score modelled as a single indicator in the structural model, reliability was calculated separately from the original ten items using the Kuder-Richardson 20 (KR-20) estimate, yielding a value of 0.598. Each of the ten dichotomous items was scored 1 for a correct response and 0 for an incorrect response, with no reverse-scored items; the composite score was the simple sum of the ten items (theoretical range 0–10). In the main sample (n = 272), observed scores ranged from 2 to 10 (M = 7.11, SD = 1.955). This value increased from the pilot stage (α = 0.549) but remained below the conventional threshold of 0.70 (41). Awareness showed good reliability (α = 0.787), although this was slightly lower than the pilot value (α = 0.824). Perceived risk showed a value of 0.678, which increased from the pilot stage (α = 0.575) but remained below the 0.70 threshold. Thus, two of the study variables, namely knowledge and perceived risk, exhibited suboptimal reliability in the main sample. This condition may reflect measurement error that could attenuate the estimated structural relationships involving these two variables. Therefore, the path coefficients involving these variables should be interpreted with caution, as the true strength of the relationships may be greater than what this study observed.

Purchasing behaviour was specified as a formative construct; internal consistency is therefore not an appropriate criterion for evaluating its measurement quality, because formative indicators need not covary. For transparency, Cronbach's alpha values computed under the earlier reflective specification (pilot α = 0.721; main sample α = 0.661) are reported only as descriptive information and are not interpreted as evidence of reliability. Its measurement quality was instead evaluated using formative criteria, namely indicator collinearity, outer weights and loadings, and content coverage (Table 4).

Data Collection and Quality Control

Primary data were collected through an online questionnaire distributed via Google Forms. Respondents were recruited voluntarily by distributing the questionnaire through social media platforms, including WhatsApp, Instagram, Discord, and X, as well as student networks. Data collection was conducted from mid-February 2025 to early March 2025. The questionnaire consisted of three sections: screening, profiling, and main variables. The screening section ensured that respondents met the study criteria and were willing to participate. The profiling section collected demographic characteristics, while the main section measured knowledge, awareness, perceived risk, and purchasing behaviour.

Several quality control measures were implemented to maintain data quality and integrity. First, Google Forms was configured to require respondents to sign in using a Google account, with responses limited to one submission per account. This control prevented repeated submissions from the same account but could not verify that each account represented a unique individual or guarantee the quality or attentiveness of respondents while completing the questionnaire. Second, all questionnaire items were set as mandatory fields, ensuring that no incomplete data were recorded at the point of submission. Consequently, no responses were excluded because of incomplete data or duplicate submissions at this stage. Third, the screening section at the beginning of the questionnaire verified three eligibility criteria sequentially: year of birth (to confirm that respondents belonged to Gen Z), current university student status, and consumption of sugar-sweetened beverages within the previous month.

Of the 310 responses collected, 38 were excluded because they did not meet one or more eligibility criteria during the screening process, namely being outside the Gen Z birth-year range, not being an active university student, and/or not having consumed sugar-sweetened beverages within the previous month. A breakdown of exclusions by specific criterion, including possible overlap among criteria, is not available, as the original response-level data were not retained for this analysis. Consequently, 272 responses were considered valid and included in the final analysis. No responses were excluded because of incomplete data, as the mandatory field setting prevented this. No post-hoc checks were performed to identify implausibly short completion times or patterned response sets that might indicate inattentive or duplicate responding. The one-response-per-account restriction prevented repeat submissions from the same Google account, but it could not rule out the possibility of unverified duplicate individuals participating under different accounts.

Statistical Analysis

Data were analysed using descriptive statistics and structural equation modelling (SEM) in accordance with the research objectives. Descriptive analysis was performed using SPSS version 26 to identify respondent characteristics and describe sugar-sweetened beverage purchasing behaviour among Gen Z, including purchase frequency, monthly expenditure, water consumption habits, and perceptions of the sugar content of sugar-sweetened beverages. We also conducted validity and reliability tests on the pilot data using SPSS version 26.

SEM analysis was performed using SmartPLS version 3.2.9. Knowledge and purchasing behaviour were modelled as single-indicator and formative constructs, respectively, while awareness and perceived risk were specified as reflective (Mode A) constructs; the rationale for these specifications is detailed below. The PLS algorithm was run using the path weighting scheme, a maximum of 300 iterations, and a stop criterion of 10^{-7}. We tested the significance of the path coefficients using bootstrapping with 5,000 subsamples, no sign changes, percentile bootstrap confidence intervals, and two-tailed testing at a significance level of 0.05. No data were missing because all questionnaire items were mandatory during data collection. We

assessed collinearity among indicators using the variance inflation factor (VIF), and all values ranged from 1.000 to 1.727, well below the threshold of 5, indicating no serious multicollinearity.

