CHAPTER I

INTRODUCTION

1.1 Background

Health supplements are products that provide nutritional content or have physiological effects to meet the nutritional needs of food and support overall health. These products may contain one or more ingredients such as vitamins, minerals, or compounds derived from both plants and non-plants, which can be combined[1]. Health supplements have become an important part of maintaining optimal body functions in today's world conditions. Changes in lifestyle, dietary habits, and increased exposure to pollution have driven people to rely more on health supplements[2].

Health supplements derived from herbal plants have been widely circulated in society because public interest in herbal medicines has increased. This increase is driven by the advance of medical science and the prevalence of modern medicines, which can sometimes cause strong and undesirable side effects.[3] Public awareness is increasing the potential of existing herbal medicines, both for main therapy, supportive therapy, and as a health supplement. According to the *World Health Organization* (WHO) report, herbal medicine plays an important role accounting about 80% of primary health care in developing countries and about 65% in developed countries[4]. Given the rising trust and demand of the public for herbal medicine products, numerous challenges remain, particularly in research and manufacturing, related to quality control and stability. The development of herbal medicine formulas for health supplements, including the use of excipients, is

[1] I Nengah B. S. et al., 'The Relationship Between Age and Knowledge and Behavior of Supplement Use in Students of Sepuluh November Institute of Technology', *Journal of Community Pharmacy* 7, no. 1 (27 August 2020): 1, https://doi.org/10.20473/jfk.v7i1.21657.

[2] Dewita Syahrul, 'High Nutritional Health Food Supplement from Chlorella and Catfish Oil', *JPHPI* 19, no. 3 (December 2016): 251–55, https://doi.org/10.17844/jphpi.2016.19.3.251.

[3] Muhammad Hafizh Pane, Ave Olivia Rahman, and Esa Indah Ayudia, 'Overview of the Use of Herbal Medicines in Indonesian Society and Its Interaction with Conventional Medicines in 2020', *Journal of Medical Study* 1, no. 1 (2021), https://doi.org/10.22437/joms.v1i1.14527.

[4] Moch Amrun Hidayat, 'Herbal Medicine: What Needs to Be Conveyed to Pharmacy Students and Medical Students?', *Educational Development* 3, no. 1 (June 2006): 141–47.

essential to establish reference points for further research[5,6]. The development of herbal medicine formulas for health supplements by developing excipients in formulas is essential to provide a reference for further research.

Herbal ingredients that have proven highly beneficial include olive oil and dates. These two natural ingredients have been extensively researched, both in vitro and in vivo, demonstrating their numerous health benefits. According to book 2022 by Anka Trajkovska, olive oil (Virgin Oil Extract) contains compounds known for their antioxidant and anti-inflammatory activities[7]. Similarly, dates play a significant role in improving health. Research conducted through literature reviews has highlighted the bioactive compounds in dates, which exhibit antioxidant, anti-inflammatory, antimicrobial, and anti-carcinogenic properties and support intestinal health[8]. Both of these herbs are also mentioned in the Qur'an, Surah An-Nahl, verse 11,

يُنۢبِتُ لَكُم بِهِ ٱلزَّرۡعَ وَٱلزَّيۡتُونَ وَٱلنَّخِيلَ وَٱلۡأَعۡنَـٰبَ وَمِن كُلِّ ٱلثَّمَرَٰتِۗ إِنَّ فِى ذَٰلِكَ لَـَٔايَةً لِّقَوۡمٍ يَتَفَكَّرُونَ ﴿١١﴾

Meaning: "*With it (rainwater) He grows for you various crops, olives, palm trees, grapesvine, and all kinds of fruits. Indeed, in such a thing there is indeed a sign (of Allah's greatness) for those who think."*

Olive oil and date extract can be formulated into an emulsion, offer many health benefits as a source of vitamins and minerals. Emulsions are preferred due to the contrasting polarity of their components. Olive oil, a vegetable oil, contains hydrocarbon compounds such as unsaturated fatty acids and exhibits non-polar properties[9]. In contrast, dates are rich in phenolic compounds, giving them polar

[5] Razieh Mirzaeian et al., 'The Role of Herbal Medicines in Health Care Quality and the Related Challenges', *Journal of Herbmed Pharmacology* 10, no. 2 (5 January 2021): 156–65, https://doi.org/10.34172/jhp.2021.17.

