

Health over price: Understanding consumer purchase intention for herbal infusions (roselle tisane)

[Kesihatan lebih utama daripada harga: Memahami niat pembelian pengguna terhadap infusi herba (*tisane* rosel)]

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Abstract

This study focuses on roselle tisane, a locally produced herbal infusion in the Klang Valley, Malaysia. Drawing on the Theory of Planned Behaviour (TPB), this research utilises data collected from 400 respondents via convenience sampling. The data were analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM) to assess the relative influence of TPB constructs, health consciousness and price. The findings confirm that the core TPB constructs, namely Subjective Norms (SNs) and Perceived Behavioural Control (PBC), are the significant predictors of purchase intention. At the same time, the predictive power of the attitude in this TPB context is questionable. Critically, the analysis also reveals that health consciousness exerts a more substantial positive influence on consumers' attitudes than price. This suggests consumers prioritise the perceived wellness benefits of functional foods over economic considerations. Overall, these results have practical implications for producers and marketers, highlighting that strategies emphasising the health attributes and nutritional value of roselle tisane will likely be more effective at driving adoption than price-based promotions.

Introduction

Modern health beverages today offer an increasingly diverse range of alternatives, with herbal infusions emerging as one of the most prominent categories. These infusions, long embraced in traditional medicine systems across various cultures, are now widely recognised as a popular global beverage choice (Poswal et al. 2019). A tisane, commonly known as an herbal tea or herbal infusion, is typically prepared from various plant parts, such as leaves, stems, roots, fruits, buds and

flowers (Ramphinwa et al. 2023). Their growing popularity can be attributed to the presence of bioactive compounds, including polyphenols, phenolic acids, flavonoids and coumarins. Notably, these naturally occurring substances have been demonstrated to reduce the risk of several Non-Communicable Diseases (NCDs). This includes cardiovascular diseases (CVDs), Type 2 Diabetes Mellitus (T2DM), certain cancers, arthritis, autoimmune conditions and neurodegenerative disorders (Etheridge and Derbyshire 2020).

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In Malaysia, the tea market, including herbal infusions such as roselle, is projected to reach USD12.57 million in 2024, rising to USD22.17 million by 2029 (Statista 2024). This growth is indicative of a broader shift in consumer preferences toward flavourful, caffeine-free and health-oriented beverage alternatives. This, in turn, positions roselle tisane as a key player in the modern health beverage movement.

As a beverage, roselle tisane is classified as an herbal infusion. It falls within the category of non-caffeinated functional beverages in the broader non-alcoholic drinks market. Given its associated health benefits, it is also considered part of the functional food or nutraceutical sector and in many traditional contexts, is viewed as a natural herbal remedy. Among the many plants used in herbal infusions, roselle (*Hibiscus sabdariffa*), a tropical shrub belonging to the Malvaceae family, stands out for its nutritional richness and health-promoting potential. Renowned for its vibrant red calyces, roselle is native to West Africa. Still, it has spread widely across Asia, the Middle East and the Caribbean due to its adaptability to tropical and subtropical climates. In Malaysia, roselle was introduced in the early 1990s and quickly gained traction as a high-value crop due to its versatility in applications ranging from beverages and jams to traditional remedies, as well as its impressive nutrient profile.

Malaysian Agricultural Research and Development Institute (MARDI) has developed a new healthy beverage from roselle, namely roselle tisane, which is well-known for its numerous health benefits, particularly its potential antidiabetic effects. One of the key bioactive compounds in roselle tisane is anthocyanin, which not only gives the tea its vibrant red colour, but also plays a crucial role in its antidiabetic properties. Studies have demonstrated that these compounds can improve glucose metabolism and inhibit digestive enzymes associated with diabetes (Jamrozik et al. 2022; Herdiani et al. 2021; Nafizah et al.

2017; Wu et al. 2009). Additionally, roselle tisane developed by MARDI has been scientifically proven to have antidiabetic effects. Moreover, results from an in vivo study in Sprague-Dawley rats demonstrated a glucose-lowering effect after 21 days of treatment, comparable to that of the commercial drug metformin.

Numerous studies have documented the nutritional and pharmacological properties of *H. sabdariffa*, including its antioxidant, antihypertensive and antimicrobial effects. However, much of the existing research has focused on its biomedical functions rather than on consumer behaviour, market readiness or cultural integration, particularly within the Malaysian context. Despite Malaysia's favourable climate for roselle cultivation and its growing popularity as a functional beverage, there remains a notable lack of in-depth studies examining local consumers' awareness, acceptance and readiness to incorporate roselle tisane into their daily dietary choices. This is especially true in urban regions such as the Klang Valley. Following this, market segmentation, demographic preferences and perceived health benefits from the consumer's perspective are underexplored areas. Consequently, this gap presents a valuable opportunity to investigate how Malaysian consumers perceive roselle tisane, what influences their purchasing decisions and how this traditional herbal infusion can be positioned more effectively in the current health beverage market. Therefore, this study was conducted to examine the factors influencing consumers' buying behaviour for herbal infusions developed by MARDI in the Klang Valley.

Literature review

Consumer study

Herbal infusions, also known as tisanes, have garnered significant global attention due to their perceived health-promoting properties, natural origin and lower caffeine content compared to traditional teas (Brillas et al. 2022). Consumer motivations for

consuming herbal infusions often include health benefits, wellness identity, sensory appeal and convenience. By contrast, barriers include safety concerns and inconsistent labelling (Sousa et al. 2024). In line with this, studies in Europe and North America indicate that health consciousness is a key driver of herbal tea consumption. For example, a survey of Portuguese adolescents noted that herbal infusion intake was associated with healthier lifestyle orientations, suggesting that health awareness strongly influences beverage choices (Sousa et al. 2024).

