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NOTE

Variation of Charantin Content in Different Bitter Melon Cultivars

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Ten bitter melon cultivars (5 from Japan and 5 from the Philippines) were evaluated to distinguish their charantin content. The charantin content varied widely among the cultivars from the 2 locations. In general, the Japanese cultivars contained higher cahrantin levels than the Philippine ones, with the highest content found in Peacock and the lowest in the cultivar Trident 357 from the Philippines. The amount of charantin was 23.8 and 18.9 times higher in the Japanese cultivars Peacock and Nikko, respectively, than that in Trident 357. Although the Philippine cultivars contained a lower amount of charantin compared to the Japanese ones, the cultivar Sta Monica contained the highest amount of charantin compared to other Philippine cultivars. Based on these results, the cultivar Peacock could potentially be used as a source of charantin.

Keywords: Bitter melon, Charantin, Cultivars, *Momordica charantia* L.

Bitter melon (*Momordica charantia* L.) belongs to the family Cucurbitaceae and is a medicinal plant indigenous to temperate and tropical regions of Asia and to other areas in the world. The fruit of *M. charantia* is commonly known as the bitter melon or the bitter gourd because of its bitter taste. The fruit is oblong and resembles a cucumber. The fruit is emerald green when young and turns to orange-yellow upon ripening[1,2].

In many countries, the bitter melon is commonly used for the treatment of diabetes and colic and as a carminative[3-5]. It can be applied topically for the treatment of wounds and used internally and externally for the management of worms and parasites. It can also be used as an emmenagogue and as an antiviral medicine for measles and hepatitis. The fruit and seeds of bitter melon are traditionally used as medicinal herbs for their anti HIV, antiulcer, antiinflammatory, antileukemic, antimicrobial, antidiabetic and antitumor properties[6-8].

The unripe fruit of the bitter melon has been found to have a blood sugar lowering capacity, similar to that of insulin and can be used to treat patients with diabetes. The component that is responsible for this activity is charantin, which is a mixture of 2 compounds (Fig. 1), sitosteryl glucoside and stigmasteryl glucoside[9]. Charantin could be used to treat diabetes and could potentially replace insulin injections as a treatment[2].

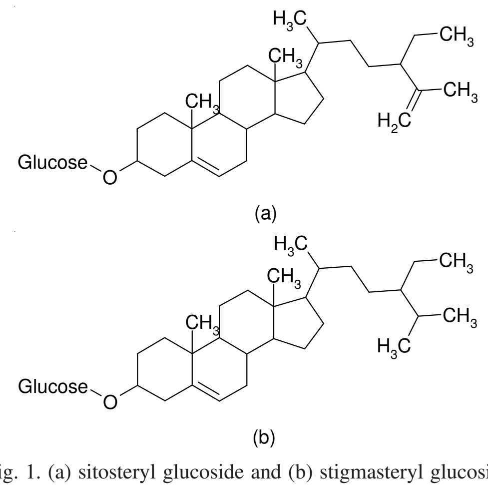

Fig. 1. (a) sitosteryl glucoside and (b) stigmasteryl glucoside

The objectives of this study were to examine cultivars from different sources in order to assess the charantin levels of the bitter melons and to evaluate several morphological characteristics (*i.e.*, length, diameter and weight) of the bitter melons.

Seeds of 10 bitter melon cultivars (5 from Japan and 5 from the Philippines) were germinated and then the seedlings were transferred to the greenhouse maintain the temperature at 25 ºC, 60 % relative humidity and allowed to normal day light condition in experimental farm at Chungnam National University (Daejeon, Korea). After 4 months (at green edible stage), the fruits of 10 bitter melon cultivars were harvested and used to compare their morphological characters and charantin contents.

Charantin extraction: Samples (1 g) were extracted at room temperature with 20 mL of hexane to remove the lipids and then dried in the hood. The procedure was repeated twice. Samples were then extracted with 10 mL of MeOH (100 %) in a Sonicator (Branson Ultrasonic Co., Danbury, CT, USA) for 1 h. The extract was filtrated through filter paper (Whatman No. 42) and evaporated (Heidoph VV2011, 40 ºC). The evaporated extract was resuspended with 1 mL of MeOH for HPLC analysis.

