Research Article

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Nutritional, Phytochemical and Carbohydrate Profile of Giant Swamp Taro *[Cyrtosperma merkusii (Hassk.). Schott]*

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ABSTRACT

Giant swamp taro is an underutilized root crop in the Philippines. The nutrient, phytochemicals, and carbohydrate profile of the processed taro from the cultivated and wild varieties were measured and the storage stability of the flour was determined.

The boiled taro from cultivated and wild varieties contained approximately 385.67 and 377.29 kcal, respectively. Beta-carotene and vitamin C contents of the boiled and floured products from wild variety were found to be significantly higher than that from the cultivated variety. However, the iron, zinc and calcium in the boiled cultivated variety was significantly higher than its wild variety. The flour produced from the wild variety were significantly higher in iron, zinc and calcium than the cultivated variety.

The boiled and floured cultivated taro had significantly higher amounts of phenols and flavonoids while significantly higher amounts of tannins and saponins were measured in the boiled and floured wild taro. The processed products from both local taro varieties had > 75% antioxidant activity. The boiled and floured cultivated taro were found to contain significantly higher amounts of amylose, dietary fiber and resistant starch compared with products from wild taro variety. The glycemic index of processed forms of taro made from the two local varieties had a range of 64-70% (intermediate).

Keywords
Degenerative diseases, Nutrition disorders, Giant swamp taro, Phytochemicals.

Introduction

The remarkable increase in the spread of degenerative diseases and other nutrition- related disorders have driven consumers' interest in healthy food items. The mindset of consumers shifted to products that claim to improve health. Their interest in healthy eating is shifting towards the potential health benefits of specific foods and food ingredients [1]. High fiber, high antioxidant foods, and fortified products were just some of the identified health products desired by consumers since these are perceived to reduce the early onset of disease and promote good health as well. With the increased cost of food at present in the Philippines, the quantity and quality of food intake are severely affected and thus might further aggravate the epidemic problem of chronic noncommunicable diseases. One possible solution to combat the rising cost of food is to tap indigenous crops in the country. These indigenous crops may not only provide basic nutrients but it might offer also other health benefits hence the need to study to further utilize and develop healthier products and provide an additional source of food to the public and generate income also to farmers and their families.

Starchy roots and tuber crops play a pivotal role in the human diet. The nutritional value of root and tuber crops lies in their ability to provide one of the cheapest sources of dietary energy in the form of carbohydrate. They are also good sources of dietary fiber. In developing countries as a whole, they provide 9% of the total calorie intake [2].

Garyang or giant swamp taro is a kind of root crop or tuber which is considered as indigenous crops in the Philippines. Based on studies this crop may also be rich in fiber and other nutritional value, it is, therefore, the aim of this study to determine the fiber content of the flour made from this root crop which may be a rich source of dietary fiber. Furthermore, this study aims to educate community people on the importance of the consumption of giant swamp taro "Garyang" since this crop were only eaten when there is a scarcity of food in the locality of Catanduanes and in other areas of the country and even in other developing countries. This is also to encourage local farmers to cultivate more of this crop to develop a product made from giant swamp taro "Garyang" flour which may give more health benefits as it is incorporated with other food items as made into nutritious and affordable food products from this indigenous and underutilized root crop.

The general objective of this study is to determine the nutritional, phytochemical and carbohydrate profile of giant swamp taro and storage stability of its flour.

Methodology

Raw Materials

The two varieties of giant swamp taro corms were obtained from Catanduanes and were authenticated at the Museum of Natural History, University of the Philippines. Raw, boiled and floured forms of the taro coms were chemically analyzed. The cultivated variety (Figure 1(A).) has a larger corm weighing approximately 7-10kg or more compared to the wild variety that is smaller which is weighing approximately 3/4kg to 1.5kg per corm. This wild variety has smaller corms that grow on its sides compared with the cultivated variety that there is only one main corm. Both cultivated and wild variety has creamy to yellowish flesh (Figure 1(B)).

