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TESTING THE RELIABILITY OF THE SCALE AND ASSESSING THE IMPACT OF SIGNAL QUALITY ON CONSUMER TRUST IN HEALTH SUPPLEMENTS IN CAN THO CITY IN 2023 - 2024

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ABSTRACT

Background: *With the development of society, healthcare needs are increasing. In addition to maintaining a healthy lifestyle and regularly engaging in sports activities, people also prioritize consuming foods that support their health. This research enhances the understanding of the role of signal quality in building consumer trust, promoting the sustainable development of the health supplement industry, and guiding the strategic development of retail establishments.* ***Objectives:*** *(1) To assess the reliability of the signal quality scale regarding consumer trust in health supplements in Can Tho city in 2023-2024; (2) To analyze the impact of signal quality on consumer trust in health supplements in Can Tho city in 2023-2024.* ***Materials and methods:*** *This study employed a cross-sectional descriptive design, utilizing both face-to-face interviews and online survey distribution via links and QR codes. Data were collected from 430 consumers aged 18 and above residing across all nine districts of Can Tho city during the period from 2023 to 2024.* ***Results:*** *The measurement scales demonstrated strong internal consistency, with Cronbach's Alpha values exceeding 0.7 (precision = 0.789, dependability = 0.840, uniformity = 0.820, and trust in health supplements = 0.842). Exploratory Factor Analysis (EFA) confirmed the appropriateness of the measurement structure (KMO > 0.8, p<0.001), and over 65% of the total variance explained and all factor loadings above 0.5. Confirmatory Factor Analysis (CFA) validated both convergent and discriminant validity, with model fit indices meeting accepted thresholds. Structural Equation Modeling (SEM) revealed that signal quality has a positive and statistically significant effect on consumer trust in health supplements (p < 0.001).* ***Conclusions:*** *The findings suggest that retail establishments exhibiting higher levels of signal quality-defined by clarity, consistency, and reliability-tend to foster greater consumer trust. These results underscore the strategic importance of enhancing marketing signals and product communication to strengthen consumer confidence and support the sustainable development of both health supplement manufacturers and the broader health food sector.*

Keywords: *Can Tho, health supplements, measurement scale, signal quality, trust*

I. INTRODUCTION

In Vietnam, particularly in Can Tho city, with the development of society, the demand for healthcare is increasing. In addition to adopting a healthy lifestyle and regularly participating in sports activities, people prioritize using health supplements to improve their quality of life. Circular No. 43/2014/TT-BYT, dated November 24, 2014, on "Regulations on the management of functional foods", defines "Health supplements as products in the form of capsules, tablets, pills, powder, liquid, and other forms that contain one or more of the following: vitamins, minerals, amino acids, fatty acids, enzymes, probiotics, and other

bioactive substances; bioactive compounds derived from natural sources such as animals, minerals, and plants in the form of extracts, isolates, concentrates, and metabolites" [1]. According to a study by Pajor EM *et al.*(2017) in the Netherlands, consumers use health supplements to alleviate health problems and prevent diseases [2]. Recognizing the growing demand for health supplements, some businesses, driven by economic motives, have produced counterfeit and low-quality products that negatively impact consumer health [3]. On social media platforms, many health supplements are advertised without complete information about active ingredients and origins, while their exaggerated benefits often mislead consumers, leading to public concern. Can Tho, one of the most dynamic and developing cities in the Mekong Delta region, has seen a growing emphasis on healthcare needs. In response, the study titled "Testing the reliability of the scale and assessing the impact of signal quality on consumer trust in health supplements in Can Tho city in 2023-2024" was conducted with two main objectives: (1) To test the reliability of the signal quality scale regarding consumer trust in health supplements in Can Tho city in 2023-2024; and (2) to analyze the impact of signal quality on consumer trust in health supplements in Can Tho city in 2023-2024.

II. MATERIALS AND METHODS

2.1. Materials

The study was conducted on consumers of health supplements in Can Tho city during the 2023-2024 period.

- Inclusion criteria: Individuals aged 18 and above living in Can Tho city who have purchased health supplements within the city's districts and agreed to participate in the survey.

- Exclusion criteria: Individuals unable to respond to survey questions or those who selected the same option for all observed variables.

