ENHANCEMENT OF FACIAL SKIN HYDRATION BY CLEANSER AND TONER MADE FROM COCOA BUTTER AND COCOA PULP

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ABSTRACT – *Cocoa butter is a fat obtained from cocoa beans. It contains fatty acids of palmitic acid, stearic acid, oleic acid and linoleic acid. These fatty acids are often used in liquid soap making for its unique properties. Cocoa pulp is a whitey mucilage surrounding the cocoa beans and it is essential in cocoa fermentation processes. Excessive amount of cocoa pulp, however, reduce the quality of cocoa beans flavor. This study was carried out to determine the efficacy of facial cleanser and facial toner which were made from cocoa butter liquid soap and cocoa pulp, respectively, on the enhancement of skin hydration. Twelve female volunteered panelist, of aged 20-50 years old, applied the products daily, for four weeks and the evaluation was carried out using Visioscan device. The results showed that enhancement of skin hydration was improved significantly, at 8.74% on the third week of product application. This study will create demand for cocoa products which can motivate the cocoa growers in positive ways.*

Key words: Cocoa butter, cocoa pulp, facial cleanser, facial toner, skin hydration

INTRODUCTION

Daily application of facial cleanser and toner affects the condition of skin acid mantle that exist as thin film on the upper layer of our skin. Although facial cleanser is a rinse-off product, application of too alkaline cleanser will disrupt the pH of skin leading to dry and itchy skin. Similarly, to the application of high pH facial toner onto the skin.

The reasons for this condition is that our skin is protected by an acid mantle which is our skin's first line of defense against the various external factors. The optimal pH of skin acid mantle is 4.7 to 5.75 (Lambers et al, 2006) to keep the moisture in and bacteria out (Fiers, 1996). Several factors that can induce negative significant changes of the skin acid mantle including using harsh ingredients of facial cleanser and cosmetic products (Blaak and Staib, 2018; Rippke, et al., 2012, and Kim, et al., 2009), air conditioning, water, over washing or over exfoliating, medication, pollution and age. Ananthapadmanabhan, et al. (2004) discussed comprehensively the effect of cleansers on skin, where the pH of the cleanser plays an important role to keep the skin acid mantle intact. According to Kim et al. (2009), the skin barrier is weakening with application of high pH product.

The results of negative influence to skin acid mantle can be related to skin diseases, such as irritant contact dermatitis, atopic dermatitis, ichthyosis, acne vulgaris and Candida albicans infections (Schmid-Wendtner and Korting, 2006). Lambers et al (2006) mentioned that at pH 4-4.5, the adhesion of resident skin microflora was maintained, while pH 8-9 dispersed the bacterial from the skin. Skin microflora helps to prevent colonization of harmful bacteria as comprehensively discussed by Chiller et al. (2001). In addition, Lambers et al (2006) found out that higher pH not only eliminate the skin microflora but also exposing the skin to irritant dermatitis due to disruption of natural moisturizing factor (NMF), transepidermal water loss (TEWL) and skin lipid formation.

According to Zainal et al. (2019), low pH skin was detected at atopic dermatitis skin area but not related to its severity, while high skin pH reduced skin hydration. In addition, shifting skin surface pH from acidic to alkaline condition leads to acceleration of stratum corneum desquamation but inhibit skin regeneration (Wohlrab et al., 2018). Moreover, Sharma (2019) mentioned that skin with high pH was vulnerable to acne due to impairment of skin barrier function (Thune et al., 1988) and reducing the production of free fatty acids on skin (Sharma, 2019).

Cocoa butter contains 35% of oleic acid, 33% of stearic acid, 28% of palmitic acid and 3% of linoleic acid. The stearic acid produces soap with creamy leather, while the oleic acid conditioned the skin. The distribution of unsaturated and saturated fatty acid determines the hardness, aroma, cleansing, lathering, and moisturizing abilities of soaps (Prieto Vidal et. al., 2018). According to Prieto Vidal et. al. (2018), the saturated fatty acids give light open foams (lather) and

a solid, hard consistency, while the unsaturated provide moisturizing, conditioning, or nourishing properties. These fatty acids provide the character or properties of the soap produced.

