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Quantitative evaluation of vitamin C in industrial lemon juice by titration method

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ABSTRACT

One of the most important micronutrients of lemon juice is vitamin C. Vitamin C is a sensitive antioxidant and heat, light and oxygen are included as important factors to reduce the amount of this vitamin. This study designed to evaluate vitamin C in industrial lemon juice quantitatively. The present cross- sectional study was conducted on 50 bottles of different types of Shiraz industrial lemon juice. Vitamin C levels were measured through iodine titration method. Each measurement was repeated 2 times. Then Data were statistically analyzed by using SPSS software. The vitamin C of samples has been reported 18.92±6.66 (mg/100ml). Maximum and minimum vitamin C were 6.01 and 34.08 (mg/100ml) respectively. By using independent sample t-test, a comparison of the mean vitamin C of industrial lemon juice and The mean vitamin C of fresh lemon (42 mg/100ml) show that vitamin C of industrial lemon juice is less than fresh lemon, significantly ($P<0.05$). By applying linear regression test determined that a significant relationship exists between the amount of vitamin C in the lemon juice and duration of post-production (p-value = 0.021). This study showed that content of vitamin C in industrial lemon juice was lower than the mean value of vitamin C in fresh lemon juice significantly and the amount of vitamin C in the lemon juice and the period after production is a significant association and with increased storage time, the amount of vitamin C reduced.

Key words: Vitamin C, Lemon juice, Titration

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1. INTRODUCTION

Ascorbic acid is a water-soluble vitamin that is recognized as a valuable antioxidant which inhibits the tissues from the damaging effects of free radicals and through this it helps substantially to prevent and reduce complications of chronic diseases that are prevalent in today's society. Human body has multiple mechanisms for the protection of the active particles, enzymes such as catalase, superoxide dismutase and repair enzymes such as DNA glycosylase and antioxidants such as ascorbic acid (vitamin C), alpha-tocopherol and beta-carotene. vitamin C reproduce alpha-tocopherol from the tocopherol radical. This vitamin plays a role in the production of reduced glutathione that it destroys the free radicals in the respiratory system. Deficiency of this vitamin in the body causes many diseases such as scurvy. It participate as an intermediate in the biosynthesis and metabolism of some substances that the immune system is involved in. Many factors influence the vitamin C content of citrus fruits such as lemon. Decadence of ascorbic acid earnings both aerobic and anaerobic pathways and pertains to many factors such as oxygen, heat, light, storage temperature and storage time. Oxidation of ascorbic acid befalls during storage, which is especially observed in thermally preserved citrus juices. In other hand, few reports exist on the contributions of flavonoids and vitamin C to the antioxidant activity in citrus juices and those that have been published do not quantify the contributions of the different types of flavonoids to the TAA (Total Antioxidant Activity), nor the influence of the process on possible interactions between the two types of compound. In the main, they are confined to widely consumed juices, such as orange, grapefruit, apple or pineapple. The objective of this study was quantitative evaluation of vitamin C in industrial lemon juice by titration method.

2. MATERIALS AND METHODS

2.1. Materials

This was a cross- sectional study, 50 bottles of different types of Industrial lemon juice were randomly purchased from Shiraz supermarkets. These were transferred to food chemistry laboratory of school of nutrition and food science, Shiraz University of medical sciences under normal conditions (temperature (27±4oC). Before testing, each sample was broached well and the necessary amount was spilled in Erlenmeyer flask.

2.2. Methods

2.2.1. Determination of ascorbic acid (Vitamin C)

Ascorbic acid of lemon juice was obtained by Iodine titration method. The content of ascorbic acid was expressed in mg/100ml. 5 ml of sample was diluted with 20ml distilled water in Erlenmeyer flask. Because of the possible presence of sulfur dioxide in the lemon juice, the amount of hydrogen peroxide was added to the solution. Then 0.5 ml starch paste was added to the solution. By iodine solution 0.01 N was titrated to a blue color appears. Finally, with regard to the amount of iodine solution used, the amount of vitamin C in the samples was calculated. Experiments were performed twice for each sample.

