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Nutritional and anti-nutritional assessment of some upland taro (*Colocasia esculenta* L. Schott) cultivars in North East India

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Abstract
A study was carried out to determine the nutritional and anti-nutritional composition of 22 upland taro cultivars in North East India. The experiment was laid out in Randomized Block Design with three replications during 2016 and 2017. The desirable characters like lowest moisture content (74.86%) and oxalate content (29.23mg/100g) in cultivar Bor-Kochu, highest starch content (46.50%) in AAU-Col-32, highest crude protein (7.18 %) in Ghoti, highest crude fibre (3.21%) in Muktakesh, highest ash (7.46%) and iron (10.73mg/100g) content in Red Garo, and lowest phytate content (71.86mg/100g) in AAU-Col-39 were recorded amongst the cultivars. Therefore these cultivars may be considered for future crop improvement programme. The taro production and consumption thus should be encouraged and popularized nationally as an additional tuber crop next potato, cassava and sweet potato. This will extend the utilization options for this underutilized tuber beyond its current use in India hence increase source of income for farmers.

Keywords: Taro, nutritional, anti-nutritional and cultivar

1. Introduction
Colocasia esculenta is a staple vegetable crop that has been used as food for over 9,000 years making it one of the world's oldest food crops (Jones, 1998) [16]. It is an important tuber crop belonging to the monocotyledonous family, Araceae. The worldwide production is on the increase, with Food and Agriculture Organization (FAO) records indicating that taro production has doubled over the past decade with 10.13 million ton per annum and is now the fifth most-consumed tuber vegetable worldwide (FAOSTAT, 2016) [11].

Food has always been one of man's foremost biological needs and its nutritional value depends on its digestibility, nutritional content and the presence or absence of anti nutrients and toxic factors (Standal, 1983) [26]. Taro crop is largely cultivated because of its underground corms and cormels. The corm contains about 70-80% starch. The minute size of the starch granules accounts for its excellent digestibility with the concomitant efficient release of nutrients during digestion and absorption (Standal, 1983) [26]. Nutritionally, taro has broader compliments of vitamins and nutrients than other root and tuber crops (Kaushal, 2015) [17]. Besides considerable amount of starch, taro is also rich in vitamin C, and has been reported to be rich in calcium, phosphorus, and potassium which are important constituents of human diets (Kaushal, 2015) [17]. Taro corm is low in fat and protein; however, the protein content of taro corm is slightly higher than that of yam, cassava, sweet potato and potato (Deo, 2009) [8].

Compounds, which act to reduce nutrient utilization and/or food intake, are often referred to as anti-nutritional factors (Gemede and Ratta, 2014) [12]. These anti-nutritional factors when consumed in foods may have adverse effects on health through inhibition of protein digestion, growth, and Fe and Zn absorption (Omoruyi and Dilworth, 2007) [24]. Like most foods of plant origin, taro contains a variety of anti-nutritional and toxic components such as oxalates, phytates, trypsin and amylase inhibitors and tannins. Therefore, it is advisable to process taro before consumption (Bradbury and Sylvia, 1995 and FAO, 1999) [5, 10].

Although North East India is one of the centres of origin of colocasia and is widely grown in these regions, they are still an underutilized crop and little is known about the proximate and micro-element composition; and anti-nutritional factors. Therefore the present study was carried out to determine the nutritional and anti-nutritional composition of some upland taro cultivars in North East India.

2. Materials and Methods

2.1 Site of cultivar collection

Taro cultivars were collected in the form of corms and cormels from farmers fields. The taro cultivars were collected from four states of North-East India (Assam, Meghalaya, Arunachal and Nagaland) with focus on potential production areas. Two of the cultivars were also obtained from Central Tuber Crops Research Institute at Thiruvananthapuram, Kerela- India.

2.2 Location

The experimental site was located at an altitude of 86.8 m above the mean sea-level, with the geographical location of 26°45′N latitude, 94°12′E longitude. The topography of the land was uniform.