HPLC analysis of charantin: The charantin was analyzed using an HPLC system (NS-4000; Futecs Co., Daejeon, Korea) with a UV detector (204 nm). The separation was performed on an Optimapak (4.6 mm × 250 mm, 5 µm, 100; RStech, Korea) with a flow rate of 0.8 mL min^{-1}. The mobile phase used was 98 % MeOH and 20 µL was injected for each sample. Identification and quantification of charantin was carried out by comparing the retention times and the peak areas, respectively, with standards or by the direct addition of the standard into the sample (spike test). Sample aliquots were filtered through a 0.45 µm poly (tetrafluoroethylene) filter prior to injection. All samples were run in triplicate. Standard chemicals were purchased from Chromadex Inc. (Santa Ana, Calif., USA).

Charantin content in different cultivars of bitter melon: The charantin content differed widely among the 10 bitter cultivars from the 2 locations (Table-1). In general, the charantin content in the Japanese cultivar was much higher than in the Philippine ones. Among the different cultivars, Peacock contained the highest charantin contents, followed by those of Nikko, Dragon and Kyushu. On the other hand, melons of the Philippines cultivar Trident 357 contained the lowest charantin contents among the 10 cultivars,. The charantin levels of the Japanese cultivars Peacock, Nikko, Dragon and Kyushu were 23.8, 18.9, 12.3 and 11.9 times higher, respectively, than those of Trident 357. Moreover, Peacock melons contained 8.2, 2.0, 1.9 and 1.3 times more charantin than those of other Japanese cultivars Erabu, Kyushu, Dragon and Nikko, respectively.

TABLE-1
CHARANTIN CONTENTS IN DIFFERENT CULTIVARS OF *Momordica charantia*

Country	Cultivar	Charantin (µg/g dry weight)
Japan	Erabu	86.8 g
	Dragon	367.1 c
	Kyushu	354.3 c
	Nikko	563.8 b
	Peacock	711.6 a
Philippines	Galaxy	120.5 f
	Sta Monica	235.7 d
	Sta. Rita Strain. L	90.4 g
	Trident 357	29.8 h
	Verde Buenas	161.9 e

Mean values (mean of three replicates with three samples from each replicate) indicated by the same letter in a column do not differ significantly at 5 % level (Duncan multiple range test).

Although Philippines cultivars contained lower amount of charantin relative to the Japanese ones, Sta Monica contained the highest amounts of charantin compared to other Philippines cultivars. This cultivar (Sta Monica) contained 7.9, 2.6, 2.0 and 1.5 times higher charantin levels than Trident 357, Sta. Rita Strain. L, Galaxy and Verde Buenas, respectively.

Morphologically (in terms of length, diameter and weight) and for the charantin content bitter melon cultivars varied significantly. Our findings are in agreement with Habicht *et al.*[10] where they reported that the levels of saponin, linoleic and linolenic varied among the cultivars of bitter melon. They found that white bitter gourd varieties were found to contain significantly lower saponin concentrations (0.25 %) compared to green varieties (0.67 %). Differences regarding these findings may result from differences regarding the extraction methods and the different varieties investigated as Oishi *et al.*[11] do not provide any information about variety or plant part used. But, the results are of the same magnitude indicating that bitter gourd is a vegetable rich in saponins. For example charantin is one important steroidal saponin in the bitter gourd with β-sitosterol and stigmasterol as aglycones[12].

Conclusion

This study has shown the levels of an important compound (charantin) in different cultivars of bitter melon from 2 locations. Charantin levels varied widely among the cultivars, so that some of them produced substantially higher levels of charantin than did others. Specially, the Peacock cultivar from Japan performed the best for charantin content. Because charantin has traditionally been used to treat diabetes, cultivars such as Peacock could be used as a food supplement to help control diabetes for lower income people in developing countries.

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