Effectiveness of utilizing VCO oil and castor oil on natural creams for dry skin treatment due to environmental factors

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Abstract. Rapid industrial development can lead to environmental pollution. Bad air environment will cause damage to the skin such as dry skin. Indonesia has biological natural resources such as coconut trees and castor oil plants. Both oils can be used to make skin care due to the impact of heat by the environment. This study aims to determine the effectiveness of using VCO oil from coconut and castor oil in natural creams to treat dry skin. The method of this research is comparing composition variation of VCO oil and castor oil to make natural creams. The experiment was carried out on 10 dry skins of student volunteers. Research using designated randomized group is divided into two groups. Group A is the experimental unit for treatment and group B is a comparison group, with subjects are selected by purposive sampling from a particular population. This study used an 8-experimental design of the initial test until the final test in both groups. The results showed that \( t_{\text{count}} > t_{\text{table}} \) is 2.441 > 1.330 so \( H_0 \) is rejected and \( H_1 \) is accepted at the 0.05 significance level. There are differences in the use of pure coconut oil cream (VCO) and castor oil cream to reduce the smoothness of the skin.

1. Introduction
Indonesia is located on the equator and is a tropical country that gets sunlight for a long time from morning to evening. Sunlight is ultraviolet light which has many benefits for life such as photosynthesis for green plants and the formation of bone organs for humans and animals. But in addition to being beneficial, there is also an adverse sunlight, especially ultraviolet B and UV C during the day [1]. The rays arrive at the earth because the filtration system in the atmospheric layer is no longer effective due to air pollution resulting in depletion of the ozone layer. UV B and C sunlight can interfere with skin health.

Coconut (Cocos nucifera) is a plantation plant in the form of a straight stem tree from Palmae's family. Minister of Agriculture Regulation (Permentan) No. 511 of 2006 and No. 3599 of 2009 concerning plantation-assisted commodities. there are 127 commodities, but the priority of handling is focused on 15 strategic commodities that are nationally superior, namely rubber, oil palm, coconut, cocoa, coffee, pepper, cashew, tea, clove, jatropha, candle nut, sugar cane, cotton, tobacco, and patchouli [2]. Aside from being one of the strategic commodities, coconut plants have many benefits ranging from roots, stems, leaves, fruits, to their midribs. In 1996 the area of coconut plantation in the world reached 11 million ha and 93% was in the Asia Pacific region. Indonesia is a country that has the largest area of coconut plantation plantations in the world, reaching 3.7 million ha [1].
Skin damage can also be caused by exposure to dust and air pollution. Given that in urban areas such as the city of Jakarta, industry and transportation have grown, all of which emit exhaust gas and endanger the health of the environment. In the era of industrialization, many chemical products are used by the public to help with their lives. Like transportation equipment that is so widely used by urban communities, industrial stands, household appliances. Industrial products that use high technology use energy and emit exhaust gas that pollutes the environment such as carbon dioxide [3]. CO2 is abundant on earth which has an impact on global warming.

Dry skin is a condition of the skin that experiences hydration. The tendency of the skin to become drier generally occurs with increasing age, because of the reduction of certain amino acids and free fatty acids in the skin layer [1]. skin disorders such as dry skin can also be caused by environmental factors, such as air pollution. air pollution occurs a lot in a very crowded urban environment and the industry develops.

Rapid industrial development can lead to environmental pollution. bad air environment will cause damage to the skin such as dry skin. Indonesia has biological natural resources such as coconut trees and castor oil plants [3]. Both oils can be used to make skin care due to the impact of heat by the environment [4]. This study aims to determine the effectiveness of using VCO oil from coconut and castor oil in natural creams to treat dry skin.

Virgin Coconut Oil (VCO) is an authentic Indonesian processed product which is widely used to improve public health. VCO contains 92% saturated fatty acids consisting of 48% - 53% lauric acid (C12), 1.5 - 2.5% oleic acid and other fatty acids such as 8% caprylic acid (C: 8) and 7% capric acid (C: 10) [5]. The content of fatty acids (especially lauric and oleic acid) in VCO, which softens the skin and the availability of abundant VCO in Indonesia makes it potential to be developed as a carrier for drug preparations, including penetration enhancement [2]. Besides that, VCO is effective and safe to use as a moisturizer on the skin so that it can improve skin hydration, and accelerate healing in the skin [6].