2.3 Details of the experiment

The twenty-two taro cultivars collected were used as treatments which were replicated thrice for two years (i.e. 2016 and 2017) to conduct the experiment. Spacing of 0.60 m x 0.45 m was maintained. The proper recommended cultivation practices were followed to raise a good crop.

2.4 Manure and Fertilizer application

The FYM @ 12 t/ha was applied at the time of final land preparation. Nitrogen, phosphotic and potassic fertilizers @100:80:120 kg/ha were applied in the form of urea, single super phosphate and muriate of potash, respectively.

2.5 Harvesting

Crop was ready for harvest in 7-9 months after planting. The maturity was judged by yellowing of leaves followed by cessation of shoot growth. The harvesting of corm was done from September to November. The harvested corms were cleaned properly and the mother corms and cormels were separated. Composite samples from three replication of each genotype were collected for chemical analysis in the laboratory.

2.6 Bio-chemical characterization

The harvested corms were cleaned properly, peeled and sliced thinly. The corm slices were then kept in the oven for about 16 hours at 60^0C to remove the moisture. The dehydrated corm slices were then powdered with the help of a grinder. The powdered taro was then used for further bio-chemical analyses. The corms were analyzed to determine the content of moisture (%), starch (%), crude protein (%), crude fibre (%), iron (mg/100g), total ash content (%), oxalate content (%) and phytate (%).

2.6.1 Moisture content

This was determined according to Udo and Ogunwele's (1986) method with slight modification where two grams of the sample (taro corm) was weighed (W1) into pre-weighed crucible (W_0) and placed into an oven at 105^0C. The crucible was removed and cooled in a desiccator and weighed. The process of drying, cooling and weighing were repeated until a constant weight (W2) was obtained. The moisture content was then calculated by the equation

$$\% \text{ moisture} = \frac{W_1 - W_2}{W_1 - W_0} \times 100$$

Where, W0 = weight of the empty crucible (g)
W1 = weight of fresh sample + empty crucible (g)
W_2 = weight of dried sample + empty crucible (g)

2.6.2 Starch content

Starch content was estimated using the colorimetric method (Sadasivan and Manickam, 1992) [25]. This method involves weighing of 100 mg of the sample flour into the centrifuge tube with 80 percent hot ethanol. The mixture was vortexed and centrifuged. The residue was washed with 80 percent hot ethanol for several times, until the filtrate gives no test for sugars. The residue was hydrolysed with perchloric acid and used to estimate starch content. Anthrone reagent was used for colour development and glucose standards were used for colour development and glucose standards were used for estimation of sugars. The absorbance was read at 630 nm using a spectrometer (Uv-vis spectrophotometer). The glucose content of the samples were found using the standard curve and the value was multiplied by a factor 0.9 (0.9 g of starch yields 1 g of glucose on hydrolysis).

2.6.3 Crude Protein Content

The crude protein of the sample was determined using the micro Kjeldhal method described by AOAC (1990) [1]. Thus,

% crude protein = % Nitrogen x 6.25

The nitrogen content of the sample is given by the formula:

$$\% \text{ N} = \frac{\text{Tv} \times \text{Na} \times 0.014 \times V_1}{\text{G} \times V_2} \times 100$$

Where, TV = titre value of acid (cm)
Na = concentration or normality of acid
V_1 = volume of distilled water used for distilling the digest (cm)
V_2 = volume of aliquot used for distillation (cm)
G = original weight of sample used in gram

2.6.4 Crude fibre

The content of crude fibre was determined by extracting two grams of powdered sample with ether to remove fat (initial boiling temperature 35-38°C and final temperature 52°C). Then two grams of dried sample was boiled with 200 ml of H_2SO_4 for 30 minutes. Then the solution was filtered through muslin cloth and washed with boiling water untill washings were free of acid. Then the residue was boiled with 200 ml of NaOH for 30 minutes. It was then filtered through muslin cloth and again washed with 25 ml of boiling H_2SO_4, 50 ml of water and 25 ml of alcohol. The residue was removed and transfered to pre-weighed ashing dish (w_1 g). The residue was dried for 2 hours at 130±2°C and cooled in desiccator and weighed (w_2 g). It was then ignited for 30 minutes at 600±15°C and cooled in the desiccator and re-weighed (w_3 g).