2.2. Methods

- Research design: The study employed a cross-sectional descriptive study.

The research includes factors: SQ (signal quality) comprises three components: DEP (dependability), PRE (precision), UNI (uniformity); FHS (trust in health supplements); hypothesis/expectation (H1): signal quality from retail outlets positively influences consumer trust in health supplements.

- Sample size and sampling method: Using the sample size formula for large populations, the sample size is calculated as follows:

$$n = \frac{Z^2_{(1-\frac{\alpha}{2})}.p(1-p)}{d^2}$$

Where: n: sample size; $Z_{(1-\alpha/2)}$: value of the confidence interval coefficient ($Z_{(1-\alpha/2)}$ = 1.96); α: statistical significance level (α=0.05); d: margin of error between sample parameter and population parameter (d=0.05); p: estimated proportion value. According to Cochran, when no prior estimate is available, p = 0.5 is often used because it represents the maximum variation and produces the largest sample size necessary [4].

Applying this formula, the minimum sample size was 385 individuals. Additionally, 10% more samples were surveyed to account for any incomplete or invalid responses. Therefore, the total sample size for the study was 424, rounded to 430 samples, and collected from 9 districts of Can Tho city.

- Sampling method: The sampling was carried out using the convenience sampling method. According to the following distribution: Ninh Kieu District – 99 respondents, Binh Thuy District – 52 respondents, Thot Not District – 52 respondents, O Mon District – 43 respondents, Cai Rang District – 39 respondents, Co Do District – 39 respondents, Thoi Lai District – 38 respondents, Phong Dien District – 34 respondents, and Vinh Thanh District – 34 respondents.

- Research Contents

+ General characteristics of the research sample

Consumer information: gender (Male and Female), age classification (Elderly, Middle-aged, Young adults and Youth), education level (University or higher, Intermediate/college, High school, Junior high school or below), address (Phong Dien District, Thoi Lai District, Co Do District, Vinh Thanh District, O Mon District, Thot Not District, Cai Rang District, Binh Thuy District, and Ninh Kieu District), occupation (Farmer, Pupils/Students, Public sector employee, Office worker, Business and trade, Homemaker and Other), income (Under 5 million, About 5 to 10 million, About 10 to 15 million and Over 15 million).

The research results were presented using a Clustered Bar Chart that illustrates the frequency and percentage of consumer survey responses.

+ The reliability of the measurement scale for signal quality and consumer trust in health supplements

The questionnaire consisted of 16 items. Of these, signal quality, serving as the independent variable, was measured using three factors: Dependability (4 items), Precision (4 items) and Uniformity (4 items). Trust in health supplements, the dependent variable, comprised 4 items.

The study used a 5-point Likert scale, with responses scored as follows: 1 for "Strongly Disagree", 2 for "Disagree", 3 for "Neutral", 4 for "Agree" and 5 for "Strongly Agree".

Evaluation method: Reliability was assessed using Cronbach's Alpha and the measurement model's structure was examined using exploratory factor analysis (EFA).

+ Analyzing the impact of signal quality on consumer trust in health supplements

The discriminant validity, convergent validity, and reliability of the measurement scale for the components of signal quality from establishments were assessed using parameters such as average variance extracted (AVE), maximum shared variance (MSV), and composite reliability (CR), correlation coefficients, and the CFA model results. The results were obtained through multiple linear regression analysis using CFA.

The assessment of discriminant validity, convergent validity, and reliability of the measurement scale was conducted using structural equation modeling (SEM). The results were evaluated based on AVE, MSV, CR, correlation coefficients, SEM model outcomes, and unstandardized regression coefficients to test hypothesis H1.

- Data collection: Data were collected using both on-site and remote surveys. On-site participants completed either paper-based questionnaires or accessed an online form via a QR code, while other participants were invited via email to complete the survey online.

- Data Analysis and Processing: Data were stored and processed using Microsoft Excel 2016, SPSS 20.0, and AMOS 24.0. The research results were presented in tabular form, illustrating the frequency and percentage of consumer survey responses.

- Location and time of study: The study was conducted across nine districts in Can Tho city from December 2023 to September 2024.

- Ethics in research: The research proposal has been approved by the Ethics Committee No. 23.071.SV/PCT-HĐĐĐ on December 25, 2023, for biomedical research at Can Tho University of Medicine and Pharmacy.