Several studies have further confirmed that perceived health benefits and taste are the strongest drivers of purchase intention for herbal beverages, while price plays a secondary role. In a survey of hibiscus-based beverages, taste and expected health benefits outweighed the effect of additional health-related information on consumer willingness to pay (Ndiaye et al. 2023). However, consumer safety perceptions remain essential. Luo et al. (2021) and Lu et al. (2024) highlighted concerns regarding potential contamination in herbal products. This includes heavy metals and pyrrolizidine alkaloids, which may undermine consumer trust despite generally acceptable risk levels. To address these concerns, organisations such as Tea and Herbal Infusions Europe (THIE) and the World Health Organisation (WHO) have established quality standards and contaminant guidelines to strengthen consumer confidence (THIE 2024; WHO 2007).

In Malaysia, herbal infusions are widely consumed and often associated with traditional health practices. A recent Knowledge, Attitudes and Practices (KAP) study on herbal tea among Malaysian consumers observed that respondents were moderately knowledgeable, expressed positive attitudes and strongly accepted herbal tea. In line with this, preferences varied by demographic group: younger consumers favoured supermarket tea-bag formats, while older

consumers purchased from stockists or direct agents (Norhayati et al. 2023). Health consciousness is also a major determinant of functional food choices among Malaysians. For instance, Sharkawi (2014) demonstrated that young adults' healthy-eating intentions were significantly influenced by health consciousness, knowledge and Perceived Behavioural Control (PBC), with price having a lesser influence. Similarly, Bajat et al. (2023) reported that perceived health benefits and health awareness shaped attitudes and purchase intention for functional foods in Malaysia. Additionally, cultural familiarity plays a role in the acceptance of herbal infusions. Likewise, Tengku Mohamad et al. (2019) highlighted that Malay women's use of herbal products was driven by cultural trust, perceived safety and efficacy, highlighting the importance of socio-cultural context. In particular, for roselle, studies emphasise its sensory attributes, especially its colour and flavour, as key drivers of acceptance in product development (Islam et al. 2022).

Malaysia's regulatory framework for herbal and functional foods is governed by the Sale of Drugs Act 1952 and the Control of Drugs and Cosmetics Regulations 1984 (CDCR). These regulations require registration of natural products with the Drug Control Authority through the National Pharmaceutical Regulatory Agency (NPRA). The Drug Registration Guidance Document (DRGD) specifies requirements for safety, quality and efficacy evidence (NPRA 2023). Additionally, Association of Southeast Asian Nations (ASEAN) guidelines set maximum limits for contaminants in traditional medicines (ASEAN 2021). At the same time, recent regulatory updates allow for natural products to carry scientifically supported "modern claims," which may help strengthen consumer confidence in herbal infusions such as roselle tisane (ChemLinked 2024). Overall, global and Malaysian evidence indicate that health consciousness is the primary factor influencing consumer purchase intention for herbal infusions.

Hypotheses development

This study adopts the Theory of Planned Behaviour (TPB) (Ajzen 1991) as the underlying theoretical framework. It extends it with additional constructs relevant to functional foods and herbal infusions. The TPB posits that attitude, SN and PBC collectively predict an individual's intention to perform a behaviour, which in turn leads to actual behaviour. In the context of herbal infusions, these constructs provide a robust foundation for explaining consumer purchase decisions.

Attitude refers to an individual's overall evaluation of performing a behaviour, in this case, purchasing herbal infusions (Ajzen 1991). Prior studies consistently demonstrate that favourable attitudes toward functional foods, particularly herbal beverages, are driven by perceived health benefits, sensory qualities and naturalness (Brillas et al. 2022; Ndiaye et al. 2023). In Malaysia, consumers' positive attitudes toward herbal tea have been linked to cultural familiarity and trust in traditional remedies (Norhayati et al. 2023; Tengku Mohamad et al. 2019).

SNs capture the perceived social pressure to engage in a behaviour (Ajzen 1991). Research indicates that family, peers and cultural groups significantly influence the acceptance of herbal infusions globally, particularly when linked to health-promoting practices (Sousa et al. 2024). In Malaysia, social influence is evident in the consumption of herbal drinks, including roselle, which is embedded in cultural traditions and often promoted through community networks (Sharkawi 2014).

PBC represents consumers' perceptions of ease or difficulty in purchasing and consuming herbal infusions. Availability, affordability and access to reliable information play key roles (Ajzen, 2002). Accordingly, studies suggest that when herbal infusions are readily available in supermarkets or convenient packaging, PBC positively affects purchase intention (Norhayati et al. 2023). Globally, PBC is

linked to access to safe, certified herbal products, where regulatory oversight reduces barriers to consumption (WHO 2007).

Building on this, there are other factors within this framework, including health consciousness, price, product labelling and promotional activities. Health consciousness is a critical predictor of functional food consumption, often surpassing economic considerations. For example, consumers with high health consciousness are more motivated to adopt herbal infusions for their preventive and therapeutic benefits (Katt and Meixner 2020). International evidence highlights that health-driven motives are particularly salient in hibiscus-based beverages (Ndiaye et al. 2023). Malaysian studies similarly indicated that health awareness significantly predicts intention toward purchasing functional foods, including herbal teas (Sharkawi 2014).

While price is traditionally a barrier to the adoption of functional foods, its influence is often secondary to health-related motivations. Globally, studies on herbal beverages indicate that while consumers are price-sensitive, they are willing to pay premiums when products are positioned as health-promoting (Ndiaye et al. 2023). In Malaysia, younger consumers are more price-sensitive, while perceived benefits and cultural familiarity are more influential among older consumers. In other words, perceived benefits and cultural familiarity have a greater influence on older consumers (Norhayati et al. 2023).

Product labelling, including health claims, ingredient transparency and certification logos, significantly affects consumer trust and intention to purchase functional foods (Grunert and Wills 2007). Herbal infusion studies reveal that clear labelling enhances perceptions of quality and safety (Sousa et al. 2024). Malaysian regulations, as outlined in the DRGD (NPRA 2023), require compliance for herbal teas, which may help strengthen consumer confidence.