Calculation: Loss in weight= $(w_2 - w_1)-(w_3 - w_1)$

$$\% \text{ Crude fibre content} = \frac{\text{on ignition}}{\text{weight of sample (g)}} \times 100$$

Where, w_1= pre weighed crucible (g)
w_2= weight of the oven dried sample (g)
w_3= weight of the cooled sample (g)

2.6.5 Ash Content

This is the measure of the residue remaining after combustion of the sample. The method followed was as described by James (1995) [15] with slight modification where two grams of the powdered sample was weighed (W_1) into pre-weighed

empty crucible (W_0) and place into muffle furnace until the sample was completely ashed at temperature 600°C. The ash was removed and cooled in a desiccator and weighed (W_2). The weight of the ashed sample was determined by difference between the ashed sample and pre-weighed crucible. Percentage ash was calculated by the equation:

$$\% \text{ Ash} = \frac{W_2 - W_0}{W_1 - W_0} \times 100$$

2.6.6 Iron estimation

Iron content was determined using the method developed by Wong (1928) [33]. The iron present in the corm is converted to ferric form by using oxidizing agents like potassium persulphate and treating thereafter with potassium thiocyanate to form the red ferricthiocynate which is measured colorimetrically at 480 nm. The ash solution of the sample prepared by dry ashing was used for colour development.

$$\text{Milligram of iron per /100 gram} = \frac{\text{OD of sample x 0.1 x Total volume of ash solution x 100}}{\text{OD of standard x 5 x weight of sample taken for ashing}}$$

2.6.7 Oxalate content

The oxalate content was determined using the method originally employed by Ukpabi and Ejidoh (1989) [29]. The procedure involves three steps: digestion, oxalate precipitation and permanganate titration.

2.6.8 Phytate content

The phytate content was determined according to method described by Latta and Eskin (1980) [18] and later modified by Vaintraub and Lapteva (1988) [30]. The phytate was extracted with trichloroacetic acid and precipitated as ferric salt. The iron content of the precipitate was determined colorimetrically and the phytate phosphorus content was calculated from that value assuming a constant 4 Fe: 6 P molecular ratio in the precipitate. The phytate 'P' was calculated as per the following equation:

$$\text{Phytate P mg/100 g sample} = \frac{\text{Fe (µg) x 15}}{\text{Weight of sample in g}}$$

2.7 Data analysis

The bio-chemical data for two years were subjected to pooled analysis following Randomized Block Design. Subsequently, the pooled mean values of both the experimental years were subjected to further statistical analysis.

3. Results and Discussion

Nutritional composition of crops is a highly challenging trait as it determines the crop quality (Wiesler *et al*., 2002) [31]. The determination of proximate composition of different colocasia cultivars will go a long way in providing substantive information on the crop. A high level of significant variation was recorded among the taro cultivars concerning the nutritional and anti-nutritional profile.

Distinguishing variation in moisture content was observed among the taro cultivars under the study. The moisture contents in the taro cultivars ranged between 74 to 81 percent and this variation may be attributed to the different taro cultivars, environmental factors and agronomic practices (Table 1). The highest moisture content was found in cultivar AAU-Col-32 i.e. 83.16%, 82.20% and 82.68% (Table 1) for 1st year, 2nd year and pooled data respectively. The cultivar with the lowest moisture content was measured in cultivar Bor with 74.86%, 74.86% and 74.86% for both the two years and pooled data indicating that it also contained the highest dry matter which is a desirable qualitative character (Table 1). The low moisture content in the taro cultivars is important as it enables long storage. These results are in consistent with the works conducted by Aregheore and Perera, (2003) [3]; Mwenye *et al*. (2011) [23] and Matikiti *et al*. (2017) [22].