Purchasing behaviour (PB) was specified as a formative construct rather than reflective, based on the conceptual consideration that its three retained indicators, current purchase status, purchase frequency, and cup size/sugar level, represent distinct facets of purchasing behaviour rather than interchangeable manifestations of a single underlying trait, and are measured on different response scales. As the construct comprised only three indicators, Confirmatory Tetrad Analysis (CTA-PLS), which requires a minimum of four indicators, could not be conducted for PB; the specification was therefore determined on conceptual grounds. For the reflective constructs, CTA-PLS was performed for awareness (six indicators); results indicated that 2 of 9 non-redundant tetrads were statistically significant (95% bias-corrected confidence intervals excluding zero), providing partial rather than conclusive support for the reflective specification. Collinearity among the formative PB indicators was acceptable (VIF: PPM1 = 1.696, PPM2 = 1.661, PPM4 = 1.107). Outer weights indicated that current purchase status (weight = 0.520, p = 0.001) and purchase frequency (weight = 0.461, p = 0.011) contributed significantly to PB, while cup size/sugar level showed a marginally non-significant weight (weight = 0.266, p = 0.056) but was retained given its acceptable outer loading (0.541) and conceptual relevance. Discriminant validity between the reflective multi-item constructs (awareness and perceived risk) was assessed using the Heterotrait-Monotrait Ratio (HTMT) with bootstrapped 95% confidence intervals (5,000 subsamples); the HTMT value (0.221) was below 0.85, and its confidence interval did not include 1, supporting discriminant validity. HTMT was not interpreted for knowledge, which was modelled as a single-indicator composite.

The structural model in this study reports path coefficients without adjustment for respondents' demographic characteristics. This decision was based on the study's focus on examining the psychological-behavioural mechanism, namely the effects of knowledge, awareness, and perceived risk on purchasing behaviour, which is conceptually assumed to apply generally to the Gen Z population, consistent with the theoretical framework underlying the adaptation of the research instruments (22,23,33,34,36–38), rather than to compare differences across demographic groups.

However, because age, sex, monthly allowance, and region may plausibly influence both the cognitive constructs and purchasing behaviour simultaneously, these characteristics could act as confounding variables rather than being purely inert background factors. To address this possibility empirically, a supplementary sensitivity analysis was conducted by adding sex, age, region, and monthly allowance as covariates with direct paths to all endogenous constructs (awareness, perceived risk, and purchasing behaviour). The results of this sensitivity analysis are presented in the Results section.

The submitted materials did not specify the coding or reference categories used for the sex, age, monthly allowance, and region covariates or whether the region variable represented current residence or region of origin. Accordingly, the covariate coefficients are reported for sensitivity analysis but are not interpreted directionally.

In addition to significance values and R^2, effect size (f^2) was also reported to assess the relative contribution of each exogenous construct to its endogenous construct. Based on Cohen's (31) conventions of 0.02 (small), 0.15 (medium), and 0.35 (large), most structural paths showed small effect sizes, except for the path from perceived risk to purchasing behaviour, which showed a medium effect size (f^2 = 0.176). The predictive relevance of the model (Q^2) was assessed using the blindfolding procedure, yielding Q^2 values of 0.005 for awareness, 0.018 for perceived risk, and 0.125 for purchasing behaviour. All values were positive, indicating some predictive relevance for the three endogenous constructs. The Q^2 value for knowledge could not be interpreted (Q^2 = 0) because this construct, represented as a ten-item composite score, was modelled as a single indicator, so the blindfolding procedure had no redundancy to evaluate for this construct. Fixing the outer loading, AVE, and composite reliability of the knowledge construct at 1.000 is a modelling convention for single-indicator constructs and does not correct for the KR-20 reliability of this composite (0.598). No disattenuation or other correction for measurement error was incorporated into the structural model; consequently, path coefficients involving the knowledge construct should be interpreted with the possibility of unmodelled measurement error and attenuation bias in mind.

Ethical Considerations

The Human Research Ethics Committee of Bogor Agricultural University approved this study under ethical approval number 1581/IT3.KEPMSM-IPB/SK/2025 on January 13, 2025. Informed consent was obtained from all participants prior to data collection. Participant confidentiality was maintained, and all personal identifiers were removed to ensure anonymity and protect participants' identities throughout the study.

