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The Prevention against Photoaging on Skin as an Effect of UV-B Radiation by Using Tomatoe (*Lycopersicum Pyriforme*) Juice

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Abstract. Photoaging is caused by a lack of collagen and skin elastine fibres due to external factors such as solar UV which may give negative effects on skin, for examples, wrinkled, pigmentation spotted, low elasticity, and hard textures. The process of such an early aging may be blocked or prevented by avoiding factors that may accelerate it. However, so far no explanation has suggested that the effect of tomato juice with a dosage of 11 g/kg Body Weigh may give effects on ROS activity and type-1 collagen expression in rat's skin radiated with UV-B with a dosage of 150 mJ/cm^2. The objective of this study is to understand the effect of tomato juice on the prevention of collagen damage due to the irradiation of UV-B light. The method of this research used 24 rats that are divided into 4 groups consisting of 6 rats each. The control group was not irradiated with UV-B or was not given tomato juice (P_0). The experimental group were given the following treatments: exposure to UV-B light of 150 mJ/cm^2 (P_1), exposure to UV-B light of 150 mJ/cm^2 + giving of tomato juice with the dosage of 11 g/Kg/ Body Weight (P_2) exposure UV-B irradiation with the dosage of 150 mJ/cm^2 + combination application of lycopene, β-carotene, and vitamin C of which their content is equal with that of tomato 11 g/kg body weight (P_3). Treatments were given to each group for 6 weeks. An experimental design using a cluster random with 4 treatments and 6 repetitions was employed. Type-1 collagen expression, were measured with immunohistochemistry, and the MDA content with NWLSS MDA Assay technique. The data were analysed using a variance analysis and then followed with LSD Test. It can be concluded that the application of tomato juice for 11 g/kg body weight or of a combination of lycopene, β-carotene, and vitamin C of which its content equals to 11 g/kg body weight may prevent to increase the content of MDA (as indicator of ROS), but may prevent to decrease the expression of type-1 collagen in the rat skin radiated with UV-B 150 mJ/cm^2. However, it is also found that the application of a combination of lycopene, β-carotene, and vitamin C of which its content equals to 11 g/kg body weight may give no significant difference compared to the application of tomato juice 11 g/kg body weight.

Key Word: ***Photoaging, UV-B, MDA and Tipe-1 collagen***

INTRODUCTION

UV radiation of sunlight in living cells can cause various chemical photo risks such as isomerization photos, and photo oxidation. Oxidation photo reactions occur due to the release of reactive oxygen species (ROS) in the form of superoxide anions (O2●), hydrogen peroxide (H2O2) and hydroxyl radicals (OH ●) by chromophores absorbing ultraviolet light [14,13]. Skin reactions to UV radiation, among which are: the formation of free radicals (O2 ● and OH ●), and cell death directly. The patobiologic effects of ultraviolet light (UV-A and UV-B) produce free radicals and cause damage to DNA, allegedly free radicals are the main factors that accelerate the aging process [1].

UV-B radiation 3 times a week for 6 weeks with a size of 130 mJ / cm2 in vivo causes increased fibroblast damage in rats [10], and [11] reported that UV-B radiation at a dose of 90 mJ / cm 2 for 2 months with 2-day administration may increase MMP-3 activity in mouse skin in vivo. UV-B radiation daily for a month at doses of 90 mj / cm2, 130 mj / cm2, 150 mj / cm2 in vivo rat skin results in increased AP-1 expression, MMP1 and collagen type 1 reduction, and the higher the UVB dose the more increased AP-1 and MMP1 expression and decreased collagen type-1 [14].

Tomato fruit (Lycopersicum periforme) contains many important components, including, among others, vitamin C, β-carotene and lycopene which have antioxidant effects. From the study conducted it is known that lycopene can function as a powerful antioxidant. Lycopene can react with free radicals to stop damaging cells. The research report shows that β-carotene as an antioxidant that can prevent the occurrence of heart disease and cancer [5]; [10]. The results showed that the administration of tomato juice with a dose of 7.11 and 15 g / kg BW was able to decrease the levels of SGOT, SGPT and MDA liver rats tried induced by CCl4 [12]. In addition, the results showed that the administration of tomato juice with 11 g / kg BW was most effective in preventing increased expression of

MMP-1, MMP-3 and preventing decreased expression of type 1 collagen in the back skin of rats that were allowed to aging from 4 to 18 months [14,15].

The data is a fact revealed from the benefits of tomatoes in preventing cell damage due to free radicals, but has not been revealed further about the ability of tomato juice in preventing the effects of free radicals on the skin due to UV-B light. The presence of ROS in the skin due to UV-B light radiation increases AP-1 expression, increasing AP-1 will increase MMP-1, which then MMP-1 will break the type-1 collagen. Damage to collagen type-1 will decrease collagen production causing wrinkles on the skin [9], besides that high ROS also causes increased levels of MDA [16]. The purpose of this research is to know the effect of tomato juice dose 11 g / kg BW and the effect of giving various antioxidant substances in tomato fruit (lycopene, β-carotene and vitamin C) whose content is equivalent to that in tomato juice juice dose 11 g / kg BW in influencing ROS activity, MDA levels, AP-1 expression and type-1 collagen expression on UV-B irradiated rat skin at a dose of 150 mJ / cm2.

