

Formulation of VCO (Virgin Coconut Oil) Massage Oil with Red Ginger (Zingiber Officinale Var Rubrum) Combination as A Muscle Pain Relief

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Abstract—Traditional medicine used by people today, sometimes uses synthetic materials to make preparations, one of which is massage oil. This has long been an inseparable part of the Indonesian nation which is believed to provide benefits for health and beauty. For centuries in Indonesia, the term massage or urut has long been known. So that massage oil made from natural ingredients is widely in demand by the Indonesian people as a traditional medicine used for relaxation, relieving muscle pain, and relaxing muscles. Purpose of the study To find out how to make a VCO (Virgin Coconut Oil) massage oil formulation combined with red ginger (Zingiber Officinale Var Rubrum) as a muscle pain reliever. The research method is experimental by testing each formula with organoleptic, pH, homogeneity, and stability tests. The results of organoleptic testing of each Formula: f1 bright yellow color, has VCO and a little ginger, runny texture, f2 golden yellow color, has VCO and red ginger, runny texture, f3 golden yellow color, has VCO and red ginger odor, slippery texture. The pH value of f1 does not meet the pH standard while f2 and f3 meet the pH standard. Homogeneity testing of all formulas meets the standard. Stability testing of all formulas meets the stability standard.

Keywords: Massage Oil; VCO; Red Ginger; Muscle Pain; Traditional Medicine.

1. INTRODUCTION

Indonesia possesses a diverse and abundant natural resources, including plants with medicinal properties. This natural wealth has been utilized by communities by exploiting the potential available in their surroundings, one of which is through the use of plants as natural remedies for various diseases. The use of traditional medicine is generally passed down from generation to generation and is part of the ancestral traditions of the Indonesian people (Suwarni et al., 2022). Traditional medicine ingredients generally come from various parts of plants growing in Indonesia, such as roots, leaves, fruit, flowers, tubers, and even bark. Indonesia possesses natural resources that can be utilized as basic ingredients for traditional medicine. Most of Indonesia's natural biological resources have potential as medicinal ingredients (Wibowo et al., 2024).

Traditional medicine is still widely used in Indonesia and is practiced by people from various backgrounds, both in rural and urban areas (Wahyudi et al., 2024). The trend of using traditional medicine continues to increase as lifestyles shift towards natural concepts (Bareetseng, 2022). This is reflected in the increasing number of herbal products on the market. Furthermore, factors such as limited healthcare facilities, the high cost of modern medicines, and the risk of side effects from these drugs contribute to the problem (Ahmed et al., 2024). Chemicals, leading people to prefer traditional medicines, which are considered safer and have fewer harmful side effects (van Wyk & Prinsloo, 2020).

Traditional massage oils can now be developed using alternatives such as VCO (Virgin Coconut Oil), which is quite popular among the public today (Jawa La et al., 2025). VCO can also be used as a base for massage oils because it has benefits for softening the skin and contains essential fatty acids that play a role in maintaining moisture and slowing the signs of aging (Liputo & Suleman, 2024). VCO (Virgin Coconut Oil) is a modified coconut oil production process from coconut milk, resulting in pure coconut oil with free fatty acids and a low water content. It has a long shelf life of more than 12 months, a clear color, and a distinctive aroma (Khairati, 2023).

In the manufacture of massage oil, the use of a single plant species can now be expanded by combining several other plant species to achieve optimal health benefits (Chandorkar et al., 2021). One potential plant for this combination is Zingiber officinale var. Rubrum (red ginger), which is known for its various benefits, such as relieving colds, being used as a liniment, treating gout, and headaches, as well as having anti-inflammatory and analgesic effects (Nurhanifah et al., 2023). This plant contains non-volatile compounds in the form of oleoresins and volatile compounds such as essential oils in greater quantities than other types of ginger (Malinda Prabhath Madhusankha et al., 2023). This oleoresin oil plays a crucial role in providing a distinctive aroma and is a functional component in massage oil formulations, making red ginger ideal as an additional ingredient in massage oil production (Pramana et al., 2024).

