Journal of Social Sciences and Management Studies
https://doi.org/10.56556/jssms.v5i1.1439
ISSN: 2957-8795

RESEARCH ARTICLE

How Information Cues Influence Online Sales of Health Supplements: An Empirical Dual-Path Study Based on the ELM Model

Junhui Guo[1*], Mengfan Wang[1]

[1]School of management, Zhejiang University of Science and Technology, hangzhou, China

Corresponding Author: Junhui Guo, Email: hzgjh2013@126.com, guojunhui@zust.edu.cn
Received: 08 February, 2026, Accepted: 15 April, 2026, Published: 14 May, 2026

Abstract

This study explores the influence of external cues on the online sales of health supplements and further investigates the moderating role of supplement type in this relationship. Drawing upon cue utilization theory, attention economy theory, and the ELM model, the study collects data using Ui-Path web scraping technology, conducts word frequency analysis via Python, and performs empirical testing using Stata software. The findings reveal that, within the central path, title involvement and product price negatively affect the online sales of health supplements, while functional position has a positive impact. In the peripheral path, brand reputation, additional services, and source credibility all exhibit significant positive effects. Additionally, supplement type plays a moderating role, with the positive influence of additional services on the sales of maintenance-oriented health supplements being notably stronger than that on regulation-oriented supplements.

Keywords: health supplements; external cues; attention economy; Elaboration Likelihood Model; online sales

1. Introduction

With the improvement of national living standards and the widespread adoption of the "big health" consumption concept, the post-pandemic era has given rise to a new health perspective emphasizing "prevention over treatment" which fosters the development of the health supplement market (Fan, 2024). Meanwhile, the ongoing aging population in China has led to the sustained prosperity of the health supplement market targeting the "silver-haired" demographic, while increasing social pressures have prompted the "younger generation" to pay more attention to health issues. Innovative products such as herbal milk tea and goji berry cola reflect the personalized pursuit of health and wellness among young consumers (Jin, 2023), indicating significant future growth potential for China's health supplement market (Song, 2023). According to predictions by Ai Mei Consulting, the market size for health supplements in China is expected to continue its upward trajectory, reaching approximately 423.7 billion yuan by 2027, as illustrated in Figure 1 (Ai Mei Consulting,2025). Additionally, the robust development of e-commerce in China has rapidly promoted online consumption

channels for health supplements. The attractiveness of online sales, characterized by a wide variety of products, favorable price, and convenient shopping experiences, has drawn a large number of consumers, making it a key growth point for health supplement sales (Song, 2023). However, in contrast to traditional offline models, the dynamic environment of online consumption, along with information asymmetries and the complexity of consumer decision-making paths, reveals significant differences and diversities in the critical factors driving sales.

However, existing research exhibits notable limitations in explaining the driving mechanisms behind online sales. Traditional studies have primarily focused on offline channels or isolated psychological factors, lacking a systematic examination of the interplay among multiple factors within the e-commerce ecosystem. Although some scholars have investigated the effects of consumer attitudes (Kantar ,2024) and perceived behavioral control (Lee et al., 2016) as well as brand trust and price sensitivity (Parinda , 2022) on purchase intentions, they have not elucidated the differential mechanisms of external cues across distinct information processing paths. In recent years, studies have begun to explore the impact of electronic word-of-mouth quality (Dahesihsari et al., 2024) and product information quality (Najib et al., 2022) on health supplement consumption. Nevertheless, no research has yet integrated the Elaboration Likelihood Model (ELM) to systematically examine the synergistic effects of the central path and the peripheral path, nor has any study revealed how supplement type moderates the relationship between external cues and online sales.

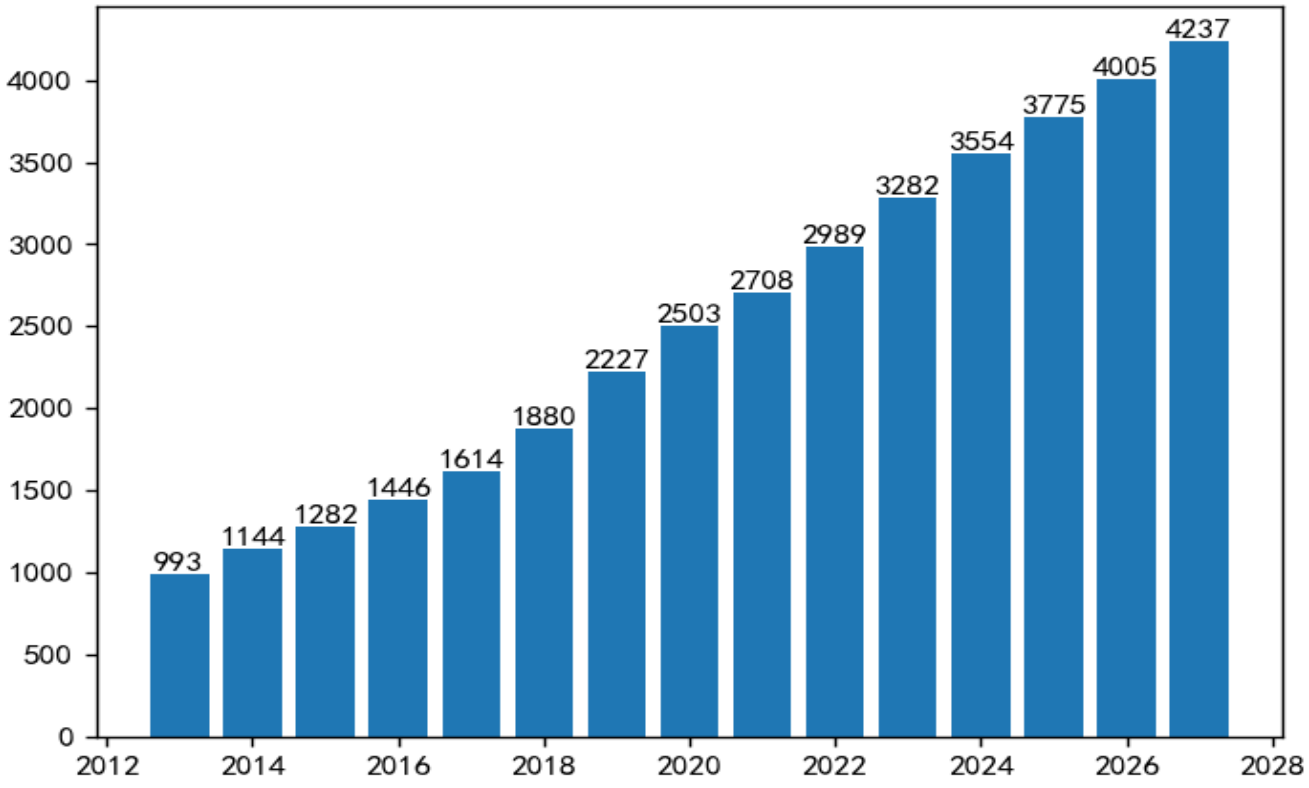

Figure 1: The Market Size and Forecast of Health Supplements in China

This study aims to address the aforementioned gap by constructing a "central-peripheral" dual-path theoretical framework to reveal the impact mechanisms of external cues on the online sales of health supplements, and to identify the differentiated strategic needs for different product types. In comparison to existing research, the main contributions of this study are presented in three dimensions: theoretical integration innovation—combining cue utilization theory, attention economy theory, and the Elaboration Likelihood Model (ELM) to construct a dual-path driving model for online health supplement purchases, thereby expanding the application boundaries of the ELM model in the online sales of functional products; methodological innovation—breaking through the traditional superficial measurement limitations of title character length, and innovatively applying Python word frequency analysis to quantify the "Title Involvement" index, achieving an objective measurement of title information density; practical insights innovation—identifying the differentiated moderating effects of supplement type on sensitivity to external cues, providing empirical evidence for the precision marketing strategies of maintenance-oriented and regulation-oriented health supplements.

