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Effect of pre-curding on nutritional and anti-nutritional composition of taro (*Colocasia esculenta* L.) Leaf

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Abstract

The objective of this study was designed to investigate the nutritive and non- nutritive constituents of taro leaf powder and leaf curd extracts through improved processing methods. The study was conducted using factorial combination of two independent variables (taro leaf varieties and processing methods) with three replications in a completely randomized design (CRD). The analysis undertaken in this study was leaf proximate composition, mineral concentration and anti-nutritional factors of samples processed as leaf powder and curd concentrates between local taro and boloso-1 taro varieties. The moisture content in the study ranged from 3.444 ± 0.192 to 3.733 ± 0.693, crude protein from 25.061 ± 1.297 to 26.252 ± 1.530, crude fat from 5.835 ± 0.169 to 6.436 ± 0.889, fiber from 3.192 ± 1.988 to 4.597 ± 1.396, total ash from 2.706 ± 0.074 to 2.876 ± 0.230, total carbohydrate from 56.221 ± 2.743 to 59.383 ± 2.942, amylose contents from 5.319 ± 1.159 to 6.276 ± 0.987, beta- carotene (mg/100 g) 2.703 ± 0.225 to 2.480 ± 0.205 and phenolic compound(mg/100 g) from 0.957 ± 0.087 to 1.113 ± 0.188. The five macro minerals, mg/100 g of Na, K, Mg, P and Ca in the study differ significantly ($p<0.05$) and ranged from lowest (6.607 ± 1.055, 14.333 ± 1.470, 8.293 ± 1.899, 1.179 ± 0.81 and 15.265 ± 6.211 respectively) to highest (7.826 ± 1.827, 17.017 ± 3.4, 9.744 ± 1.908, 1.904 ± 0.995 and 19.547 ± 6.69) value, respectively. Concerning micro minerals like Zn, Fe, and Cu contents, mg/100 g were significantly ($p<0.05$); varied from minimum (9.647 ± 4.550, 40.374 ± 9.831 and 0.415 ± 0.194) to maximum (12.750 ± 1.811, 51.868 ± 17.025 and 0.580 ± 0.221) values, for boloso-1 taro variety, respectively. From the general trend observed in this study, most of the analyzed samples that boloso-1 taro variety subjected to curd processing provided better proximate, mineral, functional and lower anti-nutritional contents than that of the local taro leaf.

Keywords: Boloso-1 taro, curd extract, leaf powder and composition

1. Introduction

Taro (*Colocasia esculenta* (L.) a family of Aracea is cultivated for its edible corms used as a subsistence food by millions of people in developing countries (FAO, 1999) [18]. The corm of taro contains more than twice the carbohydrate content of potatoes and yield 135 kcals per 100 g and 11% crude protein on a dry matter (DM) basis (Patrick *et al.*, 1999). However, the rich protein content (23% DM) found in the leaf of taro (Annan and Plahar, 1995) [6] might be favorably complements the high carbohydrate contents (87% DM) found in the tuber part of the plant as a source of human food. In Asia, the leaves of taro have been reported to be rich in minerals like Ca, P, Fe, and vitamins: vitamin C, thiamine, riboflavin and niacin. The high level of dietary fiber found in the taro leaf are also advantageous for their active role in the regulation intestinal transit, increasing dietary bulk and faeces consistency due to their ability to absorb water (Saldanha, 1995) [31].

Most rural peoples suffer from malnutrition not because of the economic status but because of inability to utilize the available nutritious raw materials to meet their daily requirements (Annan and Plahar, 1995) [6]. Currently, zinc deficiency is widespread and affects the health and well-being of populations of the developing countries worldwide. Since taro leaf, is one of the few non-animal sources of zinc, its utilization should therefore be pursued to help in the alleviation of zinc deficiency which is associated with stunting of children (Walker, 1990) [38]. While taro has many nutritional, economic and health attributes, it has some anti-nutritional compounds such as oxalic acid, cyanide, alpha-amylase inhibitors, lectins, and tannins that are harmful to health and which can be eliminate through appropriate processing (Savage and Catherwood, 2007; Ramanatha *et al.,* 2010).