Furthermore, promotional activities, such as advertisements and educational campaigns, can enhance consumer awareness and the perceived value of herbal infusions. Studies suggest that promotional messages emphasising health and natural attributes are more effective than price discounts alone (Katt and Meixner 2020). In Malaysia, promotions often link herbal beverages to cultural identity and preventive health, increasing acceptance (Bajat et al. 2023).

In addition, purchase intention is the immediate antecedent of actual behaviour in the TPB framework (Ajzen 1991). Evidence from functional food studies indicates that attitudes, SN, PBC and health consciousness significantly predict intention, which, in turn, predicts actual consumption behaviour (Sharkawi 2014). In the TPB framework, purchase intention is the strongest predictor of actual behaviour (Ajzen 1991). For herbal infusions, intention to purchase translates directly into actual buying and consumption behaviour (Ndiaye et al. 2023). Therefore, based on the TPB (Ajzen 1991) and extended consumer behaviour constructs, the following hypotheses are proposed in *Figure 1*.

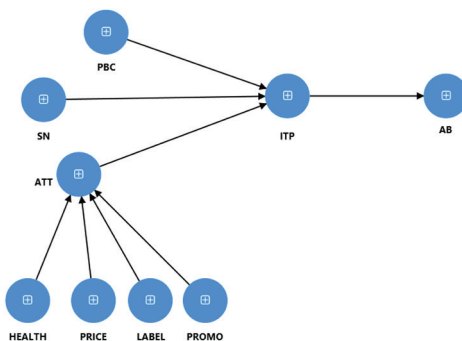


Figure 1. Structural Equation Model (SEM) based on the Theory of Planned Behaviour (TPB) with selected variables

- H_1 : SN positively influences consumer purchase intention for herbal infusions.
- H_2 : PBC positively influences consumer purchase intention for herbal infusions.
- H_3 : Attitude (ATT) positively influences consumer purchase intention for herbal infusions.
- H_4 : Health consciousness (HEALTH) positively influences consumer attitudes toward herbal infusions.
- H_5 : Price (PRICE) positively influences consumers' attitude toward herbal infusions.
- H_6 : Labelling (LABEL) positively influences consumer attitudes toward herbal infusions.
- H_7 : Promotion (PROMO) positively influences consumer attitudes toward herbal infusions.
- H_8 : Purchase intention (ITP) positively influences Actual Behaviour (AB) for herbal infusions.

Methodology

Data collection

This section outlines the systematic approach used to gather the necessary data to investigate consumer purchase intention for herbal infusions, specifically roselle tisane, in the Klang Valley. Accordingly, the study employs a quantitative research design, primarily relying on primary data collection through a structured consumer survey. The questionnaire is divided into four sections: Section A for respondents' profile; Section B for consumer awareness of MARDI-developed tisane products; Section C for consumers' acceptance of MARDI-developed tisane products and Section D for factors influencing buying behaviour for tisane. Furthermore, the target population for this study comprises consumers residing in the Klang Valley, Malaysia, who are potential or current purchasers of herbal infusions. The Klang Valley was selected due to its high population density, diverse demographic profile and accessibility, which provide a suitable representation of urban Malaysian

consumers (Mun et al. 2022). Subsequently, a total of 400 respondents were targeted for the survey to ensure a sufficient sample size for robust statistical analysis, consistent with typical requirements for quantitative studies exploring consumer behaviour. Notably, this sample size enables the detection of meaningful relationships among variables and enhances the study's statistical power. The sample size was determined using Cochran's (1977) formula for an unknown population. Based on a 95% confidence level and a 5% margin of error, the minimum required sample size was calculated to be 385 respondents. Therefore, a target of 400 respondents was set to ensure a robust sample for data analysis.

Throughout the data collection process, strict ethical guidelines were adhered to. Participants were assured of anonymity and confidentiality, with no personal identifying information collected and all responses treated with the utmost discretion. Concurrently, informed consent was obtained from all participants, clearly outlining the study's objectives, the estimated time commitment and participants' rights. Data collected was then stored securely and accessible only to the research team for analysis.

Structural Equation Modelling

This study applied Structural Equation Modelling (SEM) to identify the factors influencing the purchase intentions for roselle tisane products using Partial Least Squares (SmartPLS-4). This SEM analysis adapts the TPB model. TPB posits that behaviour is influenced by intention. The key components of TPB include PBC, SN, ATT and ITP. In this study, several factors influencing consumers' ATT were incorporated into the SEM model, including health consciousness, price, labelling and packaging and promotional activities.

Measurement model

All constructs were measured using multi-item reflective scales adapted from validated

sources. ATT, SN, PBC and ITP were measured according to TPB guidelines (Ajzen 1991). Health consciousness was adapted from Michaelidou and Hassan (2008). Meanwhile, labelling and promotional cues were drawn from the food marketing literature by Grunert and Wills (2007) and Singh and Verma (2017) and actual behaviour was assessed through self-reported purchase frequency. Correspondingly, all items were rated on a five-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree").

Convergent validity was assessed through indicator reliability (outer loadings >0.70), Average Variance Extracted (AVE 0.50) and Composite Reliability (CR >0.70). Discriminant validity was confirmed using the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio of correlations (HTMT <0.85).

Structural model

The structural model was assessed to examine the hypothesised relationships among constructs. At the same time, collinearity was examined using Variance Inflation Factors (VIF <5). Path coefficients, t -values and p -values were obtained via bootstrapping with 5,000 subsamples, ensuring robust significance testing (Hair et al. 2019). The model's predictive power was assessed using the coefficient of determination (R^2) and effect size (f^2).