RESULTS

Demographic Characteristics of Respondents

A total of 272 respondents participated in this study. The demographic characteristics showed that the majority of respondents were female (74.3%). Respondents were aged between 18 and 24 years, with most being 21 years old (52.9%). Regarding monthly allowance, nearly half of the respondents (45.2%) reported receiving between Rp1,000,000 and Rp1,500,000 per month. The marked imbalance in the reported demographic categories (74.3% female) and the concentration of respondents within a relatively narrow monthly allowance range (45.2% in the Rp1,000,000–1,500,000 category) require caution in interpreting the findings. These characteristics should not be viewed merely as descriptive features but also as potential sources of bias and limitations in applying the findings to populations with a more balanced distribution or broader socioeconomic variation. Table 1 presents further details.

Table 1. Respondent characteristics

Characteristics	Description	n	%
Sex	Female	202	74.3
	Male	70	25.7
Age	21 years	144	52.9
	22 years	49	18.1
	20 years	27	9.9
	19 years	24	8.8
	23 years	16	5.9
	18 years	8	2.9
	24 years	4	1.5
Monthly allowance	< Rp 1.000.000	89	32.7
	Rp1,000,000–1,500,000	123	45.2
	> Rp 1.500,000	60	22.1

Sweetened Beverage Purchasing Behaviour

Most respondents purchased sweetened beverages ≤ 5 times during the past month (70.6%). The majority of respondents (80.5%) reported spending less than Rp250,000 per month on sweetened beverages. In addition, nearly half of the respondents consumed fewer than eight glasses of water per day (45.6%). Most respondents (84.2%) reported that sweetened beverages did not replace water consumption, while 15.8% reported otherwise. Furthermore, more than half of respondents (62.1%) perceived contemporary sweetened beverages to contain higher sugar levels than packaged sweetened beverages, whereas 37.9% disagreed. Table 2 presents further details.

Table 2. Sweetened beverage purchasing behaviour

Purchasing Behaviour	Description	n	%
Purchase frequency in a month	≤ 5 times	192	70.6
	6–10 times	73	26.8
	≥ 11 times	7	2.6
Average monthly expenses	< Rp250,000	219	80.5
	Rp250,000 - 500,000	47	17.3
	> Rp500,000	6	2.2
Daily water consumption	< 8 glasses	124	45.6
	8 glasses	92	33.8
	> 8 glasses	56	20.6
Do sweetened beverages replace water consumption?	Yes	43	15.8
	No	229	84.2
Is the sugar content in contemporary sweetened beverages higher than in packaged sweetened beverages?	Yes	169	62.1
	No	103	37.9

Measurement Model Evaluation

Convergent validity and reliability were assessed using outer loadings, average variance extracted (AVE), and composite reliability for the reflective constructs (awareness and perceived risk). In the initial PLS-SEM analysis, three indicators (PR5 = 0.251, PR6 = −0.109, and PPM3 = 0.440) were removed because their outer loadings were below the recommended threshold of 0.50. After model re-estimation, all retained reflective indicators exhibited outer loadings above 0.50, indicating acceptable convergent validity (Table 3).

The knowledge construct was modelled as a single-indicator construct represented by the total score of ten dichotomous knowledge items. Each item was scored 1 for a correct response and 0 for an incorrect response, with no reverse-scored items; the composite score was calculated as the simple sum of the ten items, yielding a theoretical range of 0–10. In the observed sample (n = 272), scores ranged from 2 to 10 (M = 7.11, SD = 1.955). This specification was adopted because the ten items collectively represent a cumulative knowledge index rather than multiple reflective manifestations of a latent construct. Following Sarstedt et al. (42) and Hair et al. (43), a single-indicator specification is appropriate for concrete constructs measured as objective summary scores.

Consequently, the outer loading, AVE, and composite reliability of the knowledge construct were fixed at 1.000 by model specification and should not be interpreted as evidence of perfect measurement quality. Fixing these values to 1.000 is a modelling convention for single-indicator constructs and does not correct for, or account for, the internal consistency reliability of the underlying ten-item composite, which was estimated separately using the KR-20 coefficient (KR-20 = 0.598), indicating relatively low reliability. The structural model did not correct for measurement error (e.g., disattenuation); therefore, the path coefficients involving the knowledge construct should be interpreted with the possibility of unmodelled measurement error and potential attenuation bias in mind. This limitation is further discussed in the Limitations section. As presented in Table 3, the outer loadings ranged from 0.601 to 0.815 for awareness and 0.654 to 0.733 for perceived risk. Although the AVE for the awareness construct was slightly below the recommended threshold (0.473 < 0.50), the construct was retained because its composite reliability exceeded 0.70 (0.842), indicating acceptable internal consistency.

