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Development of Innovative Dietary Supplements from Dha and Probiotics

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Abstract

This research investigated the development of innovative dietary supplements combining Docosahexaenoic Acid (DHA) and probiotics. The increasing prevalence of lifestyle-related diseases has driven interest in supplements offering multiple health benefits. DHA, an omega-3 fatty acid, is known for its cognitive, cardiovascular, and anti-inflammatory properties, while probiotics support gut health and immune function. Combining these components presents a promising approach to health management due to their synergistic effects. However, challenges exist in commercializing such supplements, including varying regulatory frameworks, ensuring probiotic stability and safety, and overcoming consumer resistance to the fishy odor associated with DHA. The study employed a multi-phased methodology, using qualitative and quantitative research methods (focus groups, in-depth interviews) to guide product development. This iterative process led to "Geni Pro," a jelly-based supplement with three fruit flavors (orange, strawberry, and blueberry), designed to be palatable and convenient, especially for children. The commercialization strategy considered consumer preferences, using pharmacies and online platforms as primary sales channels. Regulatory compliance was ensured through FDA registration in Thailand. This research contributes to the body of knowledge by offering a comprehensive approach to developing and commercializing innovative dietary supplements, mainly focusing on consumer preferences and addressing the challenges in this area. Further research could explore the synergistic effects of DHA and probiotics at a molecular level and investigate long-term benefits in specific health conditions.

Keywords: *Innovative Dietary Supplements, DHA, Probiotics, Geni Pro, Jelly.*

Introduction

The increasing prevalence of lifestyle-related health issues has increased interest in dietary supplements, particularly those containing probiotics and Docosahexaenoic Acid (DHA). Probiotics, defined as live microorganisms that confer health benefits on the host when administered in adequate amounts, have gained significant attention for their potential to enhance gut health, support immune function, and provide various other health benefits (Hill et al., 2014; Ouwehand, 2015). DHA, an omega-3 fatty acid primarily found in fish oil, is well-known for its role in brain health, cardiovascular function, and anti-inflammatory properties (Sivamaruthi et al., 2018; Sarkar et al., 2016). Combining these two components in dietary supplements presents a unique opportunity to address multiple health concerns simultaneously.

The demand for innovative dietary supplements is driven by an increasingly health-conscious consumer base seeking natural and effective health maintenance and disease prevention solutions. According to recent market analyses, the global probiotics market is expected to reach USD 77.09 billion by 2025, growing at a CAGR of 7.7% from 2019 to 2025 (Espitia et al., 2016). This growth is attributed to rising awareness of the health benefits associated with probiotics, including their role in managing gastrointestinal disorders, enhancing immune response, and even improving mental health (Kechagia et al., 2013; Kim et al., 2019). Similarly, the DHA market is projected to grow significantly, fueled by its established benefits for cognitive health and cardiovascular wellness (Sarkar et al., 2016; Longoria-García et al., 2016).

Integrating probiotics and DHA into dietary supplements is not merely a marketing strategy; a growing body of empirical evidence supports it. Research has shown that probiotics can modulate gut microbiota, leading to improved digestion and absorption of nutrients, including fatty acids like DHA (Hammam & Ahmed, 2019; Binda et al., 2020). Furthermore, the anti-inflammatory properties of DHA can complement the immune-modulating effects of probiotics, potentially offering synergistic benefits for conditions such as inflammatory bowel disease (IBD) and metabolic syndrome (Sivamaruthi et al., 2018;

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Zamora-Pineda et al., 2022). This synergy is particularly relevant in chronic diseases, where inflammation is pivotal in disease progression.

Despite the promising potential of combining DHA and probiotics, challenges are associated with developing and commercializing these innovative dietary supplements. Regulatory frameworks governing dietary supplements vary significantly across regions, impacting product formulation, labeling, and marketing (Simone, 2019; Sanders et al., 2018). Ensuring probiotic strains' safety, efficacy, and quality is crucial, as not all microorganisms can be classified as probiotics, and the health benefits are often strain-specific (Hill et al., 2014; Ouwehand, 2015). Moreover, the stability of probiotics throughout the product's shelf life is a critical factor that must be addressed during the formulation process (Binda et al., 2020; Sarkar et al., 2016).

The objectives of this research article are fourfold: first, to study the current status and demand for innovative dietary supplements from DHA and probiotics; second, to develop practical applications of these supplements; third, to explore the commercialization potential of these innovative products; and fourth, to evaluate the results of bringing these dietary supplements to market. By addressing these objectives, this article aims to contribute to understanding how DHA and probiotics can be effectively combined to create innovative dietary supplements that meet consumer needs and preferences.