Thus, referring to the previously explained background, the researcher intends to create a traditional medicinal preparation in the form of a VCO (Virgin Coconut Oil) massage oil formulation combined with red ginger (Zingiber officinale var rubrum) as a muscle pain reliever.

This research addresses the question of how to formulate a massage oil using Virgin Coconut Oil (VCO) combined with red ginger (Zingiber officinale Var. Rubrum) to function as a muscle pain reliever. The study aims to determine an effective formulation method that integrates both ingredients while maintaining their natural therapeutic properties. Through this objective, the research provides a structured approach to developing a traditional preparation that can be applied for health and wellness purposes. The formulation process is explored systematically so that the final product meets practical and functional criteria. At the same time, the study highlights the scientific and educational relevance of utilizing traditional ingredients in modern preparation techniques.

The research also brings several benefits for institutions, students, and the community. For educational institutions, it helps cultivate interest, motivation, and positive attitudes among students in developing preparations derived from natural materials. Students gain hands-on experience in processing traditional ingredients into high-quality products that offer real benefits. The activity encourages skill development and supports their role in promoting natural health solutions. For the community, the research provides additional insight into the use of VCO and red ginger as traditional remedies that can support muscle pain relief. Ultimately, the study strengthens the connection between scientific knowledge and traditional practices while offering practical contributions to public health.

2. RESEARCH METHODOLOGY

2.1 Research Procedure and Framework

This study was designed as a laboratory experiment focused on producing a massage oil formulated from Virgin Coconut Oil (VCO) combined with red ginger (*Zingiber officinale* Rosc. Var. *Rubrum*). The research involved the use of natural ingredients to create a preparation intended for muscle pain relief. As an experimental laboratory study, each step of the formulation process was carried out under controlled conditions to ensure accuracy. The approach allowed the researchers to observe the interactions between VCO and red ginger during the formulation. Through this method, the study aimed to produce a stable and effective massage oil preparation.

The research was conducted at the Pharmaceutical Laboratory of the Muhammadiyah Institute of Health Technology and Science in Sidrap. This facility provided the necessary equipment and environment to support the experimental procedures. The study took place over a one-month period, beginning on May 16 and concluding on June 16. Throughout this timeframe, all stages of preparation, observation, and evaluation were completed. The duration allowed sufficient time to refine the formulation and document the results comprehensively.

2.2 Equipment and Material Requirements

The tools used in this study included measuring cylinders, a stirring rod, Erlenmeyer flasks, massage oil containers, beakers, a funnel, flannel cloth, a digital scale, and an oven. Each tool played a specific role in supporting the preparation and extraction processes. These instruments ensured that the formulation steps were carried out accurately and consistently.

The main materials consisted of Virgin Coconut Oil (VCO) and red ginger (*Zingiber officinale* Var. *Rubrum*). Both ingredients were sourced from Enrekang Regency, an area known for its availability of high-quality natural products. These materials formed the core components of the massage oil formulation.

VCO was obtained by selecting mature, brown coconuts from the local area and processing them into pure oil. Red ginger was collected by harvesting its roots, which contain the active components needed for the formulation. The collected materials were then cleaned, prepared, and managed carefully before use. This process ensured that all ingredients met the quality requirements for experimental laboratory work.

2.3 Making Red Ginger Simple Powder

The preparation of simple red ginger powder begins with selecting fresh red ginger (*Zingiber officinale* Rosc. var. *Rubrum*) sourced from plantations in Enrekang Regency. The rhizomes are harvested at around ten months of age and then sorted based on size and shape to ensure uniformity. Only rhizomes free from physical damage or signs of microbial infection are chosen for processing. Once selected, the rhizomes are washed three times under running water to remove any remaining soil or impurities. After washing, the ginger is drained until no water droplets remain, ensuring it is ready for the next stage of preparation.

The clean rhizomes are then sliced evenly to a thickness of approximately 0.3 mm to facilitate a faster and more uniform drying process. These slices are placed in an oven and dried for 300 minutes at controlled temperatures of 90°C, 100°C, 110°C, and 120°C. The drying stage helps reduce moisture content and preserve the active compounds contained in the ginger. Once the drying process is complete, the ginger slices transform into a simple dried material suitable for further use. At this point, the dried red ginger powder is ready for application in the formulation process (Nasution et al., 2023).