The structure of the paper is organized as follows to address the research objectives: The first section is the introduction, which presents the research background and significance. The second section is the literature review and theoretical foundation, where the research on health supplement consumer behavior is systematically reviewed, the "central-peripheral" dual-path theoretical framework is constructed, and research hypotheses are proposed. The third section outlines the methodology, detailing the data sources, variable operationalization, and descriptive statistics of the data. The fourth section presents the empirical results and analysis, including baseline regression, heterogeneity tests, and moderating effect tests. The fifth section concludes with findings and insights, summarizing the research results and providing management recommendations as well as highlighting research limitations.

2. Literature Review

Health supplements, abbreviated from health foods, possess both the attributes of food and certain characteristics of pharmaceuticals. According to the "Measures for the Registration and Management of health supplements (Trial)", health supplements are categorized within the realm of food (National Medical Products Administration,2016). Despite their underlying classification as food, they differ from general food products in that their core function is to supplement specific minerals or vitamins and to regulate physiological functions to achieve predetermined health objectives. These products are meticulously designed with a targeted approach to meet the specific bodily needs of defined demographics (Jin,2023).

2.1 Fear Appeal Theory

In the marketing and consumption processes of health supplements, their unique health benefits and tailored design for specific populations impart a distinctive influence at the psychological level. This influence stems not only from the positive promises associated with health supplements regarding enhancement of well-being but also from consumers' fears of health threats. Terror Appeal, as a psychological inducement strategy, effectively evokes consumers' fears related to health threats, thereby influencing their purchasing decisions. Fear appeal is

essentially understood as a process of communication and persuasion that leverages fear as a persuasive tool (Witte, 1992). In the context of health communication, health supplements are positioned as solutions to mitigate health threats, thereby providing consumers with a symbolic sense of immortality (Solomon et al., 2015).When death concerns are activated, health-related behavioral intentions and behaviors are enhanced(Courtney, 2025). Additionally, research has demonstrated that the fear elicited by COVID-19 enhances the intention to purchase health supplements, indirectly influenced by the mediating effects of attitudes, subjective norms, and perceived behavioral control (Liu et al., 2021). In summary, the fear of death intensifies the recognition of health threats, activating a deep-seated desire for life continuation, which in turn drives online consumption of health supplements.

2.2 External Cue Theory

When exploring consumers' online purchasing behavior regarding health supplements, cue utilization theory emphasizes the role of consumers' reliance on and interpretation of information cues during decision-making processes(Miyazaki et al., 2015). This theory, later expanded by Olson & Jacoby , classifies cues into internal and external types(Olson & Jacoby, 1972). Given the complexities of online sales platforms, it is often challenging for consumers to investigate internal cues; thus, external cues play a more critical role in influencing consumer decisions. Research indicates that the quality of content, as an internal cue, and the quality of descriptions, as an external cue, both significantly and positively influence consumers' perceived quality of product listings (Li et al., 2021). Furthermore, it has been found that product quality and service marketing have a significant and positive effect on consumer attitudes and intentions to purchase near-expired foods (Zhang & Liu, 2022). In the context of online consumer choices regarding health supplements, external cues such as brand reputation, product price, and additional services are crucial. Consumers frequently rely on these external cues to assess the quality and credibility of health supplements, thus making their purchasing decisions, and the influence of these external factors should not be underestimated.

2.3 Attention Economy

In the online environment, consumer judgment regarding external cues becomes a scarce resource due to limited attention. Simon pointed out in his work that "the abundance of information leads to a scarcity of attention (Simon.,1971)." Subsequently, Thorngate introduced the concept of the attention economy and stated that the future belongs to an era of attention economics (Thorngate ,1990). Authoritative cues, such as well-known brand logos, have been shown to enhance the credibility of information, thereby indirectly increasing the duration of effective attention (Ang et al., 2023). Additionally, from the perspective of the platform economy, the importance of user attention is emphasized as a critical factor within this economic context (Feng et al., 2023). Within the framework of the attention economy, online consumption choices for health supplements are constrained by both information scarcity and the value of attention. Authority cues, such as brand and functionality, can anchor consumer attention and improve information processing efficiency, ultimately influencing purchasing decisions and highlighting the key effectiveness of attention economy in consumer guidance.

2.4 Elaboration Likelihood Model

The Elaboration Likelihood Model (ELM) further elucidates how consumers process information and select decision-making paths when purchasing health supplements under different circumstances. The ELM, proposed by Petty & Cacioppo , is a dual-path communication model that divides individual information processing into two paths: the central path and the peripheral path(Cacioppo et al.,1986). Drawing on the Elaboration Likelihood Model (ELM), it has been discovered that concise brand narratives, strong arguments, and credible ecological labels significantly enhance consumer trust in green brands (Kumar et al., 2025). In the context of online reviews, it has been validated that objective information predominates in consumer decision-making through the peripheral path, while negative emotional information strengthens perceived usefulness via the central path (Sun et al., 2025). The online consumption choices for health supplements are similarly influenced by both the central and peripheral paths. Under the central path, information regarding product functionality and price encourages deep information processing; conversely, in the peripheral path, cues such as brand reputations and ancillary services guide quick decisions. Both paths collaboratively shape consumer choices.

Based on the aforementioned theoretical framework, health supplements consumption behavior can be decomposed into a multi-layered cognitive decision-making process: driven by anxiety towards mortality, consumers utilize cue-utilization theory and attention economy theory to filter online health supplements information. Given that internal cues are difficult to evaluate directly, their decision-making heavily relies on external cues to mitigate perceived risks. ELM further explains the dual paths of information processing, indicating that in today's information-overloaded society, health supplements sellers must enhance the credibility of information to compete for limited attention resources, thereby better facilitating sales. Thus, it is evident that the essence of health supplements purchasing lies in the consumer’s risk-averse strategy formed by integrating external cues, the ELM model, and attention allocation mechanisms in the context of perceived health threats.

