



ISSN: 2785-2997

# Journal of Human, Earth, and Future

Vol. 4, No. 3, September, 2023



## Development of Herbal Topical Anesthetic Mucoadhesive Spray for oral Cavity using Customer-Centric Approach

Katesaraporn Wongves<sup>1\*</sup>, Wanchai Chongcharoen<sup>2</sup>, Achara Chandrachai<sup>3</sup> 

<sup>1</sup> *Technopreneurship and Innovation Management Program, Graduate School, Chulalongkorn University, Bangkok, 10330 Thailand.*

<sup>2</sup> *Department of Pharmaceutics and Industrial Pharmacy, Faculty of Pharmaceutical Sciences, Chulalongkorn University, Bangkok, 10330 Thailand.*

<sup>3</sup> *Department of Commerce, Chulalongkorn Business School, Chulalongkorn University, Bangkok, 10330 Thailand.*

Received 19 May 2023; Revised 03 August 2023; Accepted 11 August 2023; Published 01 September 2023

### Abstract

The use of herbal medicines is increasing globally due to consumer perceptions and scientific research. The limited availability of herbal medications and a lack of effective topical anesthetics have driven the development of new products using a customer-centric strategy. This study aimed to present a novel herbal topical anesthetic mucoadhesive spray development using the New Product Development (NPD) process through three steps: the idea concept of the product, prototype development, and consumers' acceptance evaluation, involving key stakeholders-consumers and healthcare professionals. Multiple research methods were implemented, including qualitative, quantitative, and scientific methods, in each step. The findings showed insights gathered through in-depth interviews about the product needs of stakeholders. Multiple regression analysis showed that price, attitude, and social value significantly positively influenced consumer purchase intentions, while attitude influenced healthcare professionals' prescribing intentions. Consequently, the prototype was developed based on consumer needs. The results of the acceptance evaluation phase indicated high consumer acceptance of the herbal topical anesthetic mucoadhesive spray. The entire journey of the new product development process in this study enhances our understanding of customer-centric approaches in product development and can be applied to generate market-driven innovations that meet the needs of the target market.

**Keywords:** Herbal Medicine; New Product Development Process; Purchase Intention; Prescribing Intention.

## 1. Introduction

The use of herbal medicines is experiencing a rapid global expansion [1]. The widespread adoption of herbal medicines reflects a growing recognition of their therapeutic potential among patients and healthcare professionals. The factors driving the increased popularity of herbal medicines include growing demands for natural products over conventional pharmaceuticals, perceptions of herbal medicines as safe and effective [2], and integration between traditional knowledge and scientific research. The market size of herbal or traditional products is dramatically expanding around the globe [3], including Thailand [4, 5]. Moreover, the healthcare sector is encouraged by government initiatives and policies to incorporate herbal products into practice [6]. Enhancing efficacy and adding value through innovation are essentially increasing the acceptance of herbal medicine products [7].

\* Corresponding author: 6281020020@student.chula.ac.th

 <http://dx.doi.org/10.28991/HEF-2023-04-03-02>

➤ This is an open access article under the CC-BY license (<https://creativecommons.org/licenses/by/4.0/>).

© Authors retain all copyrights.

A topical anesthetic is a medication commonly used for relieving pain or discomfort in specific areas, such as the skin, mucous membranes, and oral cavity. Despite the availability of different topical dosage forms on the market, such as solutions, gels, and ointments, these forms do not effectively meet the requirements and expectations of patients. Moreover, safety concerns have been reported regarding active chemical ingredients, such as lidocaine, particularly among children aged younger than two years old [8, 9]. Unfortunately, there are no current herbal-derived products available on the market for direct use as an oral pain reliever. Various medicinal plants exhibit anesthetic properties, including clove, piper betel leaves, *Spilanthes acmella*, thyme, and myrrh [10]. In this regard, clove oil is noteworthy for its significant content of eugenol, an active ingredient known for its diverse pharmacological activities [11]. With a long history of use, clove oil has been designated as generally recognized as safe (GRAS) by the US Food and Drug Administration (FDA), establishing its safety profile [12].

The New Product Development (NPD) process is adopted to create and introduce innovative products into the market, aiming to enhance competitive advantages [13]. Due to the differences in key issues and success factors in each industry, this process is not a standard that can be generalized to individual industries or companies [14]. The critical success factors of new product development in the pharmaceutical industry are related to the company, the product, the customer, and the competitor [15]. The front-end phase of new product development is a significant process to achieve project success [16]. One of the key success factors is customer involvement [17]. Developing a new product using a customer-driven approach to understand their needs leads to successful product development [18] and also impacts an organizational strategy [19]. Gathering information from customers is important for companies to minimize uncertainties associated with new product development. Therefore, this information must be transformed into technical specifications and incorporated into the product concept to establish a successful product [20].

Purchasing pharmaceutical products differs from consumer goods. Prescribing is a process involved in the use of medication, which is the responsibility of healthcare professionals, including physicians, dentists, and community pharmacists. These healthcare professionals serve as decision-makers that significantly influence medical use [21], whereas patients take on the role of consumers [22]. Consequently, the new product development in the pharmaceutical industry needs to consider key stakeholders who greatly contribute to the decision-making process, addressing not only the customers but also the healthcare professionals [15].

Focusing on consumers, their attitudes are related to their evaluation, influencing their positive or negative behavioral intentions. Many studies have identified the relationships between attitude, consumer purchase intention, and purchase behavior. Attitude significantly influences consumers' intentions to use herbal medicines [23] and is positively related to the purchase behavior of herbal products [24, 25]. Consumers consider that there are no health harms related to the consumption of herbal medicine [26].

Other factors are related to the key elements in a marketing mix: product, price, place, and promotion. The importance of these four elements in consumer purchase decisions was reported by Khayru & Issalillah [26]. The product significantly affects consumer behaviors by influencing their perceptions, satisfaction, loyalty, and purchasing decisions. A well-designed and differentiated product that meets consumer needs can contribute to the overall success of a marketing strategy. The influence of the product on consumer purchase decisions is supported by previous research. Thongruang [27] indicated that a product was the most significant factor affecting consumer purchase decisions for herbal medicines in pharmacies. A positive relationship between product and consumer purchase decisions was also found in herbal medicines [26]. Several product attributes affect consumer considerations, such as complete drug labels, the Food and Drug Administration's approval, good indication [27], and product quality [28]. Price is the value that consumers are willing to pay to receive the products and services provided by the company. The appropriate price strategy is important for a business's marketing mix, as it affects sales, profitability, market positioning, and consumer perception. It requires careful consideration and alignment with the overall business strategy and market conditions. Price also influences consumer purchase intentions [29]. This element shows a positive effect on consumers who purchase over-the-counter (OTC) medicines at pharmacies [30]. Place is commonly used to describe the distribution channel. This refers to the distribution strategy designed to ensure a product's availability to the target customers through suitable channels. This affects consumers by influencing factors such as convenience, availability, brand image, and the overall consumer experience in obtaining the products or services. A positive relationship between place and purchase decisions towards herbal medicines has been found by Khayru & Issalillah (2021) [26]. They suggested that product availability would increase the opportunity for purchases. Promotion efficiently influences consumer intentions. Pharmaceutical companies have been using the Direct-to-Consumer advertising (DTCA) strategy to increase consumers' familiarity with their products. This strategy is essential for influencing consumers' use of medicines [31]. The increased request for prescriptions by consumers has been associated with DTCA [32]. Social values strongly impact consumers' behaviors, affecting their choices, loyalty, products, and brands' perceptions. Understanding and incorporating these values into marketing strategies can enhance a brand's appeal to its target audience. Social significance influences consumer purchase decisions for herbal products [33]. Additionally, social recommendations influence consumers' purchase intentions [34]. Recommendations from pharmacists show a positive effect on consumers' purchase intentions of OTC medicines at pharmacies [30].

Another key stakeholder group is that of healthcare professionals. Prescribing decisions by healthcare professionals are influenced by several factors. These prescribing decisions are based on product-related factors, patient-related factors, payer-related factors, marketing activities, and attitudes. These factors are consistently explored in many studies examining healthcare professionals' prescribing decisions towards herbal medicines. Attitude and prescribing decisions have been discussed in many studies related to their trust [35–37], a positive attitude towards product use [38], and their attitude towards the efficacy and safety of herbal medicines [39–41]. For the product attribute factor, healthcare professionals' express concerns about product efficacy [35–38], product safety [35–40], product information [35–38, 42, 43], product quality control [35–38], and dosage forms [35, 36]. Price indicates that herbal medicines offer lower costs than chemical medicines [35–38]. Promotion is related to marketing activities by pharmaceutical companies [21], which affect physicians' decisions [44]. This variable efficiently influences healthcare professionals' intentions. Thus, pharmaceutical companies make significant efforts to develop marketing activities that influence healthcare professionals' prescribing decisions, especially among physicians. These marketing efforts significantly influence the prescribing decisions of physicians [45]. Activities influencing healthcare professionals' prescribing decisions are present in many studies, such as interactions with medical representatives [35, 36, 38], pharmaceutical-sponsored symposia [46], medical journal advertising [47], and the distribution of drug samples [48, 49]. Stakeholders are related to patient-related factors and payer-related factors, including patient preference [35, 36], insurance coverage, governmental policies, and prescribing policies [35, 36].

