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The Effect of Essential Oil Types on The Physical Characteristics and Consumer Preference Level of Antiaging Body Lotion that Contain NLC-Coenzyme Q10

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ABSTRACT

Lavender oil and lime oil contain linalool which has a relaxing effect. This oil has potential as a fragrance in antiaging body lotion products containing Coenzyme Q10 (CoQ10) in the Nanostructured Lipid Carriers System (NLC). This study aimed to analyzed the physical characteristics and consumer preference level for anti aging body lotion containing NLC-CoQ10. NLC-CoQ10 was prepared using the High Shear Homogenization method. For F1 (Formula 1), NLC-CoQ10 is mixed with a gel base and lavender oil. For F2 (Formula 2), the type of essential oil added is lime oil. These two forms when compared with F0 (Formula 0 = formula without essential oils). The physical properties observed included organoleptic, pH, homogeneity, spreadability, and viscosity. Organoleptic test and homogeneity were analyzed descriptively. While the pH, spreadability, and viscosity were analyzed using One Way Anova. In the preference level test, the aspect that is assessed is aroma. This test was analyzed statistically using the Univariate method. Based on the physical characteristic test, it is known that the three formulas have the same color, consistency, and homogeneity. The difference between the three formulas lies in their aroma. F0 is unscented; F1 has a lavender scent; F2 has a lime scent. The viscosity of the three formulas is also different but does not affect the spreadability value. Based on the aroma preference level test, it is known that F2 has the highest value. The type of essential oil affects the aroma and level of preference of the panelists. The most preferred formula is a formula containing lime oil.

Keyword: Anti-aging; Body Lotion; Koenzim Q10; Lavender Oil; Lime Oil

ABSTRAK

Minyak lavender dan minyak jeruk nipis mengandung linalool yang memiliki efek relaksasi. Minyak ini memiliki potensi yang baik sebagai pengharum pada produk antiaging body lotion yang mengandung Koenzim Q10 (KoQ10) dalam sistem Nanostructured Lipid Carriers (NLC). Tujuan penelitian ini untuk menganalisis karakteristik fisik dan tingkat kesukaan konsumen terhadap antiaging body lotion yang mengandung NLC-CoQ10. NLC-CoQ10 dibuat menggunakan metode High Shear Homogenization. Untuk F1 (Formula 1), NLC-CoQ10 dicampur dengan basis gel dan minyak lavender. Untuk F2 (Formula 2), jenis minyak atsiri yang ditambahkan adalah minyak jeruk nipis. Kedua formula ini juga dibandingkan dengan F0 (Formula 0 = formula tanpa minyak atsiri). Sifat fisik yang diamati meliputi organoleptik, pH, homogenitas, daya sebar, dan viskositas. Uji organoleptik dan homogenitas dianalisis secara deskriptif. Sedangkan pH, daya sebar, dan viskositas dianalisis menggunakan One Way Anova. Pada uji tingkat kesukaan, aspek yang dinilai adalah aroma. Uji ini dianalisis secara statistik menggunakan metode Univariate. Berdasarkan uji karakteristik fisik diketahui bahwa ketiga formula memiliki warna, konsistensi, dan homogenitas yang sama. Perbedaan ketiga formula tersebut terletak pada aromanya. F0 tidak beraroma; F1 memiliki aroma lavender; F2 memiliki aroma jeruk nipis. Viskositas ketiga formula juga berbeda tetapi tidak mempengaruhi nilai daya sebar. Berdasarkan uji tingkat kesukaan aroma diketahui bahwa F2 memiliki nilai tertinggi. Jenis minyak atsiri berpengaruh terhadap aroma dan tingkat kesukaan panelis. Formula yang paling disukai adalah formula yang mengandung minyak jeruk nipis..

Kata Kunci: *Anti-aging; Body Lotion; Koenzim Q10; Minyak Lavender; Minyak Jeruk Nipis*

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Introduction:

Skin aging is a complex biological process that is influenced by a combination of endogenous or intrinsic factors (genetic, cell metabolism, hormones and metabolic processes) and exogenous or extrinsic factors (chronic light exposure, pollution, ionizing radiation, chemicals, toxins) (Ganceviciene et al., 2012). Skin aging is characterized by a decrease in skin quality, such as wrinkles, loss of elasticity, sagging, and roughness (Zhang & Duan, 2018). To slow down the skin aging process, the skin must be treated regularly. One way that can be done to care for the skin is to use a series of skin care products. One type of skin care product that is being widely known by the public is body lotion.