Cocoa pulp is an essential ingredient in cocoa bean fermentation process. Besides being ingredients for fermentation, the cocoa pulp ~~found~~ can be used as pectin, marmalade, jam and production of wine and vinegar (Oddoye, et al., 2012). Study on the phenolic content and antioxidant capacity was carried out by Endraiyani (2011) where the cocoa pulp contained 103 mg GAE/100 g cocoa pulp and decreased by 50% upon storage at room temperature. Table 1 is the summary of cocoa pulp content obtained from the literature. The cocoa pulp contained large amount of water to almost 85%. In the market, facial toner made from cocoa was marketed under Benton brand which contains the extract of cocoa including cocoa butter and cocoa flower. The extracts from three parts of the cacao tree, were claimed to have antioxidants, calm inflammation, and moisturize the skin.

Table 1: Cocoa Pulp Content

Content	*Content*	*References*
Water	82-87%, 86.38%, 82.6%	e, a, b
Sugar	10-15%, 18%	e, a
Pentose	2-3%	
Pectin	1-1.5%, 0.51%, 1%	e, a, b
Citric acid	1-3%, 8330 ppm	e, a
Ascorbic acid (vitamin C)	100 ppm, 120 ppm, 3000 ppm	e, c
Calcium	31.692 ppm, 240 ppm	d
Potassium	25.512 ppm	d
Sodium	10.326 ppm	d
Zinc	0.104 ppm	d
Iron	0.426 ppm, 12.2 ppm	d, c
Magnesium	3.252 ppm	d
pH	3.3-4.0, 3.5, 3.87	d, a, c

a Cassianne, et al. (2020); b Endraiyani (2011); c Afolabi, et al. (2015); d Afoakwa, et al. (2013); e Anonymous

The objective of this study was to evaluate the skin condition after application of facial cleanser and toner made from cocoa butter liquid soap and cocoa pulp, respectively. It was hope that this finding will bring prosperity to cocoa grower by increasing the demand of cocoa.

MATERIALS AND METHODS

Facial Cleanser & Toner Products

The facial cleanser formula was made of cocoa butter liquid soap and the key ingredients was listed in Table 1. The formula was not discussed in this paper. The preparations of the facial cleanser were straight forward, where all the weighed ingredients were added into a beaker at low stirring and heating until dissolved. The pH of the facial cleanser was adjusted to pH5.5 with citric acid. The cocoa pulp was used in the facial toner. The cocoa pulp was extracted using water and contained natural vitamin C at about 0.003%. Similar to facial cleanser, the making of facial toner was straight-forward, where all the ingredients were water-soluble, therefore no heat required to dissolve all the ingredients. The final pH of the facial toner solution is pH5.5. The products were subjected for physical properties, irritancy and microbiological safety test (not discussed in this paper) prior given to the panelists.

Effectiveness of the Products

Twelve women volunteers of aged 20-50 years old, were recruited in this study. Each panelist was given a consent form to fulfill for their involvement in this study. They were given a set of facial cleanser and toner to use as their facial routine in the morning and night, daily, for four consecutive weeks (Messaraa, C., et.al, 2020). A week prior to the first week measurement, the panels were instructed to halt using their existing facial cleanser and toner, but can continue using their other existing routine products. The initial measurement was taken during this time, followed by at the end of the week for another four weeks.

The measurement was carried out using Visioscan® VC98 unit (Courage + Khazaka Instruments, Germany) where a unique UVA-light video camera with high resolution and software, captured and measured the structure and dryness level of the skin. The parameters of interest in this study were; Surface – is (measurement of wavy surface in comparison to stretched surface where reduction indicates the skin becomes smoother); Variance - is (roughness index where high skin roughness will lead to increase variance values); Energy - is (general overview over the state of the skin where young, highly hydrated and elastic skin has high energy value); Homogeneity - is (an indication of skin uniformity with highly hydrated skin has a higher homogeneity value than the dry one); and SE wrinkles - is (proportional to number and width of the wrinkles).

Statistical Analysis

The results were presented as mean ± standard deviation, determined in triplicates. The comparison was made using paired t-test for the normal distributed data. If the data was not normally distributed, one-sample sign test was used. The statistical analysis was carried out using Minitab Software version 16 (U.S.A.). The results were considered significantly difference when p-value is less than 0.05 ($p<0.05$).

