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Formulation and Physical Characterization of Onion (*Allium ascalonicum* L) Bulb Extract in Cream Using Tween 80 and Span 60 as the Emulgator

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Abstract

In Indonesia, it is not uncommon to find children who suffer from fever which can occur due to the change of weather from the rainy season during the dry season or vice versa. Communities in rural areas generally use onion (*Allium ascalonicum* L) to relieve fever in children. Cream preparations were made by varying the concentration of the emulgator to determine the effect of different concentrations of the emulgator on the physical characteristics of the cream preparation. The emulgator used is tween 80 and span 60 with a concentration of Formula 1: 3.5%, Formula 2: 3.75%, formula 3: 4%. Physical evaluations carried out in this study were organoleptic, pH, homogeneity, cream washability, cream type, viscosity, spreadability, adhesion, and freeze-thaw tests. Concluded of this study that the differences in the concentration of the emulgator can affect the physical characteristics of the cream preparation, namely in the spreading test and the adhesion test shows that F3 (4%) can reduce the spreadability of the cream preparation but can be attached to a long time when compared to F1 (3.5%) and F2 (3.75%). The physically optimal cream preparation formula is F1 and F2 because it meets all the requirements in the evaluation test.

Keywords: Cream, onion, emulgator, physical characteristics

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Background

Fever is defined as a condition when an individual experiences an increase in body temperature of more than 37.8 °C peroral or 37.9 °C per rectal due to external factors. In Indonesia, it is not uncommon to find children who suffer from fever which can occur due to the change of weather from the rainy season during the dry season or vice versa. The impact of fever in children is dehydration, lack of oxygen, and neurological damage. Children under five years (toddlers), especially between the ages of 6 months and three years are at risk of febrile seizures [1]. Communities in rural areas generally use onion to relieve fever in children, flatulence, vomiting, cold, and coughs [1]. One of the chemical compounds contained in onions is flavonoids. Flavonoids have antipyretic (fever-lowering), analgesic, and anti-inflammatory effects. The flavonoid content in onion is around

29% and is the second largest after green tea. In addition to flavonoids, onion contains alliin which to destroy blood clots as the cause of improving blood circulation, so the body heat distributed easily to the peripheral blood vessels of the body [2].

To reduce fever can be crushed onions, three leaves smeared on the back and chest of the child [1]. However, this method discomfort children because the aroma of onion is quite sharp and has a painful effect on the eyes. Therefore, to simplify, increase effectiveness and reduce the side effects of using onion as a fever-reducing agent, innovations will be developed in the form of cream preparations containing onion extract for topical use as an antipyretic. Creams are topical preparations usually for application to the skin. They are semi-solid emulsions which are oil-in-water (O/W) or water-in-oil (W/O) type. O/W emulsions are most useful as water bases, whereas W/O emulsions are emollient and cleansing agents [3]. Stable creams have to use the right emulgator to reduce the interface tension between oil and water and form a layer that surrounds the dispersed droplets to prevent coalescence and separation of the dispersed phase. The emulgator used is tween 80 and spans 60. The chosen emulgator is a non-ionic group emulgator because it is not irritating to the skin, not easily influenced by pH, the presence of electrolytes, neutral, non-toxic and produces a stable emulsion [4]. The emulgator used is tween 80 and span 60 with a concentration of Formula 1: 3.5%, Formula 2: 3.75%, formula 3: 4%.

Methods

Extraction and formulation of the cream

Allium ascalonicum L bulbs acquired from Cimenyan districts, Bandung, West Java was identified by the School of Life Sciences and Technology Institute Technology Bandung. *Allium ascalonicum* L bulbs cleaned in running water then cut. After that, the bulbs were dried and then grounded to powder. Extraction was carried out by maceration using a 70 % ethanol solvent. The amount of 200 g of dried *Allium ascalonicum* L bulbs put into a maceration apparatus, and then it was added with 1000 ml of ethanol. The mixture was soaked in ethanol 70 % for 24 hours with intermittent shaking. Macerates were separated by filtration. The resulting filtrate was concentrated using a water bath [5].

The ingredients used in this study are pharmaceutical grade ingredients. The cream was prepared by separated into two parts: the water phase and the oil phase. The oil phase, i.e., adeps lanae, stearic acid, propylparaben and span 60 are diluted at 70 ^{o} C. The ingredients include water phases such as methylparaben, propylene glycol, tween 60 and water mixed at 70 ^{o} C. Then the oil phase was mixed with water phase until homogenous and forming cream base. Finally, *Allium ascalonicum* L extract was poured into this mixture [4].