In Ethiopia, root crops are widely grown in the southern part of the country (CSA, 2005). Among the root crops, taro is one of the most important food crops as well as income source to the farmers (CSA, 2005). It has a great potential to supply high quality food and one of the cheapest source of energy (Patrick *et al*., 1999) and the most underutilized root crop (Adane *et al*., 2013 and Umeta, 2000) [2]. People are eating taro corm as boiled, but there is no awareness about the quality the leaf has. Njintang *et al*. (2006) stated that taro leaf has not gained sufficient research attention with regards to its potential having nutritional, industrial and health importance. Previous researches done in Ethiopia are mainly on taro corm products and no research was conducted on taro leaf as human food. So that there is no awareness among eople about the quality the leaf has. In this context, taro leaf was evaluated for its nutritional and anti-nutritional components. Therefore, this study was designed to analyze and evaluate the nutritional and anti-nutritional components of taro leaf to recommend as a sustainable approach for the alleviation of malnutrition through transforming to edible products with central to two research questions: Do these two cultivars of taro leaf differ in nutritional and anti-nutritional contents? And do these two processing methods eliminate most of the anti-nutritional contents of taro leaf? Generally, this research brought extensive outputs on how to use taro leaves accompanied with improved processing methods for human consumption at high level of nutrient sources which have direct impact on improvement of human nutrition. Therefore the crude protein (CP), crude fat, ash, crude fiber (CF), carbohydrate, energy, minerals, phytate, oxalate, tannin and total phenols constituents of taro leaf were determined and the results obtained were discussed in discussion part and some works not carried out in the study are recommended for further study.

2. Materials and Methods

2.1. Sample Source and Study Sites

Two varieties of taro (*Colocasia esculenta* L.) leaf: Local and boloso-1, were harvested in December2014 at 6 - 7 months of age from Areka Agricultural Research Center (AARC) and brought to Addis Ababa, Ethiopia. The leafs were analyzed at the Centre for Food Science and Nutrition Laboratory (CFSNL), Addis Ababa University and the anti-nutritional components analysis was done at the Ethiopian Public Health Institute central laboratory.

2.2. Experimental Samples Preparation

Fresh leaves were divided in two equal portions. The first sub-divided fresh leaves were twigged the veins and dried in shade room by spreading the leaflets thinly on mesh tied on wood beds for 4 days. The dried samples were powdered using stainless steel hammer mill to powder particle size of 1.6 mm, packaged in polythene bags and stored in cool dry place until used for various chemical analyses. For the second leaves were made into curd concentrates, fresh leaves were washed using tape water, graded based on green color, then cut in to small pieces using leaf cutter, then were heated to 65 OC for 12 minutes using big metal pan to coagulate and separate the protein. Following this, the upper part of the boiled leaf was discarded to reduce nutrient inhibitory components and the extract retained was pressed using mechanical force presser to produce green curd. The curd was dried at standard dehydrating temperatures of 54 OC (Zhu *et al*., 2007), was powdered and packaged in polythene bags and stored in cool dry place until used for various chemical analyses (Duckworth and Wood ham 2001). These methods were chosen because of potential to eliminate the anti-nutritional factors in taro leaf and could solve the anti-nutritional problems.

2.3. Experimental Analysis

The leaf powder samples and curd extracts were analyzed for moisture, crude fiber, total ash, crude fat and crude protein using the (AOAC, 2000, and AACC, 2000) reference methods. The total carbohydrate content was determined by nutrient difference (100 – % moisture + % protein + %fat +% fibre + % ash] according to (Egan *et al.,* 1981). The energy density (ED) of taro leaf samples was calculated using standard food energy conversion factors: 4 kcal/g for carbohydrates;, 4 kcal/g for proteins; 9 kcal/g for crude fat; and 2 kcal/g for dietary fiber according to Livesey (1995). The five macro minerals, of Na, K, Mg, P and Ca and three micro minerals Zn, Fe and Cu were analyzed by using atomic absorption spectrophotometer (AACC, 2000). Beta-carotene and total phenolic compounds were determined according to Biswas *et al*., (2011).The anti-nutritional content i.e, mucilage was determined according to methods noted by (Yamazaki *et. al*., 2008). Phytic acid was determined through phytate phosphorus (Ph-P) analysis according to (Plaami and Kumpulainen, 1991). The AOAC (1990) method was used to determine the oxalate content of taro sample. Tannins were determined using the method of (Burns, 1972). Lectins, Alpha-amylase inhibitors and protease (trypsin) inhibitors were determined according to Peumans, *et al*., (1995).