METHOD

Treatment in The White Rat

Twenty-five white Rat (Rattus norvegicus, strain wistar) with 3.5 months of age weighing an average of 220 grams, acclimatized to the cage environment in the laboratory for 2 weeks. Randomized rats were divided into 4 treatment groups, with each group of 6 Rat. Group P0 as negative control (rat not given UVB rays), group P1 (rat given UVB rays). P2 group was rat receiving oral tomato extract every two days with dose of 11 g / kg BW and given UVB irradiation, P3 group was group of rat given combination of lycopene, β-carotene and vitamin C whose content was equivalent to that in tomatoes 11 g / kg / BB and given UVB irradiation. Therat were muted together after obtaining prior anesthesia with ether at day 43 in the morning for tissue removal.

Examination of NWLSS test to determine MDA and collagen type-1 levels

This research used MDA (μmol / mL) for the examiner. Levels of compounds formed by oxidation events occurring in lipids containing fatty acids with multiple double bonds in cell plasma membranes in the rats' back skin after treatment were examined using the "NWLSSTM Malondialdehyde Assay (NWK-MDA01) Test"

Statistical Analysis

Statistical analysis using One Way Anova statistical test at level of trust α = 0,01, followed by statistical test of LSD (Least Significance Difference). To examine the differences between the various treatments on MDA levels, AP-1 expression and the expression of Collagen type 1 skin of animal rats' backs.

RESULT

The results showed that MDA levels in tomato juice and lycopene, β-carotene and vitamin C were significantly different (P = 0,000) compared to positive control (P1) but not different from negative control (P0). The mean of MDA concentration in Lycopene, β-carotene and vitamin C was the lowest (0.36 ± 0.028 μmol / mL) followed by treatment of tomato juice dose 11 mg / kg BW average (0.52 ± 0.071 μmol / mL), and differed significantly (p = 0,000) compared to the mean positive control (0.766 ± 0.048 μmol / mL), but did not differ significantly with the mean negative control (0.44 ± 0.059 μmol / mL). These results indicate that the combination of lycopene, β-carotene and vitamin C as well as tomato juice 11 g / kg BW in rats before irradiated UV-B 150 mJ / cm2 rays can prevent an increase in ROS activity measured through MDA levels.

The presence of lycopene, β-carotene and vitamin C in tomato juice is able to reduce free radicals such as hydroxyl ions and superoxide anion. Because the radicals (OH●) and (O●-) of the ROS formation have been tied first by lycopene, β-carotene and vitamin C before destroying cell components such as DNA that result in decreased MDA levels. Thus, the combination of lycopene, β-carotene and vitamin C or tomato juice treatments can prevent the MDA rise due to UV-B radiation of 150 mj / cm2. As the study [10], that the provision of vitamin C can decrease the MDA given to the elderly group. While Lycopene is the most efficient carotenoid in converting singlet oxygen and ROS [2, 3]. From the results of studies showing that carotenoids can significantly decrease MDA and also by consuming carotenoids can prevent lipid peroxidation in cells [4]. Thus, the provision of tomato juice with the content in it vitamin C, lycopene and β-carotene, will decrease ROS characterized by decreased levels of MDA.

Treatment of tomato juice juice of 11 g / kg BW or combination of lycopene, β-carotene and vitamin C containing the equivalent of that in tomato juice dose 11 g / kg BW prior to UV-B 150 mJ / cm2, the lowest collagen type-1 expression was compared with the negative control, positive control. This indicates that the treatment of tomato juice juice 11 g / kg BW or combination of ikopen, β-carotene and vitamin C is an effective treatment in increasing the expression of type-1 collagen in mice irradiated UV-B 150 mJ / cm2. The results showed that the expression of collagen type-1 in combination of lycopene, β-carotene and vitamin C decreased significantly (P = 0.000) compared to positive control (P1) treatment, but no different from the treatment of tomato juice juice 11 g / kg BW, or with negative control (P0).

The presence of lycopene, β-carotene and vitamin C in tomato juice are able to bind free radicals such as hydroxyl ions and superoxide anions. Because the radicals (OH ●)

and (O●-) of the ROS formation have been tied first by lycopene, β-carotene and vitamin C before destroying cell components such as DNA that result in an increase in AP-1. Thus, tomato juice can prevent the decline of type-1 collagen expression due to UV-B radiation dose of 150 mj / cm2. This is supported also from the results of this study indicating that the increase of AP-1 expression, on the treatment of tomato juice with a dose of 11 mg / kg BW can also be prevented.

CONCLUSION

1. The administration of tomato juice at a dose of 11 g / kg BW prevents elevated MDA levels (as an indicator of ROS activity) and prevents a decrease in the expression of type 1 collagen in skin irradiated by UV-B 150 mJ / cm2.
2. Giving a combination of lycopene, β-carotene and vitamin C, whose content is equivalent to that in tomatoes 11 g / kg BW prevents elevated levels of MDA (as an indicator of ROS activity), and prevents decreased expression of type 1 collagen, on irradiated skin UV-B light 150 mJ / cm2.
3. Giving a combination of lycopene, β-carotene and vitamin C whose content is equivalent to that in tomato juice at a dose of 11 g / kg BW did not have a different effect compared with tomato juice at a dose of 11 g / kg BW, in preventing elevated levels of MDA (as an indicator of ROS activity), and prevented decrease of type 1 skin expression in skin irradiated by UV-B 150 mJ / cm2.
4. This study produced a new theory that explains the mechanisms of collagen damage prevention on the skin mediated by prevention of elevated levels of MDA (as an indicator of ROS), and the prevention of decreased expression of type 1 collagen. This is a new contribution to science and provides a scientific basis for the use of tomato juice in slowing down photoaging as a result of UVB irradiation.

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