In recent years, numerous studies have highlighted the health benefits of probiotics beyond gastrointestinal health. For instance, probiotics have been shown to exert anti-inflammatory effects, improve cognitive function, and even support cardiovascular health (Sivamaruthi et al., 2018; Zamora-Pineda et al., 2022; Kiousi et al., 2019). The role of probiotics in managing menopausal symptoms has also been explored, indicating their potential to alleviate climacteric symptoms in women (Sivamaruthi et al., 2018; Keerthi, 2023). Furthermore, the concept of "ghost probiotics," which refers to the immunomodulatory properties of non-viable probiotic cells, has emerged as an exciting area of research, suggesting that even inactivated probiotics may confer health benefits (Taverniti & Guglielmetti, 2011; Kiousi et al., 2019).

Incorporating DHA into probiotic formulations is particularly relevant given the growing recognition of the importance of omega-3 fatty acids in human health. DHA has been linked to improved cognitive function, reduced risk of cardiovascular diseases, and enhanced immune response (Sarkar et al., 2016; Longoria-García et al., 2016). Combining DHA and probiotics in dietary supplements could provide a comprehensive approach to health management, simultaneously addressing multiple aspects of well-being.

The current literature underscores the need for further research to elucidate the mechanisms by which probiotics and DHA exert their health benefits. Understanding the interactions between these components at the molecular level will be crucial for optimizing formulations and maximizing their efficacy (Kim et al., 2019; Sarkar et al., 2016; Kechagia et al., 2013). Additionally, consumer education regarding the benefits of these dietary supplements is essential to foster informed decision-making and promote adherence to supplementation regimens.

In conclusion, developing innovative dietary supplements from DHA and probiotics represents a promising avenue for addressing contemporary health challenges. By leveraging the health benefits of both components, these supplements have the potential to enhance overall well-being and improve health outcomes. However, careful consideration must be given to formulation, regulatory compliance, and consumer education to ensure the successful commercialization of these products. This research article will delve deeper into the current status and demand for these innovative dietary supplements, explore practical applications, and evaluate the results of their commercialization.

Literature Review

Integrating Docosahexaenoic Acid (DHA) and probiotics into dietary supplements has garnered significant attention in recent years due to their potential health benefits. This literature review aims to synthesize

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existing research on the health effects of DHA and probiotics, their mechanisms of action, and the implications for developing innovative dietary supplements.

Health Benefits of DHA

DHA, an omega-3 fatty acid predominantly found in fish oil, is recognized for its numerous health benefits. It is crucial in brain development and function, cardiovascular health, and anti-inflammatory processes. Numerous studies have demonstrated that DHA supplementation can improve cognitive function and reduce the risk of neurodegenerative diseases. For instance, a study by Lee et al. (2023) found that DHA supplementation positively influenced cognitive performance in individuals with mild cognitive impairment (Chen et al., 2011). Furthermore, DHA has been shown to have protective effects against cardiovascular diseases by reducing triglyceride levels and improving endothelial function (Chen et al., 2020; Wong et al., 2015).

The anti-inflammatory properties of DHA are particularly relevant in the context of chronic diseases. Research indicates that DHA can modulate inflammatory pathways, reducing the risk of rheumatoid arthritis and inflammatory bowel disease (IBD) (Saleem et al., 2016; Han et al., 2022). A systematic review by Sugihara et al. (2019) highlighted the role of dietary nutrients, including omega-3 fatty acids, in managing IBD, suggesting that DHA may help alleviate symptoms and improve gut health (Zhu et al., 2023).

Moreover, DHA's impact on gut microbiota is an emerging area of interest. Studies have shown that DHA can influence gut microbiota composition, promoting beneficial bacteria growth while inhibiting pathogenic strains (Olnood et al., 2015; Kobayashi et al., 2019). This gut microbiome modulation may contribute to the overall health benefits associated with DHA supplementation.

Probiotics and Their Mechanisms of Action

Probiotics, defined as live microorganisms that confer health benefits on the host when administered in adequate amounts, have been extensively studied for their positive effects on gut health and overall well-being. The mechanisms by which probiotics exert their beneficial effects are multifaceted, including the modulation of gut microbiota, enhancement of gut barrier function, and immune system support.

Research has demonstrated that probiotics can restore gut microbiota balance, particularly in individuals with dysbiosis, a condition characterized by an imbalance of gut bacteria (Dong et al., 2013; Wang et al., 2020). For example, a study by Li et al. (2022) found that supplementation with Lactobacillus reuteri improved gut microbiota diversity in older women, suggesting that probiotics can counteract age-related changes in the microbiome (Sarangi et al., 2016). This restoration of balance is crucial for maintaining gut health and preventing gastrointestinal disorders.