Processing of Flour

In the preparation for the processing of the giant swamp taro corm into floured form, the raw corm of giant swamp taro was scrubbed or brushed and washed thoroughly with tap water until it is free from soil particles and other dirt. The cleaned corm was hand peeled. Using a hand peeler, the corms were sliced in uniform thinness to facilitate blanching and drying. The thinly sliced corm was washed thoroughly until it is no longer slimy. It is soaked in tap water overnight. After soaking overnight, the sliced corm was blanched in boiling water for two (2) minutes and was drained off and cooled rapidly with iced water and drained properly. It was thinly spread in an aluminum tray and oven dried for three hours at 70^{o}C. The dried giant swamp taro corm was milled into flour using machine miller.

Nutrient Composition

The proximate composition, beta-carotene, zinc, iron and calcium contents of the raw and processed forms of giant swamp taro were determined following the AOAC (1980) procedures.

Carbohydrate Profile

The total starch content of the samples was determined by anthrone method (Shallenberger & Birch, 1975). The total amylose content of the purple was determined using the method by Williams et al. (1958) and the amylopectin was obtained by difference (Amylopectin = total starch % - amylose %). The quantification of the dietary fiber was done using the Total Dietary Fiber Assay Procedure by Megazyme.

Resistant Starch

The resistant starch content of the samples was determined using the Resistant Starch Assay Procedure Megazyme Kit 2008.

Glycemic Index

The determination of the estimated glycemic index is divided into two parts: in vitro starch digestibility of the samples and calculation of the estimated glycemic index.

Phytochemical Content

Total phenolic content was measured by the Folin–Ciocalteu method (Oyaizu 1986), with some modifications. The absorbance was measured using a UV–vis spectrophotometer at 710 nm against a reagent blank. The total phenolic content was expressed as milligrams of catechin equivalents per 100 gram of dry sample weight (mg of CE/100 g) using the calibration curve of (±) -catechin.

The total flavonoid concentration was measured using a calorimetric assay developed by Zhishen *et al.* (1990). One (1) mL^{-1} of appropriately diluted sample was added to a 10 mL^{-1}

Figure 1: Giant Swamp Taro *Cyrtosperma merkusii (Hassk.) Schott]* varieties used in the study: Cultivated variety (A) and Wild variety (B).

volumetric flask containing 4 mL^{-1} of diluted water. At time zero, 0.3 mL^{-1} of 5% $NaNO_2$ was added to each volumetric flask; then at 5 min, 0.3 mL^{-1} of 10% $AlCl_3$ was added; and at 6 min, 2.0 mL^{-1} of 1 M NaOH was added. Each reaction flask was immediately diluted with 2.4 mL^{-1} of distilled water and was mixed. Upon the development of pink color, absorbance of the mixtures was determined at 510 nm relative to the prepared blank. The total flavonoid content was expressed as milligrams of quercetin equivalents per 100 gram of dry sample weight (mg of QE/100 g) using the calibration curve of (±)- quercetin.

Total tannin was determined using the modified Vanillin Assay (Price 1978). Fifty (50) mg of sample was mixed with 5.0 mL^{-1} of absolute methanol. An aliquot, 1.0 mL^{-1} of the sample extract was mixed with 5.0 mL^{-1} of vanillin reagent in a test tube. The mixture was held for 20 minutes at room temperature. The absorbance was read at 500 nm. The tannin content was expressed as milligrams vanillin equivalents per 100 gram of dry sample weight (mg of VE/100 g) using the calibration curve of (±)-vanillin.

