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Sugar and alkaloid profiles of serendipity berry (*Dioscoreophyllum cumminsii*)

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Abstract

The study evaluates the chemical and physico-chemical composition of serendipity berry (*Dioscoreophyllum cumminsii*). The berries were separated into seed coat, gel and seed. The sugar and alkaloid profiles of the three components of these berries were analyzed. The predominant sugars were fructose and glucose. Fructose and glucose ranged from 0.61 to 3.47 mg/100g and 0.35 to 3.15 mg/100g respectively. The gel had higher sugar contents than the seed and the peel. Soladulcine was the predominant alkaloid in the seed and peel. Total alkaloids were 1.09 mg/100g in seed, 0.18 mg/100g in peel and traces of emetine in the gel. The alkaloid contents of the seeds were higher than the peels and the gel. Generally, the alkaloid contents in the three components of the berry were very low and could not cause any health problem when consumed. Serendipity berry is a promising fruit which could find its use in the production of juice and wine in the food industry.

Keywords: Alkaloid, Fructose, Glucose, Serendipity berry, Sugar

Introduction

Fruits are the mature ovaries of plants with their seeds. They are the fleshy part of a plant, usually eaten alone or served as a dessert. Fruits are high in organic acids and sugar. The nutritive value of vitamins, minerals, fiber, and other compounds contained in fruits and vegetables is extremely important to the diet (Vaclavik and Christian, 2008). Consumption of a diet high in fruits and vegetables increases antioxidant concentration in blood and body tissues and potentially protects against oxidative damage to cells and tissues (Yahia, 2010). Serendipity berry (*Dioscoreophyllum cumminsii*) is a tropical rainforest vine. The genus *Dioscoreophyllum* belongs to the tribe, Tinosporeae comprising *D. cumminsii* and *D. volkensii* (Oselebe and Nwankiti, 2005). *Dioscoreophyllum cumminsii* is a tropical dioecious rainforest vine. It grows in humid and heavily shaded under storey vegetation of closed forest, from May to October. The fruit, serendipity berry, contains a protein sweetener called monellin that could replace sugar in foods for diabetics and dieters (Inglett, 1976; Oselebe and Nwankiti, 2005). Monellin is a sweet protein from the fruit of "serendipity berry" (*Dioscoreophyllum cumminsii*), a tropical plant native to West Africa (Wlodawer and Hodgson, 1975). Serendipity berry is among the unpopular and under-utilized fruit found in the forest towards the end of the raining season. Fruits such as citrus, plum, peach, quince, berries and choke cherries had been studied (Walkowiak-Tomczak et al., 2008; Hajilou and Fakhimrezaei, 2011 Rop et al., 2011; Zatylny et al., 2005). The properties of serendipity berries have not been widely investigated like other fruits therefore; there is limited information on the nutritive values of the fruit. However, this work investigates the sugar and alkaloid profiles of serendipity berry components.

Materials and Methods

Materials

Serendipity berries were obtained from a farm at Esa-Odo, Osun State, Nigeria in October 2012. The berries were washed and separated into peel, gel and seeds

Methods

Sugar Profile Determination

Fifty milligram of sample was extracted by ethanol. The ethanol-extracted sample was dried overnight at 80°C and then re-suspended in a 50 mM sodium acetate buffer (pH = 5.2). Starch in the sample was then digested to glucose by incubating the pellets for 12 h at 57C with 400 units/ml a-amylase and 2 units/ml amyloglucosidase in 50 mM sodium acetate buffer. After centrifugation at 4,000 × g for 5 min., triplicate aliquots of 200 ml of supernatant from each sample was brought to a final volume of 1 ml and was quantified with glucose Trinder reagent (Sigma Chemical Co.). Qualitative analysis of ethanol-extracted sugars was accomplished by methods described by Ashworth et al. (1993). Ethanol was evaporated from 0.5 ml extract of each sample. Sugars were re-dissolved in 1 ml deionized water and filtered through a 0.45-µm nylon membrane were separated into their component peaks by injecting 25 µl each sample into the Gas chromatography equipment.