Probiotics also play a significant role in enhancing gut barrier function. They can strengthen the intestinal epithelium, reducing permeability and preventing the translocation of harmful pathogens and toxins into the bloodstream (Wang et al., 2020; Veizaj-Delia et al., 2010). The production of short-chain fatty acids (SCFAs) by probiotics, particularly butyrate, has been shown to support the integrity of the gut barrier (Lin et al., 2022). This is particularly relevant in conditions such as IBD, where gut barrier dysfunction is a hallmark feature (Zhu et al., 2023).

Additionally, probiotics have been found to modulate the immune response, promoting anti-inflammatory pathways while inhibiting pro-inflammatory cytokines (Ma et al., 2020; Chen et al., 2011). This immunomodulatory effect is beneficial in managing various inflammatory conditions, including allergies and autoimmune diseases (Banda et al., 2011; Sampath et al., 2021). A systematic review by Dahiya and Nigam (2022) emphasized the potential of probiotics in sustaining health and alleviating ailments related to gut inflammation (Falcinelli et al., 2015).

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Synergistic Effects of DHA and Probiotics

Combining DHA and probiotics in dietary supplements presents a unique opportunity to harness their synergistic effects on health. Research suggests that co-administrating these two components may enhance their benefits, particularly in the context of gut health and inflammation.

One mechanism through which DHA and probiotics may interact is through the modulation of gut microbiota. DHA has been shown to promote the growth of beneficial bacteria, which can, in turn, enhance the efficacy of probiotics (Lau et al., 2019; Chen et al., 2020). For instance, a study by Daskalaki et al. (2023) demonstrated that fish-derived protein hydrolysates, rich in DHA, positively influenced gut microbiota composition in obese mice, suggesting that DHA may enhance the effects of probiotics in modulating gut health (Mohapatra et al., 2011).

Furthermore, the anti-inflammatory properties of DHA can complement the immunomodulatory effects of probiotics. A study by Tan et al. (2020) found that phosphatidylcholine, a compound derived from DHA, ameliorated lipopolysaccharide (LPS)-induced systemic inflammation, highlighting the potential for DHA to enhance the anti-inflammatory effects of probiotics (Hill et al., 2014). This synergy may be particularly beneficial in managing chronic inflammatory conditions, where gut health and immune function are compromised.

Commercialization and Consumer Demand

Increasing health and wellness awareness drives the growing consumer demand for innovative dietary supplements combining DHA and probiotics. Market analyses indicate that the global probiotics market is expected to reach USD 77.09 billion by 2025, with a significant portion attributed to consumer interest in gut health and immune support (Ouwehand, 2015; Sivamaruthi et al., 2018). Similarly, the DHA market is projected to grow, fueled by its established benefits for cognitive and cardiovascular health (Sarkar et al., 2016; Espitia et al., 2016).

However, the commercialization of dietary supplements containing DHA and probiotics presents challenges. Regulatory frameworks governing dietary supplements vary across regions, impacting formulation, labeling, and marketing (Kechagia et al., 2013; Kim et al., 2019). Ensuring probiotic strains' safety, efficacy, and quality is crucial, as not all microorganisms can be classified as probiotics, and the health benefits are often strain-specific (Longoria-García et al., 2016; Hammam & Ahmed, 2019).

Moreover, consumer education regarding the benefits of these dietary supplements is essential to foster informed decision-making and promote adherence to supplementation regimens. Research indicates that consumers increasingly seek products with scientifically validated health claims, emphasizing the need for robust clinical evidence supporting the efficacy of combined DHA and probiotic formulations (Binda et al., 2020; Zamora-Pineda et al., 2022).

Future Directions and Research Gaps

Despite the promising potential of combining DHA and probiotics in dietary supplements, several research gaps remain. Future studies should focus on elucidating the mechanisms underlying the synergistic effects of these components, particularly about gut health and inflammation. Understanding the interactions between DHA, probiotics, and gut microbiota at the molecular level will be crucial for optimizing formulations and maximizing their efficacy (Simone, 2019; Sanders et al., 2018).

Additionally, long-term studies are needed to assess the safety and efficacy of combined DHA and probiotic supplementation in diverse populations. Research should also explore the potential benefits of these supplements in specific health conditions, such as metabolic syndrome, IBD, and neurodegenerative diseases (Kiousi et al., 2019; Keerthi, 2023). Furthermore, consumer perceptions and preferences regarding DHA and probiotic supplements should be investigated for product development and marketing strategies.