Table 2: Key Ingredients in the Tested Products

Key Ingredients	*Function*	*Cleanser*[a]	*Toner*[b]
Cocoamidopropyl betaine	Surfactant (mild, amphoteric) – removal of excessive sebum	Yes	No
Cocoa Butter Liquid Soap (Cocoa butter & Castor Oil)	Surfactant (anionic) – removal of excessive sebum	Yes	No
Glycerin	Helps in improving skin hydration	Yes	Yes
Cocoa pulp	Removal off the dead skin cells of your skin and make it more smooth and fresh.	No	Yes
Niacinamide	help to improve several skin conditions	No	Yes
Hyaluronic acid	to give skin surface hydration and to form a protective barrier	No	Yes

Notes: Product properties: a Foam index 0.973; Zeta potential -25.52 ±1.80; Final pH5.59; b Zeta-potential -28.37±1.61; Final pH5.50

RESULTS & DISCUSSIONS

The results were summarized in Figure 1, where the skin hydration or energy index showed increment. Positive significant changes were shown by all the skin indexes, but negatively by the wrinkles index. The surface, energy, variance and homogeneity are categorized as the texture parameters where it indicates the epidermis condition.

The surface and variance indexes were significantly reduced at 4.99% and 9.35%, respectively, after three weeks of continuous facial cleanser and toner application. Reduction of these indexes indicated that the roughness of the skin had declined. The improvement of skin hydration was also shown by the increased in energy and homogeneity indexes at 8.74% and 1.07%, respectively. Examples of skin condition at initial and after three weeks of product application were given in Figure 2. The highly hydrated skin has lighter tone image as observed after three weeks of application. The presence of additional hydrating agent such as glycerin (Lodén, M and Wessman,W. 2001) and niacinamide in the formula gave positive impact to skin hydration (Christman, J.C. et.al, 2012) beside the basic formula of cocoa liquid soap. The skin-friendly pH formula at pH 5.5 or neutral also minimized the effect of the cleansing agent to damage the skin (Ananthapadmanabhan, K.P., et. al, 2004). However, at neutral pH, the skin repair was longer than at pH 5.5 (Kuehl, B.L, et.al, 2003).

The wrinkles index increased at 9.99%, significantly, indicating that appearance of wrinkles increased by the application of these products. Thus, this indicated that application of these products were insufficient to rejuvenate the skin, but only can improved the skin hydration. The simple routine, which is applying cleanser and toner, did gave positive impact on skin hydration but greater positive impact was expected with advanced routine (application of cleanser/toner/eye cream/serum/day & night cream; daily) as reported by Messaraa, C., et.al (2020). They reported that application of advanced routine not only improved skin hydration in depth, but also reduced pore area, melanin heterogeneity, and crow's feet wrinkle depth. Therefore, the needs of moisturizing products such as serum, masks, gel or cream after a cleansing routine is necessary to overcome the wrinkles appearance (Tariq and Naveed, 2013). The topical application of moisturizing products beneficially maturing the skin in optimum pace where the desquamation of stratum corneum can take place, thus reducing the presence of wrinkles (Messaraa, C., et.al, 2020).