Body lotion, also known as hand and body lotion, is a type of cosmetic moisturizer. Body lotion can hydrate the skin by reducing water evaporation from the skin and pulling water from the air into the dehydrated stratum corneum (Irmayanti et al., 2021; Sumbayak & Diana, 2018). Body lotions can have several additional effects, such as anti-aging or anti-hyperpigmentation, depending on the type of active ingredients added to them. Coenzyme Q10 (CoQ10) or commonly known as ubiquinone is a type of antioxidant that can be added to body lotion formulations to provide skin anti-aging effects. This material is a fat-soluble material that is able to prevent the process of lipid per-oxidation. Therefore, this ingredient can prevent damage to collagen and elastin and help avoid wrinkles on the skin (Bank et al., 2011; Korkmaz et al., 2013). CoQ10 is a potential agent in preventing skin damage due to photo-aging (Yue et al., 2010). However, CoQ10 has several drawbacks, including low water solubility (0.193 µg/mL in water), large molecular weight (863.36 g/mol), and high lipophilicity (log P > 10) (Lucangioli & Tripodi, 2012). So that its penetration through the skin is low. In addition, CoQ10 is also easily degraded by light and high temperatures (Bao et al., 2019). One way that can be done for these things is to formulate KoQ10 in the NLC system.

Nanostructured Lipid Carriers (NLC) is a nano-sized drug delivery system which is generally composed of solid lipids, liquid lipids and emulsifying agents. This delivery system is the latest generation of SLN (Solid Lipid Nanoparticles). NLC was developed to overcome some of the disadvantages of SLN, such as low drug entrapment and the possibility of drug expulsion during storage. NLC also has many advantages over conventional drug delivery systems, such as creams, tinctures, lotions and emulsions. NLC has several advantages such as controlled drug release, negligible skin irritation, protection against active compounds and targeted drug delivery (Kaur, 2015)

In this research, an anti-aging body lotion product was developed which contains CoQ10 in the NLC system. However, this product has no fragrance. Though the scent is one important aspect in cosmetics. The sustainability of cosmetic use is closely related to the sensations felt by consumers. Therefore, cosmetics are generally formulated with pleasant sensory characteristics, such as attractive colors and pleasant aromas. To overcome this problem, essential oils can be added to the body lotion.

Essential oil (essential oil) is a concentrate of natural extracts derived from plants (Man et al., 2019). Essential oil has a pleasant aroma. This oil is the "active ingredient" of aromatherapy. Aromatherapy is a type of complementary and alternative medicine, used extensively in the management of chronic pain, depression, anxiety, insomnia and stress-related disorders. Essential oils can enter the body through the sense of smell (inhalation) or through transcutaneous (for example through massage and bathing) (Kim et al., 2014). The addition of essential oils into the anti-aging body lotion formulation containing NLC-CoQ10 is expected to make the preparations smell good and make the wearer relax.

The purpose of this study was to analyze the effect of the type of essential oil on the physical characteristics and consumer preference level of anti-aging body lotion products containing NLC-CoQ10. The essential oils used are lavender oil and lime oil. This research is expected to provide an overview of the types of essential oils most preferred by consumers. So that it can be further developed for product commercialization.

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Methods:

The tools used in the study included Durascale DAB-E223 analytical balances, glassware, mortar and stamper, Thermo Fisher magnetic stirrer, Zetasizer Nano Malvern Instrument, Brookfield Digital Viscometer DV-I, Fluko FM30D homogenizer, Eutech instrument pH-meter pH 2700.

The materials used in this study included beeswax (Xiamen), Illipe butter / tengkawang fat (PT. Gunung Hijau Masarang), jojoba oil (Jojoba Desert), Tween 80 (Brataco Chemical), Span 80 (Kolb), Propilenglikol, Aquaademineral (Brataco Chemical).

Procedure

Test Formula

The test formula in this study can be seen in Table I. Formula of NLC-CoQ10 based on Fachriani et al (2023) with several modification.