2.4. Statistical analysis

The statistical analysis was conducted to examine the interaction effects of two independent variables (taro leaf varieties and processing methods). All data were analyzed using the general linear model procedures of Statistical Analysis Systems software (version 9.4 SAS Institute Inc., Cary, USA). P values ≤ 0.05 were considered significant. The differences between the treatments were determined by analysis of variance (ANOVA). The statistical equation was: Y= V +M+V*M Where: Y= response, V=verities and M=methods

3. Results and Discussions

3.1. Moisture Content

The moisture content (%) of different samples ranged from 3.444 ± 0.192 to 3.733 ± 0.693 (Table 1). Moisture content in food sample is an index of stability and determines the appearance, keeping quality and yield of the product (Ejoh *et al*., 2006). The moisture content of B o l o s o - 1 taro leaf was the highest (3.777 ± 0.693) of all, while the lowest (3.444 ± 0.192) moisture content was obtained from local taro leaf curd. In the case of fresh taro leaf the moisture content composed 85%, indicating that leaf could not be stored favorably for a long period of time due to deterioration and microbial attack. Regarding to the dried sample, the moisture content is very low and add quality and shelf life stability for longer time (Emmanuel-Ikpeme *et al*., 2007). This might be due to all samples were dried at adequate temperature and time to insure the lowest moisture that preserve for longer time (Ghosho and Hasan, 1999) [19].

3.2. Crude Protein Content

As presented in (Table 1), the crude protein content in the study was varied from 25.061 ± 1.297 to26.252 ± 1.530. In the present study, the crude protein contents in different samples differ significantly ($p<0.05$). From the result, the crude protein contents of Boloso-1 leaf curd contained the highest (26.252 ± 1.530 followed by leaf powder of the same variety. However, the lowest (25.061 ± 1.297) protein contents were obtained from local leaf powder samples.

This implies that, curd samples exhibited better crude protein content than powder samples. This might be due to the curd processing method that would have increased the solubility of proteins and increase protein content (Ezeocha *et al.,* 2012 and Hang and Preston, 2009) [17, 20]. The result observed from the study is consistent with the report of (Nip *et al*., 1998; Agbor-Egbe and Rickard 1990 and Shanthakumari *et al*., 2008). Taro leaf contains about 23% CP on a DM basis (Ezeocha *et al*., 2012) [17]. The notable findings from this study were the crude protein values were higher than the reported value might be due to variety difference, age at which the leaf harvested and processing method applied that increase protein solubility and deactivation of protease enzyme by boiling and therefore curd processing applied in the study shows better protein supply.

3.3. Fat Content

As summarized in (Table 1), the crude fat content in different samples ranging from 5.835 ± 0.169 to6.436 ± 0.889%. The crude fat content from the study in percentage (%) differ significantly ($P \leq 0.05$). The crude fat content (%) of Boloso-1 leaf curd composed the highest and the least value was obtained in the local taro leaf powder. The curd samples in taro varieties provided the highest fat content than that of powder samples. Little reduction of fat content was observed in powder samples might be because drying leaf in to powder form would decrease due to drying treatment induced dehydration and oxidation of the samples the decrease fat content (Adeyeye and Fagbohon, 2005). Therefore, the results from the study suggest that drying methods affects the fat content. However, curd processing in this study is controlled thermal process and found to be better way to decrease fat degradation (Ndabikunze *et al.,* 2011). Also, the result of the study is similar with the reports of (Albihn and Savage, 2001; Ndabikunze*, et al.,* 2011) reported about, the effects of the drying methods fat contents.

3.4. Total Ash

As results presented in (Table 2), the total ash content in percentage (%) ranged from lowest (2.706 ±0.074) to highest (2.876 ± 0.230) values and differ significantly ($p<0.05$). The result from this study revealed that highest ash content was existed in boloso-1 leaf curd while the lowest ash content was detected in local leaf curd (Table2). The ash contents from the study were within the range of 2.354 to 3.128 % reported by (Njoku and Ohia, 2007) [29].

3.5. Crude Fiber Content

As it can be seen from (Table 2), crude fiber content of in leaf curd and powder samples from two taro varieties differ significant ($p<0.05$). The crude fiber contents decreased in leaf curd samples than powder samples and local taro had lowest values than that of taro Boloso-1 variety. As the result the present study indicated that reduction of fiber content was observed in curd samples than powder samples (Table 2). This might be due to effect of thermal processing break down the fiber components in to smaller and soluble forms (Adane *et al.*, 2013) [2].