Characterization of nutritional profile of taro cultivars is a very important factor for crop improvement programme. Significant variation was found in starch content among the twenty-two taro cultivars. The starch content ranged from 32.5 to 46.5 percent among the taro cultivars under the study (Table 1). The cultivar Karbi Anglong was recorded with the lowest starch content i.e. 33%, 32% and 32.50% while the cultivar AAU-Col-32 collected from Jorhat was recorded with the highest starch content viz. 47%, 46% and 46.50% for 1st year, 2nd year and pooled data respectively (Table 1). Wills *et al*. (1983) [32] reported varietal variation in starch content and dry matter content in taro.

The data presented in table 1 revealed that there was a significant variation in crude protein content among the various taro cultivars. The highest crude protein content was found in cultivar Ghoti with 7.18 percent for both the experimental years and pooled data. On the other hand, the cultivar Arunachal 2 was found to contain lowest crude protein among the cultivars (3.16%, 3.17% and 3.16% for 1st year, 2nd year and pooled data). It is evident from the data presented in table 2 that

Table 1: Mean moisture content, starch content and crude protein of taro cultivars

S. No.	Moisture content (%)			Starch content (%)			Crude protein (%)		
	2016	2017	Pooled	2016	2017	Pooled	2016	2017	Pooled
Kaka	78.20	79.13	78.66	37.00	36.00	36.50	4.63	4.73	4.68
Garo	79.96	80.30	80.13	36.00	35.00	35.00	4.33	4.29	4.31
Makhuti	79.70	78.86	79.28	36.00	35.00	35.50	3.21	3.19	3.20
Ghoti	80.76	81.43	81.10	35.00	34.00	34.50	7.18	7.18	7.18
Boga Ahina	78.66	79.00	78.83	34.00	33.00	33.50	3.60	3.66	3.63
Koni	79.76	81.03	80.40	35.00	34.00	34.50	4.65	4.50	4.57
Red Garo	77.03	79.36	78.20	34.00	33.00	33.50	3.60	3.64	3.62
Karbi Anglong	78.36	78.36	78.36	33.00	32.00	32.50	4.45	4.53	4.49
Bor	74.86	74.86	74.86	43.00	42.00	42.50	3.60	3.75	3.68
AAU Col-46	80.86	79.26	80.06	45.00	44.00	44.50	3.98	4.04	4.01
Arunachal 2	78.53	80.36	79.45	37.00	38.00	37.50	3.16	3.17	3.16
Panch Mukhi	78.80	78.70	78.75	36.00	37.00	36.50	4.07	4.06	4.07
Naga	80.36	80.50	80.43	40.00	41.00	40.50	5.24	5.33	5.28
JCC-31	80.53	81.00	80.76	35.00	36.00	35.50	4.28	4.34	4.31
Damor Dema	79.53	79.53	79.53	35.00	34.00	34.50	6.87	6.95	6.91

AAU Col-5	81.03	81.03	81.03	37.00	38.00	37.50	4.30	4.22	4.26
Ahina	77.46	76.53	77.00	40.00	41.00	40.50	3.69	3.69	3.69
AAU Col-32	83.16	82.20	82.68	47.00	46.00	46.50	3.70	3.83	3.76
Takali	79.93	80.93	80.43	35.00	36.00	35.50	4.42	4.57	4.50
AAu Col-39	80.03	80.50	80.26	38.00	39.00	38.50	4.62	4.66	4.64
Muktakesh	78.76	77.73	78.25	38.00	39.00	38.50	3.73	3.43	3.58
Sree Kiran	76.83	78.46	77.65	38.00	39.00	38.50	4.13	3.90	4.01
C.D (0.5%)									
Cultivars	3.23	3.13	2.21	0.96	0.96	0.67	0.21	0.15	0.13
Environment	-	-	NS	-	-	NS	-	-	NS
Interaction	-	-	3.13	-	-	0.95	-	-	0.18