Table I. An antiaging body lotion formula containing NLC-CoQ10 and essential oils

Components	F0 (%)	F1 (%)	F2 (%)
NLC-CoQ10[1)]	50	50	50
Lavender Oil	0	2	0
Lime oil	0	0	2
Gel base[2)]	until 100	until 100	until 100

Description :

1) NLC-ubiquinone contains: ubiquinone (2%) as active ingredients, beeswax (0,990%) and illipe butter (2,970%) as solid lipids, Jojoba oil (2,640%) as liquid lipids, Tween 80 (13,604%) and Span 80 (6,896%) as surfactant/emulsifier, propylene glycol (3,5%) as cosurfactant and aquademineral as the water phase.
2) The gel base consists of: glycerin (10%) as an emollient and humectant, disodium EDTA (0,3%) as a chelating agent, carbopol 940 (1,5%) as a gelling agent, triethanolamine (2,5%) as an alkalizing agent, phenoxyethanol (0,5%) as preservative and aquademineral (up to 100%) as aqueous phase.

Making of NLC-CoQ10

Making of NLC-CoQ10 refers to research that has been conducted by Fachriani et al (2023). The first stage was to prepare the oil phase which consists of jojoba oil, beeswax and illipe butter. Beeswax and illipe butter are melted at 70°C. After melting, add jojoba oil which has been heated at 70°C. Then added Tween 80 and Span 80 which had been heated at the same temperature.

The next step was to prepare the aqueous phase which consists of propylene glycol and aquamineral. Both were put into the same beaker glass, then stirred until homogeneous and heated at 70°C.

After the water phase and oil phase were ready, the water phase was added to the oil phase drop by drop while stirring using the FLUKO FM30D Homogenizer at 5000 rpm. Stirring was carried out for 26 minutes divided into 5 cycles. In the first cycle, stirring was carried out for 10 minutes. Whereas in the 2nd to 5th cycles, the stirring was carried out for 4 minutes per cycle. The pause between cycles is 1 minute.

Making of Gel Base

The gel base was prepared using a mortar and a stamper. The trick, disodium EDTA is dissolved in a heated mixture of glycerin and aquamineral. Then sprinkled Carbopol 940 on it. wait for it to grow. Then add TEA drop by drop until the desired pH. After that, added Phenoxyethano.

Making of F0, F1 and F2

The F0 test preparation was made from 50% NLC-CoQ10 mixed with 50% gel base, then stirred using a mortar and stamper until homogeneous. The F1 test preparation was made from 50% NLC-CoQ10, 48% gel base and 2% lavender oil and then mixed using a mortar and stamper until homogeneous. F2 test preparation was made from 50% NLC-CoQ10, 48% gel base and 2% lime oil, then stirred using a mortar and stamper until homogeneous. This procedure refer to Mayangsari et al (2021) with several modification.

Organoleptic Test

Organoleptic examination is carried out using the five senses. Examinations carried out include checking the color, aroma and consistency of the test sample (Fachriani et al., 2023).

Particle Size Test, and Polydispersity Index (IP)

The first stage was dilution of the preparation. A total of 50 mg of the sample was

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weighed on an analytical balance and then added with aquamineral to a volume of 50,0 mL. Stir using a magnetic stirrer at 500 rpm for 10 minutes. Then 2,0 ml of the solution was taken and then added 8 ml of aquamineral. Stir again at 100 rpm for 10 minutes(Mayangsari et al., 2021).

The second stage was the determination of particle size and polydispersity index. The test sample (which has been diluted) is put into the cuvette. Then the particle size and polydispersity index were observed using the Zetasizer Nano Malvern Instrument (Fachriani et al., 2023).

pH Test

Samples were diluted 1 : 9 using aquadmineral. Then measured the pH using a pH meter (Mayangsari et al., 2021)

Viscosity Test

Viscosity values were determined using a Brookfield Digital Viscometer DV-I+ with spindle number 7 and speed of 100 rpm. A number of samples (300-500 g) are placed in a beaker. The spindle is mounted on the viscometer and then the viscosity value of the test sample is checked (Fachriani et al., 2023).

Spreadability Test

Weigh 0.5 gram of the test preparation and then place it right in the middle of a round glass scale. After that it was covered with transparent glass and given a load of up to 150 g. Left for 1 minute, then recorded the diameter of the spread (Mayangsari et al., 2022).

Consumer Preference Level Test / Hedonic Test

The hedonic test method used in this study was adapted from the hedonic test method that was previously carried out by Mayangsari et al (Mayangsari et al., 2022). The hedonic test is an organoleptic sensory test that is used to determine the magnitude of the difference in quality between several similar products by providing an assessment or score of certain properties of a product and to determine the level of preference of a product (Tarwendah, 2017).