Alkaloid Profile Determination

Alkaloid extraction was carried out as described by Wink (1993). 2 g flour material was homogenized in 30 ml 0.5 N HCl. After 30 min at room temperature, the homogenate was centrifuged for 10 min 5,000g. For quantitative work, the residue was re-suspended in 0.5 N HCl and centrifuged again. Both supernatants were then pooled and adjusted to pH 12-14 with NH_4OH (25%). Alkaloids were extracted by solid-phase extraction using Extrelut column (Merck, Darmstadt). Total alkaloids were eluted with CH_2Cl_2 and the solvent evaporated in vacuo. The alkaloid extract was dissolved in CH_2Cl_2 and applied into a GC apparatus (Hewlett Packard Model 6890 series). Experimental conditions for capillary GC analysis were developed under the following conditions. Capillary column HP-5 (Crosslinked 5% phenylmethylsiloxane, 50 m x 0.32 mm (i.d.), with 0.17 µm film thickness, model no. HP 19091J-015), injector temperature 250 ℃, carrier gas helium (1 ml/min), split ratio 1/20, injection volume 0.2 µl, and mass range (m/z) 20-440. GC oven temperature was kept at 120 ℃ for 2 min, programmed to 300 ℃ at a rate of 6 ℃/min, and kept constant at 300 ℃ for 10 min.

Statistical analysis

All analyses were carried out in duplicate. The mean and standard deviation of the data obtained were calculated.

Results and Discussion

The fruit consists of lot of berries in a bunch and were divided into three components; the seed, peel and gel. The sugar contents of serendipity berry are shown in Table 1. Fructose and glucose were the predominant sugars in the berry. Fructose and glucose ranged from 0.61 to 3.47 mg/100g and 0.35 to 3.15 mg/100g respectively. Fructose contents were higher than other sugars in the three components of the berry. The highest sucrose content (0.99 mg/100g) was observed in the gel. Ertekina et al. (2006) and Walkowiak-Tomczak *et al.* (2008) reported sucrose, glucose and fructose, organic acids as the major components of plum fruit. Likewise, Ozilgen (2011) observed higher values for glucose (36.9g/100g), fructose (39.4g/100g) and sucrose (1g/100g) in sultana fruit bars. Sucrose contents ranging from 8.86-21.28g/100g was reported for cultivars of chestnut fruits (Erturk et al., 2006). The levels of these sugars in the berry were low when compared to other fruits.

Total sugar contents of serendipity berry are presented in Fig. 1. The highest total sugar in the berry was in the gel (7.62mg/100g) while the lowest value was in the seed (1.05 mg/100g). These values were lower than 15.2 – 30.0% in pineapple and 10.32 to 22.79 g/100g in chestnut cultivars (Othman, 2011, Erturk et al., 2006). But the total sugar value for the gel was higher than palmyra palm fruits (4.47-5.62 g/100g) as reported by Ali *et al*. (2010). Serendipity berry was low in sugar contents and was in agreement with the reports of Inglett (1976) and Oselebe and Nwankiti (2005). The intense sweetner in the berry was observed to be protein called monelin. Therefore, serendipity berry could be recommended to people requiring low sugar fruit such as diabetic patients.

Alkaloid contents of serendipity berries are shown in Table 2. Solasodine, timatidenol and soladulcine are the major alkaloids in serendipity berry. Soladulcine was the predominant alkaloid in the seed and peel. Tomatidenol was not detected in the peel but all the alkaloids were not detected in the gel except trace of emetine indicating that the gel is suitable for consumption. The total alkaloid contents ranged from 0.0006-1.09mg/100g (Fig. 2). Although the seeds had higher alkaloid contents than other components but the value was very high when compared to the alkaloid contents in mango 0.01 mg/100 g (Fowomola, 2010) and 0.13-0.17 % in wild mango fruits (Joseph and Aworh, 1991). The alkaloid contents in the peel (0.18 mg/100g) was within the range reported for wild mango peels (Joseph and Aworh, 1991) and lower than 5g/kg in the pulp of raphia palm fruit (Ogbuagu, 2008). Zulkifli *et al.* (2012) observed the presence of alkaloids in the peels of *Malus sylvestris* and *Citrus sinensis*. Aguzue *et al*. (2012) also reported the presence of alkaloids in the fruits of Borassus *aethiopum, Borassus flabellifer* and *Balanite aegyptiaca, Phoenix dactylifera and Tamarindus Indica.* No traces of alkaloid was detected in guava peels and fruits (Pandey and Shweta, 2012). High alkaloid contents cause toxicity when ingested by human being.