2.4 Making VCO (virgin coconut oil) using the soaking method

The preparation of Virgin Coconut Oil (VCO) begins by assembling all required tools and ingredients, followed by grating the coconut and mixing it with water before squeezing and straining it to obtain fresh coconut milk. The coconut milk is then placed into a plastic bag, sealed with a rubber band, and left to stand for one to two hours. During this resting period, two distinct layers gradually form, with thick coconut cream on the top and water settling at the bottom. After separation occurs, a small hole is made in one corner of the plastic bag to drain the water layer carefully. Once the water is completely removed, the thick coconut milk is poured into a clean, covered container and allowed to ferment for approximately twenty-four hours.

As the fermentation progresses, bubbles begin to appear on the surface, signaling the start of the natural oil separation process. The mixture then develops three layers consisting of clear oil on top, coconut milk dregs known as *blondo* in the middle, and water at the bottom. The resulting pure VCO is transparent and differs from cooked coconut

oil, which typically becomes cloudy. To collect the oil, a clean bottle is prepared and fitted with a funnel lined with a cloth or tissue filter. The separated oil is gently scooped and poured through the filter, allowing it to drip slowly into the bottle. Once collected, the VCO is ready for use (Ayuningtyas & Broto, 2023).

2.5 Work Procedures and Testing

The work procedure began with the formulation of the massage oil, starting by preparing all tools and materials needed for the process. Dried red ginger (*Zingiber officinale* Var. *Rubrum*) obtained from the oven was weighed according to the predetermined formula, and 500 ml of Virgin Coconut Oil (VCO) was measured. Both ingredients were combined in an Erlenmeyer flask to ensure accurate mixing. The mixture was then heated in a water bath for three cycles of eight hours at temperatures between 60 and 100 degrees Celsius. After heating, the preparation was allowed to cool before being filtered using flannel to separate the oil from the remaining herbal material.

Once filtered, the resulting oil was transferred into clean bottles or containers and sealed tightly to maintain quality. Each container was labeled to ensure proper identification of the formula. The final product represented the formulated VCO massage oil combined with red ginger as a muscle pain reliever. This procedure ensured that all steps were carried out systematically to produce a consistent and usable preparation. The formulation was then ready for further testing stages.

The testing phase began with organoleptic evaluation, which involved observing the color, shape, and aroma of the massage oil. This test helped determine whether the physical characteristics of the preparation were acceptable and aligned with expectations. The pH test followed, performed by immersing a digital pH meter into three different variations of the formula and comparing the results to normal skin pH values. These measurements ensured the product was safe for topical application. Together, these tests contributed to assessing the basic quality of the formulation.

Physical stability testing was then conducted by storing the massage oil at room temperature and observing changes weekly for four weeks through organoleptic evaluation, as suggested by (Pramana et al., 2024). This step assessed whether changes occurred in color, odor, or form over time. The final test, the homogeneity assessment, was carried out by placing several drops of the oil on a glass slide and covering it to observe the uniformity of the mixture. According to (Rahmawati et al., 2024), the preparation could be considered homogeneous if no bubbles or visible separation appeared. These combined testing methods ensured that the VCO and red ginger massage oil met quality, stability, and usability standards.

3. RESULT AND DISCUSSION

3.1 Results

The results of testing this massage oil formulation, made from VCO (Virgin Coconut Oil) and red ginger (*Zingiber Officinale* Var. *Rubrum*), include organoleptic physical properties, pH, stability, and homogeneity:

3.1.1 Organoleptic Testing

Table 1. Organoleptic test results

Formula	Organoleptic test results		
Massage oil	Color	smell	Texture
F1	Bright yellow	The characteristic smell of pure and slight coconut oil	Dilute
F2	Golden yellow	Distinctive smell of VCO and very slight smell of red ginger	Dilute
F3	Golden yellow	The distinctive smell of VCO and the distinctive smell of red ginger	Dilute

The results of organoleptic testing of the VCO (Virgin Coconut Oil) massage oil formulation combined with red ginger (*Zingiber Officinale* Var. *Rubrum*) as a muscle pain reliever, including color, odor, and texture, are shown in Table 2.

