

Effectiveness of Gac Aril Extract to Stickiness, Retrogradation and Staling of Glutinous Rice Cake

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Abstract

Gac fruit (*Momordica cochinchinensis* Spreng) is a popular fruit in rural area of Vietnam. Its aril contain high amount of β -carotene, lycopene, α -tocopherol and fatty acid. Its bright red color attracts consumers besides phytochemical constituents. It is very important to utilize these valuable constituents in Gac aril for multiple food processing applications. Glutinous rice cake is a kind of folk cake, very rustic, was present very early in the cuisine of Vietnam, also the specialty cakes of the local countryside, quite familiar and impressed in the hearts of people, products with aromatic fatty flavor, tasty, sweet flowing with delicate. Nowadays consumers require glutinous rice cake with superior appearance, texture, taste and flavor while stabilizing its nutritional value. Therefore in this present research, we examined the supplementation of Gac aril extract in different concentrations (2.0, 3.0, 4.0, 5.0%, 6.0%) to the physico-chemical, sensory and shelf-life of the glutinous rice cake. Our results showed that 5.0% Gac aril extract was adequate to supplement into glutinous rice cake making to extend its shelf-life for 5 days. Consumers have more chance to enjoy glutinous rice cake in good appearance and high functional properties.

Keywords: Gac aril extract, Glutinous rice cake, Supplementation, Physico-chemical, sensory, Shelf-life.

Introduction

Gac fruit (*Momordica cochinchinensis* Spreng) has a thick yellow mesocarp, red soft and sticky aril. Availability of Gac fruit is seasonal in three months out of the year. Gac fruit perishes quickly under ambient environment and lose its market ability after one week. Its contains extraordinarily amount of carotenoids, especially β -carotene, lycopene, α -tocopherol, polyunsaturated fatty acids associated with antioxidant capability [1, 2].

Its pulp has bright red color and palatable bland to nutty taste. According to Hiromitsu et al. [3], the lycopene concentration in Gac fruit is at least five times higher than in other fruits like carrot, tomato, guava, papaya, water melon [4, 5]. The red aril powder could be applied to improve a yellow red color in glutinous rice [6]. Glutinous rice (*Oryza sativa* L.) is one of the most important crops in Vietnam. It is washed, cooked with water, and pounded right after cooking to lose the integrity of rice kernel and to form the viscoelasticity. It is soft and slightly sticky with some elasticity [7]. Flour from glutinous rice is under-utilized in the

production of cake or similar products [8, 10]. Objective of our study investigated the effectiveness of gac aril extract supplementation to stickiness, retrogradation and staling of glutinous rice cake.

Material and Method

Material

Gac fruits were collected from Can Tho city, Vietnam. After collecting, they must be kept in dry cool place in 3 days and conveyed to laboratory for experiments. Gac fruits are chopped to collect its aril. They were subjected to steaming in 6 minutes to maintain carotene content. The steamed Gac aril was then extracted in 70% ethanol at ratio 1:1. The extract was filtered through sieve to remove unsolid particles. Then Gac extract was mixed into glutinous rice cake in different levels.

Researching Method

Glutinous rice was soaked in alkaline solution for 4 hours. It was drained and grinded into fine powder. The glutinous rice powder was added 8% sugar and the Gac

extract in different concentrations (2.0, 3.0, 4.0, 5.0%, 6.0%). The dough was mixed thoroughly for 30 minutes before being wrapped by banana leaf and steamed for 30 minutes. The finished glutinous rice cake was cooled to ambient temperature and store for 5 days. Samples were analyzed the stickiness (g), retrogradation (sensory score) and staling (total plate count, cfu/g).

Stickiness, Retrogradation and Staling Determination

Stickiness (g) of the steamed glutinous rice cake was evaluated by using texture analyzer [11]. Retrogradation was evaluated via sensory score by a group of 11 specialists using 9 point–Hedonic scale. Shelf-life or staling was estimated via enumeration of total plate count (cfu/g) by Petrifilm 3-M.

Statistical Analysis

Table 1: Effect of Gac extract supplementation (%) to stickiness (g) of the steamed glutinous rice cake

Gac extract (%)	2.0	3.0	4.0	5.0	6.0
Stickiness (g)	28.50±0.01 ^a	28.47±0.03 ^a	28.45±0.00 ^a	28.44±0.02 ^a	28.43±0.03 ^a

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant ($\alpha = 5\%$)

The molecular interaction produced after gelatinization and cooling of the paste is known as retrogradation [14]. Starch retrogradation is a process in which disaggregated amylose and amylopectin chains in a gelatinized starch paste reassociate to form more ordered structures [15]. During retrogradation, amylose molecules associate with other glucose units to form a double helix, while amylopectin molecules re-crystallize through association of its small chains [16]. Amylose retrogradation was found to be a fairly fast event relative to amylopectin retrogradation. Amylopectin retrogradation was a much slower event. It's probably due to the essentially linear structure of amylose, as

The experiments were run in triplicate with three different lots of samples. The data were presented as mean \pm standard deviation. Probability value of less than 0.05 was considered statistically significant. Statistical analysis was performed by the Stat graphics Centurion version XVI.