Saponin content was determined by placing a 500 mg ground sample a screw-capped test tube. This was added with 5.0 ml 80% ethanol and reflux at 50°C on an evapomix for 15 minutes and refuge at 3000 rpm for 10 minutes then extracted two times and combined with supernate. Supernate volume was adjusted to 15 ml with 80% ethanol. Polyvinylpolypyrollidone (PVPP) mini columns were prepared with Polyvinylpolypyrollidone (PVPP) hydrated overnight. The supernate was passed in the column and removed the first volumes of eluents with traces of water or those that were turbid. An eluate of 2.0 ml was collected. Ten (10) ml aliquot was taken and placed in a test tube, in quadruplicate. The samples were treated with 0.5 ml glacial acetic acid and shaken. This was added with 3.0 ml Liebermann – Buchard reagent which is freshly prepared and shaken. Two test tubes were heated in a 90 – 100°C water bath for 30 minutes. The two other test tubes were allowed to stand for 30 minutes at room temperature. This served as a correction from any color instability and other interfering compounds. It is cooled at room temperature and absorbance was read at 450 nm.

Alkaloid content was measured by placing one (1) gram of dried ground sample in an18 x 50 mm test tube and was added with 10.0 ml absolute methanol, shaken and allowed to stand overnight. The mixture was warmed for 4 hours at the 50°C water bath. The mixture was filtered and washed with 10.0 ml methanol. The washing was combined with the supernate and the solvent was allowed to evaporate under vacuum to about 2.0 ml final volume. This was added with 6.0 ml of 10% hydrochloric acid and the mixture was filtered. The residue was washed with 4.0 ml of 1% HCl and added with 5.0 ml concentrated ammonia and was transferred into a 50 ml separatory funnel. Extraction was done for three times with HCl_3, 10 ml each time. The extract was combined and passed in a sodium sulfate column. The extract was allowed to evaporate completely under vacuum and was added with 2.0 ml of 1% CHl and 2.0 ml $CHCl_3$. The mixture was shaken vigorously and pipetted off the aqueous layer. Five 0.25 ml aliquot of the extract was taken and placed each on a 10 x 18 mm test tube. The individual tube was treated with 0.25 ml each of the reagent. Turbidity in the test tube was observed and recorded as plus (+) or minus (-). The following observation for each test solution was recorded as (-) negative, (+) positive, (++) highly positive and (+++) with precipitation.

Antioxidant
The total free radical scavenging capacity of soghum-methanolic extract was estimated by the DPPH using the modified method of Shimada et al. (1992). One (1) mL^{-1} of the extract was adjusted to 5 mL volume with the addition of distilled water. Freshly prepared, 1 mL^{-1} DPPH solution (0.1 mM in absolute methanol) was mixed with the extract. The reaction mixture was shaken well and held for 30 min at room temperature, and the absorbance of the resulting solution measured at 517 nm against a reagent blank. The radical scavenging activity was measured as a decrease in the absorbance of DPPH, and expressed as percent radical quenching compared to that without the extracts.

Statistical Analysis
All the data that was generated from the chemical analysis was analyzed using Analysis of variance (ANOVA) and Tukey's Studentized Range (HSD) Test to find out which specific group's means (compared with each other) are different. All the statistical tests were performed at a 5% level of significance SAS System.

Results And Discussion
Proximate Composition of Giant Swamp Taro Corm
The moisture content after boiling generally increased. The boiled cultivated variety (77.96%) had significantly higher moisture content than the boiled wild variety (65.80%) (Table 1). The floured giant swamp taro from the two sample varieties had less than 5% moisture content. The increase in the moisture content of the cooked samples could be attributed to the boiling effect that could have softened the tissue, thereby increasing the water absorption and water retention capacity of the tubers [3].

Boiling decreased the amount of crude fat in the cultivated and wild varieties of the giant swamp taro. The crude fat contents of the boiled cultivated and wild varieties were 0.71% and 0.61%, respectively (Table 1). The decrease in the fat content of the boiled sample may be due to blanching which may have melted the fat into the boiling water thus causing a reduction in fat content [4]. The floured forms of cultivated and wild varieties had the same measured crude fat content of 0.75%.

Boiling raised the crude protein contents of the cultivated and wild varieties of the giant swamp taro. The boiled wild variety (7.38%) had significantly higher crude protein than the boiled cultivated variety (6.38%). The floured forms had crude protein contents of 6.38% (cultivated variety) and 6.36% (wild variety) (Table 1). The noticeable reduction of crude protein content of raw form of giant swamp taro corm when boiled and processed into flour was due to the effect of heat from blanching, boiling and drying that could have denatured the secondary and tertiary structures of the protein content and disrupted the hydrogen bonds and non-polar hydrophobic interaction causing the soluble amino acids to leach out in the cooking medium.