There was a significant variation in crude fibre content among the taro cultivars. The highest crude fibre was recorded in cultivar Muktakesh viz. 3.23%, 3.20% and 3.21% for 1st year, 2nd year and pooled data respectively (Table 2). Whereas the lowest was noted in cultivar Karbi Anglong i.e. 2.33%, 2.10% and 2.21% for the two years and pooled data respectively (Table 2). The variation in quality parameters among the taro cultivars could be attributed to the varietal differences mainly governed by the genetic makeup of the particular cultivar. These differences might also be influenced by soil and environmental factors, which play crucial role in metabolic synthesis, translocation and storage of primary and secondary metabolites. These results are in conformity with research done by Buragohain *et al*. (2013) [6].

Moderate variation was recorded among the taro cultivars under observation regarding ash content. The highest ash content was recorded in cultivar Red Garo (7.43%, 7.50% and 7.46%) which was at par with Karbi Anglong (7.16%, 7.10% and 7.13%) for 1st year, 2nd year and pooled data respectively (Table 2). The lowest was found in cultivar AAU-Col-39 i.e. 3.94%, 3.80% and 3.87% for the two years and pooled data respectively (Table 2). The ash content helps to determine the amount and type of minerals in taro (Temesgen and Tetta, 2015; Wiesler *et al*., 2002 and Matikiti *et al*., 2017) [27, 31, 22].

A perusal of the data presented in table 2 showed that a significant variation was found in iron content among the taro cultivars. The lowest iron content was recorded in cultivar AAU-Col-39 i.e. 6.56 mg, 6.60 mg, 6.58 mg per 100g for 1st year, 2nd year and pooled data respectively. The highest iron content was recorded in cultivar Red Garo (10.56 mg, 10.90 mg and 10.73mg per 100g) which was at par with Makhuti (10.06 mg, 10.13 mg and 10.10 mg per 100g) for the two years and pooled data respectively (Table 2).

A positive correlation was observed between the ash and iron content because the highest and the lowest for both the parameters were found in cultivars Red Garo and AAU-Col-39 respectively. The variation in mineral content among the cultivars suggests a wide diversity in the taro cultivar collection and offers potential genetic material to improve the micro-nutrient levels in taro cultivars through breeding (Burlingame *et al*., 2009) [7]. Since different taro genotypes have different nutrient-use efficiencies (Goenaga and Chardon, 1995) [13], the wide variations observed in chemical composition of different colocasia cultivars may be primarily due to differences in the genetic potential of each cultivar to obtain nutrients from the soil because all the cultivars were grown under similar climate and soil type, under uniform cultivation practices (Barooah, 1982 and Angami *et al*., 2015) [4, 2]. Similar observations were made by Wills *et al.* (1983) [32] for taro cultivars grown in the highlands of Papua New Guinea. In their study, Lebot *et al*. (2004) [19] found high levels of variability in South East Asia and Oceania taro germplasms with regard to chemical composition i.e. minerals, proteins, glucose, fructose and saccharose and suggested that cultivar selection would be efficient for their improvement since these traits are genetically controlled.

Characterizing the anti-nutritional profile of taro cultivars is a necessary factor before selection of any cultivars for breeding purpose. Significant variation was found in oxalate content amongst the different taro cultivars under investigation. The lowest oxalate content was recorded in cultivar Bor i.e. 28.80 mg, 29.66 mg and 29.23 mg per 100g dry weight whereas the cultivar AAU-Col-32 was recorded with the highest oxalate content viz. 51.70 mg, 51.83mg and 51.76 mg per 100g dry weight for the two years and pooled data respectively (Table 3). Levels of oxalates are of interest because of their alleged adverse effect on nutrient bioavailability (Libert and Franceschi, 1987) [21]. However, oxalates levels may not pose a health hazard since these are leached out during cooking. Huang *et al*. (2007) [14] also reported the variation in calcium oxalate levels among different cultivars of taro.