Results and discussions

Respondent profile

Based on *Table 1*, the respondents exhibit a varied age distribution, with the largest proportion falling within the 31 – 40 years category (34.8%), followed by the 21 – 30 years category (25.3%) and the 41 – 50 years category (21.5%). Individuals aged 51 – 60 years constitute 9.8% of the sample, while those younger than 20 years represent 3.0%. The small proportion is observed among participants aged 61 years and above (5.8%). In terms of gender composition, the sample is predominantly female (61.5%),

with male respondents accounting for 38.5%. Regarding ethnic distribution, the majority of respondents identify as Malay (84.8%), followed by Chinese (10.3%), Indian (3.5%) and other ethnic groups (1.5%). The household size data indicate that most respondents live in households of four or more (72.0%). In contrast, smaller household sizes are less prevalent, with households of three members (15.0%), two members (10.8%) and single-member households (2.3%) reported. Regarding educational attainment, the majority of respondents hold a university-level education (66.3%), followed by secondary school education (29.0%). A smaller proportion have attained primary school education (1.3%), informal or non-formal education (0.8%), or fall into the other educational categories (2.8%).

Measurement model

SEM was applied to the data using a two-step strategy, as suggested by Anderson and Gerbing (1988), for model testing. Following the directions of Hair et al. (2019) and Ramayah et al. (2018), the measurement model was first examined to assess the validity and reliability of the instruments. Subsequently, the structural model was run to evaluate the hypotheses.

Table 2 presents a comprehensive analysis of the reliability and validity for each construct utilised in the study's measurement model. Each row corresponds to a specific construct: AB, ATT, HEALTH, ITP, LABEL, PBC, PRICE, PROMO and SN. The first measure, Cronbach's alpha, assesses the internal consistency reliability of the items comprising each construct.

Table 1. Respondents' profile

Demographic profile	Category	Percentage (%)
Age	< 20 years	3.0 (n = 12)
	21 – 30 years	25.3 (n = 102)
	31 – 40 years	34.8 (n = 135)
	41 – 50 years	21.5 (n = 87)
	51 – 60 years	9.8 (n = 41)
	61 > years	5.8 (n = 23)
Gender	Man	38.5 (n = 154)
	Women	61.5 (n = 246)
Ethnic	Malay	84.8 (n = 339)
	Chinese	10.3 (n = 41)
	Indian	3.5 (n = 14)
	Others	1.5 (n = 6)
Numbers of household	1	2.3 (n = 9)
	2	10.8 (n = 43)
	3	15.0 (n = 60)
	4 >	72.0 (n = 291)
Level of education	University	66.3 (n = 265)
	Secondary school	29.0 (n = 116)
	Primary school	1.3 (n = 5)
	Unformal education	0.8 (n = 3)
	Others	2.8 (n = 11)

Notably, most constructs demonstrated strong internal consistency with values well above the commonly accepted threshold of 0.70. While AB (0.634) and ATT (0.691) were slightly below this benchmark, they are often considered acceptable in exploratory social science research, given overall strong model performance (Hair et al. 2019).

Following this, CR, a more robust measure of internal consistency in SEM, was evaluated. All constructs exhibited excellent CR values, consistently exceeding the 0.70 criterion, thus confirming that the indicators reliably represent their respective latent constructs (Hair et al. 2019; Ramayah et al. 2018). Finally, AVE was examined to establish convergent validity, indicating the proportion of variance captured by a construct relative to measurement error. All AVE values were notably above the recommended threshold of 0.50, signifying strong convergent validity across all constructs (Hair et al. 2019). This robust performance, as indicated by Cronbach's alpha, CR and AVE, confirms that the instruments employed in the study are both reliable and valid. This, in turn, provides a solid foundation for further hypothesis testing within the structural model.

Table 2. CR and Convergent Validity of Constructs of Indicators

	Cronbach's Alpha	Composite reliability	Average Variance Extracted (AVE)
AB	0.634	0.671	0.728
ATT	0.691	0.704	0.763
HEALTH	0.923	0.923	0.928
ITP	0.904	0.904	0.912
LABEL	0.765	0.773	0.809
PBC	0.784	0.789	0.697
PRICE	0.816	0.817	0.844
PROMO	0.894	0.896	0.758
SN	0.793	0.807	0.707

Table 3 displays the HTMT ratios for all pairs of constructs in your study, which are crucial for assessing discriminant validity. Discriminant validity is established when a construct is demonstrated to be truly distinct from other constructs in the model, rather than being a redundant measure. In particular, two common thresholds are typically applied for HTMT ratios to indicate adequate discriminant validity (Henseler et al. 2015; Hair et al. 2017). A more conservative criterion, where the HTMT value between any two constructs should be below 0.90 and a stricter criterion of below 0.85, is often recommended for conceptually similar constructs. It is observed that all the HTMT values between the constructs are consistently below 0.90.

Furthermore, in most instances, these values are also below the stricter 0.85 threshold. For example, an HTMT of 0.504 is reported between ATT and AB and 0.759 between HEALTH and ATT. Even the highest values, such as 0.898 for PBC-ATT and 0.789 for SN-AB, remain below 0.90. This evidence confirms that all constructs in the model are empirically distinct, thereby establishing satisfactory discriminant validity. This outcome is crucial for ensuring that each construct makes a unique contribution to the model and that there is no conceptual overlap among them, thereby allowing for a clear interpretation of the relationships being investigated.

Structural model

The structural model was analysed to assess the hypothesised relationships between the study's constructs and the results are presented in the provided table. Each row represents a specific hypothesis (H1 to H8), detailing the proposed path, the standardised beta coefficient (Std Beta), *t*-value, *p*-value, (effect size), as well as the Bias-Corrected and Accelerated (BCa) Confidence Intervals (BCLC for Lower Bound, BUCL for Upper Bound) and the final decision regarding each hypothesis. The analysis was conducted at the $p < 0.05$ significance level.

Table 3. Results of HTMT

	AB	ATT	HEALTH	ITP	LABEL	PBC	PRICE	PROMO	SN
AB									
ATT	0.504								
HEALTH	0.466	0.759							
ITP	0.800	0.458	0.445						
LABEL	0.446	0.681	0.553	0.472					
PBC	0.677	0.898	0.857	0.621	0.659				
PRICE	0.622	0.349	0.443	0.353	0.398	0.524			
PROMO	0.416	0.569	0.439	0.475	0.764	0.572	0.289		
SN	0.789	0.384	0.352	0.516	0.299	0.451	0.531	0.252	

The path coefficients (Std Beta) indicate the strength and direction of the relationships. Accordingly, the *t*-values and *p*-values were used to determine the statistical significance of these paths. Note that *p*-values less than 0.05 indicated a significant relationship. The (effect size) values were also examined to assess the substantive impact of the independent variables on the dependent variables. As such, values of 0.02, 0.15 and 0.35 are commonly interpreted as small, medium and large effects, respectively (Cohen 1988; Hair et al. 2017).

