

Gac Analysis Report

Introduction

Gac (*Momordica cochinchinensis* Spreng) is a popular fruit in Vietnam, and used as food and medicinal purposes. Gac has been shown to be especially high in carotenoids, vitamin E and fatty acid.

There was a large variation about lycopene and beta carotene concentrations in fresh Gac aril in the previous studies. Amount of lycopene and lycopene in Gac aril ranged from: 0.380 - 0.408mg/g and 0.083-0.101mg/g, respectively (Aoki et al., 2002; Vuong et al., 2006). While Ishida et al. (2004) reported that lycopene concentration in aril ranged between 1.546-3.053mg/g and beta-carotene between 0.636-0.836 mg/g, Nhung et al. (2010) reported even higher concentration of lycopene between 2.378-3.728mg/g and beta-carotene between 0.257-0.379mg/g. It should be noted that all these studies were carried out on frozen fruits and with small amount of samples (2-5 fruits), except the study of Nhung et al. in which samples were analyzed right after harvesting depending on ripeness. The study of Nhung et al. (2010) also showed that the concentration of lycopene and beta-carotene in aril were significantly different due to ripeness of fruits and during storage. Because Gac fruit is harvested one time by the end of this year, in order to have fresh fruit at difference time, fruit need to be stored frozen and content of Gac ingredients need to be evaluated to ensure the quality of stored fruits.

The objectives of the present work here were: (1) to evaluate the content of lycopene and beta-carotene and some other compounds in fresh Gac fruit of several varieties; and (2) to investigate effect of drying process to content of carotenoids in Gac's aril.

Materials and Methods

Materials used in this study are ripe Gac fruits collected in Nghe An province and the north of Vietnam (Hung Yen province) in December 2012.

Chemical standards including Lycopene (>90%) and beta-Carotene (>97%) were acquired from Sigma Aldrich. All chemicals and solvents used are of analytical grade.

Quantitative analyses for moisture, total protein, total sugar, and total lipid were conducted by following Vietnamese and US pharmacopoeia. Quantitative analyses of Lycopene and beta-Carotene were conducted using High Performance Liquid Chromatography (HPLC) by slightly modified published methods. Quantitative analysis of total saponin was performed by a published method (Masayo Iwamoto et al. (1985). *Chem. Pharm. Bull.* 33(2), 464-478).

Results and Discussion

Total lipid concentration in Gac fruits' pulp of species from Nghe An was significantly higher than species in the north of Vietnam (Table 1).

Content of Lycopene and beta-Carotene of fresh aril were much higher than in previous studies of Aoki et al. (2002), Vuong et al. (2006). In those studies, Gac materials were bought in market and transported from Vietnam to their laboratory. During the storage and transportation processes, degradation can happen. In other studies, Ishida et al. (2004) and Nhung et al., (2010) reported the lycopene concentration in Gac aril was 1.546-3.053mg/g and 2.378-3.728mg/g, which were in agreement with the results of this study. The concentration of beta-Carotene of gac aril in this study was 0.25 ± 0.07 mg/g for the Northern species and 0.28 ± 0.1 mg/g for the Nghe An variety which is in agreement with the results of Nhung et al., (2010). This similarity could be the result of using a similar method for extraction and detection of carotenoids.

The content of lycopene in Gac aril in the Northern species was significantly higher than that of Gac's aril in Nghe An province. (almost 2-fold). On the other hand, there was no significantly different in the content of beta-carotene between the 2 Gac species from Northern Viet Nam and those from Nghe An province.

The contents of Lycopene and beta-Carotene significantly reduced in dry Gac's aril in the North of Vietnam when compared with the fresh one. It means that heating process have great influence on the stability of these carotenoids. However, heating process lightly reduced the content of carotenoids in gac aril of in Nghe An but there was no significant different was observed. Together with carotenoids, gac aril also is rich in un saturated fatty acid, the coexistence of unsaturated fatty acids and carotenoids may protect the degradation of carotenoids, it could be a hypothesis to explain the more stable of carotenoids of gac aril in Nghe An during drying process. Thus, there may be a difference in the ingredient of sample collected in Nghe An and Northern Vietnam, further studies need to be done to elaborate this founding.