The Technology Acceptance Model (TAM) is a theoretical framework developed to understand and predict how users adopt and accept new information technology or systems. This framework was proposed by Fred Davis in 1986 [50]. The core components of TAM include perceived ease of use (PEOU), perceived usefulness (PU), attitude toward use, behavioral intention (BI), and actual use. TAM is widely used in the field of information systems and technology to assess user attitudes and behaviors toward adopting new technologies. It has been applied in various areas, including the medical field, such as in the study of medicinal herbs [51] and stem cells [52]. This model allows researchers to understand user acceptance, identify potential barriers to adoption, and develop strategies to enhance the probability of successful technology implementation.

Existing research studies have primarily focused on the NPD process, factors influencing consumer purchase intentions, factors influencing prescribing decisions, and consumers' acceptance. However, there are not many studies that have comprehensively outlined the entire journey of the new product development process, from the concept generation to consumer product evaluation. Moreover, the absence of alternative local anesthetic medicines in Thailand has created an opportunity to develop innovative products that meet the natural product needs of consumers. To enhance the sustainability of the product, it is essential to understand the factors influencing users' acceptance of the product before proceeding with commercialization [53].

The purpose of this study is to develop a novel herbal topical anesthetic mucoadhesive spray using the NPD process, which involves three steps: first, conceptualizing the product idea to explore consumer needs and factors influencing their decisions; second, developing a prototype; and third, assessing product quality and evaluating consumer acceptance of the prototype. The research also identifies the factors influencing key stakeholders' acceptance, including consumer purchase intention, healthcare professionals' prescribing intention, and consumers' acceptance evaluation. These findings will provide insights into the development of new herbal products or medicines through a customer-centric approach, thereby contributing to the creation of product strategies aimed at enhancing the product's competitiveness.

## **2. Material and Methods**

A mixed-methods research study design was employed to develop an innovative product based on consumer needs. The research consisted of multiple phases, including ideation to identify consumer needs and influential factors, prototype development for creating a suitable product, and consumer acceptance evaluation.

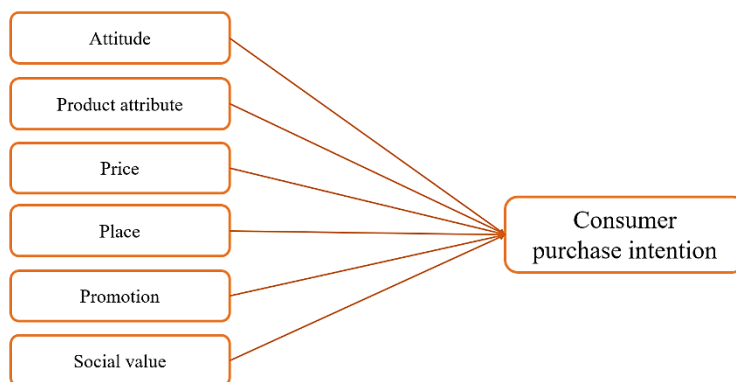
### **2.1. Idea Concept of the Product**

#### **2.1.1. Product Concept Generation**

An in-depth interview was implemented to obtain a comprehensive understanding of consumers' experiences with using topical anesthetics and their opinions regarding the herbal topical anesthetic mucoadhesive spray. The participants were divided into two distinctive groups: 10 consumers with experience using topical anesthetics and 10 healthcare professionals who recommended topical anesthetics to their patients. The participants were given an overview of the study's purpose and relevant information about the herbal topical anesthetic mucoadhesive spray before the interviews commenced. Each interview session lasted approximately one hour, following a semi-structured guideline. After transcribing the voice recordings, the data were coded and organized into categories relevant to the topic.

### 2.1.2. Factors Affecting Consumer Purchase Intention

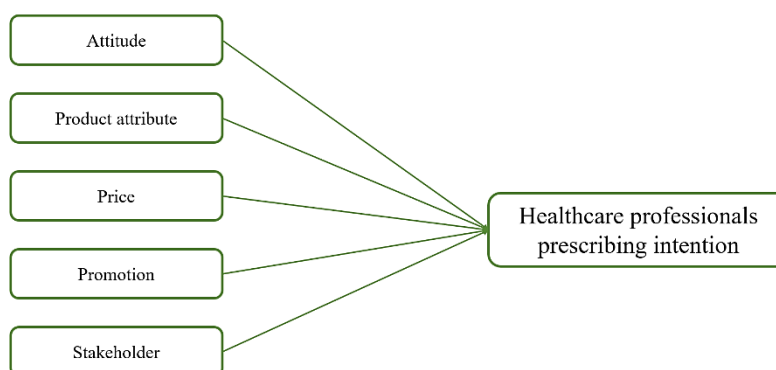
A quantitative research study was used to investigate the influential factors affecting consumers' purchase intentions of the herbal topical anesthetic mucoadhesive spray. The study employed a sample of 200 participants aged 20 years and older who had oral ulcerations, regardless of their prior use of topical anesthetics in their medical history. Data were collected through a self-administered online questionnaire using a 5-point Likert scale, ranging from "strongly agree" (5) to "strongly disagree" (1), to evaluate six factors: attitude, product attribute, price, place, promotion, and social value. The conceptual framework is presented in Figure 1. The impact of the selected factors on purchase intention and their influences were analyzed using stepwise multiple regression analysis with SPSS Version 22.0, IBM Corp., NY, USA. Statistical significance was determined by a p-value of less than 0.05.



**Figure 1. Conceptual framework: Consumer purchase intention**

### 2.1.3. Factors Affecting the Prescribing Intention of Healthcare Professionals

To understand the factors that influence healthcare professionals' intention to prescribe the herbal topical anesthetic mucoadhesive spray, a quantitative approach was employed. The data were collected through a self-administered online questionnaire completed by 200 participants, including community pharmacists, physicians, and dentists. A 5-point Likert scale, ranging from "strongly agree" (5) to "strongly disagree" (1), was utilized. The independent variables examined in the study were attitude, product attribute, price, promotion, and stakeholder. The conceptual framework was presented in Figure 2. To identify the factors that influenced recommended intention, a stepwise multiple regression analysis was conducted using SPSS Version 22.0, developed by IBM Corp. based in New York, USA. Statistical significance was determined by a p-value below 0.05.



**Figure 2. Conceptual framework: Healthcare professionals' prescribing intention**

## 2.2. Herbal Topical Anesthetic Mucoadhesive Spray Prototype Development

In this study, the main ingredients of the herbal topical anesthetic spray prototype were clove oil, thermosensitive polymers, bioadhesive polymers, sweeteners, and flavors. The product was evaluated for its physical appearance, pH, and sprayability. In order to achieve gel formation in the oral cavity, the product's ideal gelling temperature should be maintained within a specified range between 34°C and 36°C. To evaluate mucoadhesion, an *in vitro* study was performed using a modified method [54]. Additionally, the stability test was performed in three conditions at different room temperatures (5°C and 40°C) following ASEAN guidelines for 90 days. The physical stability test involved observing a color change, sedimentation, and phase separation. For chemical stability, the eugenol content and analytical marker were determined by using a modified method [55] with gas chromatography (Agilent GC-7890B), an FID detector, and an HP-5 column (30 m × 320 mm × 0.25 mm).

### 2.3. Consumers' Acceptance Evaluation

After developing the prototype, consumer acceptance was evaluated based on the Technology Acceptance Model (TAM) [50], focusing on four factors: perceived ease of use, perceived usefulness, attitude toward use, and behavioral intention. The study sample consisted of 30 participants aged 20 years and older who presented oral ulcerations, regardless of their prior use of topical anesthetics. Data were collected through a self-administered online questionnaire administered after participants viewed an online video clip providing information on the concept and details of the herbal topical anesthetic mucoadhesive spray prototype. The questionnaire was measured on a 5-point Likert scale, ranging from "strongly agree" (5) to "strongly disagree" (1). Descriptive statistics, including percentages, means, and standard deviation, were analyzed using SPSS Version 22.0 (IBM Corp., NY, USA).

## 3. Results

### 3.1. Idea Concept of Product

The product idea concept was derived through the process of product concept generation as well as the examination of factors impacting consumer purchase intention and healthcare professionals' prescribing intention. This process aimed to identify consumer needs and the factors that influenced their decisions.

#### 3.1.1. Product Concept Generation

Participants shared their experiences with two topical anesthetics: gels and solutions containing lidocaine hydrochloride as active ingredients. It was found that participants from both groups expressed satisfaction with the effectiveness of the active chemical substances in promoting pain relief. However, there was an observed increase in the awareness of the product among pediatricians and regular users. The participants also complained about the bitter taste of the product and reported experiencing irritation upon application to the affected area. The product usage among participants was influenced by the dosage form. A gel formulation provided an extended contact time in the painful area compared to solutions. The gel's cohesive properties effectively covered the wound, thus preventing irritation. However, applying the gel product to deeper areas of the oral cavity or the pharynx posed some challenges. In contrast, a solution formulation offered greater convenience for application in various areas of the mouth and the pharynx. Nonetheless, it had a shorter contact time in painful regions due to easy elimination through saliva and inadequate adhesion to the oral mucous membranes. This resulted in the solution spreading to unintended areas, leading to undesired numbness throughout the oral cavity. Some of the participants reported experiencing mouth stickiness after application. Notably, both formulations proved inconvenient for common administration and presented difficulties for portability throughout the day. Consequently, additional tools, such as syringes or cotton swabs, were frequently required to ensure precise application to the affected areas.