2.5 Factors Influencing Online Sales of Health Supplements

In examining the factors influencing the online sales of health supplements, this study investigates both the central path and the peripheral path. The central path encompasses title involvement, functional position, and product price, while the peripheral path includes brand reputation, additional services, and source credibility. The central path focuses on the product itself, requiring consumers to actively engage their cognitive resources for a deep and rational evaluation during the purchase decision-making process. In contrast, the peripheral path reduces the decision-making threshold by leveraging emotional and other peripheral cues, allowing decisions to be made without extensive rational scrutiny.

2.6 Central path

2.6.1 Title Involvement

This study defines title involvement as the proportion of the number of high-frequency words in the title relative to the total number of characters in the title. High-frequency words refer to keywords that marketers believe are

of significant interest to consumers and are strongly associated with health supplements. A higher value of title involvement indicates that the title contains more product-related information, making it easier for consumers to derive valuable insights from the item's title. Existing research on involvement highlights that tourist involvement has a significantly positive moderating effect on the perception of authenticity and the cultivation of cultural empathy in service scenarios at cultural heritage sites (Hou et al., 2025). Additionally, it has been found that product involvement affects consumers' attention to and valuation of information from raw material suppliers, which, in turn, influences consumers' purchasing decisions (Zhang et al., 2024). In summary, with higher title involvement, consumers can understand more about the health supplements from the title, thereby facilitating their purchasing decisions. Thus, the following hypothesis is proposed:

H1: Title involvement positively influences the online sales of health supplements on e-commerce platforms.

2.6.2 Functional Position

The functional position of health supplements refers to the clarity with which the item title conveys the primary effects and benefits that the supplement offers, thereby clearly communicating the core value of the product to consumers. Well-defined functional position allows consumers to have clearer expectations regarding health supplements, enhancing their trust in the products.In research on product functionality, it has been asserted that functional position is a critical factor influencing consumer purchasing decisions (Zou et al., 2025). Furthermore, it has been indicated that when purchasing functional products, consumers typically have clear goals and benefit needs (Sun & Mao, 2019). Functionally suggestive brand names, by conveying information related to product attributes and performance, can reduce perceived risk and stimulate positive feelings and purchase intentions among consumers. Given that health supplements are functional products, clear functional position is likely to facilitate consumer purchasing decisions. Therefore, the following hypothesis is proposed:

H2: Functional position positively influences the online sales of health supplements on e-commerce platforms.

2.6.3 Product Price

Product price is one of the critical factors influencing consumer purchasing decisions. For consumers, price often serves as a vital indicator for assessing the value for money of a product, directly affecting their willingness and ability to make a purchase. It has been pointed out that for low-competition new products, minimizing information disclosure and leveraging consumer curiosity can enhance price strategies (Liu et al., 2025). In contrast, for high-competition new products, it is essential to lower price in order to penetrate the market. Additionally, for promotional items, revealing the original price can effectively highlight discounts. Furthermore, it has been suggested that employing future price anchors instead of historical price anchors can lead to a higher willingness to purchase among consumers (Gao & Chen, 2025).In summary, product price serves as a significant determinant of consumer purchase intention and is a crucial criterion that consumers rely on when deciding whether to take action on their buying choices. Accordingly, we propose the following hypothesis:

H3: Product price negatively influences the online sales of health supplements on e-commerce platforms.

2.7 Peripheral path

2.7.1 Brand Reputation

Consumers typically prefer well-known brand products when making purchasing decisions, as these brands represent better quality assurance and after-sales service. A premium brand can quickly attract consumer attention and trust through its brand reputation, facilitating purchasing decisions.It has been asserted that brand attractiveness has a significant positive impact on visitor behavioral intentions (Sun et al., 2024). Additionally, it has been emphasized that the brand reputation contributes positively to the standardization of agricultural products, thereby promoting the development of rural e-commerce (Qiao et al., 2024). In summary, when the title of a product explicitly indicates the brand of health supplements, it can enhance consumers' trust, aiding their quick assessment of product quality and thereby facilitating purchasing decisions. Thus, we propose the following hypothesis:

H4: Brand reputation positively influences online sales of health supplements on e-commerce platforms.

2.7.2 Additional Services

In this research, additional services encompass promotional services during the pre-purchase stage, as well as free shipping and return services in the post-purchase stage. Given that online transactions break the traditional "cash on delivery" model, their virtual nature diminishes consumer confidence, leading them to seek more additional service guarantees. Previous research on additional services reveals that consumers are particularly sensitive to the perceived value of additional service quality when the product is associated with a general brand (Han, 2019). Furthermore, it has been pointed out that optimizing the processes of additional services can enhance a company's service capabilities and overall competitiveness, thereby boosting product sales (Li et al., 2024). Therefore, additional services are a significant factor influencing product sales, as consumers may decide to make a purchase due to the high-quality additional services provided by sellers. Consequently, we propose the following hypothesis:

H5: Additional services positively influence online sales of health supplements on e-commerce platforms.

2.7.3 Source Credibility

The rapid development of e-commerce has led to a proliferation of health supplements with varying qualities, making it challenging for consumers to discern authenticity. Generally, the higher the shop's reputation, the greater the consumer's trust in the health supplements offered. Therefore, consumers often rely on the seller's credibility to assess the reliability of both the seller and the products, tending to choose sellers with higher reputations to avoid purchasing low-quality health supplements. Regarding source credibility, It has been asserted that highly credible sources can enhance the persuasive power and trustworthiness of information (Pan, 2025). Additionally, it has been pointed out that source credibility plays an essential role in the trust judgments of online information (Chu, 2025). Furthermore, according to the IAM model, source credibility acts through marginal paths that influence users' perceptions of information usefulness, thereby impacting information

adoption. In conclusion, when the credibility of the source of health supplements is high, it increases consumer trust in product quality, which in turn promotes purchasing. Therefore, we propose the following hypothesis:
H6: Source credibility positively influences online sales of health supplements on e-commerce platforms.

2.8 Regulatory Mechanisms of Health Supplement Types

The following research suggests that the type of health supplements can influence consumer purchasing decisions. For instance, it has been argued that significant differences exist in the attributes of various types of products, which lead consumers to adopt varying degrees of difficulty in employing distinct value assessment strategies; this, in turn, affects their preferred evaluation approach (Li et al., 2023). Additionally, it has been posited that consumers perceive the value of rebate promotions differently depending on the product category, subsequently influencing their purchasing decisions (Cai, 2022). In this study, we assert that the factors within the central path are the primary focus for consumers when purchasing health supplements. These factors exert a relatively stable influence on purchasing decisions, unaffected by the types of health supplements. However, based on the theories of fear appeal and attention economy, when consumers purchase maintenance-oriented health supplements typically kept at home, they are more likely to focus on the peripheral path's influencing factors. This is because these factors can enhance consumers' sense of security to some extent, thereby affecting their final purchasing decisions. Hence, we propose the following hypotheses:
H7: The moderating effect of health supplement type on online sales volume of health supplements.
H7a: Compared to regulatory health supplements, the brand reputation has a stronger impact on the online sales of maintenance-oriented health supplements.
H7b: Compared to regulatory health supplements, the additional services have a stronger impact on the online sales of maintenance-oriented health supplements.
H7c: Compared to regulatory health supplements, the source credibility of the information has a stronger impact on the online sales of maintenance-oriented health supplements.
Based on this, the present study proposes the conceptual model shown in Figure 2.