3.1.2 PH Testing

Table 2. Results of pH testing

Formulas	Results	Skin PH standards
F1	4.3	
F2	4.8	4.5-6.5
F3	5.2	(Ayuningtyas & Broto, 2023)

The results of pH testing conducted by researchers on the massage oil formulations of VCO (Virgin Coconut Oil) combined with red ginger (*Zingiber Officinale* Var. *Rubrum*) as a muscle pain reliever yielded varying results for each formula. Table 2 shows the average pH value for each massage oil formulation of VCO (Virgin Coconut Oil) combined with red ginger (*Zingiber Officinale* Var. *Rubrum*) as a muscle pain reliever.

3.1.3 Stability Testing

Table 3. stability testing

Waktu	Organoleptic stability test		
	F1	F2	F3
Week 1	Stable	Stable	Stable
Week 2	Stable	Stable	Stable
Week 3	Stable	Stable	Stable
Week 4	Stable	Stable	Stable

The results of stability testing conducted by researchers on a massage oil formulation using a combination of VCO (Virgin Coconut Oil) and red ginger (*Zingiber Officinale Var Rubrum*) as a muscle pain reliever. After four weeks of observation, organoleptic testing and observation, each formula was relatively stable and showed no changes. The results of the stability testing are shown in Table 3.

3.1.4 Homogeneity Testing

Table 4. Homogeneity test

Formulas	Results of the homogeneity test
F1	Meets standards
F2	Meets standards
F3	Meets standards

The homogeneity test was performed by placing 3 to 4 drops of the prepared massage oil formulation, VCO (Virgin Coconut Oil), and red ginger (*Zingiber Officinale Var Rubrum*), as a muscle pain reliever, onto a glass slide and then covering it. After testing to determine whether the mixture was homogeneous, bubbles, lumps, and sediment were observed on the slide. The results of the homogeneity test can be seen in Table 4.

3.2 Discussion

Based on the organoleptic test results of three concentration variations, the VCO (Virgin Coconut Oil) massage oil formulation combined with red ginger (*Zingiber Officinale Var. Rubrum*) as a muscle pain reliever can be seen in F1, which is bright yellow, while F2 and F3 show a more golden yellow color. This is because F2 and F3 use more red ginger than F1. The yellow color of this massage oil is produced by the active ingredients of red ginger (*Zingiber officinale var. Rubrum*), which contains bioactive compounds such as β -carotene, terpenoids, essential oils, and polyphenols that dissolve in oil and give the extract or oil mixture a yellow color (Pramana et al., 2024).

While the odor produced by each formula differs, F1 has the distinctive odor of VCO (Virgin Coconut Oil) with a hint of red ginger, which gives a fresh and natural impression. F2 and F3 have the distinctive aroma of VCO (Virgin Coconut Oil) with a stronger red ginger aroma. F2 has a less pronounced red ginger aroma, while F3 has a stronger red ginger aroma. This is because F3 contains more red ginger. The F3 formula is expected to provide a better relaxation effect than F1 and F2.

The consistency of the VCO (Virgin Coconut Oil) massage oil formulation, which is combined with red ginger (*Zingiber Officinale Var Rubrum*), is used as a muscle pain reliever. All three formulas have a slippery consistency, indicating that they are easy to apply and absorb into the skin. This slippery consistency also increases comfort when used as a massage oil.

According to the National Standardization Agency (BSN), organoleptic or sensory testing is an assessment method that involves the five human senses as the primary instrument for evaluating product quality. The factors assessed include color, aroma, consistency or texture, and a number of other factors relevant to determining product quality (Cahya Wirdayanti Haruna et al., 2025).

The findings of this study align with research conducted by (Pramana et al., 2024), which also formulated a massage oil or rub from ginger using organoleptic testing, which also showed similar results in the formulation. According to (Arfaj & Llamas, 2023), pH testing is conducted to ensure that the product or sample being prepared is safe and does not cause skin irritation when used. This is because excessive acidity or alkalinity in the pH of the preparation will significantly irritate the skin (Hwang et al., 2022).