3.6. Total carbohydrate

The total carbohydrate content (%) in different samples ranged from the (56.221 ± 2.743) to the (59.383 ± 2.942) (Table 2). The carbohydrate content from the study differ significantly ($p<0.05$). The result from this study revealed that the carbohydrate content was high in local taro leaf than Boloso-1 taro leaf in both curd and powder samples. The highest carbohydrate value was comprised in local taro leaf curd and the lowest carbohydrate values were observed in boloso-1 taro leaf curd. According to the results reported by (Jane *et al.,* 1992, USDA, 2002, and Benesi *et al.,* 2004) [21, 35, 9] taro is a good source of starch and could supply high carbohydrates. Taro leaf has been reported to have 40-50% starch on dry weight basis (Jane *et al.,* 1992) [21].

3.7. Energy value

As indicated in (Table 2), the total energy value (%) in the study was ranged from (386.692 ± 11.592) to (394.695 ± 9.869). The total energy value in different samples differ significantly ($p<0.05$). The result from the study examined leaf curds of both taro varieties obtained high energy content than that of leaf powder samples. The highest energy content was existed in local taro leaf curd followed by Boloso-1 taro leaf curd. Energy content is associated with carbohydrate content and leaf samples with highest carbohydrate maintained highest energy content (Bradbury and Holloway, 2002) [12].

3.8. Leaf amylose content

As shown in (Table 3), the highest value of taro leaf amylose percentage is (6.276 ± 0.987) and the lowest was (5.319 ± 1.159) in dry weight basis. The amylose content in different samples differ significantly at ($p<0.05$). Taro leaf powder samples in both varieties showed greater amylose values than that of curd samples. In the other words, taro starch amylose decreased in curd processing and this may be due to leaf become de-starched during heat processing (Lewis, 1990 and Gordon, 2000) [26]. Such small reduction of amylose may be associated with hydrolysis of leaf starch by heat (Ekwe *et al*., 2009). Therefore, leaf powder samples kept good amylose than that of curd samples and boloso-1 taro was good sources of leaf amylose according to the result provided from this study.

The result showed in (Table 3) also summarizes the β-carotene and phenolic compounds (mg/100 g) of the analyzed taro leaf samples. The first higher β-carotene (mg/100 g) 2.703 ± 0.225 was detected in taro Boloso-1 powder and followed by least β-carotene 2.480 ± 0.205 mg/100 g in taro local curd. The β-carotene content from this study differ significantly at ($p<0.05$). Taro leaf powder samples in both varieties showed greater β-carotene content than that of curd samples. In other words, β-carotene content decreased slightly during curd processing and this might be due to leaf de-pigmentation during heat processing (Dewanto *et al*., 2002, and Horvathova *et al*., 2007). Taro leaves contain a moderate amount of β-carotene and is a good source of Vitamin C which keeps the body tissues strong, helps the body use iron and chemical actions in the body (Dumnnt and Vernier, 1997) [14]. Therefore, this study indicated that leaf powder samples held good β-carotene content than that of curd samples and boloso- 1 taro was good sources of leaf β-carotene content.

When it comes to phenolic compound composition (mg/100 g), in this study was ranged from 0.957 ± 0.087 to 1.113 ± 0.188. The total phenolic content in different samples differ significantly at ($p<0.05$). Taro leaf curd samples in both varieties provided greater phenolic compound values than that of powder samples. The highest phenolic compound concentration was prevailed from local taro leaf curd followed by Boloso-1 leaf curd while the lowest phenolic compound was recorded in Boloso-1 taro leaf powder. This might be due to phenolic compound extraction was increased during curd processing and increased the level of phenolic compound in the final analyzed samples (Jayasinghe *et al*., 2003) [22].

3.9. Macro and micro minerals

The mg/100 g values in DM basis of five major minerals were presented in (Table 4). The mg/100 g of Na in different samples ranged from (6.607 ± 1.055) to (7.826 ± 1.827) and differ significantly ($p<0.05$). Greater Na 7.826 ± 1.827 mg/100 g value was obtained from taro Boloso-1 leaf powder and the smaller value, 6.607 ± 1.055 mg/100 g from taro local leaf curd samples. The present result from this study states that the Na concentration differ significantly due to taro varieties at ($p<0.05$) and Bloso-1 has higher concentration in comparison with the local taro variety. The present result was in agreement with the work of (Umar *et al*., 2005) [34]. Thus, this study promoted that curd processing is good way of reducing the Na level from food samples and recommended for human consumption (Baruah, 2002) [8].