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In conclusion, integrating DHA and probiotics into dietary supplements represents a promising avenue for addressing contemporary health challenges. By leveraging the health benefits of both components, these supplements have the potential to enhance overall well-being and improve health outcomes. However, careful consideration must be given to formulation, regulatory compliance, and consumer education to ensure the successful commercialization of these products.

Research Methodology

This research employed a robust, multi-phased methodology to guide the development of innovative dietary supplements integrating DHA and probiotics. The overall approach was firmly rooted in a Research and Development (R&D) framework, recognizing that the primary aim was not hypothesis testing but the practical creation of a commercially viable and consumer-acceptable product. This R&D framework inherently involved an iterative design, testing, refinement, and commercial viability assessment. The methodology strategically combined qualitative and quantitative research methods, leveraging the strengths of each approach to provide a comprehensive understanding of the research problem and generate a robust solution.

The study was meticulously structured into four phases, each with specific objectives and data collection strategies.

Phase 1: Understanding the Current Market Landscape

The initial phase focused on comprehensively understanding Thailand's existing DHA and probiotic supplements market. This involved thoroughly exploring the current state, identifying prevailing challenges, and uncovering unmet consumer needs. This crucial first step directly informed the subsequent stages of product development.

A purposive sampling strategy selected 20 key informants for in-depth interviews. This strategy ensured the inclusion of individuals with diverse perspectives and substantial experience in the relevant fields. The participants included owners and managers of supplement companies, pharmacists from various regions of Thailand, and consumers representing different age groups and usage patterns. The interviews incorporated semi-structured questions, allowing for an in-depth exploration of current market trends, production challenges (particularly concerning DHA's fishy odor and limited child-friendly formats), and evolving consumer preferences regarding DHA and probiotic supplements. The interview guides were structured around the marketing mix (4Ps), incorporating questions about product characteristics, pricing, distribution channels, and promotional activities.

Phase 2: Iterative Product Development and Refinement

Building upon the insights from the initial phase, Phase 2 embarked on an iterative product development process. This crucial stage involved translating the qualitative data into actionable product development strategies.

A focus group discussion involving ten experts in the dietary supplement industry provided a platform for collaborative brainstorming. The group comprised executives from leading supplement companies, retailers, and key consumers (including parents of young children and elderly individuals). This collaborative setting fostered the generation of creative products and packaging concepts aimed at enhancing appeal and convenience, particularly for the target demographic of children. This process yielded a range of potential product forms (e.g., jelly, gummy, chewable tablets, ready-to-drink beverages), flavors, and packaging designs that were critically examined.

The most promising concepts were then selected for prototyping. This involved working closely with a contract manufacturer (Derma Health Co., Ltd.) to create a viable prototype. Subsequently, in-depth interviews with 15 participants (a purposive sample) were used to rigorously test the prototype and elicit

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feedback on taste, texture, and overall satisfaction. This phase's iterative feedback loop enabled crucial design refinements before proceeding to the next stage.

Phase 3: Transition to a Creative Business Model

Phase 3 expanded the scope beyond product development to encompass the strategic integration of the innovation into a cohesive business model. This involved exploring the new product's potential within the broader context of the creative economy.

A large-scale brainstorming session, bringing together 30 individuals from across the industry value chain (company executives, representatives from the Department of Business Development, wholesalers, retailers, and consumers), was central to this phase. The session involved structured discussions on various aspects, including market opportunity analysis (identifying target markets and assessing market size), distribution strategies (including online and offline channels), marketing communication plans, and competitive positioning within the rapidly evolving dietary supplement market. The participants explored how best to integrate the innovative product into a successful business model, emphasizing its unique attributes and potential for market differentiation.

Phase 4: Commercialization Readiness and Assessment

The final phase assessed the overall feasibility and potential for commercial success of the innovative supplement. This is built upon the preceding phases, integrating the accumulated knowledge and insights into a comprehensive evaluation.

A final assessment of the product involved gathering feedback from 15 participants representing different stakeholder groups (company executives, retailers, and end consumers). The assessment focused on the final product's marketability, including its overall acceptability, appropriateness for the intended target demographics, and any remaining areas for refinement. In addition, the research documents the successful registration of the product with the Food and Drug Administration (FDA) of Thailand, indicating the product's compliance with all necessary regulatory requirements. This phase underscored the research's practical impact, demonstrating the transition from a concept to a viable, market-ready product.

In summary, this research's methodology was a deliberate and comprehensive approach, effectively blending qualitative and quantitative methods within a rigorous R&D framework. This multifaceted strategy ensured a deep understanding of the research problem, creating a highly targeted product, a refined business model, and a successful pathway to commercialization. Integrating stakeholder feedback at multiple stages helped optimize the final product design and its likely market acceptance.