Boiling raised the crude ash content of a wild variety of giant swamp taro while a reduction was observed in the cultivated variety.

The crude fiber contents of the raw local giant swamp varieties were 2.26% (cultivated) and 2.33% (wild). The crude fiber contents of the cultivated and wild varieties of giant swamp taro increased after boiling and decreased after the processing it to flour. Heat treatments may have caused breakage in the polysaccharide chains and glycosidic linkages in the dietary fiber polysaccharides thus causing a decrease in crude fiber content [4].

The nitrogen-free extract of wild variety (85.57%) was lessened after boiling however slight increment in the nitrogen-free extract of cultivated variety (88. 44%) was noted. The nitrogen-free extracts of the floured samples were 87.79% (cultivated) and 87.98% (wild). Drying temperature and technique exerted a marginal effect on the protein, fat, fiber, ash hence the observed slight change in the nitrogen-free extracts of taro flours [5].

β -Carotene and Vitamin C Contents of Giant Swamp Taro

The raw wild variety (54.75 µg/100g) had significantly higher beta – carotene content than the raw cultivated variety (35.37 µg/100g). Reduction in beta-carotene content of the two varieties of giant swamp taro was observed. The boiled cultivated variety (23.53 µg/100g) had the lower beta – carotene content than the boiled wild variety (45.06 µg/100g). The floured form of the wild variety had 45.06 µg/100g while the cultivated variety had 33.09 µg/100g beta – carotene content (Table 2). The heat treatments undergone by the two varieties of giant swamp taros could have caused the observed reduction in the beta-carotene contents of both boiled and floured samples.

The raw wild variety (74.59mg/100g) had significantly higher vitamin C content than the raw cultivated variety (44.88mg/100g). Boiling also brought a reduction in the vitamin C content of both samples. However, much vitamin C was lost in the boiled cultivated variety (19.34mg/100g) than the boiled wild variety (59.73mg/100g) (Table 2). The amount of vitamin C did not change after processing the wild variety into flour but in the cultivated variety, an increase in vitamin C was observed in the floured product. Excessive heat exposure and contact with water as well as exposure to air can destroy vitamin C in food products [6].

Mineral Content of Giant Swamp Taro

The raw wild variety (0.51mg/100g) had significantly higher iron content than the raw cultivated variety (0.42mg/100g). A slight decrease in iron content was noted upon boiling. The boiled cultivated variety (0.59mg/100g) had significantly higher iron content than the boiled wild variety (0.46mg/100g). But when the samples were processed into flour, the wild variety had a significantly higher amount of iron at 0.46mg/100g than the cultivated variety (0.42mg/100g) (Table 3). Minerals are generally not sensitive to heat during processing, but are susceptible to leaching during processing or cooking with water [3].

Zinc was noted to be significantly higher in the raw cultivated variety (0.31mg/100g) than in the raw wild variety (0.29mg/100g). Boiling the samples resulted to increase in zinc content for both varieties. The zinc contents of the boiled and floured wild taro variety were noted to be the same however in the case of the

Table 1: Proximate Composition of Cultivated and Wild Variety of Raw, Boiled, and Flour Giant Swamp Taro Corm (Dry weight basis)*.