Table 4 and 5 also presents the mg/100 g of K, Mg, P and Ca (14.333 ± 1.470), (8.293 ± 1.899), (1.179± 0.81) and (15.265 ± 6.211) value, respectively and micro minerals like Zn, Fe and Cu contents mg/100 g were significantly (p<0.05), varied from (9.647 ± 4.550), (40.374 ± 9.831) and (0.415 ± 0.194) to (12.750 ± 1.811, (51.868 ± 17.025) and 0.580 ± 0.221) values, for Boloso-1 taro variety. The result obtained from this study predicted that curd concentrate samples had high K, Mg, P, Ca, Zn and Fe mg/100 g concentration than powder samples. This indicates the mineral concentration was elevated during curd processing and increased the available mineral contents in the final curd concentrate samples (Siddhuraju and Becker, 2001 and Adejumo *and* Bamidele, 2012) [32, 3]. In addition, during curd processing, there was simultaneous reduction in anti-nutritional contents that bind with mineral and reduce their bioavailability (Lima GPP *et al*., 2009 and Kordylas, 1990) [24]. Previous studies also provided evidence that thermal processing would reduce anti-nutritional factors in different food samples (Kordylas, 1990, Bothwell and Chalton, 2002) [24, 11]. Therefore, the present study is consistent with reviewed literatures and notable finding from the study suggests processing with heat can be appropriate method for reducing toxic compound from leaf samples.

3.10. Tannin, phytate, mucilage and oxalate contents

The greater (mg/100 g) of tannin content 504.241 ± 292.061 exhibited in taro local leaf powder and while the smaller content 301.314 ± 138.480 was found from Boloso-1 variety subjected with curd method. The mg/100 g of phytate in different samples varied from (8.525 ± 2.319) to (9.880 ± 2.458) and differ significantly (p<0.05). The mg/100 g m of mucilage in the study was ranged from (0.128 ± 0.057) to (0.165 ± 0.060) and differ significantly (p<0.05). The mg/100 g of oxalate in the study was ranged from lowest (152.301 ± 9.646) to highest (257.921 ± 13.344) and differ significantly (p<0.05). From this study boloso-1 taro leaf curd had lowest tannin, phytate, mucilage and oxalate (mg/100 g) content and local leaf powder had highest. This indicates that curd concentrate processing has effect on reduction of tannin, phytate, mucilage and oxalate (Ndimantang *et al*., 2006) [27]. More reduction of tannin, phytate, mucilage and oxalate mg/100 g content in curd samples were exhibited and this might be due curd processing would reduce the concentration of anti-nutritionals according to previous work (Onayemi and Nwigwe, 2007). Condensed tannin and other anti-nutritional factors in food samples can be reduced during thermal processing and boiled with water in leaf (Prajapati *et al*., 2011) [29]. Not all taros are edible and it should not be eaten raw because wild varieties are usually contains high anti- nutritionals and that increase the loss of essential nutrients from the body, interfering with the metabolism of absorbed essential nutrients, decreasing the digestion of food, or decreasing food intake (Bothwell and Chalton, 2002) [11]. Phytate is the main inhibitors of many nutrients and mainly inhibits the absorption of iron and, to some extent, zinc (Kordylas, 1990) [24]. Therefore, it is important to apply different methods of preparation and cooking that could reduce the risk of absorbing excess anti- nutritional compound when consumed as part of the diet. Therefore, the present study provided an over view of improved processing methods as good ways of reducing the most dominant anti-nutritionals in leaf samples and most of taro leaf samples contained low anti-nutritional substances when subjected with curd processing.