2.2.2. Statically Analysis

Statistical analysis of the data was implemented with independent sample t-test and linear regression by using SPSS software (version 20).

3. RESULTS AND DISCUSSION

The mean ± SD vitamin C of samples has been reported 18.92±6.66 (mg/100ml). Maximum and minimum vitamin C were 6.01 and 34.08 (mg/100ml) respectively. By using independent sample t-test analysis, a comparison of the vitamin C of industrial lemon juices and the mean vitamin C of fresh lemons (42 mg/100ml) show that vitamin C of industrial lemon juice is less than fresh lemon 's significantly (P<0.05). The mean vitamin C in four of quartiles calculated from the samples is observed in the Chart 1.

Chart 1. Vitamin C in quartiles obtained from 50 samples was tested (mean±SD)

By using again t-test analysis, this observed even if the mean of the fourth quartile from vitamin C of samples compared with the mean vitamin C content of fresh lemons, this is less significantly (P<0.05). By applying linear regression test determined that a significant relationship exists between the amount of vitamin C in the lemon juice and duration of post-production (p-value = 0.021). As the graph indicates (Figure 1), with increasing time, the amount of vitamin C is reduced.

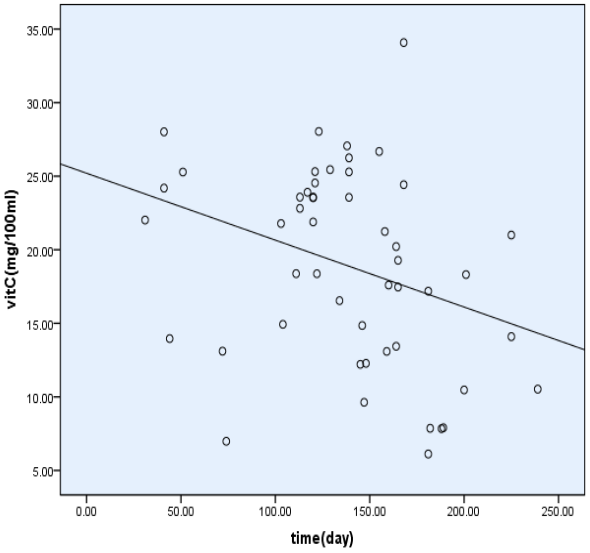

Figure 1. Variations of vitamin C with over time after production of industrial lemon juice

Linear equation between vitamin C and the time is provided below:

vit C(mg/100ml) = 25.2 - (0.045 time(day) after production)

The nutritional quality of food during storage has become a very important issue. The loss of some nutrients such as vitamin C might be a critical factor for the shelf life of some products as citrus juice concentrates. Albeit conventional thermal treatment of fruit juices has been widely and efficiently used to achieve a target shelf life, the thermal process has a negative effect on the intuitive and the nutritional specifications of the juices. Kabasakalis et al. showed that the amount of vitamin C in commercial fruit juices is between 2.4 to 43 mg/100 ml of juice and decreased between 29 to 41% after 4 months of storage at room temperature. Suntornsuk et al. determined the amount of vitamin C in lemon juice about 10.5 mg/100ml. During processing and dewatering of lemon, A quarter of total vitamin C will remain in lemon juices and three quarters of its enters the waste.

4. CONCLUSION

This study showed that content of vitamin C in industrial lemon juice was lower than the mean value of vitamin C in fresh lemon juice significantly (P<0.05) and reduced with increased storage time. Regarding to the low levels of

vitamin C in the industrial lemon juices , is recommended to be employed more appropriate methods of production and storage of lemon juices and inform the general public to make use of the richer sources of vitamin C to provide their needs. For example, make use of the fresh lemon instead of industrial lemon juices.

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AUTHORS CONTRIBUTION

This work was carried out in collaboration between all authors.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interests with respect to the authorship and/or publication of this article.

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