Table 3. Measurement model evaluation results (single-indicator and reflective constructs)

Latent Variable	Indicator	Outer Loading	AVE	Composite Reliability
Knowledge	Composite knowledge score	1.000	1.000	1.000
Awareness	Usually reads ingredient composition on beverage packaging before selecting products	0.815	0.473	0.842
	Understands how to read beverage labels, especially beverages with added sugar	0.631		
	Prefers beverages without added sugar because they are considered healthier	0.690		
	Understands alternative names of sugar commonly added to beverages	0.601		
	Has a good understanding of reading nutrition facts before purchasing beverages	0.719		
	Frequently compares calorie contribution from added sugar before purchasing beverages	0.648		
Perceived risk	Excessive calorie intake from sweetened beverages may increase obesity risk	0.726	0.505	0.803
	Frequent consumption of sweetened beverages may increase the risk of health problems	0.654		
	Illness caused by sweetened beverages may increase financial burden for treatment	0.728		
	Illness caused by sweetened beverages may result in loss of time	0.733		

Because purchasing behaviour was specified as a formative construct, its measurement quality was evaluated using indicator collinearity (VIF), outer weights and loadings, and content coverage rather than AVE or composite reliability, consistent with formative measurement model guidelines (43). As shown in Table 4, collinearity among the three purchasing behaviour indicators was well within acceptable limits. Current purchase status and purchase frequency contributed significantly to the PB construct, while cup size/sugar level showed a marginally non-significant outer weight but was retained because of its acceptable outer loading (0.541) and conceptual relevance to sweetened beverage consumption. Together, the three indicators cover current purchasing, purchase frequency, and cup size and sugar level.

Table 4. Formative measurement model evaluation for purchasing behaviour

Indicator	VIF	Outer Weight	t-value	p-value	Outer Loading
Currently still purchasing sweetened beverages	1.696	0.520	3.320	0.001	0.887
Frequency of purchasing sweetened beverages	1.661	0.461	2.533	0.011	0.856
Cup size and sugar level commonly purchased	1.107	0.266	1.914	0.056	0.541

Discriminant validity was evaluated using the Fornell-Larcker criterion (44) by comparing the square root of AVE values with the correlations among latent variables. As shown in Table 5, the square root of AVE for awareness and perceived risk was higher than their respective correlations, indicating adequate discriminant validity between these constructs. The Fornell-Larcker criterion was not applied to knowledge, which was modelled as a single-indicator composite with an AVE of 1 by definition, or to purchasing behaviour, because it is based on AVE, which is not defined for formative constructs.

Table 5. Discriminant validity results using the Fornell-Larcker criterion

Latent Variable	Awareness	Knowledge	Perceived Risk
Awareness	0.688		
Knowledge	−0.118	n.a.	
Perceived risk	0.174	0.110	0.711

Notes: Diagonal values are the square root of AVE; off-diagonal values are latent variable correlations. n.a. = not applicable (knowledge is a single-indicator composite).

As a complement to the Fornell-Larcker criterion (44), discriminant validity between awareness and perceived risk was also evaluated using the Heterotrait-Monotrait Ratio (HTMT) with bootstrapped 95% confidence intervals (5,000 subsamples), following the recommendation of Henseler et al. (45). The HTMT value was well below the conservative threshold of 0.85, and its confidence interval did not include 1, confirming that awareness and perceived risk are empirically distinct constructs (Table 6). HTMT was not interpreted for knowledge, which was modelled as a single-indicator composite and therefore has no within-construct item correlations, nor for purchasing behaviour, as this criterion likewise relies on indicator correlations appropriate for reflective, not formative, measurement.