Giant swamp taro	MOISTURE (%)			CRUDE FAT (%)			CRUDE PROTEIN (%)			CRUDE ASH (%)			CRUDE FIBER (%)			NFE (%)		
	Raw	**Boiled**	**Flour**	**Raw**	**Boiled**	**Flour**	**Raw**	**Boiled**	**Flour**	**Raw**	**Boiled**	**Flour**	**Raw**	**Boiled**	**Flour**	**Raw**	**Boiled**	**Flour**
Cultivated variety	70.24^{a}	77.96^{a}	4.55^{a}	0.69^{a}	0.71^{a}	0.75^{a}	6.18^{a}	6.38^{b}	6.38^{a}	2.55^{a}	1.98^{b}	2.67^{a}	2.26^{a}	2.46^{b}	2.38^{a}	88.08^{a}	88.44^{a}	87.79^{b}
Wild variety	70.20^{b}	65.80^{b}	4.45^{b}	0.82^{b}	0.61^{b}	0.75^{a}	6.55^{b}	7.38^{a}	6.36^{a}	2.65^{b}	3.11^{a}	2.59^{b}	2.33^{b}	3.30^{a}	2.29^{b}	88.15^{a}	85.57^{b}	87.98^{a}

* Having the same letter within the column are not significantly different at p (<0.05).

Table 2: Vitamin Contents of the Cultivated and Wild Variety of Raw, Boiled and Flour Giant Swamp Taro Corm.*

Giant swamp taro	β - CAROTENE (µg/100g)			VITAMIN C (mg/100g)		
	Raw	**Boiled**	**Flour**	**Raw**	**Boiled**	**Flour**
Cultivated variety	35.37^{a}	23.53^{b}	33.09^{b}	44.88^{a}	19.34^{b}	24.43^{b}
Wild variety	54.75^{b}	45.06^{a}	45.06^{a}	74.59^{b}	59.73^{a}	59.73^{a}

*Having the same letter within the column are not significantly different at p (<0.05).

Table 3: Mineral Contents of the Cultivated and Wild Variety of Raw, Boiled and Flour Giant Swamp Taro Corm*.

Giant swamp taro	IRON (mg/100g)			ZINC (mg/100g)			CALCIUM (mg/100g)		
	Raw	**Boiled**	**Flour**	**Raw**	**Boiled**	**Flour**	**Raw**	**Boiled**	**Flour**
Cultivated Variety	0.42^{b}	0.59^{a}	0.42^{b}	0.31^{a}	0.39^{a}	0.28^{b}	55.77^{b}	48.0^{a}	42.53^{b}
Wild variety	0.51^{a}	0.46^{b}	0.46^{a}	0.29^{b}	0.30^{b}	0.30^{a}	48.20^{a}	46.46^{b}	46.46^{a}

* Having the same letter within the column are not significantly different at p(<0.05).

cultivated variety, a lower amount of zinc was observed in the floured product than the boiled form (Table 3) similar results were reported in the study of Avila in 2017.

The raw wild variety (55.77mg/100g) had significantly higher calcium content than the raw cultivated variety (48.20mg/100g). Boiling resulted in lowered calcium content. The boiled cultivated variety had 48.0mg/100g while the boiled wild variety had 46.46mg/100g calcium contents. In addition, the floured form of the cultivated variety had 42.53mg/100g calcium while the flour made from the wild variety had 46.46mg/100g calcium (Table 3).

Nutritional Value of Boiled and Flour Giant Swamp Taro

Based on the data gathered, the boiled wild variety contributed higher amounts of protein, vitamins A and C per 100g serving portion for a normal healthy male aged 19-29. The boiled wild taro variety was observed to be a source of protein. The boiled and flour product from the wild variety was noted to be a good source of vitamin C (Table 4).

Phytochemical Contents and Antioxidant Activity of Giant Swamp Taro

Antioxidant activity of cultivated variety was observed to increase when boiled and processed into flour from 74.61% to 77.52% but decreases in cultivated variety (77.30% - 75.95%) as showed in Table 5.

Boiling and processing into flour reduced the phenolic content of the wild variety from 76.64 to 71.25mg/100g but increased in cultivated variety from 66.61 to 73.65mg/100g. Phenols reduction could also be due to the covalent binding between oxidized phenols and proteins or amino acids as well as the polymerization of oxidized phenols [8].

In raw form, the tannins were noted to be significantly higher in the wild variety (58.67 mg/100g) than in the cultivated variety (47.56 mg/100g). The tannin contents of the boiled and floured wild variety were noted to be the same, however, in the case of the cultivated variety, a lower amount of tannin was observed in boiled form than the floured form.