OF the total 28,000 species of medicinal plants in Indonesia, 1,845 have been identified as drug-like properties, and there are 283 active species explored by the compounds [7]. Some types of plants can be processed in advance to produce oil with a distinctive aroma and can be used directly or by derivative products [7]. This oil is called essential oil which is currently in the spotlight of the body care industry because it is not only able to nourish the skin well, but also ultrasonic, fast and easily absorbed.

Market demand for essential oils both domestically and abroad is increasing. In accordance with export data from the Ministry of Industry of the Republic of Indonesia, the export of coconut has a trend of 18.65% while exports of essential oils (essential oil of lemon grass, citronella, nutmeg, cinnamon, ginger) have 10.98% trend. Domestic food, pharmaceutical and cosmetics industries are markets for essential oils or essential oil derivatives. Essential oil is needed as a raw material for the cosmetics industry, body care products, health and food [8].

In the processing of ordinary coconut oil or cooking oil, traditionally produced coconut oil is of poor quality. This is characterized by high levels of water and free fatty acids in coconut oil. Instead the color is slightly browned so it quickly becomes rancid. The shelf life is not long, only about two months. Therefore, an evaluation was made to improve the coconut oil processing technique needed by coconut oil with a better improvement than the previous method. Coconut oil produced has a low moisture content and free fatty acid, clear, and contains fragrant. The shelf life is longer; it can be more than 12 months [4].

Pure coconut oil is a processed coconut product that is free from trans fatty acid (TFA) or trans-fatty acids. This trans fatty acid can occur due to the hydrogenation process [3]. In order not to undergo the hydrogenation process, the extraction of coconut oil is carried out by cold process [3]. For example, by fermentation, fishing, centrifugation, controlled heating, drying the grated coconut quickly and more.

The problem is, the highest VCO contains acidic caproicid of about 0.5%. Even short chain fatty acids are often not found because the raw material is not good or is lost during the extraction process. Therefore, although VCO can function as an antibacterial, the production and storage process is absolutely hygienic [2]. If not, instead of recovering, consumption of VCO contaminated with pathogenic bacteria such as E. coli causes stomach pain or diarrhea.
One important thing that needs to be reminded is that the ability of fatty acids and monoglycerides as antibacterial and anti-protozoa and fungal bacteria cannot last long. Its activity can decrease dramatically to 59% in just 1 day. To anticipate this, consumption of VCO must be done in a disciplined and regular manner with the right dose. As with the consumption of antibiotics and other drugs, the right dose of VCO consumption will determine its effectiveness as an antibacterial.

The efficacy of the VCO does not stop there. VCO can also treat vaginal candidiasis or vaginal discharge. Hery Winarsi, researcher from the Faculty of Biology at Jenderal Soedirman University, Purwokerto, Central Java [1], proved it through clinical trials in 30 women with vaginal discharge [9]. Winarsi provides zinc-enriched VCO to patients for 2 months. Ten people consume at a dose of 1 tablespoon; 10 people, 2 tablespoons per day. The rest consume only VCO, a dose of 2 tablespoons per day. As a result, VCO plus zinc (Zn) is effective in suppressing the growth of leucorrhoea-causing bacteria such as Streptococcus, Klebsiella, and Escherichia coli. Their growth can be suppressed respectively 53.6%, 76.2% and 47.2%. The decrease in bacterial growth was also followed by a decrease in vaginal secretion pH, from 6 to 5.1 [10].

Castor oil is oil obtained from the extraction of castor plant seeds. This oil is very rich in anti-oxidants and is able to solve various kinds of skin and hair problems. Castor oil has long been known as a raw material in various industries, especially the pharmaceutical and cosmetic industries. Castor oil has a high content of unsaturated fatty acids, namely ricinoleic fatty acids, which can reach 80-90%. Naturally ricinoleate is in the form of triglycerides (glycerides) with three main functional groups that can be transformed into various other more useful compounds [10].

This is because the chemicals contained in jatropha oil include alkaloids, flavonoids, glycosides, saponins, steroids / triterpenoids, compounds that are thought to have antibacterial activity are flavonoids and steroids / triterpenoids [10]. Antimicrobial compounds are biological or chemical compounds that can expand growth or microbial activity. Therefore, from the results of the observation of the total plate test the more concentration of jatropha oil, the more the absence of contamination.