Table 6. Heterotrait-monotrait ratio with bootstrapped 95% confidence intervals

Construct Pair	HTMT	95% CI Lower	95% CI Upper
Awareness ↔ Perceived risk	0.221	0.167	0.394

Table 7 presents the coefficient of determination (R^2) and predictive relevance (Q^2) of the endogenous constructs after respecifying purchasing behaviour as a formative construct. The R^2 values indicate that knowledge explains only 1.4% of the variance in awareness (adjusted R^2 = 1.0%), while knowledge and awareness together explain 4.8% of the variance in

perceived risk (adjusted R^2 = 4.1%). These findings suggest that the model has weak explanatory power for both constructs, indicating that most of their variance is likely attributable to factors not included in the present study. In contrast, knowledge, awareness, and perceived risk jointly explain 23.1% of the variance in SSB purchasing behaviour (adjusted R^2 = 22.2%), indicating a moderate level of explanatory power for the behavioural outcome. Across all endogenous constructs, the adjusted R^2 values are very close to the corresponding R^2 values, indicating only small differences between the unadjusted and adjusted estimates.

Table 7. Coefficient of Determination (R^2) and Predictive Relevance (Q^2)

Latent Variable	R^2	R^2 Interpretation	Q^2	Predictive Relevance
Awareness	0.014	Weak	0.005	Positive
Perceived risk	0.048	Weak	0.018	Positive
Beverage purchasing behaviour	0.231	Moderate	0.125	Positive

Consistent with the Q^2 values reported in Table 7, the Q^2 values for awareness (0.005), perceived risk (0.018), and purchasing behaviour (0.125) were all positive, indicating predictive relevance under the blindfolding criterion. The purchasing-behaviour construct had the largest Q^2 value, whereas the values for awareness and perceived risk were close to zero. Because the explanatory power of the model varies across endogenous constructs, the interpretation of the structural model should not rely solely on R^2 values. Therefore, the effect size (f^2) of each structural path was further examined, as presented in Table 8, to assess the practical contribution to the explained variance of the corresponding endogenous construct.

Table 8. Effect Size (f^2) of the Structural Relationships

Structural Relationship	f^2	Effect Size Interpretation
Knowledge → Awareness	0.014	Negligible
Knowledge → Perceived risk	0.018	Negligible
Knowledge → Purchasing behaviour	0.045	Small
Awareness → Perceived risk	0.037	Small
Awareness → Purchasing behaviour	0.029	Small
Perceived risk → Purchasing behaviour	0.176	Medium

Note. Effect sizes were interpreted according to Cohen (31): small = 0.02, medium = 0.15, and large = 0.35.

Hypothesis Testing

Hypothesis testing was conducted using the bootstrapping procedure (5,000 subsamples) in SmartPLS with a two-tailed test. A structural path was considered statistically significant if the t-statistic exceeded 1.96 and the bootstrap-based p-value was less than 0.05. As presented in Table 9, the results of the structural path analysis show that knowledge is significantly and positively associated with perceived risk (β = 0.133; t = 2.309; p = 0.021; 95% CI [0.022, 0.246]), and awareness is also significantly and positively associated with perceived risk (β = 0.190; t = 3.004; p = 0.003; 95% CI [0.077, 0.327]).

Furthermore, knowledge was significantly and negatively associated with the purchasing behaviour of sugar-sweetened beverages (β = −0.189; t = 3.000; p = 0.003; 95% CI [−0.308, −0.065]). Awareness was also significantly and negatively associated with purchasing behaviour (β = −0.153; t = 2.077; p = 0.038; 95% CI [−0.296, −0.011]). In addition, perceived risk was significantly and negatively associated with purchasing behaviour (β = −0.377; t = 5.392; p < 0.001; 95% CI [−0.510, −0.235]). Thus, H2, H3, H4, H5, and H6 are supported. However, the relationship between knowledge and awareness was not significant (β = −0.118; t = 1.763; p = 0.078; 95% CI [−0.243, 0.019]), so H1 is not supported.

Table 9. Hypothesis testing results

Path	Path Coefficient	t-value	p-value	95% CI (2.5%-97.5%)	Decision
Knowledge → awareness	−0.118	1.763	0.078	[−0.243; 0.019]	H1 not supported
Knowledge → perceived risk	0.133	2.309	0.021*	[0.022; 0.246]	H2 supported
Awareness → perceived risk	0.190	3.004	0.003**	[0.077; 0.327]	H3 supported
Knowledge → beverage purchasing behaviour	−0.189	3.000	0.003**	[−0.308; −0.065]	H4 supported
Awareness → beverage purchasing behaviour	−0.153	2.077	0.038*	[−0.296; −0.011]	H5 supported
Perceived risk → beverage purchasing behaviour	−0.377	5.392	<0.001***	[−0.510; −0.235]	H6 supported

Note. CI = confidence interval; *p < 0.05; **p < 0.01; ***p < 0.001.