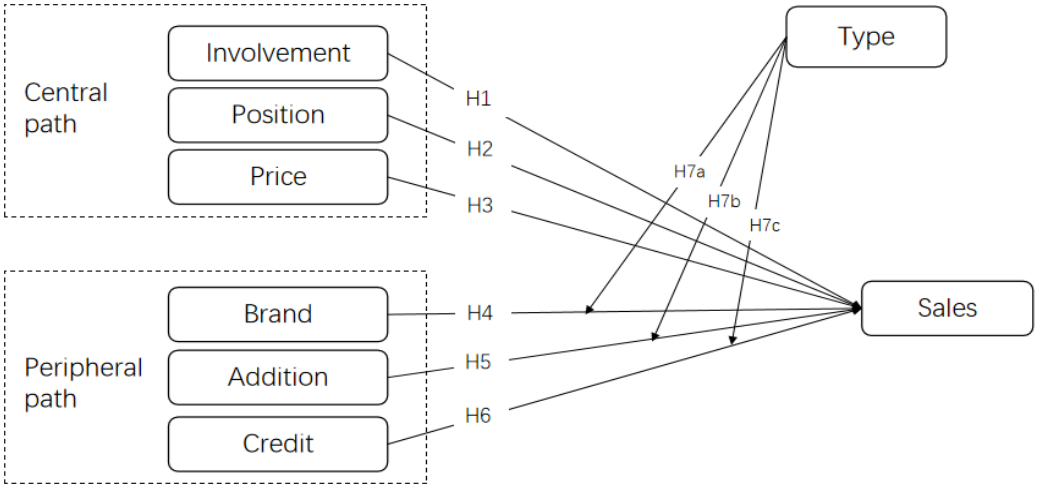

Figure 2: Conceptual Model

3. Methodology

3.1 Research Methodology

This study adopts a quantitative empirical research approach, employing deductive reasoning logic and large sample data analysis to validate theoretical hypotheses. The purpose of this study is to examine the causal relationship between the central path and peripheral path factors in the ELM model and their impact on the online sales of health supplements. The quantitative method allows for precise measurement of the relationships between variables through statistical inference. Moreover, online sales data are objective and readily accessible, effectively avoiding common biases such as social desirability bias and recall bias often associated with survey research, making it well-suited for hypothesis testing with structured data. Compared to qualitative methods, the results of large sample regression analysis offer higher external validity and provide generalizable conclusions for e-commerce practices.

In terms of specific procedures, this study follows a "theory-driven—hypothesis deduction—data validation" technical approach. First, a conceptual framework is constructed based on cue utilization theory, attention economy theory, and the ELM model, followed by the formulation of research hypotheses. Second, web scraping technology is employed to collect objective sales data from the Taobao platform, and Python is used for text mining and word frequency analysis to construct the title involvement indicator. Finally, Stata statistical software is utilized to perform multiple linear regression analysis, systematically testing the main effects of the central path and peripheral path factors on the online sales of health supplements, as well as the moderating effect of product types.

3.2 Data Source

This study takes publicly available product information on the Taobao platform as the data source. Specifically, Ui-Path Studio version 2021.10.7 was used to configure the automated workflow, it uses a click-based workflow and does not require writing code. first, the "Open Browser" activity was employed to launch Chrome and navigate to the Taobao search page; second, the "Type Into" activity was used to automatically input the keyword "health supplements" and trigger the search; subsequently, the "Data Scraping" tool was configured to extract rules, allowing the system to identify fields such as product title involvement, product price, sales volume, store type, promotional activities, and Additional Services, and store them in a Dateable variable; finally, the "Write Range" activity was used to export the data to an Excel file. The data collection frequency was set to a 5-second delay after each page’s scrolling to ensure full page rendering, resulting in a total of 920 raw entries across 50 pages.

To ensure scientific rigor and validity, the 920 health supplement data samples were processed, with extreme values removed, yielding 885 valid health supplement entries. These processed data serve as the basis for empirical analysis. The collected health supplements were categorized into maintenance-oriented and regulatory-oriented products. (Li et al., 2024) Maintenance-oriented health supplements are products that support the daily maintenance and upkeep of bodily organs and systems, helping to sustain normal physiological functions and prevent functional decline. This category includes vitamins, protein powders,

skincare products, and herbal slices suitable for direct infusion, with a total of 236 samples. Regulatory-oriented health supplements refer to products that regulate physiological functions to maintain a healthier and more balanced state, assisting in improving sub-health conditions or supporting treatment for certain chronic diseases. This category primarily includes processed products aimed at liver protection, cardiopulmonary support, and immune enhancement, totaling 649 samples. The collected data were organized according to health supplement type, product category, source credibility, and the presence of brand information to analyze product distribution, as shown in Table 1.

Table 1: Product Distribution Profile

Distribution Type		Frequency	Percentage
health supplement types	Maintenance-type health supplement types	236	26.67%
	Regulatory-type health supplement	649	73.33%
product classification	Imported health supplement	357	40.34%
	Time-honored brand health supplement	241	27.23%
	Non-time-honored, non-imported health	287	32.43%
source credibility	Tmall Supermarket/Official Brand Flagship Stores	778	87.91%
	Others	107	12.09%
brand presence	Branded	650	73.45%
	Non-branded	235	26.55%

3.3 Variable Definition

This study uses the online sales volume of health supplements as the dependent variable, with the total sales volume displayed on the product detail page of the Taobao platform as a proxy for health supplements sales. The independent variables include: title involvement, functional position, product price, brand reputation, additional services, and source credibility (Figure 3 serves as an example). In addition, health supplements type is considered as a moderating variable, classified into maintenance-type health supplements and regulation-type health supplements. Regulation-type health supplements are assigned a value of "1", and maintenance-type health supplements are assigned a value of "0". The shipping location section is treated as a control variable.

Title involvement is the core explanatory variable in this study, referring to the proportion of high-frequency words appearing in product titles. Previous research has largely focused on the quantitative effect of the character length of product titles, confirming a significant association with sales. However, merely examining the textual length of titles is insufficient to fully explain the intrinsic complexity of consumer decision-making mechanisms: do different semantic units within a title contribute differently to sales? Do high-frequency words

exert stronger behavioral guidance effects? To overcome these cognitive limitations, this study introduces a title word-frequency analysis framework to empirically examine how the proportion of key terms in titles affects consumer purchase decisions.Using the initially collected product titles, we construct a “Title Involvement” index as the independent variable to explore the causal pathway between title content structure and consumer behavior.