III. RESULTS

3.1. Characteristics of the survey sample

Table 1. Characteristics of the survey sample

Characteristic		Frequency (n)	Percentage (%)
Gender	Male	178	41.4
	Female	252	58.6
Age classification	Youth (18-24 years old)	181	42.1
	Young adults (25-44 years old)	214	49.8
	Middle-aged (45-59 years old)	29	6.7
	Elderly people (60 years and older)	6	1.4
Education Level	Junior High School or below	28	6.5
	High school	71	16.5
	Intermediate/College	82	19.1
	University or higher	249	57.9
Address	Ninh Kieu District	99	23
	Binh Thuy District	52	12.1
	Cai Rang District	39	9.1
	Thot Not District	52	12.1
	O Mon District	43	10
	Vinh Thanh District	34	7.9
	Co Do District	39	9.1
	Thoi Lai District	38	8.8
	Phong Dien District	34	7.9
Occupation	Farmer	21	4.9
	Pupils/students	217	50.5
	Public Sector Employee	52	12.1
	Office Worker	24	5.6
	Business and trade	65	15.1
	Homemaker	29	6.7
	Other	22	5.1
Income	Under 5 million	260	60.5
	About 5 million to 10 million	111	25.8
	About 10 million to 15 million	42	9.8
	Over 15 million	17	4

As depicted in Table 1, the survey sample comprised 58.6% females (252 individuals) and 41.4% males (178 individuals). Regarding educational attainment, 57.9% (249 individuals) held university degrees or higher. In terms of monthly income, 60.5% (260 individuals) earned less than 5 million VND. Half of the respondents (50.5%, 217 individuals) were students. Geographically, 23% (99 individuals) lived in Ninh Kieu District.

3.2. The reliability of the signal quality scale regarding consumer trust in health supplements in Can Tho city (2023-2024)

Table 2. Results of testing the scale

Factor		Corrected Item-Total Correlation	Standard Deviation	Mean
Signal quality (SQ)				
Precision *(Cronbach's Alpha= 0.789)*	PRE1	0.71	0.737	4.07
	PRE2	0.582	0.84	4.16
	PRE3	0.654	0.846	3.96
	PRE4	0.468	0.88	3.79
Dependability *(Cronbach's Alpha=0.846)*	DEP1	0.67	0.879	3.96
	DEP2	0.721	0.991	3.73
	DEP3	0.72	0.933	3.81
	DEP4	0.627	0.947	3.86
Uniformity *(Cronbach's Alpha= 0.820)*	UNI1	0.649	0.902	3.86
	UNI2	0.646	0.97	3.93
	UNI3	0.667	0.886	3.79
	UNI4	0.608	0.915	3.83
Trust in health supplements (FHS)				
Trust in health supplements *(Cronbach's Alpha=0.842)*	FHS1	0.703	0.841	4.1
	FHS2	0.705	0.851	4.07
	FHS3	0.639	0.853	3.93
	FHS4	0.661	0.86	4.14

The scales had Cronbach's Alpha values ranging from 0.789 to 0.846, with item-total correlation coefficients greater than 0.4. Mean values ranged from 3.73 to 4.16, and standard deviations ranged from 0.737 to 0.991. The factors were retained as they met the required conditions.

Table 3. Results of Exploratory Factor Analysis

Items	Component			
	Dependability	Precision	Uniformity	Trust in health supplements
DEP2	0.816			
DEP1	0.793			
DEP3	0.783			
DEP4	0.721			
UNI1		0.778		
UNI4		0.778		
UNI3		0.762		
UNI2		0.703		
PRE1			0.858	
PRE3			0.799	
PRE2			0.753	
PRE4			0.618	
FHS2				0.845
FHS1				0.843
FHS4				0.812
FHS3				0.796
Total variance extracted	42.172	55.609	65.612	67.950
Eigenvalue	5.061	1.612	1.200	2.718

The EFA results indicated signal quality with a KMO of 0.868, Sig. = 0.000 (Bartlett's test), three factors were extracted with Eigenvalues = 1.200, and a total variance was extracted of 65.612%, with all observed variables having factor loadings greater than 0.5. The EFA analysis for trust in dietary supplements showed a KMO of 0.813, Sig. = 0.000, with one factor extracted at Eigenvalues = 2.718 and a total variance extracted of 67.950%, with all factor loadings greater than 0.5.