Following the introduction of the concept of the herbal topical anesthetic mucoadhesive spray, the participants expressed their interests and regarded clove oil as a relatively safe and harmless herbal medicine. However, further investigation was necessarily required to compare the efficacy of clove oil with other synthetic medicines. The participants expressed their belief that the sprayable product provided convenience and enhanced user friendliness. The product was in solution form at room temperature, facilitating an easy application to any painful area through spraying. Upon contact with the oral mucosa, the solution is transformed into a gel, resulting in prolonged contact time in painful areas and the prevention of elimination through saliva. The participants' purchase decisions were influenced by multiple factors, including product efficacy, reasonable pricing, advertising, authorization by the Thai FDA, ease of purchase, attractive packaging design, convenience, and pleasant taste.

The participants provided valuable insights regarding the development of the herbal topical anesthetic mucoadhesive spray. Firstly, the product should provide detailed information about its efficacy and safety to establish trust. Secondly, it should effectively adhere to the painful area and provide coverage for the wound without causing any irritation. To enhance the overall experience, participants recommend a sweet flavor profile, with the inclusion of mint to mask the taste of clove oil and provide a refreshing sensation. In terms of packaging, the spray bottle should be designed for oral use with a throat applicator, facilitating direct and precise spray onto the wound for accurate application. Moreover, the size of the bottle should accommodate the convenient portability that fits a pocket or handbag. The packaging design should be visually appealing, effectively representing the brand and establishing a sense of trustworthiness. Lastly, the price of the product should be competitive and reasonable when compared to other products on the market.

#### 3.1.2. Factors Affecting Consumer Purchase Intention

In the study, the demographic profile of the participants revealed a predominance of women (74.00%) within the age range between 20 and 35 years (45.50%). Most of the participants had completed graduate education (51.50%). The characteristics of the participants and their medical history are presented in Figure 3. All participants reported

experiencing oral ulcers, with an average frequency of  $4.36 \pm 3.86$  occurrences per year (range = 1–20). Additionally, most participants had not been prescribed topical anesthetics; however, among those who had, the average usage rate was  $2.31 \pm 1.72$  times per year (range = 1–12). The average score of factors influencing healthcare professionals prescribing intention is reported in Figure 4, with attitude ( $\bar{x} = 4.07 \pm 0.49$ ), product attribute ( $\bar{x} = 4.47 \pm 0.45$ ), price ( $\bar{x} = 3.98 \pm 0.69$ ), promotion ( $\bar{x} = 4.13 \pm 0.59$ ), and social value ( $\bar{x} = 3.89 \pm 0.51$ ).

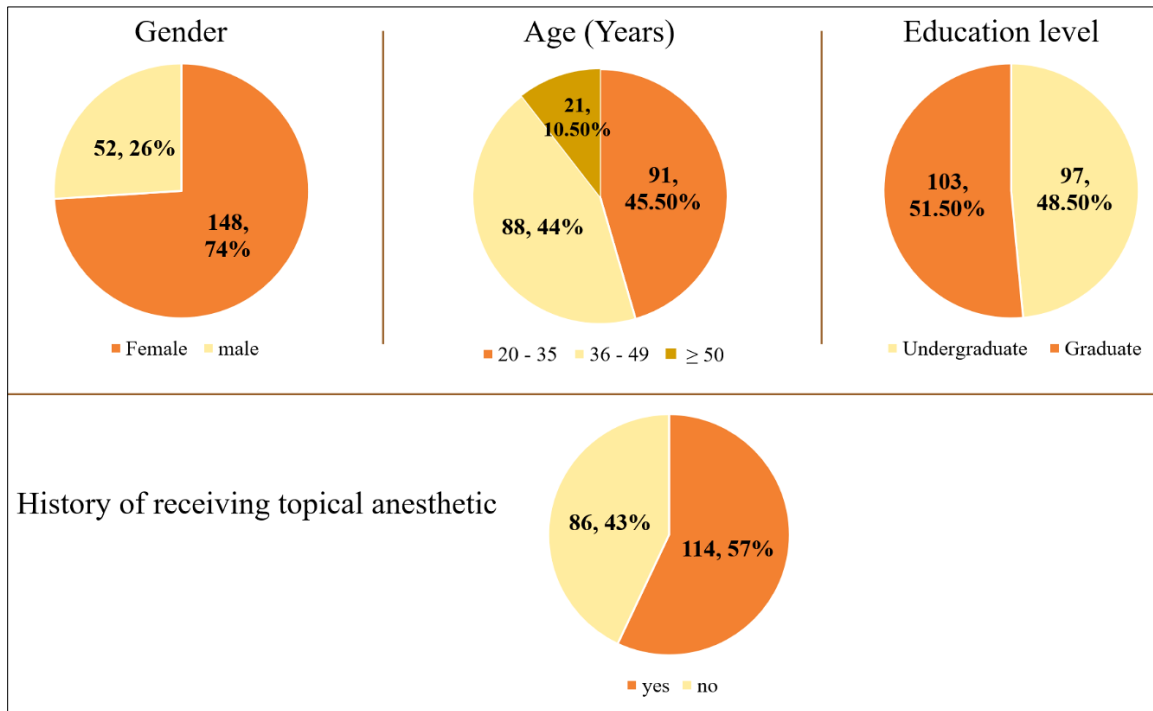


Figure 3. Demographic information and past medical history of participants (n=200)

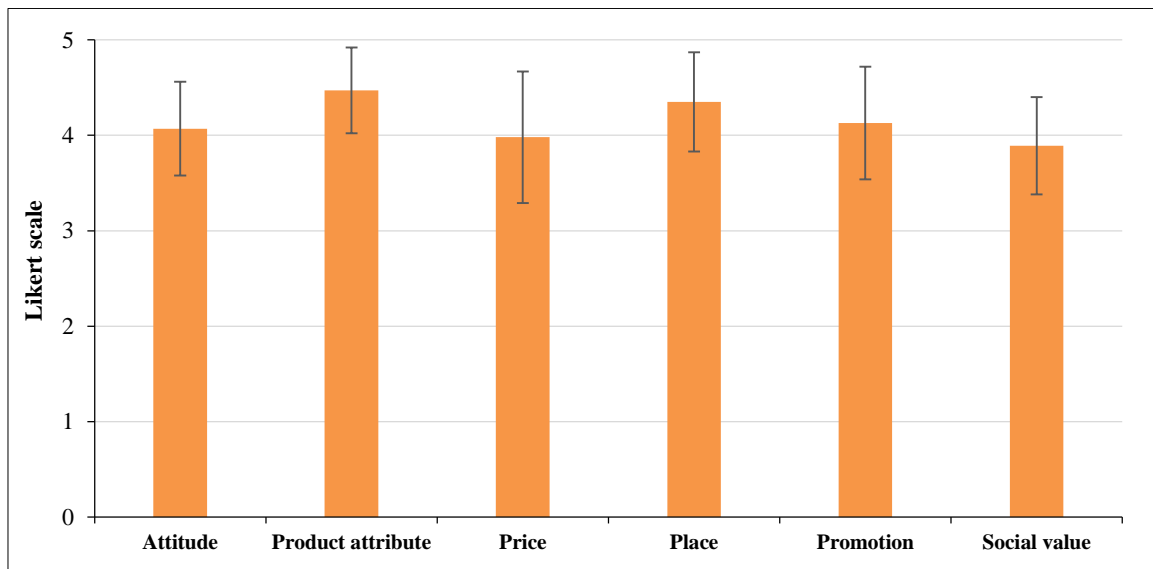


Figure 4. Average score of factors influencing consumer purchase intention

The factors influencing consumer purchase intention for the herbal topical anesthetic mucoadhesive spray were evaluated using multiple regression analysis with a stepwise approach. To examine multicollinearity, the variance inflation factor (VIF) values were calculated for attitude, price, and social value in the model. These variables showed moderate correlation, with VIF values of 1.333, 1.373, and 1.138, respectively. These findings suggested an acceptable level of multicollinearity since all VIF values were below 5. Consequently, the final model comprised three independent variables—attitude, price, and social value—that significantly influenced consumer purchase intention at a significant level of 0.05. Product attribute, promotion, and place were excluded from the final model due to their lack of statistical significance. The results of the multiple linear regression analysis are presented in Table 1.