Figure 3: Example of Extracted Attributes for Health Supplements

This index is calculated through word-frequency analysis of product titles using Python 3.8. Specifically, the procedure is as follows: first, the jieba library is used to segment 885 collected product titles in precise mode, loading a custom dictionary to ensure professional terms such as “collagen” and “vitamins” are correctly recognized; second, all words’ frequencies are counted using “collections.Counter”, filtering out 19 high-frequency words with occurrences greater than 50; subsequently, an expert review removes 4 words (“authentic,” “official,” “flagship,” “self-operated”) that are unrelated to product intrinsic attributes but primarily reflect product origin; finally, 15 core health-related terms are determined for calculating the title involvement index, as shown in Table 2 ,with the specific calculation method shown in Equation (1).

$$\text{Involvement}_i = \frac{n_i}{N_i} \quad (1)$$

The term Involvement_i represents the involvement degree of the (i)-th title, where n_i indicates the number of high-frequency terms contained in the (i)-th title, and N_i denotes the total number of characters in the (i)-th title. The overall title involvement degrees for all products are ultimately obtained, as shown in Table 3. The value of this metric ranges from 0 to 1, with higher values indicating a greater density of keywords in the title.

Table 2: Final List of High-Frequency Terms

Ranking	High-frequency words	Term frequency	Ranking	High-frequency words	Term frequency
1	Official	232	9	Beijing	72
2	Capsule	148	10	Soft capsules	71
3	Middle-aged and elderly	141	11	Ginseng	71
4	Health supplements	113	12	Oral liquid	65
5	Tongrentang	98	13	Restorative	65
6	Adult	82	14	Regulate	55
7	U.S. imported	81	15	Immunity	52
8	Vitamin	78	/	/	/

Table 3: Proportion of High-Frequency Terms in Product Titles

item	High-frequency keyword count	Title character count	Involvement ($\frac{n_i}{N_i}$)
item1	10	28	0.36
item2	6	29	0.21
item3	9	33	0.27
item4	11	30	0.37
item5	0	28	0.00
item6	0	38	0.00
item7	9	30	0.30
……	……	……	……
item29	0	27	0.00
item20	3	31	0.10
item31	8	30	0.27
item32	5	29	0.17
……	……	……	……

Functional position refers to whether the product title explicitly indicates the health effects of the supplement. If clearly stated, it is assigned a value of "1"; otherwise, it is assigned a value of "0". product price refers to the actual price displayed on the Taobao page. brand reputation indicates whether the product title mentions the brand of the product. If the brand is included, it is assigned a value of "1"; otherwise, it is assigned a value of "0". Additional Services refers to whether the product includes promotional activities, free shipping, or provides

a return service. If all three are present, the value is "3"; if two are present, the value is "2"; if one is present, the value is "1"; and if none are present, the value is "0". source credibility refers to the reliability of the channel through which the health supplement is purchased, and whether the store chosen by the consumer is trustworthy. The study uses the type of Taobao store as the criterion for measuring source credibility. If the product comes from Tmall Supermarket, Taobao, or the brand's official self-operated store, it is assigned a value of "1"; otherwise, it is assigned a value of "0". Detailed descriptions of each variable are shown in Table 4.

Table 4: Model Variables and Measurement Items

Variable Category	Variable Name	Variable Description	Coding
Dependent Variable	Sales	Product Sales	The sales quantity displayed on the product page
Central path	Involvement	Title Involvement	Proportion of high-frequency keywords present in the product title
	Position	Functional Position	Whether the product title precisely describes its function (0=No; 1=Yes)
	Price	Product Price	The price displayed on the product page
Peripheral path	Credit	Source Credibility	Type of store selling the product (0=Other; 1=Tmall Supermarket,or Official Brand Flagship Store)
	Brand	Brand Reputation	Whether a brand is displayed for the product (0=No; 1=Yes)
	Addition	Additional Services	Presence of promotions, free shipping, return policy,shown on the page (0=None; 1=One service; 2=Two services; 3=Three services)
Control Variable	Place	Shipping Region	Location from which the product is shipped (0=Eastern China; 1=Central China; 2=Western China; 3=Overseas)
Moderating Variable	Type	supplements Type	Type of the health supplements (0=Maintenance-type; 1=Regulatory-type)

3.4 Description of Variable Characteristics

The study conducted descriptive analysis of the organized data using Stata software to gain an overview of each variable, as shown in Table 5. The table indicates that indicators such as product price and sales volume exhibit relatively large standard deviations, reflecting high dispersion. This suggests substantial differences in prices among various health supplements, indicating that the data selected in this study can adequately represent the online sales situation of health supplements. The means of functional position and brand reputation are 0.81 and

0.73, respectively, indicating that 81% of health supplement sellers clearly reflect the product's functional position in the title, and 73% clearly display the brand name in the title. The mean of source credibility is 0.88, indicating that 88% of the health supplements originate from Taobao's official self-operated stores or the brand's official flagship stores.

Table 5: Descriptive Statistics and Correlation Analysis of Variables

Variables	M	SD	1	2	3	4	5	6	7
Sales	6381.89	16178.409	1						
Involvement	0.14	0.123	-0.045	1					
Position	0.81	0.389	0.296**	0.133**	1				
Price	182.85	259.050	-0.102**	0.098**	-0.038	1			
Brand	0.73	0.442	0.192**	0.113**	0.036	0.087**	1		
Addition	2.53	0.690	0.142**	0.152**	0.056	0.167**	-0.017	1	
Credit	0.88	0.326	0.187**	0.058	0.126**	0.131**	0.138**	0.127**	1

Note: Figures in parentheses represent t-statistic estimates; *p<0.1, **p<0.05, ***p<0.01.

Correlation analysis is a method used to explore whether a dependency exists between two or more factors, and to examine the direction and degree of their correlation. In this study, the Pearson correlation coefficient is used to measure the relationships between variables, and the results are presented in Table 6. As indicated in the table, the functional position in the central path is positively correlated with health supplement sales; product price is significantly negatively correlated with health supplement sales; while title involvement does not show a significant linear relationship with online health supplement sales. In the peripheral path, brand reputation, additional services, and source credibility are all positively correlated with online health supplement sales. Furthermore, the correlation coefficients among the independent variables are all below 0.7, suggesting that multicollinearity is not present in the regression model.

4. Results and discussions

4.1 Baseline Regression Analysis

To further investigate the interrelationships among the variables, this study establishes a baseline model for regression analysis, aimed at exploring the impact and degree of external cues on online product sales under different paths.

In this study, some products have sales figures reaching tens of thousands, while others may only have single-digit sales. Additionally, the prices of the products range significantly—from a few dollars to several hundred dollars. To mitigate potential discrepancies in results and achieve optimal fitting, a logarithmic

transformation is applied to both online sales volumes and product prices. All data used in this study are sourced from objective data on the Taobao platform. The sales volume of the products is taken as the dependent variable to establish the following baseline regression model:

$$\ln\text{Sales} = \beta_1 * \text{Involvement} + \beta_2 * \text{Accuracy} + \beta_3 * \ln\text{Price} + \theta_1 * \ln\text{Price} + \theta_2 * \text{Addition} + \theta_3 * \text{Credit} + \lambda\text{Place} + \varepsilon$$

In the model, Sales represents the sales volume of the product; β_0 denotes the intercept; β_1~β_3 are the regression coefficients for the central path variables; θ_1~θ_3 are the regression coefficients for the peripheral path variables; Place serves as a control variable; and ε represents the error term.

