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Determination of phenolic content and antioxidant activity of some cosmetic creams available in Syrian market

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***Corresponding author: E-Mail: ayatabbood@yahoo.fr** **ABSTRACT**

This work was aimed to evaluate the antioxidant activity and phenolic content in 40 commercial cosmetic creams available in Syrian market. Phenolic content was determined according to the *Folin–Ciocalteu* method using gallic acid as the standard. Antioxidant activity of cosmetic creams were measured using the method of FRAP (Ferric Reducing Antioxidant Power). 23% of studied cosmetic creams contained phenolic compounds between 2.9 and 29.8 mg GAE/g cream. 58% of total studied cosmetic creams had antioxidant activity ranged from 54 to 360 µM Fe^{+2}.

KEY WORDS: Cosmetics, Antioxidant activity, Phenolic content.

1. INTRODUCTION

There is a variety of commercially available cosmetic products containing various types of important bioactive compounds from natural or synthetic sources. They differ in their cost and in their quality. Interest in the antioxidants used in cosmetics increased considerably because of their capacity to prevent the action of free radicals and other reactive species that can cause damage to cells and cells compounds of skin. The importance of antioxidants led to test quality of cosmetics in terms of their antioxidant activity.

Skin possesses different defense mechanisms to deal with free radicals and other reactive species. These include non-enzymatic and enzymatic molecules (Bickers, 2006). Chronic exposure to UV can lead to oxidative stress and damage resulting certain skin disorders. They can be minor problems (e.g., wrinkles, acne) or serious problems such as cancer (Yaar, 2007; Ridley, 2009; Pandel, 2013; Panich, 2016). The topical effects of antioxidants have been profited in cosmetic formulations. Antioxidants may be natural or synthetic. The consumer demand for natural ingredients in *cosmetic* products is increasing. Among the natural antioxidants, polyphenols constitute a large and complex family of compounds (Epstein, 2009; Pereira, 2009; Dzialo, 2016).

Phenolic compounds are secondary metabolites in plant. They can be used in treating of a variety of skin disorders since they have antioxidant, anti-inflammatory and antimicrobial activity (Balasundarma, 2006; Dai, 2010; Boudjou, 2013; Mello, 2014; Karim, 2014; Danciu, 2015; Wittenaue, 2015). Their antioxidant activity relies on their ability to inhibit the "Reactive Oxygen Species" (ROS) and to reduce the chelated metal ions (Epstein, 2009; Pereira, 2009). They also interrupt the cascade of free radical reactions in lipid peroxidation and protect the other compounds. This study aimed to determine the phenolic content and the antioxidant activity of some commercial cosmetic creams available in Syrian market.

2. MATERIALS AND METHODS

Chemicals: Ferric chloride anhydrous, ferrous sulfate, Folin-Denis reagent and 2, 4, 6-Tris (2-pyridyl)-s-triazine were purchased from Fluka (Sigma-Aldrich). Gallic acid was purchased from Biotech LTD. Sodium acetate and anhydrous sodium carbonate were purchased from BDH, England.

Apparatus: Different apparatus were used including: spectrophotometer (DLAB Scientific Inc), Water bath (Memmert).

Samples: Cosmetic creams were purchased in supermarkets in Syria. The samples were manufactured in different countries (France, Germany and USA, Syria).

Preparation of samples: For each sample of cosmetic creams, a total amount of 2 gram was weighed into a beaker and portions of 200 ml of freshly boiled water were added and left for three min at room temperature. The samples were then cooled, filtered and diluted to proper concentration prior to analysis.

Preparation of standard gallic acid and ferrous sulfate solutions: A standard stock solution containing gallic acid was prepared in water of 10 g. L^{-1}. The standard solutions from 0.1 to 0.7 g.L^{-1} in water were made by a serial dilution of stock solution.

A standard stock solution containing ferrous sulfate was prepared in water of 1 µM. The standard solutions from 100 to 300 µM in water were made by a serial dilution of stock solution.

Determination of total phenolic content: The total phenolic content of the extracts was measured according to the Folin-Ciocalteu method. Two ml of sodium carbonate solution 2% (w/v) was mixed with 0.1 ml of the diluted sample then allowed standing for 5 min. Then diluted Folin-Denis reagent of 1:1 (0.1 ml) were added. After 30 min of incubation at room temperature, absorbance was measured at 750 nm. The absorbance of blank solution prepared in the same way like samples using 0.1 ml of distilled water instead of the sample was measured. The total phenolic

content was expressed as milligrams of gallic acid equivalents (GAE) /g of cream. All measurements were performed in duplicate.

Ferric reducing antioxidant power: The Ferric Reducing Antioxidant Power (FRAP) was measured spectrophotometrically. The preparation of the FRAP reagent was prepared by mixing 300 mM acetate buffer (pH 3.6), 10 mM 2,4,6-tripyridyl-s-triazine (TPTZ) solution in 40 mM HCl and 20 mM ferric chloride solution at a ratio of 10:1:1 (v/v/v) respectively. One ml of FRAP reagent was added to 100 µl of sample. After incubation for 4 min at room temperature, absorbance was measured at 593 nm. The antioxidant activity was expressed as mM Fe^2 according to a calibration curve obtained using $FeSO_4$. All measurements were carried out in duplicate.

3. RESULTS AND DISCUSSION

In this study, phenolic content and antioxidant activity were determined in 40 cosmetic creams which included moisturizing (40%), nourishing (37%) and sunscreen (23%) creams (figure.1).