Several hypotheses were reported to be statistically significant and were consequently accepted. Specifically, a significant positive relationship was found for : SN → ITP (Std Beta = 0.052, *p*-value = 0.000, = 0.104), indicating that SNs significantly influenced purchase intention. Similarly, : PBC → ITP (Std Beta = 0.067, *p*-value = 0.000, = 0.099) was accepted, demonstrating that PBC had a significant effect on purchase intention. Health perception was also highlighted to influence attitude (: HEALTH → ATT; Std Beta = 0.046, *p*-value = 0.000, = 0.325) and product label significantly influenced attitude (: LABEL → ATT; Std Beta = 0.049, *p*-value = 0.000, = 0.103). Furthermore, promotional activities were also expected to impact attitude significantly (: PROMO → ATT; Std Beta = 0.043, *p*-value = 0.000, *f*-squared 0.059). Finally, purchase intention was

indicated to have a strong and significant influence on actual behaviour (: ITP → AB; Std Beta = 0.043, *p*-value = 0.000, = 0.612).

Conversely, two hypotheses were not supported by the data and were thus rejected. : ATT → ITP (Std Beta = 0.057, *p*-value = 0.350) was rejected since the relationship between attitude and purchase intention was not statistically significant. Likewise, : PRICE → ATT (Std Beta = 0.06, *p*-value = 0.874) was also rejected, indicating that price did not have a significant influence on consumer attitude in this model.

Additionally, the predictive power of the model was assessed using the values, which represent the proportion of variance in the dependent variables explained by the independent variables. For ATT, the value was 0.44, indicating that its predictors explained 44% of the variance in attitude. For ITP, an of 0.349 was observed, indicating that its predictors accounted for 34.9% of the variance in purchase intention. Lastly, 37.8% of the variance in AB was explained by its predictors, as indicated by an of 0.378. Collectively, these values suggest a moderate to substantial explanatory power of the model for the endogenous constructs (Hair et al. 2017).

Table 4. Direct Ppaths between constructs in the SEM

Hypotheses	Std Beta	t-value	p-value	f ² (effect size)	BLCL	BUCL	Decision
H ₁ : SN -> ITP	0.052	5.526	0.000	0.104 (medium)	-0.164	0.062	Supported
H ₂ : PBC -> ITP	0.067	5.33	0.000	0.099 (small)	0.171	0.365	Supported
H ₃ : ATT -> ITP	0.057	0.935	0.350	0.003 (small)	0.526	0.692	Not supported
H ₄ : HEALTH -> ATT	0.046	10.598	0.000	0.325 (medium)	0.388	0.57	Supported
H ₅ : PRICE -> ATT	0.06	0.159	0.874	0 (no effect)	0.134	0.305	Not supported
H ₆ : LABEL -> ATT	0.049	5.534	0.000	0.103 (medium)	0.181	0.388	Supported
H ₇ : PROMO -> ATT	0.043	5.085	0.000	0.059 (small)	-0.132	0.103	Supported
H ₈ : ITP -> AB	0.043	14.44	0.000	0.612 (strong)	0.231	0.494	Supported

Note: R² for ATT = 0.44, R² for ITP = 0.349; R² for AB = 0.378

Factors influencing attitude, purchase intention and actual consumer behaviour of roselle tisane

The findings derived from the structural model analysis offered significant insights into the determinants of consumer ITP and AB for herbal infusions. A complex interplay among direct and indirect predictors was revealed, providing a nuanced understanding of consumer decision-making in this context.

Among the direct paths, SN, PBC, HEALTH, LABEL and PROMO were identified as significant determinants of either intention or attitude. This suggests that consumers' purchase intentions were more strongly shaped by external social pressures, their perceived ability to access and acquire the product and contextual marketing factors than by internal evaluations of attitude or price sensitivity (Ajzen 1991; Arvola et al. 2008). The significant influence of SN and PBC on ITP was particularly noted. This indicates that social expectations and perceived ease of acquisition played a pivotal role in driving consumer interest in herbal infusions (Amanda and Marsasi 2024; Peña-García et al. 2020). At the same time, health concern label information and promotion were noted to significantly shape attitudes. This underscores the significance of health perception and clear product communication in fostering a favourable disposition towards these products, as well

as effective promotion (Ndiaye et al. 2023; Grunert and Wills 2007).

The mediation analysis, while not explicitly detailed in the results table, was implicitly supported by the accepted path of ITP → AB, reinforcing the centrality of intention as a proximal predictor of behaviour. This aligns with the core tenet of the TPB, which holds that intention is the key driver linking antecedents to actual behaviour (Ajzen 2002; Bosnjak et al. 2020; Vamvaka et al. 2020). The significant indirect effects, where variables influenced behaviour through intention, would further underscore that consumer confidence, social expectations and promotional efforts primarily operated by first strengthening purchase intention before translating into actual buying behaviour.

However, several hypothesised relationships were not supported, yet they offered equally valuable insights. The rejection of the direct path from ATT to ITP was noteworthy. Despite health labelling being a substantial driver of attitude, these favourable attitudes did not significantly carry over to intention. Given that labelling is a significant driver of attitude, these favourable attitudes did not carry over to intention to a significant extent. Interestingly, this finding resonates with the well-documented attitude-behaviour gap in consumer research, particularly in the context of health-related and sustainable

food choices (Vermeir and Verbeke 2006; Yadav and Pathak 2017; Plooll and Stern 2020; Chen et al. 2023). Moreover, it implies that while consumers may express positive sentiments towards the perceived health benefits and clear labelling of herbal infusions, these attitudes might not be sufficiently strong to overcome other situational or social barriers when forming concrete purchase intentions.