**Table 1. Stepwise multiple linear regression analysis result of consumer purchase intention**

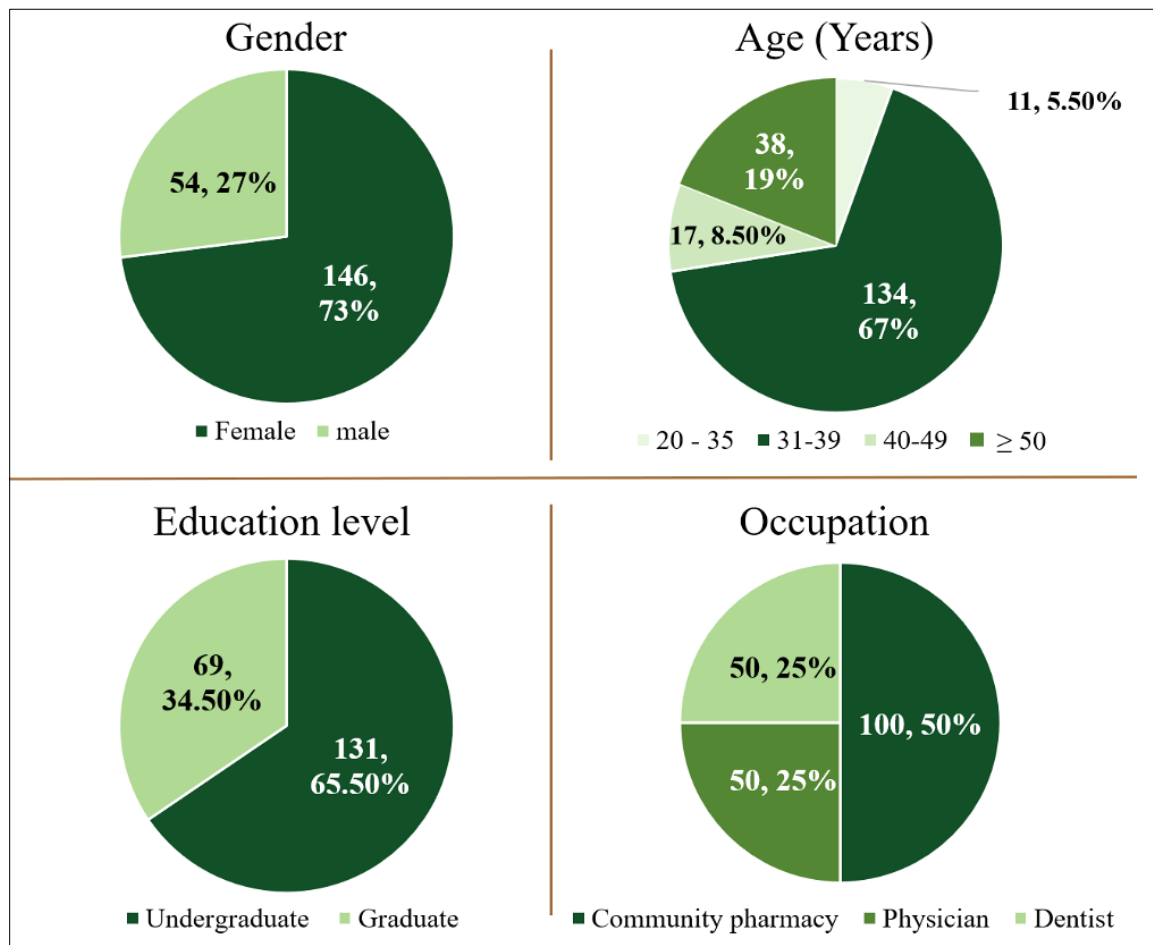
Independent Variable	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	$\beta$			Tolerance	VIF
(Constant)	-0.048	0.330		-0.146	0.884		
Attitude	0.433	0.077	0.336	5.614	0.000	0.750	1.333
Price	0.320	0.056	0.348	5.730	0.000	0.728	1.373
Social value	0.256	0.069	0.206	3.734	0.000	0.879	1.138

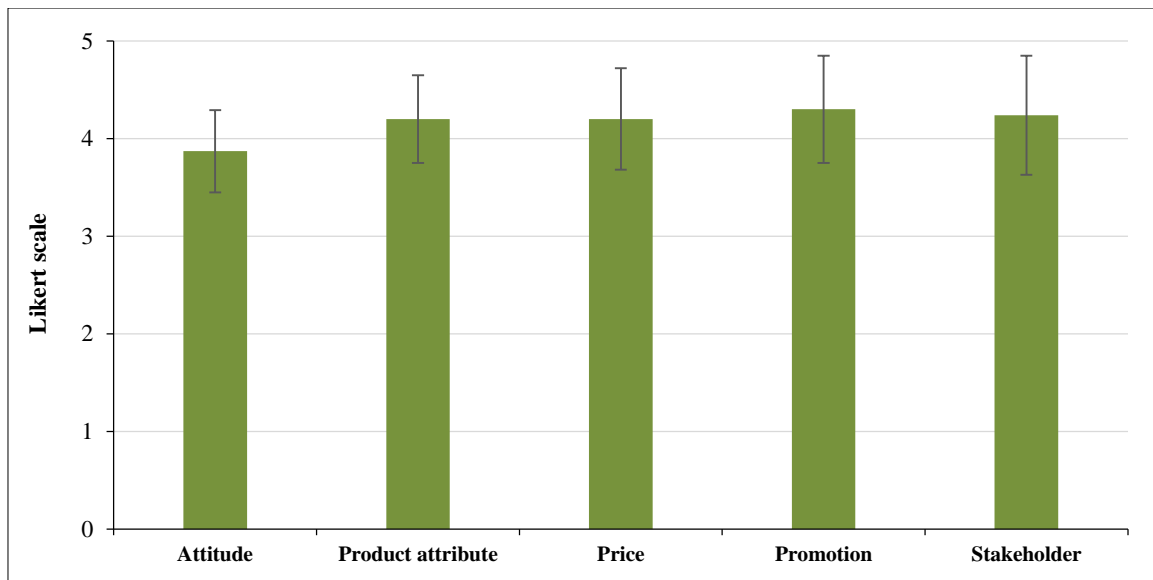
Equation 1 shows the relationship between the consumer's purchase intention for the herbal topical anesthetic mucoadhesive spray and the respective factors. The standardized coefficients ( $\beta$ ) indicated the relative importance of each factor. The outcomes revealed that price ( $\beta = 0.348$ ) emerged as the primary factor influencing purchase intention, followed by attitude ( $\beta = 0.336$ ) and social value ( $\beta = 0.206$ ). A positive relationship between price, attitude, and social value factors indicated a significant influence on consumer purchase intention.

$$\text{Consumer purchase intention} = -0.048 + 0.320 \text{ Price} + 0.433 \text{ Attitude} + 0.256 \text{ Social value} \quad (1)$$

### 3.1.3. Factors Affecting the Prescribing Intention of Healthcare Professionals

In the study, the demographic profile of the participants revealed a predominance of women (73.00%) within the age range of 31 to 39 years (67.00%). Most participants had completed a bachelor's degree (65.50%). The participants were community pharmacists (50.00%), physicians (25.00%), and dentists (25.00%). The characteristics of the participants are presented in Figure 5. The average score of factors influencing healthcare professionals prescribing intention was reported in Figure 6, with attitude ( $\bar{x} = 3.87 \pm 0.42$ ), product attribute ( $\bar{x} = 4.20 \pm 0.45$ ), price ( $\bar{x} = 4.20 \pm 0.52$ ), promotion ( $\bar{x} = 4.30 \pm 0.55$ ), and stakeholder ( $\bar{x} = 4.24 \pm 0.61$ ).

**Figure 5. Demographic information of participants. (n=200)**



**Figure 6. Average score of factors influencing healthcare professionals prescribing intention**

Multiple regression analysis with a stepwise approach was employed to assess the factors that impact healthcare professionals' intention to prescribe the herbal topical anesthetic mucoadhesive spray. Therefore, attitude was the factor in the final model that significantly influenced the healthcare professionals' prescribing intention at a significance level of 0.05. Product attributes such as price, promotion, and stakeholder were excluded from the final model because of the lack of statistical significance. The results of the multiple linear regression analysis are presented in Table 2.

**Table 2. Stepwise multiple linear regression analysis result of healthcare professionals prescribing intention**

Independent Variable	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	$\beta$			Tolerance	VIF
(Constant)	1.559	0.243		6.415	0.000		
Attitude	0.651	0.062	0.596	10.431	0.000	1.000	1.000

The positive relationship between the intention to prescribe the herbal topical anesthetic mucoadhesive spray and the attitude, a corresponding factor, is shown in Equation 2.

$$\text{Healthcare professional prescribing intention} = 1.559 + 0.651 \text{ Attitude} \quad (2)$$

### 3.2. Herbal Topical Anesthetic Mucoadhesive Spray Prototype Development

The herbal topical anesthetic mucoadhesive spray prototype was developed based on consumer opinions during the product concept generation process to ensure that the product aligned with consumer preferences. The active component of the formulation was clove oil, an herbal topical anesthetic agent, chosen specifically for its pain-relieving effects. To develop a spray, we utilized thermosensitive polymers and bioadhesive polymers as our main platforms. This formulation enables transforming the spray into a gel at oral temperature, thereby enhancing its efficacy by prolonging contact duration in affected areas, preventing saliva elimination, and maintaining viscosity. A non-calorie sweetener and mint flavor were included in the formulation to provide a pleasant taste and mask the unpleasant flavor of clove oil, resulting in a refreshing sensation. The packaging of the product was well-suited for an oral spray bottle with a throat applicator. This bottle design provided several benefits, including precise application, improved ease of use, and enhanced portability.

The herbal topical anesthetic mucoadhesive spray prototype demonstrated conforming physical attributes, with a clear solution at room temperature that transformed into a gel at 35°C. The neutral pH of the product was suitable for oral application within the range of 6.5 to 7.5. The solution can be conveniently emitted through a bottle applicator and administered into the oral cavity with a specified spray nozzle. The mucoadhesive property was a desirable attribute of the product, enhancing its retention at the wound. Mucoadhesion was evaluated by measuring the remaining amount of the product on a mucin-coated semipermeable membrane. After passing the SSF over the applied product, the gel layer derived from the product still existed, with an approximate retention of 90.34%.



In terms of the stability of the product, physical and chemical stability over a 90-day storage period under three conditions: room temperature, 5°C, and 40°C were demonstrated. The color of the product remained consistent, ranging from clear to pale yellow, comparable to its initial appearance. No occurrences of sedimentation or phase separation were observed during the storage period. Furthermore, the eugenol content of the product complied with the USP guidelines, falling within the acceptable range of 90 to 110% of the labeled amount.

### 3.3. Consumers' Acceptance Evaluation

The characteristics and medical history of the participants are described in Figure 7. Most of the participants were women (70.00%), aged between 20 and 35 years (50.00%), and had completed graduate education (63.33%). All participants reported experiencing oral ulcers, with an average frequency of  $2.33 \pm 1.18$  occurrences per year (range = 1–5). Most of them received topical anesthetics, with an average usage rate of  $1.75 \pm 0.87$  times per year (range = 1–4).