Based on the econometric model specifications, this study employs the Ordinary Least Squares (OLS) method and utilizes STATA software to perform a full sample regression. The aim is to explore the impact mechanism of different variables on online product sales under the influences of both the central path, the peripheral path, and their joint effects. The baseline regression results are presented in Table 6:

Table 6: Baseline Regression Results

Variables Type	Variables	Sales（1）	Sales（2）	Sale（3）	Sales（4）
Central path	Involvement		-1.093**		-1.891***
			(-1.97)		(-3.62)
	Position		1.883***		1.661***
			(-10.79)		(-10.15)
	Price		-0.107*		-0.276***
			(-1.72)		(-4.63)
Peripheral path	Brand			0.918***	0.999***
				(-5.98)	(-6.95)
	Addition			0.515***	0.602***
				(-5.25)	(-6.44)
	Credit			1.327***	1.244***
				(-6.34)	(-6.28)
	Place	0.116*	0.144**	0.075	0.111*
		(-1.66)	(-2.19)	(-1.15)	(-1.81)
_Cons		6.876***	5.979***	3.760***	3.730***
		(-82.66)	(-18.04)	(-12.07)	(-10.11)
N		885	885	885	885
Adjust R^2		0.002	0.121	0.123	0.243

Note: Figures in parentheses represent t-statistic estimates; *p<0.1, **p<0.05, ***p<0.01.

Based on the regression results, the first column of the model presents the regression results for control variables. Among these variables, the shipping region for products (Place) significantly impacts online sales of health supplements (β=0.116, $p<0.1$). This could be attributed to the established reputation of foreign health supplement brands; consequently, consumers may prioritize purchasing from sellers that ship from abroad to ensure their products are authentic.

The model's (2) central path in the ELM model shows that title involvement (Involvement) has a significant negative impact on sales (β = -1.093, $p < 0.05$). This suggests that the higher the title involvement with a product, the lower the product sales. The reason may lie in the overuse of high-frequency health-related terms in the title, which results in an excessively dense and lengthy title, leading to cognitive overload and visual fatigue for consumers. In an environment with scarce attention, overly complex information presentation increases the cost of processing for consumers, reducing the efficiency of information acquisition, thus inhibiting purchase intention. Furthermore, the excessive use of high-frequency terms may lead to title homogeneity, making it difficult for the product to stand out in the information-saturated e-commerce platforms, ultimately weakening its differentiated competitive advantage. Therefore, hypothesis H1 is not supported. Functional position (Position) has a significant positive impact on sales (β = 1.883, $p < 0.01$), indicating that clear functional position promotes sales growth. This suggests that consumers still primarily focus on the function of health supplements when making purchases. Product price (Price) has a significant negative impact on the online sales of health supplements (β = -0.107, $p < 0.1$). Although health supplements are experience-based products, information asymmetry in the online environment makes it difficult for consumers to assess the true quality in advance. In this case, price becomes an important cue for inferring quality. However, excessively high prices trigger consumers' perception of financial risk, especially when the product's efficacy is uncertain. In such cases, a high price may be seen as a "premium trap" rather than a quality signal. Additionally, the health supplement market contains many similar alternatives with comparable functions, making the price highly elastic. A price increase will lead consumers to switch to alternative options with better cost-effectiveness, thus suppressing demand. Hypotheses H2 and H3 are supported.

The third column of the model represents the peripheral path of the ELM model, where the brand reputation (Brand) has a significant positive impact on sales (β=0.918, $p<0.01$), indicating that the presence of brand information in the product positively influences consumer purchasing behavior. Strong brand information enhances consumers' trust in the health supplement brand, thereby facilitating their purchasing decisions. Both additional services (Addition) and source credibility (Credit) significantly positively influence the online sales of health supplements (β=0.515, $p<0.01$; β=1.327, $p<0.01$). In the peripheral path, consumers typically use less cognitive effort in decision-making. Therefore, additional services and source credibility serve as simple and intuitive signals, becoming important criteria for consumers to quickly assess the product's quality. When a store offers more additional services and is a highly reputable platform, such as Tmall Supermarket, Ali Health Pharmacy, or an official brand flagship store, consumers' trust in the product quality increases. This indicates that positive environmental characteristics promote consumers to make purchasing decisions. Therefore, hypotheses H4, H5, and H6 are validated.

The fourth column of the model integrates both the central path and peripheral path, where R^2 increases from 0.121 to 0.243, indicating that both paths jointly influence sales. The title involvement (Involvement) (β=-1.891, $p<0.01$), functional position (Accuracy) (β=1.661, $p<0.01$) in the central path, and brand reputation (Brand) (β=0.999, $p<0.01$), additional information (Addition) (β=0.602, $p<0.01$), and source credibility (Credit) (β=1.244, $p<0.01$) in the peripheral path all have a significant positive influence on online sales of health supplements. The product price (Price) (β=-0.276, $p<0.01$) in the central path continues to exert a significant negative effect on sales in the integrated model.

4.2 Moderating Effects of Health supplement Type

This study categorizes health supplements into two types: maintenance-oriented and regulatory. Maintenance-oriented health supplements refer to products that serve to maintain and safeguard the daily functioning of various organs and systems within the body, helping to preserve normal physiological functions and prevent the decline of bodily functions. This category primarily includes products such as vitamins, protein powders, skincare products, and herbal slices that can be directly infused in water. Regulatory health supplements refer to those capable of modulating physiological functions to help achieve a healthier, more balanced state, thereby improving certain sub-health conditions or assisting in the treatment of chronic diseases. This category mainly includes refined products for liver protection, lung health, and immune enhancement.

Existing research indicates that different product types can influence how consumers process peripheral cues, subsequently affecting purchasing decisions. Therefore, this study further investigates the moderating effects of health supplement type on the relationship between external cues and health supplement sales. Incorporating interaction terms between health supplements type and independent variables into the multiple linear regression model yields results as presented in Table 7.

In the second column of the model, an interaction term between brand reputation and health supplement type was added. The regression results indicated that the effect of health supplement type on the interaction between brand and health supplement sales was not significant, thus hypothesis 7a was not validated. In the third column of the model, an interaction term between additional services and health supplement type was introduced. The regression results showed $P<0.05$, indicating the presence of a moderating effect. Specifically, compared to moderating-type health supplements, additional services had a stronger impact on the online sales of maintenance-type health supplements. Consequently, hypothesis 7b was validated. In the fourth column of the model, an interaction term between source credibility and health supplement type was included. The regression results indicated that health supplement type did not have a significant moderating effect on the relationship between source credibility and health supplement sales, leading to the non-validation of hypothesis 7c. For models (2) and (4), this may be attributed to the fact that, regardless of the category of health supplements, consumers tend to prioritize the brand and source credibility of health supplements. Therefore, health supplement type does not play a moderating role when brand reputation and source credibility are treated as independent variables influencing online sales of health supplements. In the fifth column of the model, all marginal path factors and their interactions with health supplement type were added. The results still indicated that only the interaction between additional services and health supplement type had a significant effect on

online sales. This further confirms the critical role of additional services for maintenance-type health supplements, thereby validating hypothesis H7.