Sensitivity Analysis

To evaluate the robustness of the structural paths to potential confounding by demographic characteristics, we conducted a sensitivity analysis in which sex, age, monthly allowance, and region were added as covariates with direct paths to all endogenous constructs: awareness, perceived risk, and purchasing behaviour. These covariates were included in the equations for all endogenous constructs because demographic characteristics such as sex and locality have been associated with awareness-related attitudes towards sugar-sweetened beverages (35). As shown in Table 10, all structural paths retained

their direction and significance, and the path coefficients differed from those of the main model by at most 0.006. The paths from perceived risk (β = −0.375, p < 0.001), knowledge (β = −0.184, p = 0.003), and awareness (β = −0.154, p = 0.035) to purchasing behaviour all remained significant, as did the paths from knowledge (β = 0.134, p = 0.021) and awareness (β = 0.185, p = 0.007) to perceived risk. The knowledge → awareness path remained non-significant in both models (p = 0.078 in both the main and adjusted models).

Among the covariates, sex showed significant direct associations with purchasing behaviour (β = 0.178, p = 0.004) and awareness (β = 0.142, p = 0.030), while age (β = −0.100, p = 0.053) and monthly allowance (β = 0.106, p = 0.051) did not reach statistical significance for purchasing behaviour. None of the covariates was significantly associated with perceived risk, and region was not significantly associated with any endogenous construct. These findings indicate that although sex was independently associated with purchasing behaviour and awareness, the hypothesized structural relationships remained stable and robust after accounting for these covariates.

Table 10. Comparison of main model and covariate-adjusted (sensitivity) model

Path	Main Model β (p)	Adjusted Model β (p)	Robust
Knowledge → awareness	−0.118 (0.078)	−0.112 (0.078)	Consistent (both non-significant)
Knowledge → perceived risk	0.133 (0.021*)	0.134 (0.021)*	Robust
Awareness → perceived risk	0.190 (0.003**)	0.185 (0.007)**	Robust
Knowledge → beverage purchasing behaviour	−0.189 (0.003**)	−0.184 (0.003)**	Robust
Awareness → beverage purchasing behaviour	−0.153 (0.038*)	−0.154 (0.035)*	Robust
Perceived risk → beverage purchasing behaviour	−0.377 (<0.001***)	−0.375 (<0.001***)	Robust
Sex → awareness	–	0.142 (0.030)*	—
Sex → perceived risk	–	0.009 (0.869)	—
Sex → beverage purchasing behaviour	–	0.178 (0.004**)	—
Age → awareness	–	0.080 (0.260)	—
Age → perceived risk	–	0.022 (0.678)	—
Age → beverage purchasing behaviour	–	−0.100 (0.053)	—
Monthly allowance → awareness	–	0.007 (0.908)	—
Monthly allowance → perceived risk	–	−0.050 (0.365)	—
Monthly allowance → beverage purchasing behaviour	–	0.106 (0.051)	—
Region → awareness	–	−0.045 (0.471)	—
Region → perceived risk	–	−0.009 (0.882)	—
Region → beverage purchasing behaviour	–	0.078 (0.174)	—

Note. *p < 0.05; **p < 0.01; ***p < 0.001.

DISCUSSION

Knowledge and Awareness

The non-significant path between knowledge and awareness (β = −0.118; t = 1.763; p = 0.078) diverges from prior studies suggesting that greater knowledge of sweetened beverages is associated with higher awareness of their health impacts and product details when making purchases (19,46). Several factors may explain this finding: the relatively low internal consistency of the ten-item knowledge composite (KR-20 = 0.598), which may have introduced unmodelled measurement error; the negligible effect size (f^2 = 0.014) and minimal variance explained (R^2 = 0.014); possible range restriction if Gen Z respondents had similarly high knowledge and awareness because of prior health-campaign exposure; and the cross-sectional design, which cannot establish temporal ordering between the constructs. The finding should not be read as evidence that knowledge and awareness are unrelated in general, only that this study's specific measurement and design detected no association.