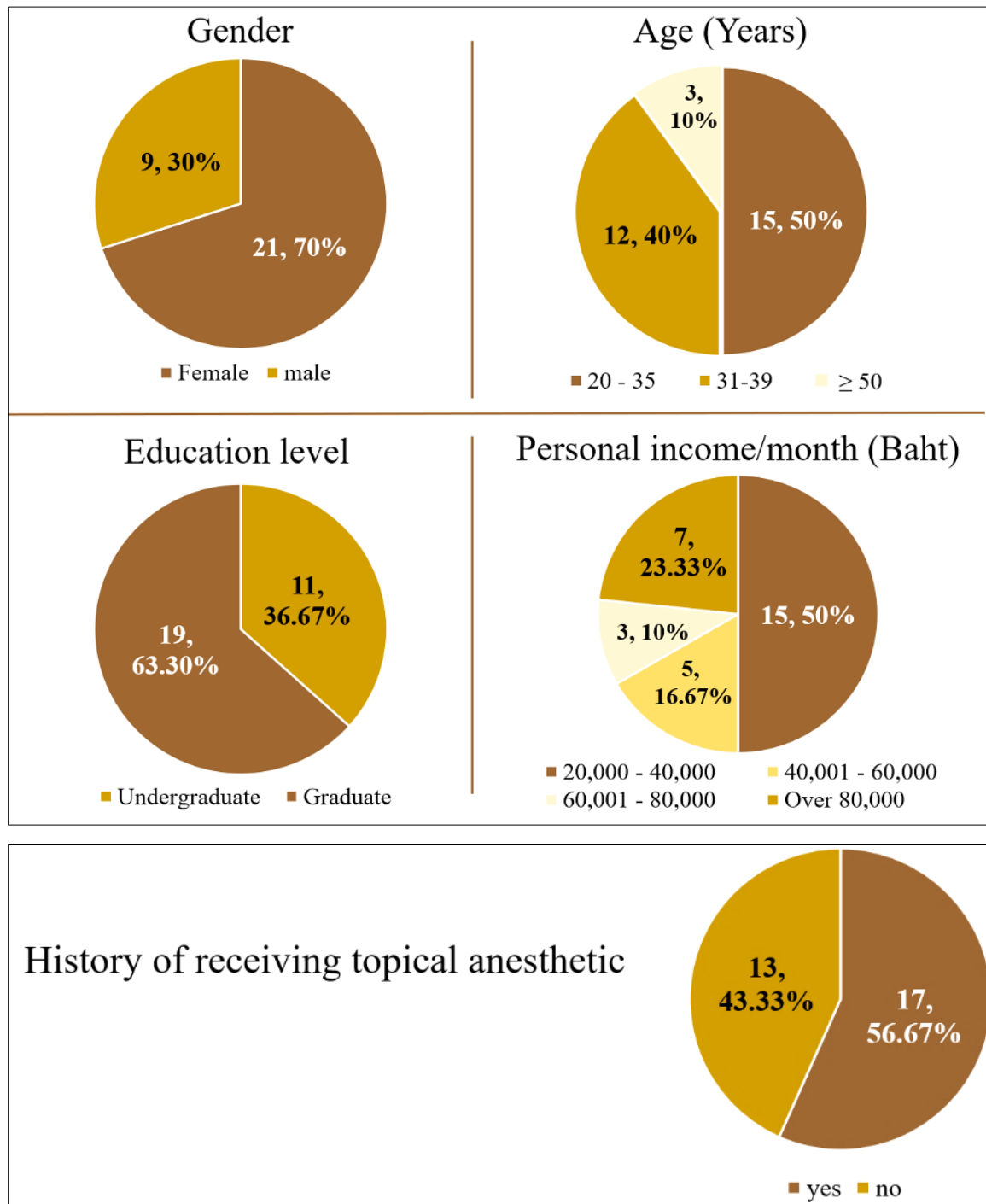


Figure 7. Demographic information and past medical history of participants (n=30)

The purpose of this section is to evaluate the factors that influence the acceptance of consumers, including perceived ease of use, perceived usefulness, attitude towards use, and behavioral intention. The individual's internal beliefs, perceived ease of use, and perceived usefulness directly impact their attitude towards use and behavioral intention.

Perceived ease of use refers to the belief that using a specific system does not require any effort. The participants showed a high level of acceptance, with an average score =  $4.57 \pm 0.06$  regarding the perceived ease of use factor, highlighting the product's user-friendliness. They agreed that the product provided greater convenience, portability, improved precision in wound treatment, and ease of storage. Perceived usefulness is associated with the belief that utilizing a particular system will lead to performance improvement. In terms of the perceived usefulness factor, the participants strongly preferred using the spray over other dosage forms, with an average score =  $4.58 \pm 0.02$ . This dosage form enabled precise administration of the product to the targeted site, efficaciously meeting their requirements. Regarding the attitude towards use, the participants had confidence in the safety of the herbal-based product for oral pain treatment, with an average score =  $4.39 \pm 0.15$ . They found the product visually appealing and expressed interest in using herbal medicine instead of chemical-based products. They believed herbal products had fewer side effects compared to chemicals. For behavioral intention, the participants were interested in this prototype, with an average score =  $4.55 \pm 0.06$ . They expressed their willingness to use the product for oral pain relief and demonstrated satisfaction with the prototype's performance, instilling confidence in its effectiveness for pain relief.

#### 4. Discussion

Unlike other products, the major factors that affect the buying decision process of herbal-derived pharmaceutical products are healthcare professionals and patients [56]. Their perception influences product acceptance. The present study aims to develop a new herbal topical anesthetic mucoadhesive spray based on customer preference. The process consists of three phases: 1) The idea and concept of the product 2) Herbal topical anesthetic mucoadhesive spray prototype development; and 3) Consumers' acceptance evaluation, respectively.

The concept of the product process is used to identify consumer needs and factors affecting their decisions. Product concept generation reveals consumers' opinions regarding both topical anesthetic pharmaceuticals and the herbal topical anesthetic mucoadhesive spray concept. The findings indicate that consumers are satisfied with the effectiveness of the active chemical substance for pain relief. However, they express dissatisfaction with undesirable attributes found in existing oral products on the market. Consumers show their interest in the herbal topical anesthetic mucoadhesive spray concept and exhibit a positive attitude towards the nature of the herbal active ingredient and the sol-gel transformation appearance of the product. Additionally, the consumers also provided their opinions regarding the product specifications of herbal topical anesthetic mucoadhesive spray.

Multiple regression analysis reveals the factors influencing consumer purchase intention and healthcare professionals' prescribing intention. Attitude, related to the consumer's evaluation, affects positive or negative behavioral intention. The results indicate a significant impact of attitude on the intention to purchase and prescribe the herbal topical anesthetic mucoadhesive spray, showing a positive influence among both consumers and healthcare professionals. The increasing positive attitude among consumers and healthcare professionals contributes to a higher intention to purchase and prescribe herbal topical anesthetic mucoadhesive spray. This finding corresponds to previous research that found attitudes influenced herbal products and dietary supplements used by consumers [57]. Their attitude toward herbal products is positively related to purchase intention, actual purchase [58], and purchase behavior [59]. The consumers who purchased herbal medicines had positive attitudes toward the herbal medicines [27], related to their natural benefits, fewer side effects, and good absorption and degradation [60]. Furthermore, the attitude of healthcare professionals was a significantly positive intention to prescribe the herbal topical anesthetic mucoadhesive spray. This is consistent with earlier findings, suggesting that healthcare professionals' attitudes influence prescribing behavior and intention [61]. Healthcare professionals who prescribe herbal medicine for their patients have positive attitudes toward herbal medicine [62]. They accepted that herbal medicines offer advantages and are safer than conventional medicine [39]. This suggests that presenting the naturalness of the product is an essential factor in creating a positive attitude. The product should highlight the benefits of natural active ingredients to increase consumer awareness. Moreover, the product should present key features and scientific information about the product's efficacy and safety to increase their acceptance.

Price is one of the key elements of the marketing mix. A positive correlation of price indicates a significant influence on consumer purchase intention. Interestingly, consumer purchase intention continues to increase even when the price of the product becomes higher. The finding supports the positive perception of price in the context of medicines and herbal products. It can be attributed to consumers recognizing the correlation between price and

product quality. Moreover, the price image also affected the purchase intentions of consumers [63]. Consumers believe that expensive medicines are more effective than low-cost medicines [64]. Consumers who purchase products at pharmacies tend to perceive low-priced products as untrustworthy [65], particularly in the case of herbal products. They believe that herbal products offer lower health risks and are chemical-free, which leads to a higher price than chemical-based products [66]. Consequently, aligning the price of a product with its quality leads to an increase in consumer purchase intention. The result suggests that using a product differentiation strategy to communicate the uniqueness of the herbal topical anesthetic mucoadhesive spray, regarding effective active ingredients, innovative dosage forms, quality, and convenience, highlights the differences between the herbal topical anesthetic mucoadhesive spray and conventional topical anesthetic. When consumers perceive the product's benefits and ease of use, their willingness to pay will then increase. However, our finding shows that price does not have a significant impact on the intention to prescribe the herbal topical anesthetic mucoadhesive spray to healthcare professionals. The result disagrees with the finding, which explains the effect of price on the prescribing intention of herbal medicines [62, 67].