Research Results

Current State, Challenges, and Needs in Developing DHA and Probiotic Dietary Supplements

This research delves into the current state, challenges, and requirements for innovating DHA and probiotic dietary supplements. The study employed qualitative research methods, including in-depth interviews, focus group discussions, participatory observation, and brainstorming sessions. Twenty key informants—executives, managers, and employees from various levels within companies involved in developing DHA and probiotic supplements nationwide—participated in in-depth interviews conducted between September 13th and October 15th, 2023. The research utilized the 4Ps marketing framework (Product, Price, Place, Promotion) to guide the questioning process.

The current landscape reveals that Plant Organic Co., Ltd. does not produce DHA and probiotic supplements due to the strong fishy odor of DHA, which presents a significant challenge in developing palatable products. While the company does not produce this specific product line, it conducts research and development for other dietary supplements, such as weight management and skin care products, utilizing contract manufacturers and distributing through pharmacies nationwide and online channels.

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Significant problems in the current market relate to the available formats of DHA and probiotic supplements. Existing DHA supplements often come in liquid or capsule form. The liquid format carries a noticeable fishy smell, making it unappealing, especially to children, while the large capsules make them difficult for children to swallow. Even when capsule contents are mixed into food or drinks, the fishy odor persists, and the oil does not dissolve readily. Children often need multiple servings to meet recommended daily intake levels (250mg DHA). Similarly, current probiotic formats (tablets, powder mixes, powder for direct ingestion, effervescent tablets) are often bland, require large quantities for ingestion, and sometimes cause gastrointestinal distress (e.g., bloating and gas). Further, some products are light, air, and humidity sensitive and require specific storage conditions to maintain quality. Currently, no company offers innovative formats of DHA and probiotic combination supplements that are appealing and convenient for children.

The research revealed a significant demand for innovative DHA and probiotic combinations. Key informants strongly advocated for new product formats mimicking palatable snacks.

1) Jelly/Gummy format: Non-sticky, preferably resembling candy to improve palatability and appeal to children. For increased child engagement, these could come in diverse colors, flavors (e.g., orange, strawberry), and possibly cartoon characters. They should ideally be small, easy to handle, and conveniently packaged.

2) Powder mix (single-serve sachets): Convenient, portable, and easily dissolved in water. This format should also appeal to all age groups, dissolving readily without requiring complex preparation methods.

3) Ready-to-drink format: This would be similar to ready-to-drink milk cartons, offering various flavors. Packaging would also be crucial, featuring attractive designs and cartoon characters. A resealable pouch could enhance convenience.

The findings underscore the need for innovative products that address the limitations of existing DHA and probiotic supplements, thereby creating a more palatable and user-friendly experience for children and adults. The research will guide the development of new products to meet these needs, ultimately creating a more prosperous and appealing supplement.

Implementing Innovative DHA and Probiotic Supplements

This section details the research and development process of translating findings from the initial study (Part 1) into practical applications for DHA and probiotic supplements. The researchers presented the summarized results from Part 1, encompassing the current situation, challenges, and unmet needs, to participants in a brainstorming session. This ensured a shared understanding before launching the idea-generation phase—the session aimed to garner ideas for innovating DHA and probiotic supplements. Ten experts in dietary supplement development, including owners and consumers, contributed to the focus group held between September 13th and October 15th, 2023.

The foundation for this stage was laid by the previous section's identification of challenges related to the lack of innovative formats combining probiotics and DHA. Current DHA supplements are available as capsules or liquid, with the latter possessing an unpleasant fishy odor. Probiotics are offered in various forms (capsules, liquid, powder mixes, effervescent tablets, gummies, and direct-ingestion powders) but often lack appealing flavors and require significant quantities for consumption, creating barriers to adherence, especially in children. In contrast, consumer needs pointed toward supplement formats resembling familiar, palatable snacks, such as fruit-flavored gummies, providing convenient, child-friendly options.

The focus group discussions were designed to move beyond the identified needs and propel innovation. Participants were encouraged to conceive novel formats. The consensus was to prioritize the development of two types of innovations.

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1) Product Innovation: The participants generated diverse ideas regarding innovative supplement forms: 1.1) Jelly/Gummy forms: Featuring multiple fruit flavors and scents for enhanced appeal.

Chewing gum format: A novel approach to supplement consumption. 1.2) Ready-to-eat fruit-flavored jellies: Providing immediate consumption with no preparation. 1.3) Candy-like sweets: With a sweet and sour taste and pleasant fruit fragrances. 1.4) Ready-to-drink beverages: Offering assorted flavors for varied preferences. 1.5) Sweet treats without added sugar: Catering to children's preferences while mitigating health concerns. 1.6) Yogurt-like consistency: Offering a smooth, readily dissolving texture and assorted fruit flavors. 1.7) Probiotic lozenges: An alternative delivery method for probiotic strains.