3.3. The impact of signal quality on consumer trust in health supplements in Can Tho city (2023-2024)

3.3.1. CFA analysis results

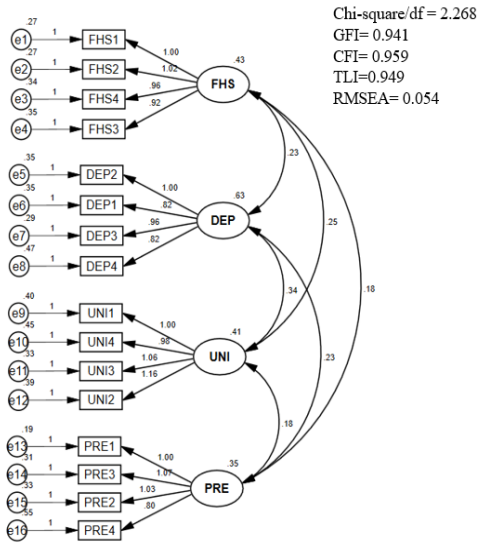

Figure 1. Results of CFA analysis.

The CFA results according to Hu & Bentler (1999) yielded the following indicators: TLI = 0.949, CFI = 0.959, GFI = 0.941, RMSEA = 0.054, Pclose = 0.216, and Cmin/df = 2.268. According to conventional thresholds, model fit was considered acceptable when TLI and CFI > 0.90, GFI > 0.90 (preferably > 0.95), RMSEA < 0.06, Pclose > 0.05, and Cmin/df < 3. The composite reliability (CR) was greater than 0.7, and the variance of excerpts (AVE) was greater than 0.5, which was larger than the maximum shared variance (MSV). Additionally, the square root of the AVE ($\sqrt{AVE}$) exceeded the correlation coefficient between the concepts (Table 4).

Table 4. Results of testing the discriminant validity, convergence validity, and reliability of the scale measuring the components of signal quality from retail establishments.

Factor	CR	AVE	MSV	Correlation Coefficient			
				FHS	DEP	UNI	PRE
FHS	0.844	0.575	0.348	0.758			
DEP	0.848	0.584	0.452	0.448	0.764		
UNI	0.820	0.533	0.452	0.590	0.672	0.730	
PRE	0.804	0.511	0.237	0.463	0.487	0.480	0.715

3.3.2. SEM analysis results

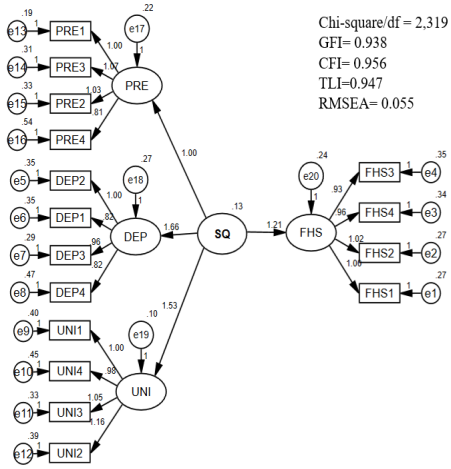

Figure 2. SEM analysis results

The SEM analysis revealed the following indices: CMIN/df = 2.319, CFI = 0.956, TLI = 0.947, GFI = 0.938, RMSEA = 0.055, and PCLOSE = 0.162. The composite reliability (CR) for the research concepts was 0.792 and 0.844. The extracted variance (AVE) was 0.565 and 0.575, respectively, larger than MSV. The $\sqrt{AVE}$ was greater than the correlation coefficient between concepts (Table 5).

Table 5. The results of the discriminant validity, convergence validity, and reliability of the scale.

Factor	CR	AVE	MSV	Correlation Coefficient	
				FHS	SQ
FHS	0.844	0.575	0.442	0.758	
SQ	0.792	0.565	0.442	0.665	0.751

The results of hypothesis H1 testing, based on the unstandardized regression coefficients, indicated that the relationship between signal quality (SQ) and trust in health supplements (FHS) was statistically significant (Estimate = 1.208, SE = 0.149, C.R. = 8.088, $p < 0.001$). This finding confirms that SQ has a positive effect on FHS and is consistent with the expectations outlined in Section 2.2.