Freeze-thaw stability test

The stability test was done using the freeze-thaw method (a stress condition). Each cream was placed at a cold temperature (±4 °C) for 1×24 hours then placed at hot temperature (40±2 °C) for 1×24 hours, counted one cycle. Testing is done up to 6 cycles, then evaluated the physical properties of cream before and after the Freeze-thaw stability test [6].

Determination of organoleptic properties

This test examined the smell, color, and consistency of cream [4].

Determination of homogeneity

The formulation was tested for the homogeneity by visual appearance and by touch [7]. A 0,1 g sample was taken from the cream and placed on a glass object. This sample was then pressed with another glass object and observed to identify whether coarse grains still existed in the preparation [8].

Determination of pH

The pH was determined with a pH meter. Then the pH meter was calibrated using a standard buffer solution (pH 9 and pH 4) [3]. One gram of the preparation was weighed and added with 10 mL of Aqua distillate. The electrode was rinsed in distilled water then dipped into the diluted preparation to obtain the pH level [8].

Determination of viscosity and rheology

The viscosity determinations and rheology were carried out using a Brookfield Viscometer using spindle number LV-4 at 5 rpm, 3 rpm, 6 rpm, 12 rpm and, 30 rpm [7].

Determination of the cream type

The amount of cream preparations is placed on the glass object, then add one drop of methylene blue. If methylene blue distributed evenly, it means that the type of cream produced is an oil in water (M/A) [4].

Determination of cream washability

One gram of cream applied to the palm of a hand, washed with a volume of water while rinsing hands. Visually observe the presence or absence of cream left in the palm of hand [4].

Determination of spreadability

One gram of cream was weighed and placed between two glass plates for 1 minute. This procedure spread the cream to all directions and also created a diameter; the result recorded. Afterward, 10 g weights placed on the glass plate for 1 minute, and then the results were recorded. Do the same for 25 g weight [9]. Spread ability test also was performed by applying the cream on the skin and noticing whether spreading was good or not [12].

Determination of adhesion

A total of 0.5 grams of preparation were spread on the disc glass, on top of it other glass objects placed and pinned under a load of 250 g for 1 minute. Then disc glass mounted on test equipment, weighing 250 g load is released and the time is recorded up to the second object of the glasses fallen off [10].

Data Analysis

The data were processed statistically with analysis of variance (ANOVA) to identify their significance. A set of data was considered to be significant when the resulted coefficient was lower than 0.05 ($p<0.05$).

■ Result and Discussion

The results of plant determination show that the plants used in this study are real onion (*Allium ascalonicum* L), plants of the Liliaceae family. The maceration method was chosen because this method is easy to do, the equipment is simple, does not involve heat, so no temperature factor that accelerates the reaction or affects the active compound in the extract. The solvent used to extract is 70% ethanol, which can dissolve phytochemical compounds more optimally because 70% ethanol still contains enough water (30%) which helps the extraction process so that some of these compounds can be interested in ethanol and some are interested in water. Amino acids, sugars, alkaloids, flavonoids, and flavonoid glycosides and chlorophyll dissolved in polar solvents, so the compounds extracted with 70% ethanol solvent is quite a lot [11].

Table 1. The formula used in the preparation of Allium ascalonicum L. cream

Ingredients	Amount (%)		
	Formula 1	Formula 2	Formula 3
Allium ascalonicum L. extract	3	3	3
Methyl paraben	0,18	0,18	0,18
Propyl paraben	0,02	0,02	0,02
Propylene glycol	10	10	10
Tween 80	3,5	3,75	4
Span 60			
Adeps lanae	10	10	10
Stearic acid	5	5	5
Aqua distillate	Ad 100	Ad 100	Ad 100

Stable creams must use the right emulgator to reduce the interface tension between oil and water and form a layer that surrounds the dispersed droplets to prevent coalescence and separation of the dispersed phase. Based on table 1, the emulgator used is tween 80 and span 60 with a concentration of Formula 1: 3.5% (F1), Formula 2: 3.75% (F2), Formula 3: 4% (F3).

Organoleptic properties determination result

Based on figure 1, the organoleptic result found that in F1, F2, and F3 before and after stress condition showed beige color due to the influence of the brown *Allium ascalonicum* L. extract. All of the formula had a soft texture and a distinctive odor.