The raw of wild and cultivated giant swamp taro varieties had 26.85mg/100g and 23.71mg/100g flavonoid contents, respectively. The cultivated floured form (55.39 mg/100g) had significantly higher flavonoid content than the wild variety (53.12 mg/100g). Upon boiling and processing into flour an increase in flavonoid in both varieties was noted.

Anthocyanidin contents of cultivated variety increased when boiled and processed into flour from 17.63% to 19.78%. The wild variety slightly decreased upon boiling and processing into flour (18.72% to 18.17%) (Table 5). Similarly, the observed reduction in anthocyanidin was reported to be affected by cooking processes

Table 4: Approximate Percent Nutrient Contribution per 100g of Boiled and Floured Giant Swamp Taro Based on Recommended Nutrient Intake (RNI) per Day [7] of 19-29 Male with Normal Nutritional Status.

Nutrients	RNI 19-29 Male	Giant Swamp Taro			
		Boiled		Flour	
		Cultivated (%)	Wild (%)	Cultivated (%)	Wild (%)
Energy (kcal)	2530	15.24	14.91	15.15	15.18
Protein (g)	71	8.9	10.4	8.9	8.9
Vitamin A (ugRE)*	700	0.28	0.53	0.39	0.54
Vitamin C (mg)	70	27.62	85.32	34.9	85.32
Zinc (mg)	6.5	8.9	4.6	3.5	4.6
Iron (mg)	12	4.91	3.83	3.5	3.8
Calcium (mg)	750	6.4	6.19	5.67	6.19

*1ugRE =12 ug beta carotene

Table 5. Phytochemical Contents of the Cultivated and Wild Variety of Raw, Boiled and Flour Giant Swamp Taro Corm*.

Giant swamp taro	Antioxidant Activity %			Phenols (mg/100g expressed as g/catechins eq/g)			Tannins (mg/100g expressed as g/vanillin eq/g)			Flavonoids (mg/100g expressed as g/gallic acid eq/g)			Saponins (mg/100g saponins)			Anthocyanidin			Alkaloids		
	Raw	Boiled	Flour	Raw	Boiled	Flour	Raw	Boiled	Flour	Raw	Boiled	Flour	Raw	Boiled	Flour	Raw	Boiled	Flour	Raw	Boiled	Flour
Cultivated Variety	77.30^{a}	76.80^{a}	77.52^{a}	66.61^{a}	71.86^{a}	73.65^{a}	47.56^{a}	30.31^{b}	31.79^{b}	23.71^{a}	53.95^{a}	55.39^{a}	31.34^{a}	21.85^{b}	22.67^{b}	17.63^{a}	18.33^{a}	19.78^{a}	Negative	Negative	Negative
Wild variety	74.61^{a}	75.95^{b}	75.95^{b}	76.64^{b}	71.25^{a}	71.25^{b}	58.67^{b}	34.32^{a}	34.32^{a}	26.85^{b}	53.12^{b}	53.12^{b}	37.31^{b}	25.28^{a}	25.28^{a}	18.72^{b}	18.17^{a}	18.17^{b}	Negative	Negative	Negative

* Having the same letter within the column are not significantly different at p (<0.05).

Table 6: Starch, Amylopectin and Amylose content of Raw, Boiled and Flour Giant Swamp Taro Corm*.

Giant swamp taro	Starch (%)			Amylopectin (%)			Amylose (%)		
	Raw	Boiled	Flour	Raw	Boiled	Flour	Raw	Boiled	Flour
Cultivated variety	80.29^{a}	83.23^{a}	82.60^{a}	58.47^{a}	59.37^{a}	58.74^{a}	21.95^{a}	23.85^{a}	23.74^{a}
Wild variety	81.21^{b}	81.08^{b}	81.08^{b}	59.02^{b}	58.74^{b}	58.86^{a}	59.02^{b}	22.34^{b}	22.34^{b}

*Having the same letter within the column are not significantly different at p(<0.05).

like baking, steaming and boiling in the study of Hong and Koh in 2015.