Castor oil and VCO oil can be used as active ingredients in cream preparations. Cream preparation has the advantage of absorbing active substances in the skin [11]. Lotions, creams, body butters and moisturisers are all emulsions and are made the same way with mostly the same ingredients. Lotions and moisturisers tend to be more fluid than creams or body butters so may contain less oils, less emulsifier and less thickener [12,13]. Moisturisers and creams are usually used on the face and special ingredients called actives are more likely to be included. Also less concentrated oils are used. A common complaint of non-water containing products, such as body butters and balms are they are greasy, heavy and can be grainy [14]. These complaints can be solved by creating an emulsion. Emulsions allow oils and butters to be applied to the skin in an aesthetically pleasing fashion and offers the formulator a great degree of formulation flexibility and easy modification of characteristics such as viscosity, feel and appearance. Emulsions allow otherwise incompatible ingredients, such as oils, glycerine and actives to be brought together in the same product [9].

2. Method
The method of this research is an experiment that is looking for the right comparison to make natural creams from each VCO oil and castor oil. The experiment was carried out on 10 dry skins of student volunteers. Research using randomized group only design is divided into two groups. Group A is the experimental unit for treatment and group B is a comparison group, subjects are selected by purposive sampling from a particular population. This study used an 8-experimental design of the initial test until the final test in both groups.

The sampling technique is done by purposive sampling which is a feasible sample. This measurement is limited only to the moisture of dry skin and data collection is done before and after treatment. Samples selected according to criteria:

- Mature women aged 35-45 years
- Having dry or normal dry skin type
- Not in the care of a beautician
- Domiciled in the street of Pemuda, Rawamangun East Jakarta

The samples taken were 10 facial skins for women having criteria which have been set. 10 samples were divided into 2 groups with 5 samples each. The division of groups is determined randomly. Group A consisted of 5 facial skins for women, who were treated using natural VCO oil and group B creams consisting of 5 skins of women hand treated with natural control creams, namely natural olive oil cream [15].

The process of making natural creams begins by weighing the ingredients that will be used in making natural creams. The basic formula used is the cream preparation [6] divided into two parts, namely the oil group and water group. Then these two phases are each heated and then mixed and stirred until homogeneous.

| Material       | Cream of VCO (%) | Cream of control (olive oil) (%) |
|----------------|------------------|---------------------------------|
| Glicerine      | 2.5              | 2.5                             |
| VCO            | 6.5              | -                               |
| Olive oil      | -                | 6.5                             |
| Stearic acid   | 2.3              | 2.3                             |
| Cetyl alcohol  | 1.2              | 1.2                             |
| Propyl parabhen| 0.02             | 0.02                            |
| aquadest       | 82               | 82                              |
| Propiline glicol| 5               | 5                               |
| Metil parabhen | 0.2              | 0.2                             |

3. Result/findings and discussion

The results showed a score of increasing the smoothness of the hand skin using VCO natural cream with a total sample of 10 facial skins for women having a range between 42.00 to 48.24 with a total value of 228.36, an average value of 45.67, and standard deviation of 2.61, and variance amounting to 6.86.

The results showed a score of increased moisture content on facial skin using natural olive oil cream as a control with a sample size of 10 people having a range between 31.96 to 35.80 with a total value of 172.19, an average value of 34.43, and a standard deviation of 1.60, and variance amounting to 2.56 [16]. The results of calculating the normality of facial treatments using natural VCO creams and natural olive oil cream are as follows:

| Group | Lcount | Ltable | A  | n  | Test result | Conclusion               |
|-------|--------|--------|----|----|-------------|--------------------------|
| A: Reduction of facial skin wrinkles using natural virgin coconut oil (VCO) cream | 0.208  | 0.239  | 0.1| 10 | Lcount < Ltable, Ho accepted | The population is normally distributed |

On the table above, in the last column the highest price is obtained Lo = 0.208 with n = 10, and the significance rate α = 0.1 is obtained by Ltable = 0.239, it turns out Lo <Ltable is: 0.208 <0.239. So the null hypothesis is accepted, meaning that the sample taken comes from a population that is normally distributed. That is, the sample in the experimental group (which uses natural virgin coconut oil (VCO) cream) is a sample that comes from a population that is normally distributed.
Table 3. Data normality test results for wrinkle reduction on facial skin using olive oil

| Group | L_count | L_table | α  | n  | Test Result | Conclusion            |
|-------|---------|---------|----|----|-------------|-----------------------|
| B: Reduction of facial skin wrinkles using natural olive oil cream | 0.226   | 0.239   | 0.1| 10 | L_count < L_table, Ho accepted | The population is normally distributed |

From tabel above, in the last column the highest price is obtained Lo = 0.226 with n = 10, and a significant level α = 0.1 is obtained by L_table = 0.239, it turns out Lo < L_table is: 0.226 < 0.239. So that the null hypothesis is accepted, meaning that the sample taken comes from a population that is normally distributed.