In this study, the panelists involved in the hedonic test were untrained panelists. The number of panelists involved was 40 people. Inclusion criteria for panelists in this study were willing to become panelists, not currently smoking, not wearing perfume during the test, mentally and physically healthy (not experiencing olfactory disorders, not experiencing psychological disorders, not color blind).

In this test, panelists were asked to provide an assessment of the aroma aspects of preparations F1, F2 and F2. The rating scale used was 1-4 (point 1 for dislike very much; 2 for dislike; 3 for like; and 4 for like very much). After that, the test results data were analyzed statistically using the Univariate method. If the significance value is less than 0.05, then the test is continued with Duncan's Post-Hoc Test.

Ethical approval for this study was obtained from Universitas Muhammadiyah Lamongan (No. 232/EC/KEPK-S1/09/2022).

Results:

The results of organoleptic observations can be seen in table II. Based on the test results, it is known that the three formulas have differences in the aroma aspect. F0 is unscented, F1 is scented with lavender and F2 is scented with lime. Even though they have different aromas, the three formulas have no difference in color and consistency. All three are light yellow in color and have a semisolid consistency.

Based on the results of the visual homogeneity test, it is known that F0, F1 and F2 have good homogeneity. This is evidenced by the absence of coarse grains in the test preparation.

The next test is testing the acidity / pH. The average value of the pH test results can be seen in Table II. To determine whether or not there is a difference in pH values between F1, F2 and F2, a statistical analysis is carried out using One Way Anova. Based on this test, a significance value of 0.276 was obtained, which means that there was no difference in the pH value between F0, F1 and F2.

The results of the spreadability test can be seen in Table II. The results of the spreadability test were analyzed statistically using One Way Anova. As a result, a significance value of 1.000 is obtained, which means that there is no

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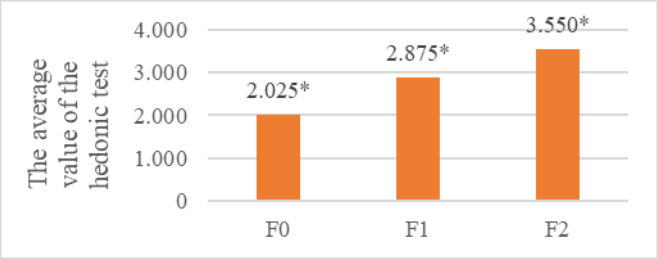
difference in the spreading power values between F0, F1 and F2.

The results of the viscosity test can be seen in Table II. The results of the viscosity test were analyzed statistically using One Way Anova. As a result, a significance value of 0.000 is obtained, which means that there is a difference in value between the formulas. So the test was continued using the Turkey's Post-Hoc test. As a result, all formulas have significantly different viscosity values. F2 has the highest viscosity value than F1 and F0. While F0 has the lowest viscosity value.

Table II. Results of Observation of Physical Characteristics

	F0	F1	F2
Organoleptic	light yellow; semisolid consistency; not scented	light yellow; semisolid consistency; Lavender Scented	light yellow; semisolid consistency; Lime Scented
Homogeneity	Homogen	Homogen	Homogen
pH	6.49 ± 0.02	6.43 ± 0.02	6.43 ± 0.03
Viscosity (cP)	8.480 ± 5.77	9.026 ± 8.82	9.220 ± 5.77*
Spreadability (cm)	3.4 ± 0.06	3.4 ± 0.05	3.4 ± 0.06

Description :
- The values of pH, viscosity, spreadability and level of preference shown are the mean value of ± standard error of the mean
- Sign (*) = there is a significant difference with F0, F1



Description :
All formulas have significantly different values (based on statistical analysis using the Univariate method. Followed by Duncan's Post-Hoc Test.

Figure 1. Bar Chart of the Average Hedonic Test Results

The average value of the hedonic test results or consumer preference level test can be seen in Figure 1. The hedonic test results were statistically analyzed using the Univariate method. If the significance value is less than 0.05, then the test is continued with Duncan's Post Hock to determine which groups are significantly different. As a result, it is known that the three formulas have significantly different values because each formula occupies a different subset column (Table III).

Table III. Results of Statistic Analysis using Duncan's Post Hock Test

Formula	N	Subset 1	Subset 2	Subset 3
F0	40	2.02		
F1	40		2.87	
F2	40			3.55
Sig.		1.000	1.000	1.000

Description :
Each formula occupies a different subset column → All formulas have significantly different values.