Furthermore, the rejection of price as a direct predictor of attitude underscored that price was not a salient factor in purchase decisions for herbal infusions in this context. This outcome may be explained by the perception of herbal products as health-oriented, premium goods. As such, consumers prioritise perceived health benefits and social approval over monetary cost (Rezai et al. 2017; Nystrand and Olsen 2020; Jadhav et al. 2023). For such products, the value derived from health and quality appears to outweigh financial considerations in the consumer's decision-making process.

Taken together, these results suggest that social norms and perceived control more strongly influenced decision-making for herbal infusion products than did individual attitudes or direct price considerations. The dominance of intention as a mediator validated the core assumption of the TPB while simultaneously highlighting its limitations in fully explaining attitude-behaviour discrepancies. Thus, future interventions aimed at increasing actual purchases may therefore benefit from leveraging social endorsement, enhancing accessibility and targeted promotions, rather than relying solely on attitude-formation campaigns.

Conclusions

This study applied an extended TPB model to examine consumer ITP and AB toward herbal infusions. Using Partial Least Squares Structural Equation Modelling (PLS-SEM), the results confirmed that ITP is the strongest predictor of behaviour, consistent with prior TPB applications. Among the antecedents, SN, PBC and PROMO activities significantly influenced intention and subsequent behaviour. While health consciousness and labelling shaped attitudes, they did not, in turn, translate into purchase behaviour. At the same time, price was highlighted to have no significant effect. In addition, this study extends TPB by integrating marketing-related constructs, namely labelling and promotional cues, which improved the model's explanatory power for herbal infusion consumption. Building on this, the findings suggest that marketers should emphasise promotional strategies, credible labelling and enhancing consumer control over product availability rather than competing primarily on price. Social influence also emerged as a powerful driver, underscoring the role of peer endorsement and community-based campaigns. In conclusion, the extended TPB framework demonstrates its utility in predicting consumer behaviour toward herbal infusions, while highlighting the need for more nuanced approaches to bridge the gap between attitudes and actual purchase behaviour. Overall, this study contributes both to theory by refining TPB in a health-food context and to practice by offering actionable insights for marketers and policymakers promoting herbal infusions and other functional foods.

The study's findings provide clear and actionable implications for both marketers and policymakers. From a managerial perspective, the key directive is to pivot marketing strategies away from price-based promotions and toward a heavy focus on the product's health and wellness value. Given that health consciousness is the primary driver, campaigns should prominently feature specific nutritional benefits such as antioxidant content, natural ingredients, or immunity-boosting properties rather than competing on cost. Concurrently, this health-centric branding can be reinforced by leveraging SNs through targeted social proof, such as endorsements from health influencers and consumer testimonials. Furthermore, to enhance PBC, managers must ensure wide distribution across relevant channels, such as health stores and cafes and provide clear preparation instructions to make the product accessible and easy to use. On the policy front, these findings support a dual approach of promoting public health while supporting the local economy. Similarly, policymakers can leverage consumer interest by including local herbal infusions in public anti-sugar campaigns, positioning them as healthy alternatives. Correspondingly, government agencies can bolster local roselle farmers and producers through "Buy Local" initiatives or subsidies. Finally, to protect these health-seeking consumers, it is crucial to enforce strong, transparent health labelling regulations, which build consumer trust and reward honest producers.

Recommendation

In response, future research should address the limitations of this study by employing longitudinal or experimental designs to establish causal relationships more robustly, as this study used convenience sampling. Moreover, the study's geographical scope was confined to the Klang Valley, a highly urbanised and economically distinct region. For instance, consumer attitudes and price sensitivities may differ from those in semi-urban or rural areas. Likewise, the cross-sectional research design captures consumer intentions at a single static point in time, precluding the analysis of temporal shifts in attitudes or the causal link between purchase intention and sustained actual purchase behaviour. To address these limitations, future research should prioritise enhancing external validity. First, it is imperative to replicate this study using probability sampling or, at a minimum, stratified or quota sampling to ensure a more heterogeneous and representative demographic. This would validate the model and ascertain whether the prioritisation of health over price persists across different societal segments. Second, future investigations should expand the geographical scope to include a comparative analysis, test the model's robustness and identify potential regional moderators. Finally, a longitudinal study is recommended to track the evolution of these purchase drivers over time and empirically confirm behavioural adoption. Therefore, further integration of health psychology frameworks, such as the Health Belief Model or Value-Belief-Norm Theory, may enrich the understanding of health-related consumption.