Table 4. Data homogeneity test results for reducing wrinkles on the skin using natural cream of virgin coconut oil (VCO) and control creams.

| Group | F_count | F_table | α  | n  | Test Result | Conclusion          |
|-------|---------|---------|----|----|-------------|---------------------|
| A : Reduction of facial skin wrinkles using natural virgin coconut oil cream (VCO) | 0.34    | 2.44    | 0.1| 10 | F_count < F_table, Ho accepted | Population homogeneity |

Can be seen the table above shows the results of calculations, obtained F_count = 0.34. Located in the recipient region H0 which is 0.34 < 2.44 the results indicate that H0 is accepted and HI is rejected so it is concluded that the population group is homogeneous.

Table 5. Comparison of research results treatment by natural cream with VCO and olive oil.

| Variables               | Natural Cream VCO | Natural cream Castor oil as control |
|-------------------------|-------------------|-------------------------------------|
| Amount of samples       | 10                | 10                                  |
| Sum of data             | 12.50             | 4.30                                |
| Average                 | 2.50              | 0.86                                |
| Variance                | 0.130             | 0.023                               |
| Deviation standar       | 0.61              | 0.152                               |
| The highest of value    | 3.0               | 1.1                                 |
| The smallest of value   | 2.1               | 0.7                                 |

The data above shows that the average value of skin care results using virgin coconut oil cream is greater than the results of treatment using castor oil cream. It can also be seen that the highest value is the result of hand skin care using VCO cream compared to the average data using castor oil cream.
Calculation of hypothesis testing is done by using the T test. Based on the results of calculations using the T test obtained \( t_{\text{count}} > t_{\text{table}} \) i.e. \( 2.441 > 1.330 \) then \( H_0 \) is rejected and \( H_1 \) is accepted at the significance level of 0.1. So, there is the effect of using natural virgin coconut oil (VCO) cream to reduce wrinkles on facial skin. According to the results of calculations and comparisons of 20 samples treated differently, the results were different. Not only seen through the figures obtained from the calculation results in the table, it can be seen from the graph also proving that virgin coconut oil (VCO) has more influence in some treatment. Although both have an effect on reducing facial skin wrinkles, it seems clearer that changes occur in samples that use experimental oil. Variation in the results of wrinkle reduction between one sample and another, both for samples using the same material or even those that indicate the same, if each sample has a different skin condition that requires specific skin care (according to the condition of the skin).

In this study, the concentration of VCO in the cream formula was 40%. Previous research shows that the cream base containing 40% VCO provides good consistency, physical stability with the best increase in drug permeation rate which is 3.5 times greater than cream without VCO [3]. VCO penetration enhancing power was tested and compared with 10% dimethyl sulfoxide (DMSO) power which has been shown to increase drug penetration rates [7]. The amount of VCO greater than DMSO is equivalent to the lauric acid content of about 20% of the total weight of the cream because VCO contains ± 50% lauric acid. In cream with DMSO, 30% of liquid paraffin is added to the oil phase in the cream so that the amount is equal to the cream oil phase containing VCO [15].

| No. | Parameter          | amount          |
|-----|--------------------|-----------------|
| 1   | Protein            | -               |
| 2   | Water quantity     | 0.035 gram      |
| 3   | Oil                | 98.255 gram     |
| 4   | Vitamine E         | 0.095 mgram     |
| 5   | Lauric Acid        | 48.225 mgram    |
| 6   | Miristate Acid     | 13.735 mgram    |
| 7   | Palmitate Acid     | 7.925 mgram     |
| 8   | Caprilat Acid      | 7.715 mgram     |
Because of the high content of vitamin E, VCO is very useful for moisturizing the skin. The benefits of VCO as a substitute for skin moisturizer to get smooth skin reduce wrinkles without touching chemicals that often cause problems for the skin later on. VCO itself is one of the best oils for skin care because it helps maintain skin elasticity. Skin elasticity is very important so that the skin looks youthful. Vitamin E and its antioxidants will not only moisturize the skin but dispel fine wrinkles prematurely [1].