IV. DISCUSSION

4.1. General characteristics

The study was conducted on 430 residents from nine districts in Can Tho city. In our study, the proportion of females was higher. This ratio is similar to the study by Trinh Quoc Thinh and colleagues on assessing the attitude, behavior and related factors of consumers for functional foods in Can Tho city in 2022 - 2023, where females accounted for 54.0%, and males accounted for 44.8% [5]. In terms of education, the majority of survey participants held university degrees or higher (57.9%), reflecting the high level of education typical in Can Tho, a large and developed city with a highly skilled workforce. Regarding age, young adults aged 25 to 44 years accounted for the highest proportion (49.8%), followed by youths aged 18 to 24 years (42.1%). A study by Nguyen Phuc Hung and Le My

Phung in 2023 also found that most consumers of health supplements in Vinh Long were aged 18 to 30 years [6]. In this study, the majority of participants reported an income below 5 million VND (60.5%), which may be explained by the use of convenience sampling or the possibility that some participants were not entirely truthful with their responses.

4.2. Reliability of the scale

The reliability assessment of the scale shows that all factors have Cronbach's alpha values greater than 0.6, specifically clarity (0.789), reliability (0.846), consistency (0.820), and trust in health supplements (0.842). Furthermore, each factor has a total variable correlation value of 0.3. According to Nguyen Dinh Tho's research, a Cronbach's alpha coefficient value between 0.75 and 0.95 indicates good reliability, while a value of 0.6 is still considered acceptable. Additionally, if a variable has a total variable correlation of 0.3, it meets the reliability requirements [7]. Therefore, these factors were retained in the study. This result is consistent with Bui Thanh Trang's research on the relationship between signal quality and trust in safe vegetables. In that study, signal quality (comprising clarity, reliability, and consistency) and trust in products were also found to have Cronbach's Alpha values greater than 0.6 (from 0.709 to 0.922), with total variable correlation coefficients exceeding 0.3 [8]. Accordingly, the measurement scale for signal quality in relation to consumer trust in health supplements demonstrates strong reliability. This, in turn, provides businesses and retailers with objective insights to develop appropriate and effective communication strategies.

4.3. The impact of signal quality on trust in health supplements

The study employed SEM analysis, beginning with model fit assessment. Based on Figure 2, the model fit indices all meet the acceptable thresholds outlined in the research by Hu & Bentler (1999) [9]. Additionally, this analysis helps evaluate the significance and fit of the relationships in the structural model (the impact relationship of signal quality—as an independent factor comprising the components of clarity, dependability, and uniformity—on the dependent factor, which is trust in health supplements) thereby identifying the impact of the factors proposed in the research hypotheses [10]. According to the unstandardized regression coefficient table, the study achieved a p-value of <0.001, confirming that the proposed hypothesis is statistically significant. The positive sign of the estimated value further indicates the direction of the impact in the model. These findings align with previous studies, such as Nguyen Thi Hong Nguyet's research on the role of signal quality in creating brand value and brand credibility in the Vietnamese consumer market, which affirms that signal quality has an impact on trust [11]. In Bui Thanh Trang's study on the relationship between signal quality and trust in safe vegetables, the hypothesis was accepted at $p < 0.01$. Thus, the current study reaffirms that signal quality influences trust in health supplements [8]. Retail establishments ang businesses should pay more attention to developing the signal quality of health supplements such as product packaging containing clear information about the use of ingredients, uses, users, etc. In addition, communication campaigns ensure that information to consumers is accurate, consistent with product quality, avoiding causing buyer discomfort. Through signal quality ensuring three factors of clarity, reliability and consistency, the information transmitted to consumers will make them feel secure and confident in the product's safety, thanks to which, you can trust in health supplements, their health is also tried harder.

V. CONCLUSION

The study aimed to clarify the impact of signal quality on consumer trust in the health supplemets market. Specifically, retail outlets with clear, consistent, and reliable signal quality are more likely to establish a strong reputation and gain consumer trust. This research provides a fresh perspective and serves as a scientific foundation to motivate brands and retail outlets to enhance consumer trust. Ultimately, it proposes strategies for product improvement, contributing to the future development of this market.

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