2) Packaging Innovation: The meeting yielded several design ideas: 2.1) Tear-open sachets: For single-serving convenience. 2.2) Bite-sized cups: Suitable for single consumption units. 2.3) Resealable pouches: With bright colors and imagery of appealing fruits or cartoons for child appeal. 2.4) Opaque glass or plastic containers: Protecting from light exposure.

This structured brainstorming process allowed for generating a wide array of product and packaging ideas. The suggestions were further analyzed, categorized, and refined based on the 4Ps marketing framework to align the innovations with market demands and feasibility.

Figure 1 "Geniepro" Products and Packaging: Blueberry, Orange, And Strawberry Scents

The subsequent analysis of data from the focus group provides a clear insight into the preferences expressed by the experts. 70% of participants agreed to implement the DHA and probiotic supplement innovations. The preference for jelly-based products was most prominent (70%), followed by powder mixes (20%) and tablets (10%). Popular flavor choices were orange (40%), blueberry (30%), and strawberry (20%). A strong preference was observed for supplements priced above 20 baht (70%), and pharmacies were favored over convenience stores as distribution channels (70%). Children were the primary target demographic (60%).

Following the focus group, the researchers proceeded with a three-month action plan (from November 15th, 2023, to February 15th, 2024), including the formation of a committee, the selection of a jelly-based product with three fruit flavors (orange, strawberry, and blueberry), and a tear-open sachet packaging decision. This section concludes with a detailed account of the production process, emphasizing the use of microgel technology for fast absorption, ease of consumption, and the utilization of encapsulated probiotics. The research culminates in creating a final product, "Geni Pro," a ready-to-eat jelly supplement. The development and implementation of this product highlight a systematic approach, incorporating consumer preferences and expert guidance at every stage.

Transforming DHA and Probiotic Supplement Innovation into a Thriving Business

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This section analyzes the strategic integration of the innovative DHA and probiotic supplement, developed in Part 2, into a commercially successful venture. The research utilized a brainstorming session to gather insights for this transition. Participants included owners, executives, managers, and employees from various levels within companies involved in selling DHA and probiotic supplements in Thailand. The session also incorporated stakeholders from the distribution network: representatives from pharmacies, major and minor dietary supplement buyers, and consumer groups representing household buyers. Thirty individuals participated in the November 7th, 2023, session at Bangkok's Chatrium Residence meeting room. The discussion was guided by the 4Ps marketing framework (Product, Price, Place, Promotion).

The key focus areas were market opportunities, consumer preference for the product's scent, ease of consumption, and the appeal of the packaging. Analysis of the feedback reveals several vital insights.

Market Opportunities and Target Demographics: A significant majority (70%) of participants believed the innovative DHA and probiotic supplement presented substantial opportunities for capturing market share among the target demographic. Conversely, 30% expressed reservations regarding the product's market potential. This disparity suggests further market research to identify specific customer segments and refine marketing strategies for increased market penetration.

Consumer Preference for Scent and Flavor: Sixty percent of participants preferred the innovative product's developed scent and flavor profiles, indicating a good alignment with the market's sensory expectations. However, 40% stated either a dislike or indifference towards the chosen scent and flavor. This indicates the need to further refine the product's sensory aspects or diversify flavor profiles to expand the appeal to a broader range of consumers. This could involve market testing with a more diverse sample to understand consumer preferences better.

Ease of Consumption and Convenience: A substantial 70% of the respondents reported the product's ease of consumption and convenient format. This highlights successful product design based on initial consumer feedback, addressing the limitations of existing products. However, 30% still considered the convenience aspects unsatisfactory, suggesting room for improvement. This might involve adjustments to the product's texture, size, or packaging to meet the requirements of consumers.

Packaging Design and Appeal: 60% of participants expressed satisfaction with the packaging's design and color palette, recognizing its visual appeal and suitability for the intended target audience. However, 40% deemed the packaging less appealing or lacking in credibility. The feedback on the packaging suggests enhancing the product's overall perception of quality and brand identity. This might require design modifications or the integration of additional cues of quality and trust.

The findings indicate significant market opportunity and generally favorable perceptions regarding the innovative supplement. The majority of respondents saw strong potential for sales growth. The positive response concerning ease of consumption and packaging's visual appeal is particularly encouraging. However, further refinement of certain aspects, such as flavor profiles, credibility of packaging for a wider age group, and further market research to address some reservations, is crucial to mitigate potential challenges and ensure success.