Table 7: Moderating Effects of Health Product Type

Variables	Baseline model	Moderated model			
	Sales（1）	Sales（2）	Sales（3）	Sales（4）	Sales（5）
Involvement	-1.673***	-1.691***	-1.570***	-1.649***	-1.542***
	(-3.23)	(-3.24)	(-3.03)	(-3.17)	(-2.95)
Position	1.714***	1.719***	1.665***	1.714***	1.666***
	(-10.57)	(-10.55)	(-10.21)	(-10.56)	(-10.16)
Price	-0.223***	-0.223***	-0.223***	-0.226***	-0.228***
	(-3.71)	(-3.72)	(-3.72)	(-3.75)	(-3.79)
Brand	1.044***	1.111***	1.024***	1.044***	1.085***
	(-7.32)	(-4.35)	(-7.19)	(-7.32)	(-4.22)
Addition	0.543***	0.542***	0.982***	0.542***	1.001***
	(-5.82)	(-5.80)	(-4.85)	(-5.80)	(-4.90)
Credit	1.273***	1.272***	1.275***	1.096***	0.997***
	(-6.49)	(-6.48)	(-6.52)	(-3.35)	(-3.02)
Type	-0.656***	-0.589**	0.773	-0.888**	0.544
	(-4.53)	(-2.29)	(-1.28)	(-2.38)	(-0.81)
Brand×Type		-0.097			-0.089
		(-0.32)			(-0.29)
Addition×Type			-0.551**		-0.578**
			(-2.44)		(-2.53)
Credit×Type				0.271	0.424
				(-0.68)	(-1.04)
Place	0.103*	0.104*	0.102*	0.102*	0.103*
	(-1.70)	(-1.71)	(-1.70)	(-1.69)	(-1.70)
Cons	3.986***	3.944***	2.873***	4.149***	3.033***
	(-10.79)	(-10.03)	(-4.90)	(-9.40)	(-4.90)
N	885	885	885	885	885
Adjusted R^2	0.259	0.258	0.263	0.259	0.263

Note: Figures in parentheses represent t-statistic estimates; *p<0.1, **p<0.05, ***p<0.01.

4.3 Heterogeneity Analysis

In the process of selecting goods, consumers exhibit varying focal points and priorities depending on different product categories. Moreover, individual differences in beliefs and emotions can lead to preferences for distinct categories of products. Hence, the study will categorize the acquired goods into three types—time-honored brands, imported goods, and non-time-honored non-imported goods—to explore the differential impacts of product categories on online sales of health supplements.

Table 8: Heterogeneity Analysis of Product Categories

Variables Type	Variables	Sales（1） Time-honored brand	Sales（2） Imported	Sales（3） others
Central path	Involvement	2.510* (-1.85)	1.33 (-1.33)	-3.472*** (-3.63)
	Position	1.278*** (-4.67)	1.674*** (-6.15)	1.241*** (-3.90)
	Price	-0.466*** (-4.31)	-0.125 (-1.25)	-0.289** (-2.41)
Peripheral path	Brand	0.709 (-1.34)	1.737*** (-7.57)	0.755*** (-3.13)
	Addition	0.693*** (-4.21)	0.224 (-1.40)	0.461*** (-2.64)
	Credit	1.415*** (-4.58)	1.010** (-2.41)	0.796** (-2.36)
Control Variables	Place	0.332 (-1.5)	-0.108 (-1.61)	0.286 (-1.60)
Cons		3.667*** (-4.97)	3.609*** (-5.56)	5.142*** (-7.00)
N		241	357	287
Adjust R^2		0.304	0.292	0.168

Note: Figures in parentheses represent t-statistic estimates; *p<0.1, **p<0.05, ***p<0.01.

Others: non-time-honored non-imported goods

As shown in Table 8, regardless of whether the product is a time-honored brand, imported, or neither, both functional position (Accuracy) and source credibility (Credit) have a significant positive effect on sales, whereas product price (Price) generally exerts a significant negative effect on sales. Moreover, the effects of title involvement (Involvement), brand reputation (Brand), and additional services (Addition) vary across different types of products. Specifically, for time-honored brand products, title involvement (Involvement) has a significantly positive impact on online sales (β=2.510, p<0.1), which contradicts the negative effect of title involvement on online sales observed in the baseline regression. This may be because, for consumers of Chinese time-honored health supplements, actively seeking information about the product often starts with the title. Therefore, for time-honored products, deeper title involvement positively facilitates consumers' purchase decisions. For non-time-honored, non-imported health supplements, the impact of title involvement (Involvement) along the central path on online sales is significantly negative (β=-3.472, p<0.01). In contrast, for imported products, this effect is not significant, possibly because consumers have limited ability to assess the quality of imported health supplements. Consequently, consumers focus more on brand reputation and source credibility, reducing the influence of product titles on purchase decisions. Brand reputation (Brand) exerts a positive effect on imported health supplements (β=1.737, p<0.01) and non-time-honored, non-imported health supplements (β=0.755, p<0.01), with the effect being stronger for imported products than for the latter. In contrast, brand reputation does not have a significant effect on time-honored health supplements, likely because

these brands are already century-old, and consumers do not need to rely on brand information when purchasing them.

Additional services (Addition) positively influence the online sales of time-honored health supplements (β=0.693, $p<0.01$) and non-time-honored, non-imported health supplements (β=0.461, $p<0.01$), but have no significant effect on imported health supplements. We suggest that when purchasing imported health supplements domestically, consumers typically opt for e-commerce platforms or official flagship stores of the brand, which generally provide comprehensive additional services. As a result, additional services do not significantly affect consumers' purchase decisions in this context.