3.11. Level of lectin, α-amylase and protease inhibitors

As demonstrated in (Table 7), lectin, α-amylase and protease inhibitors in leaf curd and powder samples from two taro varieties with and without peel did not differ significantly (p>0.05). The protease inhibitor in taro local leaf curd had the greater (0.025 ± .008 mg/100 g) while the smaller (0.016 ± 0.009 mg/100 g) protease inhibitor level was found in taro Boloso-1 variety. However; protease inhibitor in different samples did not significantly differ. The dominant protease inhibitor found in taro leaf is trypsin inhibitor and is a type of serine protease inhibitor that reduces the biological activity of trypsin. As a result, protease inhibitors that interfere with trypsin activity can have an anti-nutritional effect (Kiran and Padmaja, 2003) [23]. It is noted that the lectin and protease inhibitor effect can be reduce using different processing methods which are processing by heat, for increasing the eating quality and safety of taro leaves (Ravindarn *et al*., 2006 and Sumathi and Pattabiraman, 2007) [30, 33].

4. Conclusions and Recommendations

In conclusion, this study highlighted the proximate composition, the major and minor mineral contents and anti-nutritional contents of taro leaf processed as leaf powder and leaf curd. The study shows good nutritional values and taro can be good food sources for rural peoples if processed in the way that anti-nutritional components can be reduced. Therefore, the study shows taro has much importance in terms of nutritional and phytochemical sources. So that, the leaves, can be used as dietary ingredients, but it must be cooked. While taro has many nutritional, economic and health attributes, it has some anti-nutritional compounds that are harmful to health. Taro leaf has good nutritional and functional properties. The phytochemical such as β-carotene and phenols of taro leaf from this study obtained in good amount and could be serving as disease protective effect and enhance health promoting response in the body. Regarding to anti-nutritional factors, application of various domestic processing methods has good reduction effect on anti-nutrients and enhanced the bioavailability of essential nutrients mainly minerals. Therefore, the utilization of underutilized and neglected crops like taro is important and it can be promoted through introduction of different effective methods that reduce huge post-harvest lose and anti-nutritional substance. Therefore, Boloso-1 taro and curd processing were the best research out puts of the study that maximize the utilization of taro leaf as food sources.

The following recommendations have been drawn from the results of this study:

- Efforts need to investigate and domesticate different varieties of taro leaf for food sources in rural areas of southern and other areas of the country for alternative food diets.
- Taro leaf processing need to be promoted to reduce the anti-nutritional substances that limits the potential utilization
- Characterization and domestication of underutilized food crops need to be continued mainly taro in wider regions of Ethiopia.

- The findings obtained from this study need to be assisted with other relevant works to maximize the utilization of underutilized food crops for food sources and as a key solution for food insecurity problems

Table 1: Content of moisture, crude protein and crude fat (% DM basis) in leaf powder and curd samples from two taro varieties

Treatments				
Crude Taro varieties	**Processing methods**	**Moisture**	**Protein**	**Crude Fat**
Boloso-1	Leaf powder	3.733 ± 0.693a	26.069 ± 1.829bb	6.369 ± 0.959ab
	Curd concentrate	3.733 ± 0.693a	26.252 ± 1.530a	6.436 ± 0.889a
	Leaf powder	3.733 ± 0.693a	25.061 ± 1.297cd	5.835 ± 0.169cd
Local	Curd concentrate	3.444 ± 0.192a	25.428 ± 1.923c	6.324 ± 0.988c
	CV (%)	2.004	5.585	4.009
Significance level	(A x B)	ns	*	*

a-d Means ± SD within a column with different superscripts differ significantly ($p<0.05$); SD: standard deviation; CV: coefficient of variation; ns: non-significant; A:Variety and B: Processing method.

Table 2: Content of crude fiber, total ash, total carbohydrate and energy value (% DM basis) in leaf powder and curd samples from two taro varieties

Treatments					
Taro varieties	**Processing methods**	**Crude Fiber**	**Carbohydrate Total ash**	**Energy value**	**Carbohydrate**
Boloso-1	Leaf powder	4.597 ± 1.396a	2.826 ±	56.221 ±	387.213 ± 12.465c
	Curd concentrate	3.277 ± 2.122c	2.876 ± 0.230a	57.607 ± 4.774c	392.633 ± 13.432b
	Leaf powder	4.037 ± 2.363b	2.849 ±	58.116 ±	386.692 ± 11.592d
Local	Curd concentrate	3.192 ± 1.988c	2.706 ± 0.07d	59.383b ± 2.942a	394.695 ± 9.869
	CV (%)	9.851	5.713	4.022	1.502
Significance level	(A x B)	*	*	*	*

a-d Means ± SD within a column with different superscripts differ significantly ($p<0.05$); SD: standard deviation; CV: coefficient of variation; ns: non-significant; A:Variety and B: Processing method.