Discussion:

In this study, we observed the effect of essential oil types on physical characteristics and the preference level of anti-aging body lotion products containing NLC-CoQ10. The essential oils used are lavender oil and lime oil.

Lavender oil was chosen because this oil has the main content of linalyl acetate and linalool. Both of these compounds have a sedative effect so they can improve sleep quality (Fismer & Pilkington, 2012). According to Linck et al (2010), inhaling essential oils rich in linalool can be useful as a means of achieving relaxation and overcoming anxiety (Linck et al., 2010). An article written by Ayuningtyas and Burhanto (2021) stated that "inhaling the aroma of lavender oil increases alpha waves and this state is associated with relaxation (relaxation), and can treat insomnia and can maintain body balance, stress, headaches, muscle spasms" (Ayuningtias & Burhanto, 2021).

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Lime oil was chosen because this oil has a refreshing aroma. This is because the main ingredients of lime oil are geranial, neural, and linalool compounds (Adokoh et al., 2019). Since this oil contains linalool, it is also has the potential as an anxiolytic agent.

In the evaluation of physical characteristics, the observed aspects were organoleptic, homogeneity, spreadability, pH and viscosity. Meanwhile, in the evaluation of the level of preference, the aspect that is assessed is the aroma.

The initial stage in this research was to make NLC-CoQ10 using the High Shear Homogenization method. Then test the physical characteristics of NLC-CoQ10 to ensure that the NLC-CoQ10 used meets the desired specifications. Physical characteristic tests carried out for NLC-CoQ10, namely organoleptic tests, pH, particle size, and polydispersity index.

Based on the organoleptic test, the results obtained were yellow, odorless, and had a liquid consistency. In the particle size test, it is known that NLC-CoQ10 has a particle size of 126,3 ± 0,78 nm. This value has met the desired specifications. According to Khosa et al (2018), NLC has a nanoparticle size of less than 1000 nm (Khosa et al., 2018).

The next test for NLC-CoQ10 is the polydispersity index test. The term "polydispersity" is used to describe the degree of non-uniformity of the particle size distribution (Danaei et al., 2018). Formulas that have a polydispersity index value of less than 0.5 can be said that the particle size of the formula is homogeneous and monodisperse. Converseis more than 0.5 it can be said that the particle size of the formula is not homogeneously, if the polydispersity index value and is polydispersity (Supriya et al., 2021). Based on the observations of the polydispersity index, a value of 0,276 ± 0,005 was obtained. This value is less than 0,5. So it can be said that the NLC-CoQ10 made has a homogeneous particle size. The results of the pH test for NLC-CoQ10 showed that the pH of NLC-CoQ10 had a pH value of 614 ± 0,03. This value is within the range of pH specifications desired. According to Fathoni et al (2021), the pH of topical preparations must be in the pH range of the skin in which within 4,5 – 6,5 (Fathoni et al., 2021).

After the making and testing of NLC-CoQ10, the next step is the making of test formulas F0, F1 and F2. F0 is an antiaging body lotion that contains NLC-CoQ10 without essential oils. F0 is a negative control formula. F1 is an antiaging body lotion that contains NLC-CoQ10 with the addition of 2% lavender oil. F2 is an antiaging body lotion containing NLC-CoQ10 with the addition of 2% lime oil.

The next step is to observe the physical characteristics of F0, F1 and F2. Observation results can be seen in Table II. From the results of the organoleptic test, it is known that the three formulas have no difference in color and consistency. All three formulas have the same color, which is light yellow. This is because the test preparation contains CoQ10. This material has a yellow-orange color. All three formulas contain NLC-CoQ10 at the same level. So the intensity of the yellow color at F0. F1 and F2 there is no difference.

F0, F1 and F2 have no difference in consistency. So it can be concluded that the different types of essential oils added to the antiaging body lotion containing NLC-CoQ10 did not affect the consistency.

F0, F1 and F2 have different aromas. F0 has no scent. This is because at F0 no essential oil is added. F0 is a negative control formula. F1 has a lavender scent. While F2 has a lime scent. Based on the aroma test, it can be seen that the addition of 2% essential oil affects the aroma of the preparation. The type of essential oil added to the preparation also affects the aroma of the preparation.