[6] Juntra Karbwang et al., 'Herbal Medicine Development: Methodologies, Challenges, and Issues', *Evidence-Based Complementary and Alternative Medicine* 2019 (9 October 2019): 1–2, https://doi.org/10.1155/2019/4935786.

[7] Anka Trajkovska Petkoska and Anita Trajkovska-Broach, 'Health Benefits of Extra Virgin Olive Oil', in *Olive Oil - New Perspectives and Applications*, ed. Muhammad Akram (IntechOpen, 2022), https://doi.org/10.5772/intechopen.96570.

[8] Raudhah Nurul Ainina, 'Dates and Their Uses for Health (Literature Review)' (Makassar, Hasanuddin University, 2022).

[9] Eko Naning Sofyanita, Arya Iswara, and Djoko Priyatno, 'Olive Oil as a Substitute for xylene in Histological Tissue Processing for Skin and Hepatology of Mice with Hematoxylin Eosin: A Comparative Study', *Medical Laboratory Network* 4, no. 2 (8 July 2022): 117–24, https://doi.org/10.31983/jlm.v4i2.8688.

characteristics[10]. These opposite characteristics make them well-suited for emulsion formulations. Emulsions are also effective in masking the unpleasant taste of olive oil. To ensure stability, factors such as sensory attributes, pH, viscosity, and overall stability must be carefully tested and optimized[11].

The stability of an emulsion is a critical factor in formulation, as emulsions tend to degrade over time. Emulsifiers play a key role in ensuring emulsion stability. combination of emulsifiers and co-emulsifiers, such as lecithin and pectin, is commonly used due to their complementary and synergistic properties. This combination helps optimize the interaction between water and oil phases, leading to the creation of a stable formulation[12].

Taking these factors into consideration, this study focuses on the optimization of lecithin and pectin as emulsifiers in health supplement emulsions made from date extracts and olive oil. The formulation process aims to enhance product quality through improved evaluation parameters and stability. As a result, this research has the potential to contribute the development of innovative and practical health supplement products for the pharmaceutical industry.

1.2 Problem Formulation

The problem addressed in this study is formulated as follows:

1. What are the optimal concentrations of lecithin and pectin to serve as the most stable emulsifiers and co-emulsifiers in the emulsion of olive oil and date extract preparations?
2. What are the results of the physical stability tests for the emulsion of olive oil and date palm extract?

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[10] Lu'lu Ulul Albab et al., 'Antibacterial Effects of Aquades Extract of Date Fruit (Phoenix dactylifera L.) Ajwa Variety Against Staphylococcus aureus In Vitro', *Journal of Integrated Health & Science* 2, no. 2 (September 30, 2020), https://doi.org/10.29313/jiks.v2i2.5769.

[11] Najma Annuria Fithri et al., 'Furosemide Self Nano Emulsifying Drug Delivery System (SNEDDS) Formulation Comprising of Capryol-90, Polysorbate-80, and Peg-400 with Simplex-Lattice-Design', *Science and Technology Indonesia* 2, no. 4 (3 October 2017): 85–88, https://doi.org/10.26554/sti.2017.2.4.85-88.

[12] Bianca Levie Tania et al., 'Sunscreen Cream Formulation of Noni Leaf Extract (Morinda Citrifolia L.) with Emulsifier Combination of Tween 80 and Lecithin', *Indonesian Journal of Pharmacy and Pharmaceutical Sciences* 9, no. 3 (9 December 2022): 262–71, https://doi.org/10.20473/jfiki.v9i32022.262-271.

1.3 Research Objectives

The objectives of this study are:

1. To determine the optimal concentrations of lecithin as emulsifier and pectin as co-emulsifier in emulsion of olive oil and ajwa date extract preparations.
2. To evaluate the physical stability tests for emulsion of olive oil and ajwa date extract emulsion preparations.