The ideal pH standard for products applied to human skin is between 4.5 and 6.5 (Pramana et al., 2024). The pH test showed that the VCO (Virgin Coconut Oil) massage oil formulation combined with red ginger (*Zingiber Officinale Var Rubrum*) for muscle pain relief showed significant results in three formula variations with different pH values: F3 with a pH of 5.8, F2 with a pH of 4.8, and F1 with a pH of 4.3. Formula 1 has a pH of 4.3, which is below the minimum standard for human skin pH. This low pH can potentially cause irritation if used for too long. Formula 2 and 3 have pH values that are within the standard human skin pH range. Formula 3 exhibits a higher pH.

Higher than F1 and F2, which could mean that F3 has components that are better at maintaining the pH balance of human skin. According to research (Khan et al., 2024), there is a neutralization process originating from the "acid mantle." The skin's response reaches its maximum point around five minutes after application, then gradually begins to decline. Almost all types of preparations, especially those applied to the skin, such as cosmetic products, are forced to return to a

pH closer to its physiological state by the "acid mantle." The skin's surface is returned to a pH closer to its physiological state, approximately one hour after application (Sehgal & Singh, 2022). Therefore, Formula 1 can be used, but it is recommended to rinse it off thoroughly after the massage oil's effects begin to wear off.

Organoleptic testing is considered successful if the testing process is carried out systematically and according to established procedures, involving trained panelists who are able to provide accurate assessments of sensory parameters such as color, aroma, taste, and texture. Furthermore, the test results must demonstrate a significant difference or sufficient level of preference for the tested samples, which can be statistically analyzed to ensure data validity. If these criteria are met, the organoleptic test can be considered successful, and the results can be used as a basis for decision-making regarding product quality. The results of this pH test differ from previous research conducted by (Anggraini & Widjaya, 2025), in which each This homogeneity test aligns with research conducted by (Anggraini & Widjaya, 2025), which also tested the homogeneity of ginger massage oil formulations. This is consistent because each formula used the same solvent. Homogeneity testing is considered successful if the tested sample shows an even distribution of substances or components without clumping, sedimentation, or phase transfer, thus meeting the homogeneity standards set in the testing procedure.

The results of research conducted by (Hongratanaworakit et al., 2018) served as the basis for the physical stability testing in this study. The use of massage oil for three weeks maintained its physical stability, as evidenced by the absence of changes in the dosage form, color, and odor (Anggraini & Widjaya, 2025). One method for assessing physical stability is through organoleptic testing, which involves observing the massage oil preparation using the five senses. The characteristics assessed include the appearance, color, odor, and appearance of the preparation. The results of the stability test on the VCO (Virgin Coconut Oil) massage oil formulation combined with red ginger (*Zingiber Officinale* Var *Rubrum*) as a muscle pain reliever showed almost no changes in color, odor, or appearance and were considered physically stable.

The results of this study align with research conducted by (Pramana et al., 2024), who tested massage oil formulations with a four-week stability test. Each formula was relatively stable. Stability testing is considered successful if the product maintains consistent physical and organoleptic properties and meets quality standards throughout the specified stability test period, without significant changes that could affect its organoleptic or physical properties. Massage oil containing VCO and red ginger is beneficial for relieving muscle pain due to its anti-inflammatory and analgesic properties.

4. CONCLUSION

The results of this study indicate that a massage oil formulation combining Virgin Coconut Oil (VCO) with red ginger can be successfully produced and meets the expected quality criteria. Among the variations tested, Formula 3 (F3) emerged as the most optimal formulation. This formula produced a yellow-colored preparation with a measured pH of 5.4, which falls within the acceptable range for topical products and remains compatible with normal skin conditions. In addition, the homogeneity test showed that F3 displayed a uniform mixture, indicating that all components were well-integrated without visible separation or air bubbles. Stability observations conducted over a four-week storage period also confirmed that F3 maintained consistent physical characteristics, including appearance, odor, and texture, indicating strong stability throughout the evaluation process. Overall, these findings support that the combination of VCO and red ginger can produce a practical, stable, and safe massage oil formulation, with F3 demonstrating the best performance across all testing parameters.

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