Table 3: Content of amylose (% DM basis), β-carotene and total phenols (mg/100 g) in leaf powder and curd samples from two taro varieties

Treatments				
Taro varieties	**Processing methods**	**Amylose content**	**β-carotene**	**Phenols**
	Leaf powder	6.276 ± 0.987a	2.703 ± 0.225a	0.957 ± 0.087bd
Boloso-1	Curd concentrate	5.507 ± 1.462c	2.566 ± 0.341ac	1.073 ± 0.237b
	Leaf powder	5.959 ± 1.520ab	2.630 ± 0.337bd	1.057 ± 0.244ac
Local	Curd concentrate	5.319 ± 1.159cd	2.480 ± 0.205d	1.113 ± 0.188a
	CV (%)	7.306	3.229	8.131
Significance level	(A x B)	*	*	*

a-d Means ± SD within a column with different superscripts differ significantly ($p<0.05$); SD: standard deviation; CV: coefficient of variation; ns: non-significant; A:Variety and B: Processing method.

Table 4: Concentration of Na, K, Mg, P and Ca (mg/100 g) in leaf powder and curd samples from two taro varieties

Treatments						
Taro varieties	**Processing methods**	**Na**	**K**	**Mg**	**P**	**Ca**
	Leaf powder	7.826 ±	16.03 ±	8.293 ±	1.179 ±	15.26 ±
Boloso-1	Curd concentrate	7.216 ± 2.110c	17.017± 3.400a	9.744 ± 1.908a	1.904 ± 0.995a	19.54 ± 6.610a
	Leaf powder	7.825 ± 1.820ab	14.333 ± 1.400d	8.546 ± 2.330c	1.399 ± 1.190cd	15.89 ± 7.240c
Local	Curd	6.607 ±	16.480 ±	9.499 ±	1.831 ±	19.40 ±
	CV (%)	9.830	10.449	7.680	5.739	5.682
Significance level	(A x B)	*	*	*	*	*

a-d Means ± SD within a column with different superscripts differ significantly ($p<0.05$); SD: standard deviation; CV: coefficient of variation; ns: non-significant; A:Variety and B: Processing method.

Table 5: Concentration of Zn, Fe and Cu (mg/100 g) in leaf powder and curd samples from two taro varieties

Treatments				
Taro varieties	**Processing methods**	**Zn**	**Fe**	**Cu**
	Leaf powder	10.751 ± 5.267b	51.724 ± 17.241ab	0.559 ± 0.256ab
Boloso-1	Curd concentrate	12.750 ± 1.811a	51.868 ± 17.025a	0.415 ± 0.194cd
	Leaf powder	9.775 ± 4.718c	40.374 ± 9.831d	0.580 ± 0.221a
Local	Curd concentrate	9.647 ± 4.550cd	46.121 ± 19.784c	0.459 ± 0.270c
	CV (%)	35.868	29.048	36.743
Significance level	(A x B)	*	*	*

a-d Means ± SD within a column with different superscripts differ significantly ($p<0.05$); SD: standard deviation; CV: coefficient of variation; ns: non-significant; A:Variety and B: Processing method.

Table 6: Content of tannin, phytate, mucilage, and oxalate (mg/100 g) in leaf powder and curd samples from two taro varieties

Treatments					
Taro varieties	**Processing methods**	**Tannin**	**Phytate**	**Mucilage**	**Oxalate**
	Leaf powder	419.80 ± 343.45c	8.592 ± 2.44b	0.128 ± 0.05b	198.610 ±171.61c
Boloso-1	Curd concentrate	301.314 ±138.40d	8.525 ± 2.319b	0.132 ±0.064b	152.301 ± 9.646d
	Leaf powder	504.241 ± 292.061a	9.880 ± 2.291a	0.165 ±0.060a	257.921 ± 13.34a
Local	Curd concentrate	494.362 ± 305.81b	9.880 ± 2.458a	0.165 ± 0.061a	243.192 ± 158.80b
	CV (%)	56.328	27.454	41.941	72.3765
Significance level	(A x B)	*	*	*	*

a-d Means ± SD within a column with different superscripts differ significantly ($p<0.05$); SD: standard deviation; CV: coefficient of variation; ns: non-significant; A:Variety and B: Processing method.

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