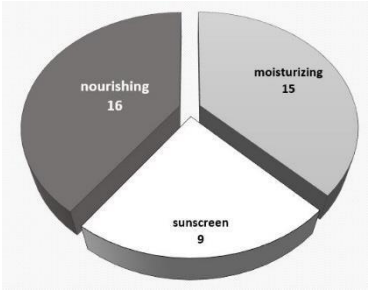

Figure.1. Types of studied cosmetic creams

Total phenolic content: Numerous plant-based ingredients are being used in the skincare world for their actions. Among them, polyphenols are natural antioxidants abundant in medicinal plants, fruits and vegetables. They can be used for treating skin orders and for the prolongation of the stability of cosmetic products. In this investigation, the total phenolic content was determined in the studied creams by Folin–Ciocalteu method. The declared list of ingredients indicated the presence of plant extract in 40% of studied creams.

As shown in figure.2, only 9 creams contained phenolic compounds, which constitute 23% of total studied cosmetic creams. These creams contained extract plant as indicated on the container.

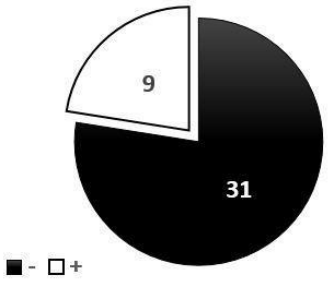

Figure.2. Phenolic content of studied cosmetic creams

The total phenolic content was expressed as mg GAE/g cream (figure.3). It varied from 2.9±1.15 to 29.8±1.91 mg GAE/g cream.

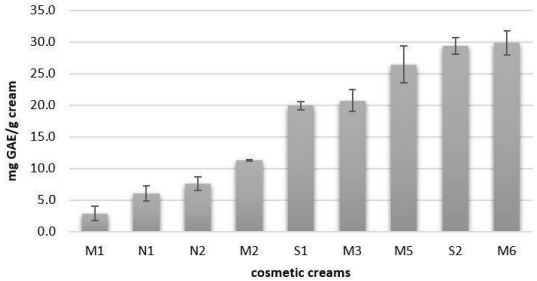

Figure.3. Phenolic content of different types of cosmetic creams determined according to the *Folin–Ciocalteu* method and expressed as mg GAE/g cream. M. N, S Abbreviation of: Moisturizing, nourishing, and sunscreen respectively

Antioxidant activity: Antioxidant is synthetic or natural substances added to cosmetic creams to enhance their stability against deterioration by action of oxygen. In addition, they are capable to protect the skin cell from the damaging effects of oxidation.

List of ingredients indicated that some studied creams contained only synthetic antioxidant compounds mainly tocopheryl acetate, some contained plant extract beside synthetic antioxidant compounds, other creams contained only plant extract without antioxidant compounds.

Antioxidant activity of studied creams was determined by FRAP method. As shown in figure.4, 23 creams had antioxidant activity, which constitute 58% of total studied cosmetic creams.

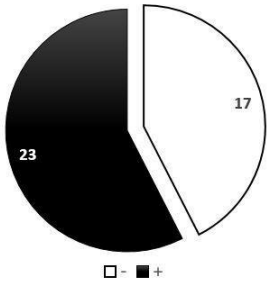

Figure.4. Antioxidant activity of 40 studied cosmetic creams

Total antioxidant activity of different types of cosmetic creams was expressed as µM Fe^{+2} (figure.5). It ranged from 54 to 360 µM Fe^{+2}. The remarked antioxidant activity of some studied cosmetic could be attributed to natural antioxidant (phenolic content) (N1, M1, N2, M2, N3, N4, N5, M8, N7, S4), to synthetic antioxidants (M3, M5, M7, M9, S2, S3, M7, S6) or to natural and synthetic antioxidants (M4, N6, N8, S5).

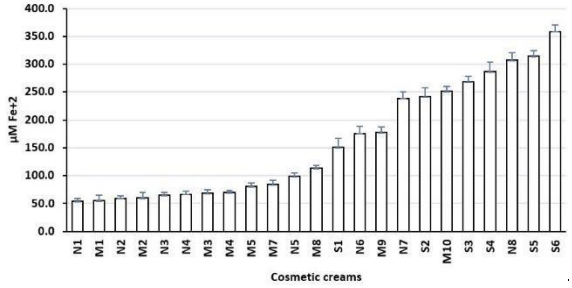

Figure.5. Total antioxidant activity of different types of cosmetic creams, determined according to FRAP method (M. N, S Abbreviation of: Moisturizing, nourishing, and sunscreen respectively)

It was so difficult to establish a relationship between phenolic content and antioxidant activity of cosmetic creams (figure.6) due to the different types of plant extract added to these creams.

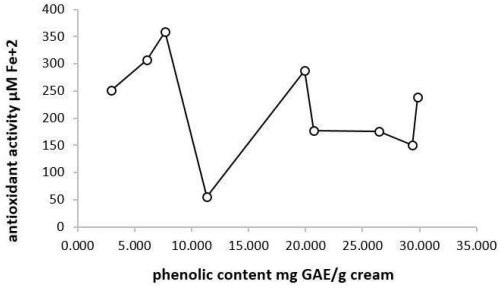

Figure.6. Total antioxidant activity in function of phenolic content in 9 cosmetic creams 4. CONCLUSION

This study focused on determining total antioxidant activity and phenolic content in some cosmetic creams available in Syrian market. The findings of this study reveal that quart of studied cosmetic creams contained phenolic compounds and that about half of creams had antioxidant activity.

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