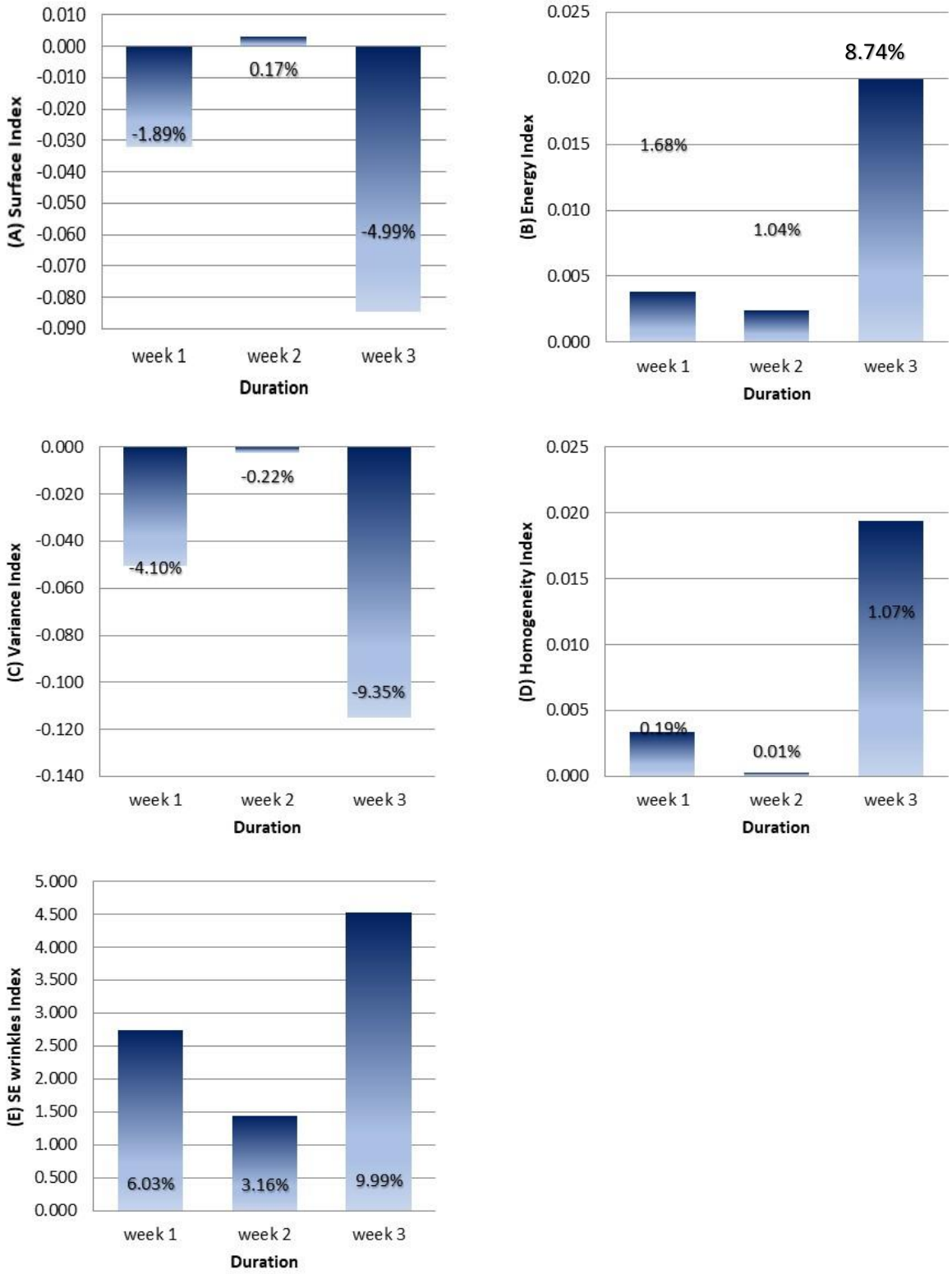

Figure 1 (A) Improvement of skin surface, (B) Increase in Energy Index, (C) reduction of Variance Index, (D) Significant increment of Homogeneity Index (E) Significance of Wrinkles, by the Application of Cocoa Facial Cleanser and Toner

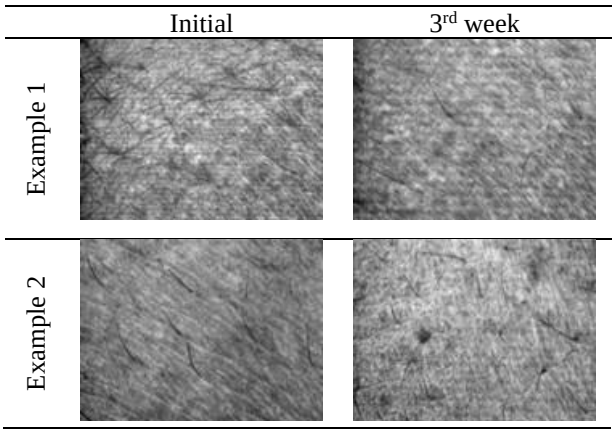

Figure 2: Example of Skin Condition at Initial and after Third Week of Product Application

CONCLUSIONS

The skin hydration was enhanced by the application of facial cleanser and toner made with cocoa materials. Although, the skin wrinkles were not diminished by these products, the application of complete or advanced skin routine can improved the skin condition, which will be carried out later. Diversifying the usage of cocoa materials in cosmetic products is to create the demand of cocoa which could increase the cocoa growers' income.

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