Effect of Thermal Treatment on Synephrine, Ascorbic Acid and Sugar Content of *Citrus aurantium* (Bitter Orange) Juice

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ABSTRACT

**Objective / Purpose:** The aim of this study was to understand the change of synephrine, ascorbic acid and sugar contents after thermal treatment of peeled and grated *Citrus aurantium* (Bitter Orange) Juice. **Material and Methods:** *Citrus aurantium* was extracted either by peeling or grating methods. Clarification of juice was achieved by a pectic enzyme. After filtration, juices were thermally treated using rotary evaporator until 67ºBrix. Synephrine, sugar and ascorbic acid analysis were performed with a HPLC system. **Results:** All compounds’ amounts, except synephrine, changed significantly after thermal treatment. The results, given as dry matter based, were as below. Synephrine contents of fruit juice and concentrated juice of grated bitter oranges were 14.15 g/L and 12.88 g/L, respectively. Ascorbic acid contents of fruit juice and concentrated juices of grated sample were 6.33 and 5.85 g/L, respectively. Synephrine content of peeled fruit juice and concentrated samples were 12.84 and 10.64 g/L, respectively. Ascorbic acid content of peeled fruit juice and concentrated samples were 5.28 and 4.31 g/L, respectively. **Conclusion:** Thermal treatment has no significant effect on synephrine content of fruit juices. Ascorbic acid content decreased significantly after thermal treatment. Moreover, glucose and fructose content of samples increased and sucrose content diminished significantly.

**Key words:** Bitter (Sour) Orange, *Citrus aurantium*, Ascorbic Acid, Synephrine, Thermal Treatment.

INTRODUCTION

*Citrus aurantium* L. var. *amara* is also called sour orange, Seville orange and bitter orange. It is a plant belonging to the Rutaceae family. The origin of the plant is East Africa and Tropical Asia. It is used hundreds of years to remedy headaches, indigestion, to aid weight loss and for treatment of cancer. It is also used pharmacologically as a vasococonstrictor. Primary constituents of the plant are adrenergic amines, which mimic like endogenous agonists of nervous system and stimulate thermogenesis and conduce to lipolysis in the body. *P*-synephrine is the most important alkaloid of the bitter orange. After banning of ephedrine in US market, because of increasing blood pressure and heart rate and some cardiovascular abnormalities, synephrine has become best alternative. Some studies, being carried out to determine the adverse effects of synephrine, show that synephrine doesn’t lead any side effect in the limits of daily dosages. These limits were defined by several studies. According to Hansen *et al.* doses of up to 100 mg of synephrine per kg body weight did not show any toxicity on embryo development. Kaats *et al.* reported that 98 mg/day usage of synephrine appeared to be without adverse effects. Ascorbic acid (Vitamin C) is a very well-known and easily accessible antioxidant. Citrus fruits are good sources of ascorbic acid. Sugar are the major

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component of all citrus species. Bitter orange has glucose, fructose and sucrose, which are compose almost 80% of all carbohydrate constituents. Citrus fruits can be consumed both as raw and after processing. Thermal treatment can usually be applied for longer shelf lives of fresh fruits. Most studies showed that after heat processing of fresh fruit, some bioactive ingredients are degraded. However, there are some exception that heat treatment can increase bioactivity positively. Improvement of lycopene and β-carotene bioactivity after cooking process of tomato and carrots are good examples for this case.

The aim of this study was to understand the change of synephrine, ascorbic acid and sugar content after thermal treatment of peeled and grated Seville (bitter) orange juice.

**MATERIAL AND METHODS**

Bitter oranges were collected from garden of Alata Horticultural Research Institute, Mersin, Turkey. The time of harvesting was decided according to maturity index ratio of fruit (°Brix/acidity). Samples were harvested on January and March. All chemicals were of analytical grade.

**Thermal treatment**

Bitter oranges were cleaned in water and divided in two for peeling and grating extraction processes. After extraction and finishing at 1000 rpm, juice were pasteurized at 85°C for 3 min. Pasteurized fruit juices were clarified with a pectic enzyme, Pectinex Ultra clear, Novozyme (Denmark). Juices were filtrated with rough filter paper under vacuum. Filtrated samples were aliquoted and stored at -20°C until analyzed. Thermal treatment was held using rotary evaporator (Heidolph, Germany) up to 67°C/Brix.

**Synephrine, ascorbic acid and sugar analysis**

Synephrine, ascorbic acid, reducing sugars and sucrose contents of thermally processed samples were compared with control sample (fruit juice) on wet basis and dry matter basis. Results are shown in Table 1.

Wet basis results clearly indicate that all compound's amounts increased significantly (p<0.05). Synephrine contents of grated and peeled fruit juice were found as 1.16 g/L and 1.10 g/L respectively. The results were compatible with some studies. According to Sun et al., synephrine content of bitter orange was 2.25 g/kg. Pellati et al. reported that synephrine percentages of fruit juice and dry extract of bitter orange were 0.1-0.35% and 3.5-3.08%, respectively.

Ascorbic acid contents of grated and peeled fruit juices were 0.57 and 0.48 g/L, respectively. Ascorbic acid content of blood orange was between 0.318 and 0.416 g/L. According to Gazdik et al., ascorbic acid amount of bitter orange was between 0.30 to 0.56 g/kg fresh weight. In another study, ascorbic acid contents of peeled lemon juice and peel of lemon fruit were 0.48 and 0.60 g/L, respectively. However that of grapefruits were 0.35 and 0.44 g/L. Ascorbic acid content of conventionally pasteurized grape juice decreased from 0.36 g/kg to 0.34 g/kg. This results are compatible with present study.

In order to understand the effect of thermal treatment on control sample, the results were converted to dry matter basis. According to Table 1, except for synephrine, all compounds’ contents changed significantly after thermal treatment (p<0.05).
CONCLUSION

The results show that thermal treatment of bitter orange doesn’t have significant effect on synephrine content of fruit juices. However, ascorbic acid content of grated and peeled bitter orange juice significantly diminished. After thermal treatment, while glucose and fructose content of samples increased, sucrose content diminished significantly.

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CONFLICT OF INTEREST

None

ABBREVIATION USED

DAD: Diode array detector; RID: Refractive index detector; HMF: Hydroxyl methyl furfural.

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