References

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T).
- Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control and the theory of planned behavior. *Journal of Applied Social Psychology*, 32(4), 665–683.
- Ajzen, I. (2020). The theory of planned behavior: Frequently asked questions. *Human Behavior and Emerging Technologies*, 2(4), 314–324. <https://doi.org/10.1002/hbe2.195>.
- Ajzen, I. (2020). The theory of planned behavior: Recent developments, refinements and extensions. In O. E. O’Keefe (Ed.), *The Oxford handbook of persuasion, social influence and compliance* (pp. 343–359). Oxford University Press.
- Amanda, T. A., & Marsasi, E. G. (2024). Exploration of perceived behavioral control and intention to purchase to increase actual behavior. *Image: Jurnal Riset Manajemen*, 12(1), 14–30.
- Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, 103(3), 411–423.
- Arvola, A., Vassallo, M., Dean, M., Lampila, P., Saba, A., Lähteenmäki, L., & Shepherd, R. (2008). Predicting intentions to purchase organic food: The role of affective and moral attitudes in the Theory of Planned Behaviour. *Appetite*, 50(2–3), 443–454. <https://doi.org/10.1016/j.appet.2007.09.010>.
- ASEAN. (2021). ASEAN Guidelines for the control of traditional medicines and health supplements. ASEAN Secretariat.
- Bajat, C. D. anak, Marhamah, S., Ling, P.-S., & Ling, L. S. (2023). Do Health Consciousness and Perceived Benefits Play a Role in Motivating Buyers to Purchase Functional Foods? <https://doi.org/10.35370/bjssh.2023.5.2-06>.
- Bosnjak, M., Ajzen, I., & Schmidt, P. (2020). The theory of planned behavior: Selected recent advances and applications. *Europe’s Journal of Psychology*, 16(3), 329–335.
- Brillas, C., Guarnieri, V., & Faccin, A. (2022). Herbal tea consumption: Insights into consumer behaviour and product attributes. *Foods*, 11(13), 1957.
- ChemLinked. (2024). Malaysia’s regulatory landscape for natural products and health supplements: Recent updates. ChemLinked.
- Chen X, Jiang X and Wu L (2024). Drivers of consumers’ intention to adopt sustainable healthy dietary patterns: evidence from China. *Front. Sustain. Food Syst.* 7: 1269242. doi: 10.3389/fsufs.2023.1269242
- Cochran, W. G. (1977). *Sample techniques* (3rd ed.). John Wiley & Sons.
- Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Routledge. <https://doi.org/10.4324/9780203771587>.
- Etheridge, C., & Derbyshire, E. (2020). Hibiscus tea and health: A scoping review of scientific evidence. *Nutr. Food Sci.*, 50, 969–985. <https://dx.doi.org/10.16966/2470-6086.167>.
- Grunert, K. G., & Wills, J. M. (2007). A review of European research on consumer response to nutrition information on food labels. *Journal of Public Health*, 15(5), 385–399.
- Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)* (2nd ed.). SAGE Publications.
- Hair, J. F., Jr., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate Data Analysis* (8th ed.). Cengage Learning.
- Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, 43(1), 115–135.
- Herdiani N., Wikurendra E.A. Effect of roselle petal extract on decreased levels of MDA in rats with type 2 diabetes. 2021. *Journal of Health Science*. 14(1): 48–52.
- Islam, A. K. M. A., Jamini, T. S., Islam, A. K. M. M., & Yaesmin, S. (2016). Roselle: A Functional Food with High Nutritional and Medicinal Values. *Fund Appl. Agric.* 2016, 1(1), 44–49.
- Jadhav, H. B., Sablani, S., Gogate, P., Annapure, U., Casanova, F., Nayik, G. A., Alaskar, K., Sarwar, N., Raina, I. A., Ramniwas, S., & Mousavi Khaneghah, A. (2023). Factors governing consumers buying behavior concerning nutraceutical product. *Food Science & Nutrition*, 11(9), 4988–5003. <https://doi.org/10.1002/fsn3.3518>.
- Jamrozik, D., Borymska W., & Kaczmarczyk-Żebrowska, I. (2022). *Hibiscus sabdariffa* in Diabetes Prevention and Treatment—Does It Work? An Evidence-Based Review. *Foods*, 11(14), 2134.
- Katt, F., & Meixner, O. (2020). A systematic review of drivers influencing consumer willingness to pay for organic food. *Trends in Food Science and Technology*, 100, 374–388.

- Kumar, S., Malik, A., & Goyal, S. (2024). Exploring the drivers of consumer purchase intention for organic food: A systematic review and meta-analysis. *Journal of Cleaner Production*, 442, 140683.
- Lu, Y. S., Qiu, J., Mu, X. Y., Qian, Y. Z., & Chen, L. (2024). Levels, toxic effects and risk assessment of pyrrolizidine alkaloids in foods: a review. *Foods*, 13(4), 536.
- Luo, L., Wang, B., Jiang, J., Fitzgerald, M., Huang, Q., Yu, Z., Li, H., Zhang, J., Wei, J., Yang, C., Zhang, H., Dong, L., & Chen, S. (2021). Heavy Metal Contaminations in Herbal Medicines: Determination, Comprehensive Risk Assessments and Solutions. *Frontiers in pharmacology*, 11, 595335. <https://doi.org/10.3389/fphar.2020.595335>.
- Michaelidou, N., & Hassan, L. M. (2008). The role of health consciousness, food safety concern and ethical identity on attitudes and intentions towards organic food. *International Journal Of Consumer Studies*, 32(2), 163–170. <https://doi.org/10.1111/j.1470-6431.2007.00619.x>.
- Mun, C. Y., Abdullah, A., & Ibrahim, M. A. (2022). Exploring factors influencing consumer intention to use e-hailing services in Klang Valley, Malaysia. *International Journal of Academic Research in Business and Social Sciences*, 12(1), 162–178.
- Nafizah AHN, Budin SB, Zaryantey AH, Mariati SR, Santhana RL, Osman M, Hanis MIM and Jamaludin M. Aqueous calyxes extract of Roselle or Hibiscus sabdariffa Linn supplementation improves liver morphology in streptozotocin induced diabetic rats. *Arab Journal of Gastroenterology*, 2017, 18(1): 13–20.
- National Pharmaceutical Regulatory Agency (NPRA). (2023). Drug registration guidance document (DRGD) (2nd ed.). National Pharmaceutical Regulatory Agency, Ministry of Health Malaysia.
- Ndiaye O, Hedrick VE, Neill CL, Carneiro RCV, Huang H, Fernandez-Fraguas C, Guiro AT and O'Keefe SF (2023) Consumer responses and willingness-to-pay for hibiscus products: A preliminary study. *Front. Sustain. Food Syst.* 7:1039203.
- Norhayati, H., Salim, A. A., Mohamad, S. F., et al. (2023). Evaluation of consumer's knowledge, attitude, practice towards herbal tea consumption, preparation and their association with demographic profile. *MOJ Food Process Technol.*, 11(2): 84–96 DOI: 10.15406/mojfpt.2023.11.00285.
- Nystrand, M., & Olsen, S. O. (2020). To identify motivators and barriers of nutraceutical products. *International Journal of Food Science & Technology*, 55(3), 960–968.
- Peña-García, N., Núñez-Tabales, J. M., & Rey-Maqueira, J. (2020). Perceived behavioral control and intention to adopt electronic commerce among consumers in Colombia and Spain. *Journal of Retailing and Consumer Services*, 53, 101968.
- Ploll, T., & Stern, T. (2020). Vegetarian and vegan diets: An application of the theory of planned behavior. *Food Quality and Preference*, 86, 103988.
- Poswal, F. S., Russell, G., Mackonochie, M., MacLennan, E., Adukwu, E. C., & Rolfe, V. (2019). Herbal teas and their health benefits: a scoping review. *Plant Foods for Human Nutrition*, 74(3), 266–276.
- Ramayah, T., Cheah, J., Chuah, F., Ting, H., & Memon, M. A. (2018). *Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 3.0: An Updated Guide and Practical Guide to Statistical Analysis*. Pearson.
- Ramphinwa, M. L., Mchau, G. R. A., Mashau, M. E., Madala, N. E., Chimonyo, V. G. P., Modi, T. A., Mabhaudhi, T., Thibane, V. S., & Mudau, F. N. (2023). Eco-physiological response of secondary metabolites of teas: Review of quality attributes of herbal tea. *Frontiers in Sustainable Food Systems*, 7, 990334.
- Rezai, G., Kit Teng, P., Mohamed, Z., & Shamsudin, M. N. (2014). Structural Equation Modeling of Consumer Purchase Intention Toward Synthetic Functional Foods. *Journal of Food Products Marketing*, 20(sup1), 13–34. <https://doi.org/10.1080/10454446.2014.921868>.
- Sharkawi, I. (2014). Factors influencing healthy eating intention among Malaysian adults. Thesis.
- Singh, A., & Verma, P. (2017). Factors influencing Indian consumers' actual buying behaviour towards organic food products. *Journal of cleaner production*, 167: 473–483. <https://doi.org/10.1016/j.jclepro.2017.08.106>.
- Sousa, A. C., Pádua, I., Gonçalves, V. M., Ribeiro, C., & Leal, S. (2024). Exploring tea and herbal infusions consumption patterns and behaviours: The case of Portuguese consumers. *Heliyon*, 10(7).
- Statista. (2024). Tea - Malaysia: Market insights, statistics and trends. Statista. <https://www.statista.com/outlook/emo/beverages/hot-drinks/tea/malaysia>.