Social value affects consumer intention to purchase the herbal topical anesthetic mucoadhesive spray, as a positive influence was observed in this study. Higher social values in consumers lead to higher intentions to purchase the herbal topical anesthetic mucoadhesive spray. This finding supports previous research, indicating that social value positively influences consumer purchase intention, directly impacting individuals' behavior and purchasing decisions [59, 68]. Increasing social value significantly influences consumer purchase intention. Healthcare professionals play an important role as trustworthy and influential sources of information [69, 70]. The consumers trust their own opinions, which then affect their herbal medicine usage [60]. Their recommendations also significantly influence consumer recognition and product information searches, leading to purchase decisions and impacting pharmaceutical product usage [71]. They are key opinions that affect consumer purchase intentions. Therefore, introducing a product to healthcare professionals is an essential strategic initiative to increase their familiarity, trust, and subsequent advocacy and endorsement of that product by patients. However, the result indicates that stakeholders related to social value do not have a significant impact on the intention to prescribe the herbal topical anesthetic mucoadhesive spray to healthcare professionals. Our result disagrees with a finding that stakeholders, patients, and payers significantly impact medicines [72] and herbal medicine prescriptions [35, 36]. This is possible due to the difference in participation in this study, which includes not only physicians but also dentists and community pharmacies.

The product attribute, in our findings, did not significantly influence the intention to purchase and prescribe the herbal topical anesthetic mucoadhesive spray. A product attribute is one of the factors that affects healthcare professionals, such as physicians and pharmacists, in the prescription of medicine and consumer purchase intention. However, the result contradicts the finding, which indicated the influence of product attributes, especially product aesthetics, on consumer purchase intention for OTC pharmaceutical products [73]. Some key product attributes, such as product safety, are related to their intention, but this variable does not significantly predict an actual purchase [74]. This is possible due to personal factors that vary among consumers and healthcare professionals, including their perceptions, experiences, and personal finances, which influence their buying behavior. They are concerned about product attribute factors; however, some attributes may not be considered. This variable may influence their purchase and prescribing intention, but an actual purchase must be considered.

Promotion did not have a significant impact on the intention to purchase and prescribe the herbal topical anesthetic mucoadhesive spray. This finding supports Mubarak & Mufteeth (2020) [66] that advertising does not significantly influence consumer purchase intention. Although media, one of the promotion tools, could enhance consumers' product awareness, it was not efficiently providing essential information to consumers [75]. Moreover, our study agrees with the study of Sharifnia et al. [72] that the promotional activities of pharmaceutical companies do not influence the prescribing decisions of physicians. This might be associated with healthcare advertising regulations in Thailand that limit promotional activities for pharmaceutical products, including herbal medicines.

Place did not significantly influence consumer purchase intention for the herbal topical anesthetic mucoadhesive spray. Our finding disagrees with research that suggests place significantly influences consumer purchase intention [69, 76]. This discrepancy may be attributed to the regulations of the Thai FDA, where the medicine can only be sold in licensed places such as hospitals or pharmacies.

The findings of the consumers' acceptance evaluation phase provide insights into the level of acceptance among consumers regarding the prototype of the herbal topical anesthetic mucoadhesive spray. The consumers showed a high level of acceptance for this prototype in terms of perceived ease of use, perceived usefulness, attitude towards use, and behavioral intention, indicating their acceptance of the innovation.

## 5. Conclusions

The research demonstrates the novel herbal topical anesthetic mucoadhesive spray development process, employing a customer-centric strategy through three phases: product conceptualization, prototype development, and consumers' acceptance evaluation.

The result from the idea concept of the product phase shows consumers' perspectives on topical anesthetics. The study started with the perspectives of consumers and healthcare professionals to create product specifications for the herbal topical anesthetic mucoadhesive spray. This insightful information guides the prototype development phase, ensuring that the product attributes and packaging align with consumer requirements. Additionally, the study identifies factors that influence consumer purchase intention and healthcare professionals' prescribing intention. The findings indicate a significant positive correlation between consumer purchase intention and key variables, including price, attitude, and social value, while attitude demonstrates a significant positive association with the prescribing intention of healthcare professionals. Consequently, the results of the consumers' acceptance phase highlight the high level of acceptance for this herbal topical anesthetic mucoadhesive spray, aligning with target consumer preferences.

This study provides significant contributions to the field of herbal product development and marketing by offering valuable insights and practical guidance. The research findings not only enhance our comprehension of customer-centric approaches in product development but also contribute to the advancement of research in herbal medicines and their marketing. The research methodology employed in this study holds potential as a reference point for future investigations and contributes to the advancement of knowledge in the field. Furthermore, the insights derived from this study provide considerable potential for assisting herbal businesses in making informed decisions regarding product development, marketing strategies, and resource allocation. Ultimately, this research facilitates the growth and sustainability of herbal businesses by helping them generate innovative and desirable products that are well-received by target customers.

However, the study focused on a specific product with a limited sample size, meaning that the findings do not readily allow for the generalization of effects to all herbal medicines. The researchers recommend future studies in other businesses such as cosmetics, nutraceuticals, food supplements, and natural functional foods. Moreover, future studies could consider more related variables to enhance the relationship between the purchase intention and the actual purchase, such as the 7Ps marketing mix, lifestyle, and consumer knowledge.

## 6. Declarations

### 6.1. Author Contributions

Conceptualization, K.W. and A.C.; methodology, K.W., W.C., and A.C.; formal analysis, K.W.; writing—original draft preparation, K.W.; writing—review and editing, W.C. and A.C.; visualization, K.W. All authors have read and agreed to the published version of the manuscript.

### 6.2. Data Availability Statement

The data presented in this study are available in the article.

### 6.3. Funding

The research was financially supported by Technopreneurship and Innovation Management Program, Graduate School, Chulalongkorn University, Grant Number 111/2565.

### 6.4. Acknowledgements

The authors thank the Pharmaceutical Research Instrument Center, Faculty of Pharmaceutical Sciences, Chulalongkorn University for providing equipment.

### 6.5. Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki 2013, Belmont Report 1979, Council for International Organizations of Medical Sciences (CIOM) 2016 and approved by the Ethics Committee of Chulalongkorn University (protocol code 138/65 and 059/66, date of approval: 30/6/2022 and 24/3/2023).

### 6.6. Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

## 6.7. Declaration of Competing Interest

The authors declare that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

## 7. References

- [1] WHO. (2005). National policy on traditional medicine and regulation of herbal medicines: Report of a WHO global survey. World Health Organisation, Geneva, Switzerland. Available online: <https://apps.who.int/iris/bitstream/handle/10665/43229/9241593237.pdf?sequence=1&isAllowed=y> (accessed on May 2023).
- [2] Kumar, G., Jalaluddin, M., Rout, P., Mohanty, R., & Dileep, C. L. (2013). Emerging trends of herbal care in dentistry. *Journal of Clinical and Diagnostic Research*, 7(8), 1827–1829. doi:10.7860/JCDR/2013/6339.3282.
- [3] Euromonitor International. (2023). Herbal/Traditional Products in World 2020. Euromonitor International, London, United Kingdom. Available online: <https://www.euromonitor.com/herbal-traditional-products> (accessed on June 2023).
- [4] Euromonitor International. (2023). Herbal/Traditional Products in Thailand 2020. Euromonitor International, London, United Kingdom. Available online: <https://euromonitor.com/herbal-traditional-products-in-thailand/report> (accessed on May 2023).
- [5] DITP. (2023). Herb and Herbal Product. Department of International Trade Promotion, Bangkok, Thailand. Available online: <https://www.ditp.go.th/en/home> (accessed on June 2023).
- [6] DTAM. (2023). Master plan for Thai herbs development No.1 2560-2564BE. Ministry of Public Health, Bangkok, Thailand. Available online: <https://www.dtam.moph.go.th/images/download/dl0021/MasterPlan-Thaiherb.pdf>. (accessed on May 2023).
- [7] KBank. (2023). Herb Market for SME. Kasikorn Research Center, Bangkok, Thailand. Available online: [https://kasikornbank.com/th/business/sme/KSMEKnowledge/article/KSMEAnalysis/Documents/Herb\\_Market.pdf](https://kasikornbank.com/th/business/sme/KSMEKnowledge/article/KSMEAnalysis/Documents/Herb_Market.pdf) (accessed on May 2023).
- [8] FDA. (2018). Risk of serious and potentially fatal blood disorder prompts FDA action on oral over-the-counter benzocaine products used for teething and mouth pain and prescription local anesthetics. U.S Food and Drug Administration, United States. Available online: <https://www.fda.gov/drugs/drug-safety-and-availability/risk-serious-and-potentially-fatal-blood-disorder-prompts-fda-action-oral-over-counter-benzocaine> (accessed on May 2023).
- [9] Fresenius Kabi. (2014). (Lidocaine HCl) Solution: 2% Xylocaine® Viscous Patient Information Leaflet. Fresenius Kabi, Bad Homburg, Germany. Available online: [http://www.accessdata.fda.gov/drugsatfda\\_docs/label/2014/009470s0251bl.pdf](http://www.accessdata.fda.gov/drugsatfda_docs/label/2014/009470s0251bl.pdf) (accessed on May 2023).
- [10] Tsuchiya, H. (2017). Anesthetic agents of plant origin: A review of phytochemicals with anesthetic activity. *Molecules*, 22(8), 1369. doi:10.3390/molecules22081369.
- [11] Chung, G., & Oh, S.B. (2013). Eugenol as local anesthetic. In K. Ramawat & J.M. Mérillon (Eds.), *Natural Products: Phytochemistry, Botany and Metabolism of Alkaloids, Phenolics & Terpenes*, 4001–4015. doi:10.1007/978-3-642-22144-6\_171.
- [12] FDA. (2023). Listing of Specific Substances Affirmed as GRAS: Clove and its derivatives. U.S Food & Drug Administration, United States. Available online: <http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?fr=184.1257> (accessed on May 2023).
- [13] Owens, J.D. & Davies, J. (2000). The Importance of a New Product Development (NPD) process: Getting Started. First European Conference on Knowledge Management. Bled School of Management, Bled, Slovenia, 1-12
- [14] Suwannaporn, P., & Speece, M. W. (2010). Assessing new product development success factors in the Thai food industry. *British Food Journal*, 112(4), 364–386. doi:10.1108/00070701011034394.
- [15] Yousefi, N., Mehralian, G., Rasekh, H. R., & Yousefi, M. (2017). New product development in the pharmaceutical industry: Evidence from a generic market. *Iranian Journal of Pharmaceutical Research*, 16(2), 831–843.
- [16] Verworn, B.; Herstatt, C. & Nagahira, A. (2006). The impact of the fuzzy front end on new product development success in Japanese NPD projects, Working Paper, No. 39, Hamburg University of Technology (TUHH), Institute for Technology and Innovation Management (TIM), Hamburg, Germany.
- [17] Florén, H., Frishammar, J., Parida, V., & Wincent, J. (2018). Critical success factors in early new product development: a review and a conceptual model. *International Entrepreneurship and Management Journal*, 14(2), 411–427. doi:10.1007/s11365-017-0458-3.
- [18] Kärkkäinen, H., Piippo, P., & Tuominen, M. (2001). Ten tools for customer-driven product development in industrial companies. *International Journal of Production Economics*, 69(2), 161–176. doi:10.1016/S0925-5273(00)00030-X.