Result & Discussion

Stickiness is an important parameter to indicate rheological property of dough [12]. Stickiness is a vital textural property strongly effecting to dough handling and cake quality.

It reflects quality of steamed products [13]. In our research, the stickiness of the glutinous rice cake is nearly stable irrespective of Gac extract supplementation from 2.0% to 6.0% (see Table 1).

opposed to amylopectin. Initially, the amylose content exercises a strong influence over the retrogradation process; a large amount of amylose is associated with a strong tendency for retrogradation. Amylopectin and intermediate materials influence the retrogradation process during storage under refrigeration. After retrogradation, starch exhibits lower gelatinization and enthalpy compared to native starch because its crystalline structure has been weakened [17]. In our research, when increasing the Gac extract supplemented into the glutinous rice dough, the retrogradation would be lower (or higher sensory score) during 5 days of consumption (see Table 2).

Table 2: Effect of Gac extract supplementation (%) to retrogradation of the steamed glutinous rice cake in 5 days

Retrogradation (sensory score)	Gac extract (%)				
	2.0	3.0	4.0	5.0	6.0
1 st day	7.34±0.03 ^c	7.69±0.01 ^{bc}	7.95±0.03 ^b	8.27±0.00 ^{ab}	8.45±0.02 ^a
2 nd day	7.17±0.03 ^c	7.52±0.01 ^{bc}	7.81±0.01 ^b	8.19±0.03 ^{ab}	8.34±0.00 ^a
3 rd day	7.05±0.00 ^c	7.37±0.02 ^{bc}	7.73±0.00 ^b	8.11±0.01 ^{ab}	8.25±0.02 ^a
4 th day	6.98±0.02 ^c	7.28±0.00 ^{bc}	7.65±0.02 ^b	8.04±0.00 ^{ab}	8.16±0.00 ^a
5 th day	6.87±0.01 ^c	7.15±0.01 ^{bc}	7.52±0.03 ^b	7.99±0.00 ^{ab}	8.05±0.01 ^a

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant ($\alpha = 5\%$)

Concerning the staling during storage, Gac extract supplementation could reduce the amylopectin retrogradation effectively. Similarly, Ying et al [18]. Revealed that

β -amylase, carboxymethyl cellulose, xanthan had anti-staling effect on glutinous rice cake. Yang et al [19]. Proved that dry-heat treatment showed significant impact on

viscoelasticity of glutinous rice flour. In our research, Gac extract showed positive effect to slow down the staling process by

minimizing the total plate count proliferation (see Table 3).

Table 3: Effect of Gac extract supplementation (%) to staling (total plate count, cfu/g) of the steamed glutinous rice cake in 5 days

Total plate count (10 ¹ cfu/g)	Gac extract (%)				
	2.0	3.0	4.0	5.0	6.0
1 st day	2.0±0.2 ^a	1.9±0.0 ^{ab}	1.7±0.2 ^b	1.6±0.1 ^{bc}	1.4±0.3 ^c
2 nd day	3.3±0.1 ^a	2.6±0.3 ^{ab}	2.2±0.0 ^b	1.9±0.0 ^{bc}	1.5±0.1 ^c
3 rd day	4.6±0.3 ^a	3.9±0.1 ^{ab}	2.8±0.3 ^b	2.2±0.3 ^{bc}	1.8±0.0 ^c
4 th day	5.8±0.2 ^a	4.7±0.2 ^{ab}	3.4±0.1 ^b	2.5±0.1 ^{bc}	2.0±0.3 ^c
5 th day	7.3±0.0 ^a	6.1±0.2 ^{ab}	4.0±0.2 ^b	2.9±0.0 ^{bc}	2.2±0.2 ^c

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant ($\alpha = 5\%$)

Conclusion

Glutinous rice cake exhibits unique viscoelastic property. The red aril of Gac is rich in lycopene and β -carotene content. Gac extract has been utilized as a great natural red colorant. In this research, we have attempted to verify the impact of Gac extract supplementation to the stickiness, retrogradation and staling of the steamed glutinous rice cake. There was not significant

difference in respect of stickiness when adding Gac extract from 2.0% to 6.0%. Fortunately, the retrogradation and staling of the steamed glutinous rice cake could be controlled effectively by adding 5.0% Gac extract into dough. These findings revealed that red natural colorant extracted from Gac aril could be utilized to not only improving nutritional value, raising overall acceptance but also extending the shelf life of the glutinous rice cake [20].

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