Similarly, olive oil is fat or oil obtained from the grinding of olives. Oil derived from traditional plants in the Mediterranean region contains fat, vitamin E, antioxidants, and vitamin K. Olive oil also contains iron, calcium, and potassium, but the levels are very little. The nutritional content is so varied, so olive oil is used for skin care so smooth and reduce wrinkles [16].

This indicates if based on the results of research, virgin coconut oil (VCO) and castor oil used together have an influence on the reduction of wrinkles on the skin of the face and facial skin brighter. However, it seems that the effect of reducing wrinkles on the facial skin is greater by using virgin coconut oil (VCO). It is also based on research data which is shown from the greater number of average values between judges given to the experimental group sample namely pure coconut oil compared to the control group namely castor oil.

Penetrating enhancing compounds such as DMSO work to modify (relax) the composition of the lipid layer on the skin cell membrane so that it becomes more permissible [17]. Meanwhile VCO is thought to be able to act as a penetration enhancer through a different mechanism, namely through increased skin hydration or through the help of short chain fatty acids that easily cross the skin membrane [16,18]. The presence of penetration enhancers in addition to increasing the amount and rate of penetrating substances is also thought to affect the mechanism of the penetration process [16].

Utilization of Virgin Coconut Oil (VCO) in semi-solid preparations is possible because it has a number of good properties to the skin which are emollient and moisturizer. This makes the skin soft and moist so that it can reduce resistance diffusion [15]. Furthermore, short and medium chain fatty acids such as lauric acid and oleic acid are easily absorbed through the skin so as to increase the penetration rate of the active substance from VCO-based cream preparations [12,13]. Increasing the rate of penetration of the drug by the good properties of the oil content in the VCO will increase the therapeutic effect and accelerate healing [18].

Castor oil is a vegetable oil obtained from the extraction of Ricinus communis seeds. In the pharmaceutical field it is also known as castor oil or castor oil. This castor oil is versatile and has a physically distinctive character. At room temperature castor oil is liquid and remains stable at low temperatures and very high temperatures [18]. Castor oil is produced naturally and is a triglyceride acid ricinoleate. This castor oil is also the main source of sebacic acid, a dicarboxylic acid which contains 90%. The use of castor oil and its derivatives is very wide in various industries: soap, lubricants, brake fluid and hydraulics, paints, dyes, cold-resistant plastics, coatings, ink, night and polish, nylon, pharmaceuticals (1% of total world products), and perfume. Ricin poison is a by-product of castor oil processing. As a pharmaceutical ingredient, castor oil is used to neutralize the feeling of bloating (constipation) and stimulate vomiting. The high consumption in this oil in women who are ready to give birth can induce labor [13].

VCO contains of lauric acid and ricinoleic acid that perform to smooth and to moisturize the skin. Castor oil has ricinoleic acid that serves to protect the skin. Therefore, both of the oil are suitable to be the raw material for liquid soap making. This study aimed were to produce a liquid soap, to determine the exact concentration of VCO and castor oil for liquid soap and to find out the effect of VCO and Castor Oil concentrations to the characteristics of liquid soap [19]. The method used was laboratory experimental method with descriptive analysis. The treatments in this study were A = concentrations of VCO 100 %, B = concentrations of VCO 80 % and castor oil 20 %, C = concentrations of VCO 50 % and castor oil 50 %, D = concentrations of VCO 20 % and castor oil 80 %, [17] and E = concentrations of castor oil 100 %, from 200 gram soap base. The parameter observed for liquid soap included chemical properties, physical properties of soap, and organoleptic test. The result shows that all treatments complies the requirement SNI 06-4085-1996. The formula of liquid soap with treatment B was revealed as the best product with 0.01 % of total alkali content, pH value of 9.16, specific gravity 1.06, and total plate count.
5 colonies/g. This technology process of natural liquid soap production with the VCO and castor oil could be developed and applied in industrial scale.

4. Conclusion
There are differences in the use of pure coconut oil cream (VCO) and castor oil cream to reduce the smoothness of the skin; since in the results showed that $t_{\text{count}} > t_{\text{table}}$ is 2.441 > 1.330 so $H_0$ is rejected and $H_1$ is accepted at the 0.05 significance level.

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