Concentrations of Lycopene and beta-Carotene in gac aril after drying process by hot air at 50°C in 24 hours in this study were much higher than previous report of Jittawan et al. (2013), it might because of the difference of extraction method or somehow reason.

Table 1. Content of GAC ingredients in ripe fruits

Parameter analysis		Northern species	Nghe An species	Published papers	Note
Fruit pulp					
Moisture (%)		90 ± 1.9	90.6 ± 2.5	not reported	
Total protein (g/100g)		10.9 ± 2.37	11.2 ± 3.62	not reported	
Total lipid (g/100g)		1.1 ± 0.27 ^a	1.9 ± 0.16 ^b	not reported	
Total sugar (g/100g)		18.5 ± 1.83	18.8 ± 3.02	not reported	
Aril					
Moisture (%)		64.1 ± 4.1	61.7 ± 2.1	not reported	
Fresh Aril	Lycopene (mg/g)	5.9 ± 2.1 ^a	3.6 ± 1.9 ^b	2.378-3.728 1.546-3.053 0.38 0.408	Nhung et al., 2010; Ishida et al., 2004; Aoki et al., 2002; Vuong et al.2002, 2006;
	beta-Carotene (mg/g)	0.25±0.07	0.28±0.1	0.257-0.379 0.636-0.836 0.101 0.083	Nhung et al., 2010; Ishida et al., 2004; Aoki et al., 2002; Vuong et al.2002, 2006;
Dried aril	Lycopene (mg/g)	3.7 ± 1.9	3.2 ± 1.9	0.82	Jittawan et al., 2013
	beta-Carotene (mg/g)	0.12±0.05	0.23±0.15	0,002	Jittawan et al., 2013
Seed					
Absolute Moisture (%) water+lipid in liquid form		46.2 ± 2.1	45.0 ± 3.5	6	Vietnamese report
Total saponin (%)		1.3 ± 0.1	1.4 ± 0.1	not reported	
Total lipid (g/100g)		49.4 ± 4.6	51.0 ± 5.2	55.3	Vietnamese report

Each value is presented as mean ± SD (n=6). Number on the same row with different superscript are significant different at P≤0.05.

Note: Lycopene and β-carotene concentration were all calculated on the base of dry weight (deduct moisture content). Drying process of Gac's aril is done by hot air at 500C in 24 hours

Table 2. Influence of drying process to content of Lycopene and beta-Carotene in Gac's aril

Sample Condition	Lycopene (mg/g)		beta-Carotene (mg/g)	
	Northern species	Nghe An species	Northern species	Nghe An species
Fresh	5.9 ± 2.1 ^a	3.6 ± 1.9 ^a	0.25±0.07 ^a	0.28±0.1 ^a
Dry	3.7 ± 1.9 ^b	3.2 ± 1.9 ^a	0.12±0.05 ^b	0.23±0.15 ^a

Each value is presented as mean ± SD (n=6). Number on the same column with different superscript are significant different at P≤0.05.

Note: Lycopene and β-carotene concentration were all calculated on the base of dry weight (deduct moisture content). Drying process of Gac's aril is done by hot air at 500C in 24 hours

Conclusion

Gac fruit is an extraordinarily rich source of Lycopene and beta-Carotene. Systematic analyses are needed to separate the effect of ripeness, storage conditions, processing, and varieties on the nutrient composition of fruit. Total lipid and saponins in the seed are also of interest.

References

- Le Thuy Vuong et al. (2006). *Momordica cochinchinensis* Spreng. (gac) fruit carotenoids reevaluated. *Journal of Food Composition and Analysis* 19: 664–668.
- Dang Thi Tuyet Nhung et al. (2010). Changes in lycopene and beta carotene contents in aril and oil of gac fruit during storage. *Food Chemistry* 121: 326–331.
- Ishida et al (2004). Fatty acid and carotenoids composition of Gac (*Momordica cochinchinensis* Spreng) fruit. *J. Agric. Food Chem.* 52: 274-279.
- Aoki et al (2002). Carotenoids pigments in Gac fruit (*Momordica cochinchinensis* Spreng). *Biosci. Biotechnol. Biochem.* 66(11): 2479-2482.
- Jittawan Kubola et al (2013). Lycopene and beta carotene concentration in aril of gac (*Momordica cochinchinensis* Spreng) as influenced by aril-drying process and solvents extraction. *Food Research International* 50: 664-669.