Conclusion

The results revealed low sugar and alkaloid contents in serendipity berry. The fruit may be taken by people requiring low sugar fruit. Serendipity berries may also be useful in the food industry for production of juice and other products.

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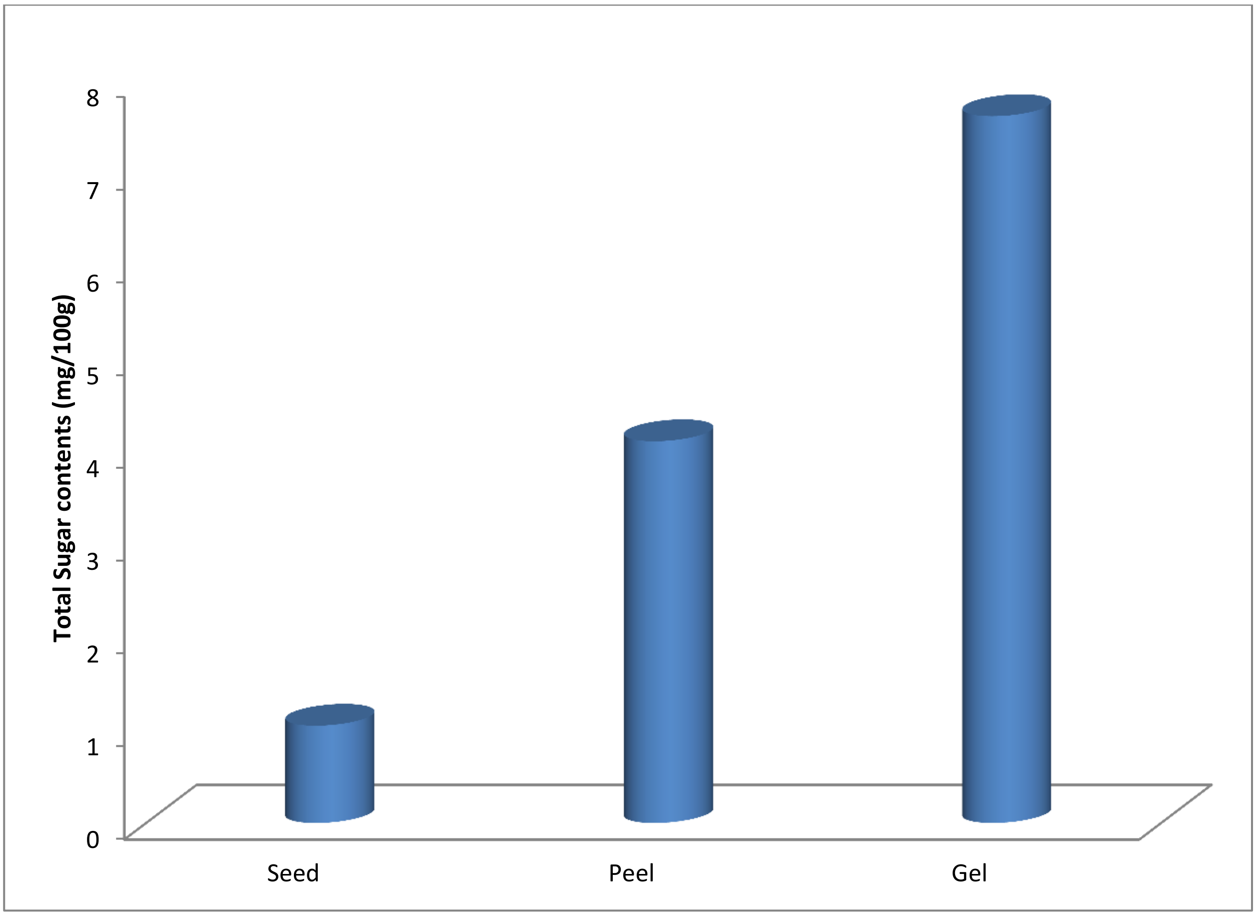