- Tea & Herbal Infusions Europe [THIE]. (2024). Quality standards and guidance for herbal infusions. THIE. <https://thie-online.eu/>.
- Tengku Mohamad, T. A. S., Islahudin, F., Jasamai, M., & Jamal, J. A. (2019). Preference, Perception and Predictors of Herbal Medicine Use Among Malay Women In Malaysia. *Patient preference and adherence*, 13, 1829–1837. <https://doi.org/10.2147/PPA.S227780>.
- Vagias, W. M. (2006). Likert-type scale response anchors. clemson international institute for tourism. & Research Development, Department of Parks, Recreation and Tourism Management, Clemson University, 4(5).
- Vamvaka, V., Stoforos, C., Palaskas, T., & Botsaris, C. (2020). Attitude toward entrepreneurship, perceived behavioral control and entrepreneurial intention: dimensionality, structural relationships and gender differences. *Journal of Innovation and Entrepreneurship*, 9(1), 5.
- Vasić, D., Katanić Stanković, J. S., Urošević, T., Kozarski, M., Naumovski, N., Khan, H., & Popović-Djordjević, J. (2023). Insight into bioactive compounds, antioxidant and anti-diabetic properties of rosehip (*Rosa canina* L.)-based tisanes with addition of hibiscus flowers (*Hibiscus sabdariffa* L.) and saffron (*Crocus sativus* L.). *Beverages*, 10(1), 1.
- Vermeir, I., & Verbeke, W. (2006). Sustainable food consumption: Exploring the consumer “attitude–behavioral intention” gap. *Journal of Agricultural and Environmental Ethics*, 19(2), 169–194. <https://doi.org/10.1007/s10806-005-5485-3>.
- WHO. (2007). WHO guidelines for assessing the safety, efficacy and quality of herbal medicines. World Health Organization.
- Wu, Y., Ding, Y., Tanaka, Y., & Zhang, W. (2014). Risk factors contributing to type 2 diabetes and recent advances in the treatment and prevention. *International Journal Of Medical Sciences*, 11(11), 1185.
- Yadav, R., & Pathak, G. S. (2017). Determinants of consumers’ green purchase behavior in a developing nation: Applying the theory of planned behavior. *Ecological Economics*, 134, 114–122.

Abstrak

Kajian ini mengkaji *tisane* rosel iaitu minuman fungsian yang diakui mempunyai manfaat nutrisi dan perubatan serta merupakan produk tempatan. Data telah dikumpulkan daripada 400 responden di Lembah Klang menggunakan kaedah pensampelan mudah dan dianalisis menggunakan PLS-SEM dengan Teori Tingkah Laku Terancang (TPB) untuk menilai pengaruh kesedaran kesihatan, harga dan faktor-faktor pemasaran lain. Komponen utama Teori Tingkah Laku Terancang (TPB) iaitu Persepsi Kawalan Seseorang terhadap Sesuatu Tingkah Laku (PBC) dan Norma Subjektif (SN), terbukti mempengaruhi niat pembelian dan pembelian sebenar produk *tisane* rosel. Hasil kajian juga menunjukkan bahawa kesedaran kesihatan memberikan kesan yang lebih kuat terhadap niat pembelian berbanding dengan harga. Ini menunjukkan bahawa pengguna lebih mengutamakan manfaat kesihatan berbanding dengan pertimbangan ekonomi. Penemuan ini menekankan peranan kritikal kesedaran kesihatan dalam membentuk keputusan pengguna dan memberikan implikasi praktikal untuk pengeluar. Penekanan terhadap ciri-ciri kesihatan dan nilai kesejahteraan mungkin lebih berkesan daripada strategi berasaskan harga dalam menggalakkan penerimaan makanan fungsian seperti *tisane* rosel.