The findings from this section show a strong potential for success in the market for the developed innovative DHA and probiotic supplement. With the product's appealing format and generally favorable feedback, further strategic planning in marketing and distribution should allow for strong market entry and rapid growth. The research identifies areas needing further attention to expand consumer acceptance and build brand credibility, contributing to a sustainable business strategy.

Evaluation of DHA and Probiotic Dietary Supplement Innovation for Commercial Sales

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Current State, Challenges, and Needs: Before launching the new product, the research examined the current market landscape, challenges, and consumer demands. Existing DHA supplements are primarily available in liquid or capsule forms. The liquid form often has an unpleasant fishy smell, while the capsules are large and complex for children to swallow. Probiotic supplements, meanwhile, are available in various forms (tablets, powders, effervescent tablets) but often lack appealing taste and require large quantities, deterring children from consumption. The study highlighted the need for a novel, palatable DHA and probiotic combination targeting children.

Product and Packaging Innovation: The brainstorming sessions developed two key innovations: a novel product format and packaging. Participants suggested various product forms, including jelly, gummy, chewing gum, and ready-to-drink formats with diverse flavors and appealing colors. The consensus favored a jelly format due to its palatability and ease of consumption for children. The packaging was designed for easy use and portability, including individual sachets with colorful designs.

Product Testing and Market Analysis: The final product, "Geni Pro," was a jelly supplement in three fruit flavors (orange, strawberry, and blueberry). Product testing involved 15 participants, including company executives and consumers. The results indicated high satisfaction (93%) with the taste, smell, texture, and ease of consumption. A minor concern (7%) was raised regarding the slightly larger-than-ideal size for young children.

Market Opportunities and Commercialization Strategy: The study investigated the market opportunities for Geni Pro. The results showed strong potential, with 70% of participants believing the product could generate significant sales. Consumer preference for the chosen fruit flavors (60% positive) and convenient format (70% positive) supported this positive outlook. The appealing packaging design also received positive feedback (60%). The research also explored two primary sales channels: pharmacies and online platforms. Pharmacies provide trustworthiness, while online platforms offer convenience and broader reach.

Regulatory Compliance and Future Outlook: A crucial step in commercializing Geni Pro was obtaining regulatory approval from the Thailand Food and Drug Administration (FDA). The researchers detailed the process of preparing the necessary documentation, including product details, manufacturing processes, labeling information, and safety test results. Successfully obtaining FDA approval would ensure that the product met safety and quality standards and enhance consumer confidence.

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แบบ สบ.5/1 (อิเล็กทรอนิกส์)

ใบสำคัญการจดทะเบียนอาหาร

เลขสารบบอาหาร 13-1-15859-5-1352 ให้ไว้ ณ วันที่ 11 เมษายน 2567

ให้ไว้เพื่อแสดงว่าผลิตภัณฑ์อาหารตามข้อมูลนี้ได้จดทะเบียนไว้กับสำนักงานคณะกรรมการอาหารและยาหรือจังหวัด ตามระเบียบสำนักงานคณะกรรมการอาหารและยาว่าด้วยการดำเนินการเกี่ยวกับเลขสารบบอาหาร

☑ การผลิตเพื่อจำหน่าย ☐ การนำเข้าเพื่อจำหน่าย ☐ การผลิตเพื่อส่งออก (ไม่จำหน่ายในประเทศ)

ชื่ออาหารภาษาไทย	จีนี่ โปร (ผลิตภัณฑ์เสริมอาหาร)
ชื่ออาหารภาษาอังกฤษ	Geni Pro (Dietary Supplement Product)
ประเภทอาหาร	ผลิตภัณฑ์เสริมอาหาร
ชนิดอาหาร	ผลิตภัณฑ์เสริมอาหาร/วอย้อมยเลลีและผลิตภัณฑ์รอยัลเยลลี
ประกาศกระทรวงสาธารณสุข	(ฉบับที่ 293) พ.ศ. 2548, (ฉบับที่ 294) พ.ศ. 2548, (ฉบับที่ 309) พ.ศ. 2550, (ฉบับที่ 405) พ.ศ. 2562 และ (ฉบับที่ 411) พ.ศ. 2562
กรรมวิธีการผลิตหลัก	พาสเจอไรซ์ (Pasteurization) (อาหารที่มีความเป็นกรด/ปรับกรด,Non-Hermatic Sealing)