Knowledge and Perceived Risk

The results showed that knowledge was significantly and positively associated with perceived risk (β = 0.133; t = 2.309; p = 0.021). This finding indicates that individuals with higher knowledge regarding sweetened beverages tended to perceive greater health risks associated with their consumption. Therefore, Hypothesis 2 (H2) was supported. These findings are consistent with previous studies showing that informed or experienced consumers tend to be more aware of potential risks and more selective in their purchasing decisions (47), particularly when confident in their knowledge (48). However, the effect size for this path was negligible (f^2 = 0.018) (31), and together with awareness, it accounted for only 4.8% of the variance in perceived risk (R^2 = 0.048). This suggests that knowledge was associated with perceived risk, but the practical magnitude of the association was limited. These cross-sectional findings do not establish whether knowledge-based interventions would substantially change SSB-related risk perceptions.

Awareness and Perceived Risk

The results showed that awareness was significantly and positively associated with perceived risk (β = 0.190; t = 3.004; p = 0.003). This finding suggests that individuals with higher awareness regarding sweetened beverages tended to perceive

greater health risks associated with their consumption, supporting Hypothesis 3 (H3). These findings align with previous studies, indicating that greater consumer awareness is accompanied by increased information processing and heightened perceptions of risk and uncertainty during purchase decisions (49). In another behavioural context, an awareness-raising intervention was associated with increased risk perceptions (50). Nonetheless, this path also showed a small effect size (f^2 = 0.037), reinforcing that awareness, like knowledge, explains only a modest share of variation in perceived risk. Whether combining awareness-raising with other risk-communication strategies would strengthen consumers' risk perception remains a question for experimental research.

Knowledge and Beverage Purchasing Behaviour

The results showed that knowledge was significantly and negatively associated with sweetened beverage purchasing behaviour (β = −0.189; t = 3.000; p = 0.003). This finding indicates that individuals with higher knowledge regarding sweetened beverages tended to show lower purchasing behaviour, supporting Hypothesis 4 (H4). These findings align with previous studies showing that greater consumer knowledge may be associated with lower levels of purchase and consumption of sweetened beverages, particularly among youth who are still developing cognitive and behavioural patterns (51). Moreover, awareness of health risks related to sweetened drinks corresponds with reduced purchasing (19). The effect size for this relationship was small (f^2 = 0.045), indicating that while consumers with higher knowledge reported lower purchasing, knowledge had only a modest association with purchasing behaviour. Whether complementing knowledge-based education with risk-focused communication would be more effective cannot be determined from these cross-sectional data and warrants experimental evaluation.

Awareness and Beverage Purchasing Behaviour

The results showed that awareness was significantly and negatively associated with sweetened beverage purchasing behaviour (β = −0.153; t = 2.077; p = 0.038). This finding indicates that individuals with higher awareness regarding sweetened beverages tended to show lower purchasing behaviour, supporting Hypothesis 5 (H5). These findings align with previous studies, indicating that awareness is linked to purchasing decisions, with consumers who are more informed showing different patterns of product selection and consumption (22). Additionally, consumers who are aware of the health risks associated with sweetened drinks are more likely to limit or avoid their consumption, although the reported association may be small (52). Similarly, this path showed a small effect size (f^2 = 0.029), suggesting that the association between awareness and purchasing behaviour is modest relative to that of perceived risk. Whether awareness campaigns that also heighten risk perception would be associated with larger changes in purchasing behaviour is a testable question for future experimental or longitudinal research.

Perceived Risk and Beverage Purchasing Behaviour

The results showed that perceived risk was significantly and negatively associated with sweetened beverage purchasing behaviour (β = −0.377; t = 5.392; p < 0.001). This finding indicates that individuals with higher perceived risk regarding sweetened beverages tended to show lower purchasing behaviour, supporting Hypothesis 6 (H6). These findings are consistent with previous research indicating an association between perceived risk and lower likelihood of making purchases, particularly when health concerns are involved (19). As perceived risk is inherently subjective, consumers may differ in their evaluation of the risks associated with purchasing decisions (53). This pattern is echoed in Indonesian consumer research, where perceived risk and institution-based trust have been associated with service purchasing behaviour (54). Greater perceived health risks in relation to sweetened beverages were associated with lower purchasing-behaviour scores.

This path showed the largest effect size in the model (f^2 = 0.176) and the highest R^2 among endogenous constructs (0.231), indicating that perceived risk had the strongest association with purchasing behaviour among the constructs examined here. This association remained similar after adjustment for demographic covariates in the sensitivity analysis (see Table 10), although the cross-sectional design still precludes causal or directional inference. However, most variance remains unexplained, and the cross-sectional design cannot confirm directionality. Within this cross-sectional model, perceived risk showed the strongest association with purchasing behaviour among the three predictors examined.