- [19] Desouza, K. C., Awazu, Y., Jha, S., Dombrowski, C., Papagari, S., Baloh, P., & Kim, J. Y. (2008). Costomer-driven innovation. *Research Technology Management*, 51(3), 35–44. doi:10.1080/08956308.2008.11657503.
- [20] Verworn, B., Herstatt, C., & Nagahira, A. (2008). The fuzzy front end of Japanese new product development projects: Impact on success and differences between incremental and radical projects. *R and D Management*, 38(1), 1–19. doi:10.1111/j.1467-9310.2007.00492.x.
- [21] Yusuff, K. B. (2018). Patients', Consumers', and Healthcare Professionals' Perceptions, Beliefs, Knowledge, Attitudes, and Practices toward the Use of Medicines. In M.I.M. Ibrahim, A.I. Wertheimer, & Z.U.D. Babar (Eds.), *Social and Administrative Aspects of Pharmacy in Low-and Middle-Income Countries: Present Challenges and Future Solutions*, 35–52. doi:10.1016/B978-0-12-811228-1.00003-0.
- [22] Burmann, C., Meurer, J., & Kanitz, C. (2011). Customer centricity as a key to success for pharma. *Journal of Medical Marketing*, 11(1), 49–59. doi:10.1057/jmm.2010.30.
- [23] Gupchup, G. V., Abhyankar, U. L., Worley, M. M., Raisch, D. W., Marfatia, A. A., & Namdar, R. (2006). Relationships between Hispanic ethnicity and attitudes and beliefs toward herbal medicine use among older adults. *Research in Social and Administrative Pharmacy*, 2(2), 266–279. doi:10.1016/j.sapharm.2006.02.002.
- [24] Rapaka, R. S., & Coates, P. M. (2006). Dietary supplements and related products: a brief summary. *Life sciences*, 78(18), 2026–2032. doi:10.1016/j.lfs.2005.12.017.
- [25] Mitha, S., Nagarajan, V., Babar, M. G., Siddiqui, M. J. A., & Jamshed, S. Q. (2013). Reasons of using complementary and alternative medicines (CAM) among elderly Malaysians of Kuala Lumpur and Selangor states: An exploratory study. *Journal of Young Pharmacists*, 5(2), 50–53. doi:10.1016/j.jyp.2013.05.002.
- [26] Khayru, R. K., & Issallillah, F. (2021). Study on Consumer Behavior and Purchase of Herbal Medicine Based on the Marketing Mix. *Journal of Marketing and Business Research*, 1(1), 1–14. doi:10.56348/mark.v1i1.33.
- [27] Thongruang, C. (2008). Consumer Purchasing Behavior for Herbal Medicine in Drugstore in Bangkok. *Naresuan University Journal*, 16(3), 195–202.
- [28] Beneke, J., Flynn, R., Greig, T., & Mukaiwa, M. (2013). The influence of perceived product quality, relative price and risk on customer value and willingness to buy: A study of private label merchandise. *Journal of Product and Brand Management*, 22(3), 218–228. doi:10.1108/JBPM-02-2013-0262.
- [29] Wang, Y.H. & Chen, L.Y. (2016). An Empirical Study of the Effect of Perceived Price on Purchase Intention Evidence from Low-Cost Carriers. *International Journal of Business and Social Science*, 7(4), 97–107.
- [30] Temechewu, M. W., & Gebremedhin, M. (2020). Factors Affecting Consumers' Purchase Decision of Over-The-Counter (OTC) Medicines: Empirical Evidences from Community Pharmacies in Ethiopia. *Journal of Medicine, Physiology and Biophysics*, 65, 8–25. doi:10.7176/jmpb/65-02.
- [31] Salmasi, S., Ming, L. C., & Khan, T. M. (2016). Interaction and medical inducement between pharmaceutical representatives and physicians: A meta-synthesis. *Journal of Pharmaceutical Policy and Practice*, 9(1), 1–12. doi:10.1186/s40545-016-0089-z.
- [32] DeFrank, J. T., Berkman, N. D., Kahwati, L., Cullen, K., Aikin, K. J., & Sullivan, H. W. (2020). Direct-to-Consumer Advertising of Prescription Drugs and the Patient–Prescriber Encounter: A Systematic Review. *Health Communication*, 35(6), 739–746. doi:10.1080/10410236.2019.1584781.
- [33] Suriyage, R. D. S. D., & Leon, S. A. J. (2023). Factors Influencing Consumer Buying Decision towards Herbal Products in Monaragala District, Sri Lanka. *Kelaniya Journal of Management*, 12(1), 55–62. doi:10.4038/kjm.v12i1.7739.
- [34] Grace, P. I., & Ming, T. (2018). Antecedents of consumer attitude towards blogger recommendations and its impact on purchase intention. *Asian Journal of Business and Accounting*, 11(1), 293–324. doi:10.22452/ajba.vol11no1.10.
- [35] Medicine, A. (2019). Evaluation of Policies Promoting the Use of Herbal Medicine in Hospitals. In the Ministry of Public Health in Saraburi Province in 2017. *Journal of Thai Traditional and Alternative Medicine*, 17(1), 516–526.
- [36] Meechumnarn, T. Evaluation of the Use of Herbal and Thai Traditional Medicines in Hospitals under the Ministry of Public Health in Roi-Et Province in 2014. *Thai Journal of Pharmacy Practice*, 7, 155–166.
- [37] Hilal, M., & Hilal, S. (2017). Knowledge, attitude, and utilization of herbal medicines by physicians in the Kingdom of Bahrain: A cross-sectional study. *Journal of the Association of Arab Universities for Basic and Applied Sciences*, 24, 325–333. doi:10.1016/j.jaubas.2016.11.001.
- [38] Jehso, K., Lerkiatbundit, S., & Wiroonpanich, W. (2015). Integration of Thai traditional medicine into physicians' practice part 2: Raising consciousness, the process of integration from physicians' experiences. *Thai Journal of Pharmaceutical Sciences*, 39(2), 57–63.