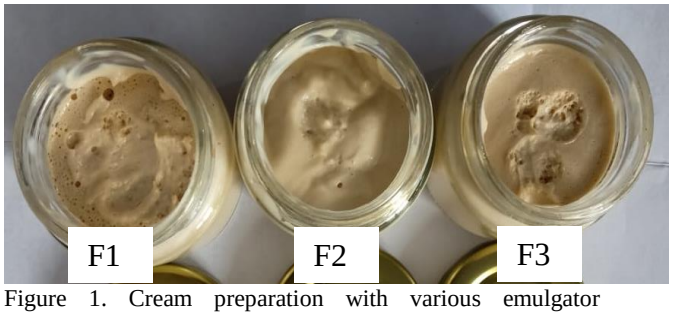

Figure 1. Cream preparation with various emulgator concentration

Homogeneity result

The homogeneity test aimed to determine the homogeneity of active ingredients and other additives in the preparations. The homogeneity result found that in the three formulas before and after stress condition showed homogeneous and smooth texture were marked with no visible coarse on the cream. That condition was as expected because it proved that the cream formula showed no separation phase between the oil phase and water phase.

pH result

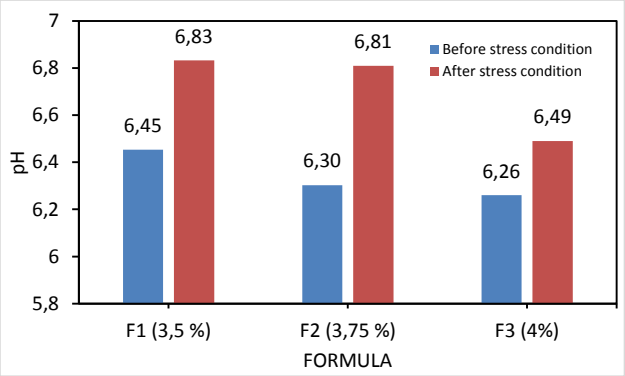

Figure 2. The pH of the cream formula before and after the stress condition

From the results of pH measurements, it can be seen that the higher the concentration of the emulgator, the pH of the produced cream lowered. Also shows an increase in the pH value after the stress condition, but still within the pH range required. Based on figure 2, the pH value obtained by each formula before and after stress condition from 6.26 to 6.83. Cream preparations must have a pH that similar to the skin's pH, which is between 4.5-7.5. If the cream has a pH that is too alkali, it can cause scaly skin, while a pH that is too acidic can cause skin irritation [13]. The results of ANOVA revealed that the pH levels of all preparations were not significantly different.

Viscosity result

Based on figure 3 and figure 4, show that the three cream preparations have thixotropic flow properties and, there is no change between before and after stress condition. Thixotropic is an excellent flow characteristic in cream preparations because it has high consistency in the container, but can be poured and can penetrate well into the skin [14]