Fig. 1: Total sugar contents of serendipity fruits components

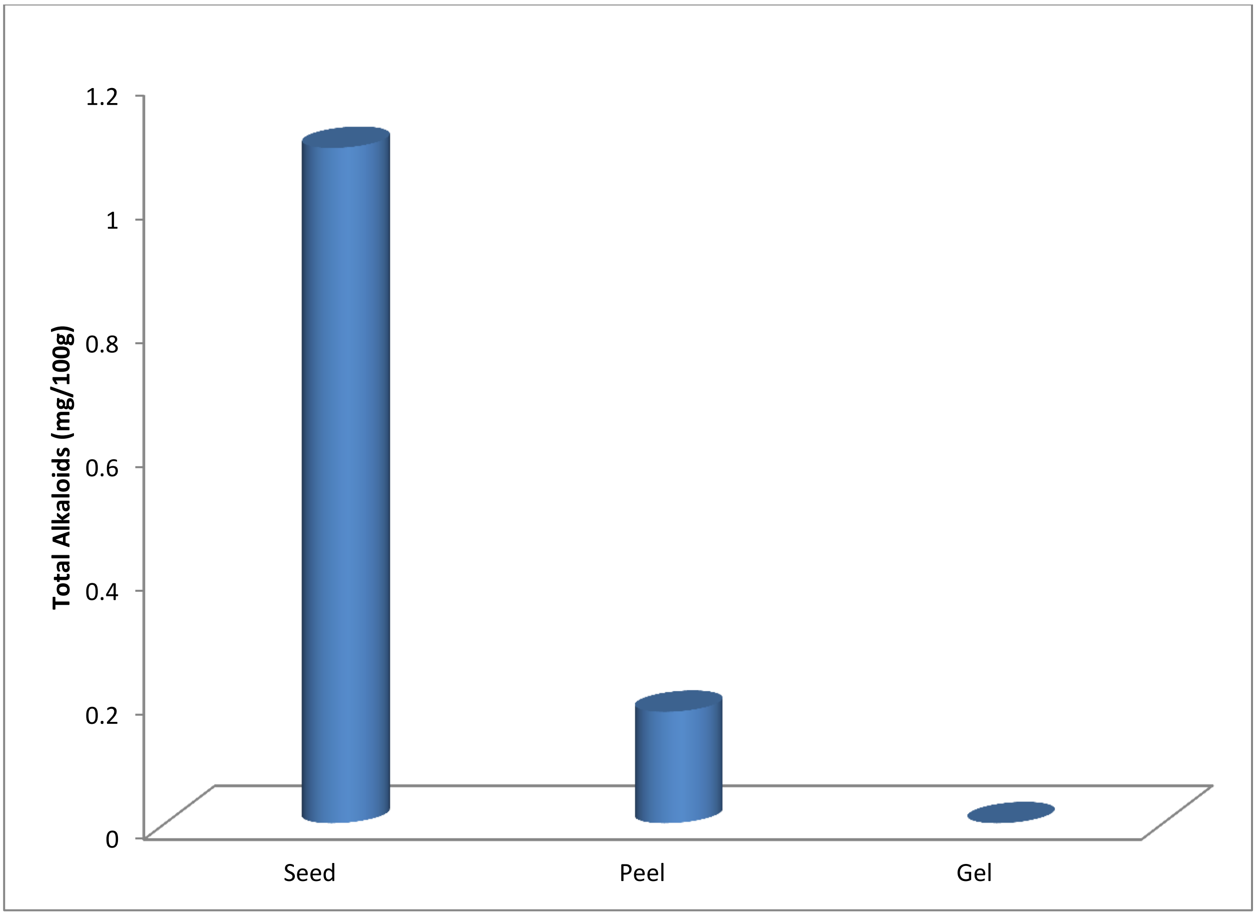

Fig. 2: Total alkaloids of serendipity fruits components

Table 1: Major sugars in serendipity fruit components

	Seed	Peel	Gel
Fructose	0.61 ±0.12	2.01 ±0.09	3.47 ±0.12
Glucose	0.35 ±0.10	1.47 ±0.11	3.15 ±0.03
Sucrose	0.09 ±0.02	0.64 ±0.04	0.99 ±0.02

Mean ± Standard deviation

Table 2: Major alkaloids in serendipity fruit components

Alkaloid	Seed	Peel	Gel
Solasodine	0.15 ±0.10	0.02 ±0.01	ND
Tomatidenol	0.24 ±0.08	ND	ND
Soladulcidine	0.68 ±0.02	0.15 ±0.01	ND

ND- Not detected

Mean ± Standard deviation