- [39] Sweileh, W., Abu Arrah, E., Abu Taha, A., Sawalha, A., Salah, O., Jamous, R., & Adawi, D. (2013). Dispensing practices, attitudes and knowledge of pharmacists towards herbal products in Palestine. *Ibnosina Journal of Medicine and Biomedical Sciences*, 05(03), 123–130. doi:10.4103/1947-489x.210535.
- [40] Asmelashe Gelayee, D., Binega Mekonnen, G., Asrade Atnafe, S., Birarra, M. K., & Asrie, A. B. (2017). Herbal Medicines: Personal Use, Knowledge, Attitude, Dispensing Practice, and the Barriers among Community Pharmacists in Gondar, Northwest Ethiopia. *Evidence-Based Complementary and Alternative Medicine*, 2017, 6480142. doi:10.1155/2017/6480142.
- [41] Kwak, G., Gardner, K., Bolaji, B., Franklin, S., Aung, M., & Jolly, P. E. (2021). Knowledge, attitudes and practices among healthcare professionals regarding complementary alternative medicine use by patients with hypertension and type 2 diabetes mellitus in Western Jamaica. *Complementary Therapies in Medicine*, 57, 102666. doi:10.1016/j.ctim.2021.102666.
- [42] Pereira da Silva, A., Geraldles, M., Díaz-Lanza, A. M., Kovacs, I., & Costa, M. C. (2018). Family medicine physicians' perception and attitudes of herbal substances use in greater Lisbon region. *Phytomedicine*, 47, 1–11. doi:10.1016/j.phymed.2018.04.040.
- [43] Clement, Y. N., Williams, A. F., Khan, K., Bernard, T., Bhola, S., Fortuné, M., Medupe, O., Nagee, K., & Seaforth, C. E. (2005). A gap between acceptance and knowledge of herbal remedies by physicians: The need for educational intervention. *BMC Complementary and Alternative Medicine*, 5(1), 20. doi:10.1186/1472-6882-5-20.
- [44] Karayanni, D. (2010). A Cluster Analysis of Physician's Values, Prescribing Behaviour and Attitudes towards Firms' Marketing Communications. *International Journal of Customer Relationship Marketing and Management*, 1(4), 62–79. doi:10.4018/jcrmm.2010100104.
- [45] Ahmed, R. R., Streimikiene, D., Ahrhám, J., Streimikis, J., & Vveinhardt, J. (2020). Social and behavioral theories and physician's prescription behavior. *Sustainability (Switzerland)*, 12(8), 3379. doi:10.3390/SU12083379.
- [46] Orlowski, J. P., & Wateska, L. (1992). The effects of pharmaceutical firm enticements on physician prescribing patterns; There's no such thing as a free lunch. *Chest*, 102(1), 270–273. doi:10.1378/chest.102.1.270.
- [47] Wang, T. J., Ausiello, J. C., & Stafford, R. S. (1999). Trends in antihypertensive drug advertising, 1985-1996. *Circulation*, 99(15), 2055–2057. doi:10.1161/01.CIR.99.15.2055.
- [48] Groves, K. E. M., Sketris, I., & Tett, S. E. (2003). Prescription drug samples - Does this marketing strategy counteract policies for quality use of medicines? *Journal of Clinical Pharmacy and Therapeutics*, 28(4), 259–271. doi:10.1046/j.1365-2710.2003.00481.x.
- [49] Boltri, J. M., Gordon, E. R., & Vogel, R. L. (2002). Effect of antihypertensive samples on physician prescribing patterns. *Family Medicine*, 34(10), 729–731.
- [50] Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science*, 35(8), 982–1003. doi:10.1287/mnsc.35.8.982.
- [51] Jokar, N. K., Noorhosseini, S. A., Allahyari, M. S., & Damalas, C. A. (2017). Consumers' acceptance of medicinal herbs: An application of the technology acceptance model (TAM). *Journal of Ethnopharmacology*, 207, 203–210. doi:10.1016/j.jep.2017.06.017.
- [52] Phusiri, P., Somjai, S., & Sriwatanakul, K. Perceived Usefulness, Perceived Risk, Perceived Ease of Use and Attitude Affecting on Consumer Acceptance in Stem Cell Technology in Anti-Aging Medicine. *Journal of the Association of Researchers*, 24(3), 57–73. Available online: <https://so04.tci-thaijo.org/index.php/jar/article/view/240741> (accessed on May 2023).
- [53] Chen, C. J., Chang, C. C., & Hung, S. W. (2011). Influences of Technological Attributes and Environmental Factors on Technology Commercialization. *Journal of Business Ethics*, 104(4), 525–535. doi:10.1007/s10551-011-0926-6.
- [54] Soe, H. M. S. H., Luckanagul, J. A., Pavasant, P., & Jansook, P. (2020). Development of in situ gel containing asiaticoside/cyclodextrin complexes. Evaluation in culture human periodontal ligament cells (HPLDCs). *International Journal of Pharmaceutics*, 586, 119589. doi:10.1016/j.ijpharm.2020.119589.
- [55] Sruthi, B. Y. K., Gurupadaya, B. M., Venkata Sairam, K., & Narendra Kumar, T. (2014). Development and validation of GC method for the estimation of eugenol in clove extract. *International Journal of Pharmacy and Pharmaceutical Sciences*, 6(2), 473–476.
- [56] Abratt, R., & Lanteigne, J. (2000). Factors influencing general practitioners in the prescription of homeopathic medicines. *South African Journal of Business Management*, 31(3), 91–98. doi:10.4102/sajbm.v31i3.738.
- [57] Marinac, J. S., Buchinger, C. L., Godfrey, L. A., Wooten, J. M., Sun, C., & Willsie, S. K. (2007). Herbal products and dietary supplements: A survey of use, attitudes, and knowledge among older adults. *Journal of the American Osteopathic Association*, 107(1), 13–23. doi:10.7556/jaoa.2007.107.1.13.

- [58] Ismail, S., & Mokhtar, S. S. M. (2016). Moderating role of perceived benefit on the relationship between attitude and actual purchase. *International Review of Management and Marketing*, 6(7Special Issue), 22–28.
- [59] Ismail, S., Awi, N. A., Mohamed, M., Yusof, Y. M., Saputra, J., & Thurasamy, R. (2021). Investigating the structural relationship of mass media on attitude, social influence, product safety and its impact on purchase behaviour of herbal product in malaysia. *International Journal of Data and Network Science*, 5(4), 531–546. doi:10.5267/j.ijdns.2021.8.014.
- [60] Welz, A. N., Emberger-Klein, A., & Menrad, K. (2018). Why people use herbal medicine: Insights from a focus-group study in Germany. *BMC Complementary and Alternative Medicine*, 18(1), 92. doi:10.1186/s12906-018-2160-6.
- [61] Zhou, X., Zhang, X., Yang, L., Hu, X., Shen, A., Huang, X., & Xie, X. (2019). Influencing factors of physicians' prescription behavior in selecting essential medicines: A cross-sectional survey in Chinese county hospitals. *BMC Health Services Research*, 19(1), 980. doi:10.1186/s12913-019-4831-5.
- [62] Roekruangrit, N., Sumpaonthong, K., & Itharat, A. Factors influencing on use of herbal medicinal products in U-Thong hospital, Suphanburi province. *Thammasat Medical Journal*, 10, 302–310.
- [63] Erdil, T. S. (2015). Effects of Customer Brand Perceptions on Store Image and Purchase Intention: An Application in Apparel Clothing. *Procedia - Social and Behavioral Sciences*, 207, 196–205. doi:10.1016/j.sbspro.2015.10.088.
- [64] Díaz-Lago, M., Blanco, F., & Matute, H. (2023). Expensive seems better: The price of a non-effective drug modulates its perceived efficacy. *Cognitive Research: Principles and Implications*, 8(1), 8. doi:10.1186/s41235-023-00463-4.
- [65] Bootsumran, L., Siripipathanakul, S., & Phayaphrom, B. (2021). Factors Influencing Consumers' Purchase Intention at Pharmacies in Thailand. *Journal of Management in Business, Healthcare, and Education (JMBHE)*, 1(December), 1–16.
- [66] Mubarak, K., & Mufeeth, M. (2020). An Analysis of Factors Impacting Consumer. *SEUSL Journal of Marketing*, 5(1), 41–52.
- [67] Jitpukdeebodintra, S., & Jangwang, A. (2009). Coffee for smoking cessation. *Journal of Food, Agriculture and Environment (JFAE)*, 7(3-4), 130-133.
- [68] Liao, H. L., Ma, T. C., Chiu, Y. L., Chen, J. T., & Chang, Y. S. (2008). Factors influencing the purchasing behavior of TCM outpatients in Taiwan. *Journal of Alternative and Complementary Medicine*, 14(6), 741–748. doi:10.1089/acm.2007.7111.
- [69] Satsue, S., Prompomjorn, K., & Rukpurk, W. Survey of Factors Affecting Herbal Medicine Consumption Behavior among People in Sai Noi District, Nonthaburi Province. *Journal of Thai Traditional & Alternative Medicine*, 16, 463–473.
- [70] Eastin, M. S. (2001). Credibility assessments of online health information: The effects of source expertise and knowledge of content. *Journal of Computer-Mediated Communication*, 6(4), JCMC643. doi:10.1111/j.1083-6101.2001.tb00126.x.
- [71] Ting, C. Y., Ismail, M. Bin, Ting, H., Bahri, S. B., Sidek, A. Bin, Idris, S. F. B., Tan, R. T. H., Abu Seman, S. S. Bin, Sethiaram, M. R. A., Md Ghazali, M. H. Bin, Lim, Q. H., Mohd Zaki, M. S. Bin, & Sohot, M. S. Bin. (2019). Consumer behaviour towards pharmaceutical products: a model development. *International Journal of Pharmaceutical and Healthcare Marketing*, 13(3), 387–402. doi:10.1108/IJPHM-07-2018-0040.
- [72] Sharifnia, S. H. A., Mohammadzadeh, M., Arzani, G., Salamzadeh, J., Abolfazli, S. A., Zali, A., & Khoshdel, A. R. (2018). Main factors affecting physicians' prescribing decisions: The Iranian experience. *Iranian Journal of Pharmaceutical Research*, 17(3), 1105–1115.
- [73] Srivastava, R. K., & Wagh, S. (2020). Factors impacting consumer purchase behaviour for pharmaceutical products. *International Journal of Healthcare Management*, 13(2), 113–121. doi:10.1080/20479700.2017.1348004.
- [74] Ismail, S., & Mokhtar, S. S. M. (2015). The antecedents of herbal product actual purchase in Malaysia. *Management Science Letters*, 5, 771–780. doi:10.5267/j.msl.2015.5.011.
- [75] Satyapan, N., Patarakitvanit, S., Temboonkiet, S., Vudhironarit, T., & Tankanitlert, J. (2010). Herbal medicine: affecting factors and prevalence of use among Thai population in Bangkok. *Journal of the Medical Association of Thailand: Chotmaihet Thangphaet*, 93 Suppl 6(6), 139–144.
- [76] Kaur, B., Gangwar, V. P., & Dash, G. (2022). Green Marketing Strategies, Environmental Attitude, and Green Buying Intention: A Multi-Group Analysis in an Emerging Economy Context. *Sustainability (Switzerland)*, 14(10), 6107. doi:10.3390/su14106107.