The homogeneity test is one of the most important tests for topical semisolid preparations. The purpose of the homogeneity test is to find out whether the ingredients in the formulation are mixed evenly or not (Mursal et al., 2019). The homogeneity test results for F0, F1 and F2 show that the three formulas are homogeneous. The addition of 2% essential oil did not affect the homogeneity of the preparation. The different types of essential oils (lavender and lime oil) added to the preparations also did not affect the homogeneity of the preparations.

The pH test aims to determine the acidity level of the preparation. One of the functions of this test is to ensure that the preparation does not cause irritation to the skin surface. The pH value of the preparation that is too low (too acidic) can irritate the skin. Whereas the pH value of the preparation which is too high (too alkaline), the formula causes the skin to become dry or scaly (Rosida et al., 2018). According to Fathoni et al (2021), the pH of topical preparations must be in the pH range of the skin, namely within 4,5 – 6,s5 (Fathoni et al., 2021).

The results of the pH test showed that the three formulas had a pH value between 4,5 – 6,5. So the pH of the three formulas is still relatively safe. Based on statistical analysis using One Way Anova, a significance value of 0,276 is obtained, which means there is no difference in value between the formulas.

Spreadability test is a test that aims to determine the ability of a preparation to be applied or used on the skin surface (Lumentut et al., 2018). The results of the spreading power test can be seen in Table II. Based on statistical analysis using One Way Anova, a significance value of 1,000 was obtained, which means that there was no difference in the spreadability values of the three formulas. The different types of essential oils added to the antiaging body lotion containing NLC-CoQ10 did not result in differences in the spreadability values.

The viscosity test aims to determine the level of viscosity of the preparation (Pertiwi, 2016). The results of the viscosity test can be seen in Table II. Based on statistical analysis using One Way Anova, a significance value of 0.000 is obtained, which means that there is a difference in value between the formulas. So the test was continued using the Post Hock Tukey. As a result, all formulas have significantly different viscosity values. F2 has the highest viscosity value than F1 and F0. While F0 has the lowest viscosity value. Although the three formulas have different viscosity values, the three formulas do not have different spreadability values. The three formulas also have no difference in consistency. The viscosity values of the three formulas are still within the ideal viscosity range of topical preparations. According to Rakhmawati et al (2019), the ideal viscosity for topical preparations is 2.000-50.000 cP (Rakhmawati et al., 2019).

The next test is the hedonic test. This test is also known as the preference level test or sensory test. According to Oliveira and Tescarollo (2021), sensory analysis is one of the elements that must be taken into account during the development of cosmetics (Oliveira & Tescarollo, 2021).

In this study, testing the level of preference focused on the aroma aspect. Panelists were asked to provide a score on a scale of 1 to 4. Score 1 for dislike very much; score 2 for dislike ; 3 for like and 4 for like very much. After that, the results of the hedonic test or (consumer preference level) were statistically analyzed using SPSS 16.0 with the Univariate method followed by Duncan's Post-Hoc test (if the significance value is less than 0.05).

Based on the hedonic test on the aroma aspect, it is known that the average value of F0 is 2,02 ; for F1 is 2,87 and for F2 is 3,55. Based on the results of statistical analysis, it is known that the significance value obtained is 0,000 (less than 0,05). That is, there are significant differences between the formulas. Testing continued using Duncan's Post Hock. As a result, all formulas occupy different subset columns. This means that all formulas have different values. The formula that has the highest value is F2. While the formula that has the lowest value is F0. This proves that the addition of 2% essential oil affects the level of panelists' preference for antiaging body lotion containing NLC-CoQ10. The different types of essential oils also proved to have an effect on the level of preference of the panelists. In this study, the formula that the panelists liked the most was F2 (an antiaging body lotion containing NLC-CoQ10 containing lime oil). The results of this study are in line with the results of research conducted by Rusdianto et al (2020). In that study, Rusdianto et al observed the effect of variations in the concentrations of tuberose oil and lime oil in massage oil on the characteristics and level of preference. As a result, the formula that was most preferred was the formula containing the highest concentration of lime oil (Rusdianto et al., 2020). The weakness

of this research is that it only involved 40 panelists in the hedonic test.

Conclusions:

Based on the results of the physical characteristic test, it is known that the type of essential oil (lavender and lime oil) affects the aroma of NLC-CoQ10 body lotion. Based on the hedonic test, it is known that the type of essential oil (lavender and lime oil) affects the panelist's level of preference. The antiaging body lotion NLC-CoQ10 formula that the panelists liked the most was a formula containing lime oil. Recommendations or suggestions from this research for next projects are antioxidant activity tests and safety tests.

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