รายละเอียดผลิตภัณฑ์ (Product Profile) ตามเอกสารแนบท้ายใบสำคัญนี้
เมื่อได้รับเลขสารบบอาหารแล้ว ต้องมีเอกสารและหลักฐานที่เกี่ยวข้องกับผลิตภัณฑ์ อย่างน้อย ได้แก่ สูตรส่วนประกอบ 100 % รายละเอียดกรรมวิธีการผลิต ชนิดภาชนะบรรจุ และกรณีสูตรส่วนประกอบมีการเติมสารสำคัญต้องจัดเตรียม Raw Material Specification ณ สถานที่ผลิตหรือสถานที่นำเข้า สำหรับการตรวจสอบของพนักงานเจ้าหน้าที่

ให้ไว้แก่

ผู้รับอนุญาตผลิตชื่อ บริษัท เซน ไบโอเทค จำกัด เลขที่ใบอนุญาตผลิต/เลขสถานที่ผลิต 13-1-15859
สถานที่ผลิตชื่อ บริษัท เซน ไบโอเทค จำกัด อยู่เลขที่ 55/1,55/3 ห้อง
ชั้น อาคาร/ตึก ตรอก/ซอย
ถนน หมู่ที่ 3 ตำบล/แขวง อำเภอ/เขต อำเภอกา
จังหวัด ปทุมธานี รหัสไปรษณีย์ 12130
โทรศัพท์ โทรศัพท์มือถือ โทรสาร
ไปรษณีย์อิเล็กทรอนิกส์ (E-mail address)
ผู้รับอนุญาตนำเข้าชื่อ เลขที่ใบอนุญาตนำเข้า
สถานที่นำเข้าชื่อ อยู่เลขที่ ห้อง
ชั้น อาคาร/ตึก ตรอก/ซอย

ตรวจสอบเอกสารอิเล็กทรอนิกส์ ตรวจสอบข้อมูลใบสำคัญ

พิมพ์จากเอกสารอิเล็กทรอนิกส์ต้นฉบับ
สำนักงานคณะกรรมการอาหารและยา กระทรวงสาธารณสุข

Figure 2. Food Registration Certificate for "Geni Pro" dietary supplement issued by the Thailand Food and Drug Administration

Conclusion and Discussion

In conclusion, this research investigated the development of innovative dietary supplements combining Docosahexaenoic Acid (DHA) and probiotics. The increasing prevalence of lifestyle-related diseases has fueled significant interest in dietary supplements offering multiple health benefits (Espitia et al., 2016). DHA, an omega-3 fatty acid, is well-known for its cognitive, cardiovascular, and anti-inflammatory benefits (Sarkar et al., 2016; Longoria-García et al., 2016), while probiotics support gut health and immune function (Hill et al., 2014; Ouwehand, 2015). The synergistic potential of combining these two components is promising, offering a comprehensive approach to health management (Sivamaruthi et al., 2018; Zamora-Pineda et al., 2022).

However, challenges exist in developing and commercializing such innovative supplements. Regulatory frameworks vary across regions, impacting product formulation, labeling, and marketing (Simone, 2019;

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Sanders et al., 2018). Ensuring probiotic strain safety, efficacy, and stability throughout the product's shelf life is crucial (Binda et al., 2020; Sarkar et al., 2016). Furthermore, the strong fishy odor of DHA presents a significant barrier to consumer acceptance, particularly for children. Existing DHA supplements often come in liquid or capsule forms, making them unappealing, particularly for children.

This research addressed these challenges through a multi-phased methodology combining qualitative and quantitative research methods. Focus groups and in-depth interviews with industry experts, retailers, and consumers guided product development. The iterative process resulted in creating "Geni Pro," a jelly-based supplement with three fruit flavors (orange, strawberry, and blueberry) designed to be palatable and convenient for children. The product's formulation considers the challenges of incorporating DHA and probiotics.

The commercialization strategy also considered consumer preferences, utilizing pharmacies and online platforms as primary sales channels. Regulatory compliance was ensured through successful registration with the Thailand Food and Drug Administration (FDA), highlighting the product's adherence to safety and quality standards.

This study contributes to the existing body of knowledge by providing a comprehensive approach to developing and commercializing innovative DHA and probiotic dietary supplements. Future research could focus on further elucidating the mechanisms underlying the synergistic effects of DHA and probiotics at a molecular level (Kim et al., 2019; Sarkar et al., 2016; Kechagia et al., 2013), conducting long-term studies on safety and efficacy in diverse populations, and exploring the potential benefits of these supplements in specific health conditions, such as metabolic syndrome, IBD, and neurodegenerative diseases (Kiousi et al., 2019; Keerthi, 2023). This research provides a model for developing and successfully commercializing innovative dietary supplements that effectively address consumer preferences and regulatory requirements.

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