1.4 Research Benefits

1. Theoretical Benefits

The findings of this study can be a reference for future research on the in vivo or in vitro effectiveness of stabilized olive oil and ajwa date extract emulsion preparations as health supplements.

2. Practical Benefits

The results of this study are expected to contribute to science and increase readers insight, especially by informing the public about the stable formulation of olive oil and ajwa date extract emulsions.

1.5 Originality of Research

Research on the formulation and evaluation of emulsion preparations using olive oil and ajwa date extract, with lecithin and pectin as emulsifier agent, has been conducted by several researchers, as summarized in Table 1 below:

Table 1. Originality of Research

Research Title	Research Methods	Variable	Result	Research Differences
Formulation and Evaluation of Combined Emulsion of Tomato Extract and Olive Oil with Variations of Sponge 80 and Tween 80 as Emulgator[13]	Experimental	**Dependent:** Characterization of evaluation of a combination emulsion of tomato extract and olive oil **Independent:** Tomato extract and olive oil	Tomato fruit extracts (Lycopersicum esculentum) and olive oil (Olea europaea) can be formulated into stable and qualified emulsion preparations. In a 28-day room temperature storage test, formula II and formula III were qualified to be reviewed in terms of pH, viscosity, specific weight, homogenity, phase separation, emulsion type, odor, color, and taste. Formula I is not eligible to be reviewed from the phase separation evaluation.	**Dependent:** Physical quality and stability test results of olive oil and date extract emulsion **Independent:** Olive oil and date extract concentration
Date Palm Extract (Phoenix dactylifera) PEGylated Nano emulsion Development, Optimization, and Cytotoxicity Evaluation[14]	Experimental	**Dependent:** Physiochemical characteristics of nanoemulsion preparations **Independent:** Surfactant concentration (Tween 80) and oil concentration (Arachis oil)	PEGylated nanoemulsion formulations containing date palm extract (DPE) have appropriate physicochemical characteristics. The developed nanoemulsion has an optimal particle size, polydispersity index (PDI), and zeta potential, which are important indicators for the stability of the nanoemulsion. The amount of serum proteins attached to the surface of PEG-NE is relatively small, suggesting that this nanoemulsion has good stability in the biological environment.	**Dependent:** Physical quality and stability test results of olive oil and date extract emulsion **Independent:** Olive oil and date extract concentration
Understanding the different emulsification mechanisms of pectin:	Experimental	**Dependent:** Characteristics of stability and size of oil	Pectin from watermelon peel (WRP) has a higher emulsion capacity compared to citrus pectin (CP) and apple pectin	**Dependent:** Physical quality and stability test results of olive oil

[13] Vera Astuti, Ratnaningsih Dewi Astuti, and Cik Ayu, 'Tomato Extract (lycopersicum esculentum) and olive oil (olea europaea) with variations of Sponge 80 and Tween 80 as', 2020.

[14] Heba S. Elsewedy et al., 'Date Palm Extract (Phoenix Dactylifera) Encapsulated into Palm Oil Nanolipid Carrier for Prospective Antibacterial Influence', *Plants* 12, no. 21 (25 October 2023): 3670, https://doi.org/10.3390/plants12213670.

Research Title	Research Methods	Variable	Result	Research Differences
Comparison between watermelon rind and two commercial pectin sources[15]		droplets in o/w emulsions. **Independent:** Concentration and type of pectin.	(AP). This is due to the relatively high protein content in WRP, which serves as the surface active ingredient, and the presence of longer sugar chains that help stabilize oil droplets in the emulsion. Apple pectin (AP) has the lowest emulsion capacity, which is only related to its viscosity effect. Meanwhile, citrus pectin (CP) can form a better adsorption layer at the oil/water interface, but it cannot prevent flocculation and thickening at low pectin concentrations during storage in the refrigerator.	and date extract emulsion **Independent:** Olive oil and date extract concentration

[15] D.A. Mendez et al., 'Understanding the Different Emulsification Mechanisms of Pektin: Comparison between Watermelon Rind and Two Commercial Pektin Sources', *Food Hydrocolloids* 120 (November 2021): 106957, https://doi.org/10.1016/j.foodhyd.2021.106957.