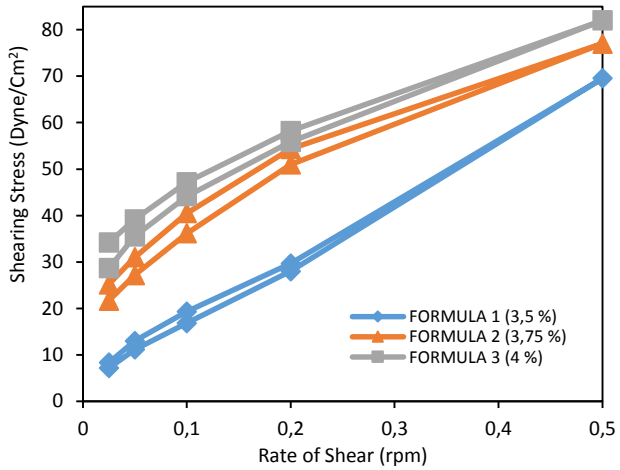

Figure 3. Chart of cream rheology before the stress condition

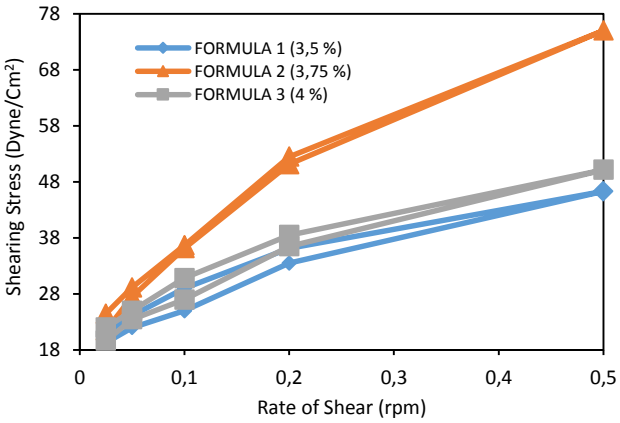

Figure 4. Chart of cream rheology after the stress condition

Cream type result

A cream type test result found that in the three formulas before and after stress condition, it was oil cream in water (M/A), because the amount of dispersed phase (oil/fat) used in the cream is smaller than the dispersing phase (water phase) so that the oil phase will be dispersed evenly into the water phase and form an oil emulsion in water with the addition of emulgator [15].

Cream wash ability result

Cream wash ability result found that in the three formulas before and after stress condition, it shows that the cream can be washed clean and

disappear from the skin surface well because the type of cream produced is typed M / A so that it can be washed well by water.

Spread ability result

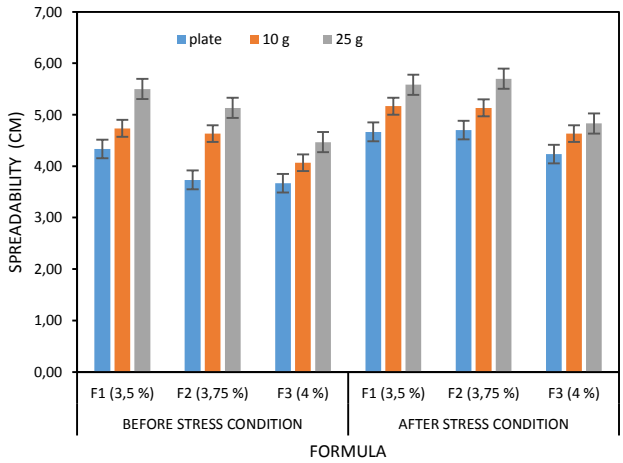

Figure 5.Spread ability chart of the formula before and after stress condition

The therapeutic efficiency of the formulation also depends upon its spreading value to the skin, and the cream will spread quickly without using excessive emphasis. The spreadability of consistent and comfortable-for-use semi-solids varies between 5-7 cm [16]. Based on figure 5 found that in the three formulas before and after stress condition on the addition of 25 gr load, it shows that the spreadability of F1 and F2 ranges from 5.13 to 5.70 cm, which is still in the range of topical preparations, while for F3 is 4, 47-4.83 cm and does not match the requirements. That shows that there is an effect of the concentration of the emulgator on the spreadability; a high emulgator can reduce the spreadability of the cream preparation. The result of ANOVA revealed that the three formulas had differed significantly in spreadability.

Adhesion result

Good adhesion allows the drug not to be easily detached and become attached to the skin for longer so that it can penetrate longer into the skin and produce the effect [9]. Based on figure 6, found that in the three formulas before and after stress condition showed that all formulas conform to the requirements for the topical adhesion with a range of values of 5.40-7.27 seconds. However, after stress conditions, all formulas show a decrease in adhesion with values ranging from 3.97-4.53 seconds. That shows that stress conditions can affect the physical characteristics of the cream preparation, which can reduce the stickiness of the cream preparation. Also besides, the higher the concentration of the emulgator, the higher the adhesion result. The result of ANOVA revealed that the three formulas had differed significantly in adhesion.

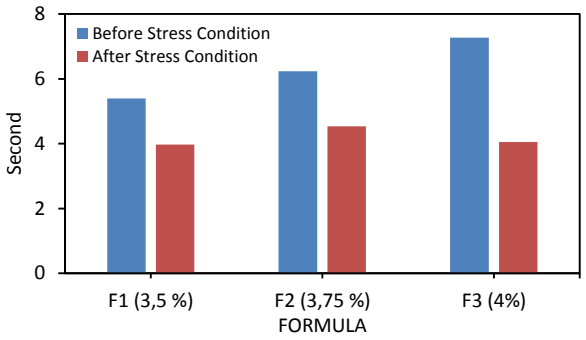

Figure 6. Adhesion chart of the formula before and after stress condition

Conclusion

The results of the research, it can be concluded that the differences in the concentration of the emulgator and stress condition can affect the physical characteristics of the cream preparation. The physically optimal cream preparation formula is F1 and F2 because it meets all the requirements in the evaluation test.

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