Table 9: Hypothesis testing

Hypothesis	T-value	P-Value	Path coefficient	Result
H1: Title involvement positively influences the online sales of health supplements on e-commerce platforms.	-3.62	P<0.001	-1.891	Rejected
H2: Functional position positively influences the online sales of health supplements on e-commerce platforms.	-10.15	P<0.001	1.661	Accepted
H3: Product price negatively influences the online sales of health supplements on e-commerce platforms.	-4.63	P<0.001	-0.276	Accepted
H4: Brand Reputation positively influences online sales of health supplements on e-commerce platforms.	-6.95	P<0.001	0.999	Accepted
H5: Additional services positively influence online sales of health supplements on e-commerce platforms.	-6.44	P<0.001	0.602	Accepted
H6: Source credibility positively influences online sales of health supplements on e-commerce platforms.	-6.28	P<0.001	1.244	Accepted
H7: The moderating effect of health supplement type on online sales volume of health supplements.	-4.53	P<0.001	-0.656	Accepted
H7a: Compared to regulatory health supplements, the Brand Reputation has a stronger impact on the online sales of maintenance-oriented health supplements.	-0.32	P>0.1	-0.097	Rejected
H7b: Compared to regulatory health supplements, the additional services have a stronger impact on the online sales of maintenance-oriented health supplements	-2.44	P<0.05	-0.551	Accepted
H7c: Compared to regulatory health supplements, the source credibility of the information has a stronger impact on the online sales of maintenance-oriented health supplements.	-0.68	P>0.1	0.271	Rejected

5. Conclusion

5.1 Research Findings

Given the current scarcity of relevant business academic research in the field of health supplements, especially the lack of high-quality research outcomes in the domestic context, this makes the study of significant academic and practical value. This paper uses the information of health supplements sold on the Taobao platform as the independent variable, and online sales volume as the dependent variable, based on the ELM model, to explore the impact mechanism of external cues on online sales under different paths. The research conclusions are as follows:

In the central path, title involvement and product price have a significant negative impact on the online sales of health supplements, while functional position has a significant positive effect on sales. From a theoretical perspective, the negative effect of title involvement reveals the "information overload paradox" in the attention economy: when the information density of the title exceeds the consumer's cognitive processing capacity, attention resources are diluted, leading to a decrease in decision-making efficiency. The negative effect of product price reflects the special characteristics of health supplements as trust products — in situations where the efficacy is difficult to verify beforehand, an increase in price exacerbates consumers' perceived financial risk and quality uncertainty, thereby suppressing their purchase intentions. The brand reputation, additional services, and source credibility along the peripheral path all have significant positive effects on sales. This finding suggests that in information-overloaded online environments, consumers tend to adopt a compromise strategy of the Heuristic-Systematic Model: when the processing cost of central path information is too high, consumers shift to relying on peripheral cues for rapid decision-making (Chaiken, 1980). Well-known brands, as authoritative heuristic cues, can reduce perceived risk and quickly establish trust; comprehensive additional services convey quality commitment through signaling theory (Spence, 1973), thereby reducing consumer uncertainty; and high source credibility enhances the persuasive power of information via the Source Credibility Model (Hovland & Weiss, 1951). Heterogeneity analysis shows that for long-established health supplements, title involvement positively affects sales, whereas brand reputation is not significant. For imported health supplements, title involvement, product price, and additional services have no significant impact, while non-imported health supplements are more sensitive to brand reputation and perceived additional services. Moreover, the type of health supplement significantly moderates the relationship between external cues and sales. Specifically, for maintenance-oriented health supplements, given their basic functionality and lower perceived risk, consumers rely more on peripheral path cues for decision-making. In contrast, for regulatory-oriented health supplements, although consumers also pay attention to peripheral cues, the assurance effect of additional services is relatively weakened, possibly because their functional promises are more specific, requiring consumers to verify them through central path information such as functional position. Thus, compared with regulatory-oriented products, additional services have a stronger effect on maintenance-oriented health supplements.

5.2 Management Implications

This study, grounded in the elaboration likelihood model, systematically reveals the dual-path influence mechanism of external cues on online sales of health supplements.

From a theoretical perspective, this study integrates cue utilization theory, attention economy theory, and the ELM model to construct a theoretical framework for online health supplement purchasing, identifying the moderating role of product type as a boundary condition, thereby extending research on the online consumption behavior of functional products. From a managerial perspective, health supplement sellers should implement differentiated strategies: for brand and functional attributes, merchants should clearly present the brand and core efficacy in the product title to help consumers quickly match their needs and enhance conversion rates; regarding product price strategy, a reasonable price should be set by considering cost, market positioning, and consumer acceptance, balancing pricing to reduce perceived risk—avoiding loss due to high prices while ensuring quality value; for additional services, merchants should proactively offer free shipping, promotions, and after-sales support to add value and reinforce purchase decisions; concerning source credibility, information must be accurate and transparent, detailing ingredients and usage, while maintaining store reputation through good after-sales service and reviews. For different types of health supplements, well-established domestic brands should increase title involvement, imported products should highlight functional attributes and brand reputation, and non-established, non-imported products should avoid redundant title wording, emphasize brand function, and focus on additional services and source credibility to build trust and promote consumer decision-making in a differentiated manner. For maintenance-oriented health supplements, emphasis should be placed on brand visibility, comprehensive after-sales service, and listing on high source credibility platforms; for regulatory-oriented health supplements, the brand should be highlighted alongside a clear functional description, while price strategy should balance to reduce perceived risk. Overall, health supplement merchants should optimize title information structure to avoid cognitive overload caused by keyword stuffing; enhance source credibility through authoritative certification and ingredient transparency; and design reasonable price ranges to balance quality signaling and financial affordability.

5.3 Research Limitations and Future Directions

This study, based on the ELM model, investigates the influence mechanisms of external cues on consumers' purchasing decisions when buying health supplements online. However, due to limitations imposed by the e-commerce platform and data collection tools, the research only analyzed sales data from a single time point on the Taobao platform, and was unable to conduct continuous observation of online health supplement sales or obtain panel data for more in-depth analysis. Future research could further expand the data sources, covering multiple e-commerce platforms and longer time spans, in order to gain a more comprehensive understanding of the factors influencing online health supplement sales and their dynamic trends. Moreover, integrating theories from consumer behavior and psychology could enable a deeper exploration of consumers' purchasing decision processes in different contexts, incorporating the effects of emotions on consumer decision-making, thereby providing more scientific theoretical support and practical guidance for online health supplement sales.

Declaration

Acknowledgment: The authors thank the teachers and fellow students who provided suggestions during the discussion of this study. We also extend our gratitude to the reviewers and editors for their valuable feedback, which helped improve the quality of this paper.

Funding: Soft Science Research Program of Zhejiang Province (2022C35076)

Conflict of interest: All authors declare that there is no conflict of interest regarding this study.

Ethics approval/declaration: Not applicable. This study did not involve human or animal subjects.

Consent to participate: Not applicable. This study did not directly collect data from human subjects.

Consent for publication: Not applicable. This article does not contain any personally identifiable information, and thus consent for publication is not required.

Data availability: The datasets generated or analyzed during the current study are available from the corresponding author upon reasonable request.

Authors' contribution: Junhui Guo: funding acquisition, study supervision, manuscript revision, final approval; Mengfan Wang: study design, data collection, data analysis, drafting of the manuscript.

AI Generative text statement: During the preparation of this work, the author used the free version of ChatGPT to improve grammar and clarity.

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How to cite this article:

GUO, J., & wang, mengfan. (2026). How Information Cues Influence Online Sales of Health Supplements: An Empirical Dual-Path Study Based on the ELM Model. Journal of Social Sciences and Management Studies, 5(1). https://doi.org/10.56556/jssms.v5i1.1439