Research Implications

This study found that perceived risk showed the strongest association with purchasing behaviour among the constructs examined, followed by knowledge and awareness. Because the data are cross-sectional, this finding does not establish that risk-focused communication would be more effective than other approaches. Risk communication, used alongside knowledge-based approaches rather than replacing them, is therefore a candidate for future longitudinal or experimental evaluation. For health educators and university health-promotion units, such studies could test whether nutrition education materials that go beyond listing sugar content or health facts, and instead frame concrete, relatable health risks associated with regular SSB consumption, are associated with changes in purchasing behaviour over time. For public health communicators and campaign designers, these associations suggest a testable direction: whether campaigns designed to heighten risk perception are associated with changes in purchasing behaviour warrants future evaluation.

Whether regulatory measures, such as re-evaluating sugar-content labelling requirements or oversight jurisdiction for ready-to-drink beverages, would translate into meaningful shifts in consumer risk perception and purchasing behaviour remains an open question that this study cannot answer, as it did not assess product sugar content, regulatory compliance, or policy

effectiveness. Future policy-oriented research is needed to examine whether such regulatory interventions produce measurable behavioural change among young consumers.

CONCLUSION

The analysis showed that knowledge, awareness, and perceived risk were significantly and negatively associated with sweetened beverage purchasing behaviour scores in this sample of recent SSB-consuming university students. Higher scores on these constructs were associated with lower purchasing-behaviour scores, although these cross-sectional, self-reported data cannot establish that increasing these factors would reduce purchasing behaviour. Awareness was also significantly and positively associated with perceived risk, with higher awareness scores associated with higher perceived-risk scores. However, knowledge was not significantly associated with awareness in this sample, suggesting that the two constructs did not covary as measured here, though this should not be generalised as evidence that knowledge and awareness are unrelated more broadly.

This study had several limitations. First, the study focused exclusively on Gen Z university students in Indonesia, excluding younger individuals within the same generation, such as high school students, as well as other population groups. Therefore, the findings may not be generalisable to broader populations. Second, the use of a non-probability voluntary sampling technique may have introduced selection bias because participation depended on respondents' willingness and access to the online survey. Third, the use of an online questionnaire may have introduced measurement bias, particularly in the assessment of knowledge, due to the possibility that respondents searched for answers while completing the survey; knowledge was also measured as a ten-item composite score with relatively low internal consistency (KR-20 = 0.598), and perceived risk likewise showed internal consistency below the conventional 0.70 threshold (α = 0.678). Because no correction for measurement error was incorporated into the structural model, this may have attenuated the path coefficients involving knowledge and perceived risk. Purchasing behaviour, specified as a formative construct, was evaluated using collinearity, outer weights and loadings, and content coverage rather than internal consistency. Fourth, the study did not account for variations in sweetened beverage brands and product types, including "less sugar" or "no sugar" options, which may relate to purchasing behaviour and perceived health risks. Fifth, the cross-sectional design precludes any conclusion about the temporal or causal ordering among knowledge, awareness, perceived risk, and purchasing behaviour. Sixth, the model showed weak explanatory power for awareness (R^2 = 0.014) and perceived risk (R^2 = 0.048), indicating that factors beyond those examined here likely play a larger role in shaping these constructs. Seventh, the awareness construct combined items on information seeking, understanding of nutritional information, and preference for low-sugar products into a single reflective score. This followed the source instrument, in which five of the six items belong to the attitude domain assessing awareness (34,35); however, one item was drawn from the practice domain, and all items were reworded as first-person statements. A higher composite score therefore does not show which aspect of awareness drives the observed associations. Future studies could treat these aspects as separate constructs, or use a formative rather than reflective measurement model, to clarify their distinct contributions.

Despite these limitations, the findings suggest that sweetened beverage purchasing behaviour may be associated with knowledge, awareness, and perceived risk, as well as access to information regarding daily sugar intake and the health impacts of sweetened beverages. Given the limited research on this topic in Indonesia, future studies should explore differences across educational levels, analyse brand-specific factors such as price and sugar content, and consider additional variables, including peer influence, social media exposure, sedentary behaviour, and lifestyle, to gain a more comprehensive understanding of purchasing behaviour. Longitudinal or experimental designs, along with multi-item knowledge measures, would also help clarify the direction and robustness of the relationships identified here.

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Author contributions: MS: Conceptualization, Methodology, Supervision, Formal analysis, Writing – review & editing. ERM: Investigation, Writing – original draft, Project administration. Both authors reviewed and approved the final version of the manuscript.

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