Carbohydrate Profile of Giant Swamp Taro

The raw wild and cultivated giant swamp taro varieties had 81.21% and 80.29% starch, respectively. Upon boiling, an increase in the starch content was observed in both giant swamp taro varieties. The boiled cultivated variety (83.23%) had significantly higher starch content than the boiled wild variety (81.08%). The floured cultivated variety had 82.60% starch content and the floured wild variety had 81.08% (Table 6).

As in its raw form, higher and lower amounts of amylopectin and amylose were found in the wild compared to the cultivated variety. The boiled and floured products from the cultivated taro variety measured significantly higher amounts of amylose than the processed products from a wild variety (Table 6).

Total Dietary Fiber Content of Giant Swamp taro

Boiling increased the dietary fiber of the cultivated taro variety from 4.14% to 4.82% but decreased in the wild variety from 4.63% to 4.38%. The flour from wild taro variety (4.71) had significantly higher dietary fiber content than the flour made from the cultivated taro variety (4.38%) (Table 7).

Table 7. Total Dietary Fiber Content of the Cultivated and Wild Variety of Giant Swamp Taro Corm.*

Giant swamp taro	Total dietary fiber (%)		
	Raw	Boiled	Flour
Cultivated Variety	4.14^{a}	4.82^{a}	4.38^{b}
Wild variety	4.63^{b}	4.38^{b}	4.71^{a}

*Having the same letter within the column are not significantly different at p(<0.05)

Resistant Starch Content of Giant Swamp Taro

Boiling increased the resistant starch of the cultivated variety from 1.66% to 2.27% but decreased in the wild variety from 2.12% to 1.89% (Table 8). High-temperature processing techniques such as baking, boiling, and roasting also increased RS in corn and in wheat, rice, and pearl millet [9].

Table 8: Resistant Starch Contents of the Cultivated and Wild Variety of Raw, Boiled and Flour Giant Swamp Taro Corm*.

Giant swamp taro	Resistant starch content (%)		
	Raw	Boiled	Flour
Cultivated variety	1.66^{a}	2.27^{a}	2.08^{a}
Wild variety	2.12^{b}	1.89^{b}	1.89^{b}

*Having the same letter within the column are not significantly different at p(<0.05).

Glycemic Index of Giant Swamp Taro

The raw form of wild variety (74.70%) had significantly higher glycemic index than the raw form of cultivated variety (67.28%). The boiled form of wild variety had 70.96% and the boiled form of cultivated variety had 64.72% glycemic index. The floured form of wild variety had 70.98% and the floured form of cultivated variety had 66.25% glycemic index (Table 9).

Table 9: Glycemic Index Contents of the Cultivated and Wild Variety of Raw, Boiled and Flour Giant Swamp Taro Corm*.

Giant swamp taro	Glycemic index (%)		
	Raw	Boiled	Flour
Cultivated variety	67.28^{a}	64.72^{b}	66.25^{b}
Wild variety	74.70^{b}	70.96^{a}	70.98^{a}

*Having the same letter within the row are not significantly different at p (<0.05).

Conclusion

The boiled giant swamp taro of cultivated and wild varieties has energy contents of 385.67 kcal and 377.29 kcal, respectively. Beta – carotene and vitamin C contents of the boiled and floured products from wild variety were found to be significantly higher than that from the cultivated variety. However, the boiled cultivated variety and the flour of the wild variety were noted to be high in minerals. Moreover, the boiled and floured cultivated giant swamp taro had significantly higher amounts of phenols and flavonoids while significantly higher amounts of tannins and saponins were measured in the boiled and floured wild giant swamp taro. The boiled and floured cultivated giant swamp taro were found to contain significantly higher amounts of amylose, dietary fiber, and resistant starch compared with products from wild taro variety. The glycemic index of processed forms of giant swamp taro made from the two varieties was classified as intermediate.

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