The different taro cultivars under study showed significant variation in phytate content. The amount of phytate among the taro cultivars ranged from 71.86 to 95.30 mg/100g (Table 3). The cultivar AAU-Col-39 was recorded with the lowest phytate content i.e. 72.40 mg, 71.33 mg and 71.86 mg per 100g dry weight for two years and pooled data respectively (Table 3). On the other hand, the highest content was found in cultivar Red Garo viz. 95.16 mg, 95.43 mg and 95.30 mg per 100g dry weight for 1st year, 2nd year and pooled data respectively (Table 3). The variation in phytic acid content among the cultivars under experiment may be due to different cultivars, climatic conditions, location, irrigation conditions, type of soil and the growing season of the plant. Similar results were also documented by Deshpande *et al*. (1982) [9] and Lewu *et al*. (2010) [20].

Table 2: Mean crude fibre, ash content and iron content of taro cultivars

Sl. No.	Crude fibre (%)			Ash content (%)			Iron content (mg/100g)		
	2016	2017	Pooled	2016	2017	Pooled	2016	2017	Pooled
Kaka Kochu	2.43	2.43	2.43	4.79	4.86	4.82	9.50	9.56	9.53
Garo	2.53	2.53	2.53	4.90	4.90	4.90	9.00	9.00	9.00
Makhuti	2.73	2.73	2.73	4.61	4.79	4.70	10.06	10.13	10.10
Ghoti	2.46	2.46	2.46	5.03	5.06	5.05	8.29	8.22	8.25
Boga Ahina	3.00	2.90	2.95	6.53	6.58	6.56	8.19	8.09	8.14
Koni	2.43	2.43	2.43	5.11	5.22	5.16	6.87	6.87	6.87
Red Garo	2.43	2.43	2.43	7.43	7.50	7.46	10.56	10.90	10.73

Karbi Anglong	2.33	2.10	2.21	7.16	7.10	7.13	7.80	7.72	7.76
Bor Kochu	2.63	2.63	2.63	6.03	6.10	6.06	9.64	9.74	9.69
AAU Col-46	2.56	2.56	2.56	6.08	6.14	6.11	9.26	9.23	9.25
Arunachal 2	2.86	2.81	2.83	4.05	4.12	4.08	9.50	9.63	9.56
Panch Mukhi	2.60	2.60	2.60	5.16	5.29	5.22	7.23	7.40	7.31
Naga Kochu	2.53	2.53	2.53	6.00	6.31	6.15	8.90	8.99	8.95
JCC-31	2.60	2.60	2.60	4.12	4.06	4.09	7.10	7.10	7.10
Damor Dema	2.53	2.53	2.53	6.11	6.11	6.11	8.71	8.87	8.79
AAU Col-5	2.60	2.60	2.60	4.83	4.56	4.70	7.40	7.53	7.46
Ahina	2.53	2.53	2.53	4.26	4.26	4.26	7.80	7.75	7.77
AAU Col-32	2.63	2.63	2.63	4.86	4.84	4.85	8.36	8.28	8.32
Takali	2.20	2.26	2.23	4.78	4.60	4.69	7.66	7.71	7.69
AAu Col-39	2.40	2.40	2.40	3.94	3.80	3.87	6.56	6.60	6.58
Muktakesh	3.23	3.20	3.21	5.16	5.20	5.18	8.00	8.06	8.03
Sree Kiran	3.1	3.06	3.08	6.06	5.96	6.01	8.20	8.20	8.20
C.D (0.05%)									
Cultivars	0.12	0.16	0.10	0.48	0.36	0.300	0.42	0.25	0.24
Environment	-	-	NS	-	-	NS	-	-	NS
Interaction	-	-	0.14	-	-	0.42	-	-	0.34

Table 3: Mean oxalate content and phytate content of taro cultivars

Sl. No.	Oxalate content (mg/100g)			Phytate content (mg/100g)		
	2016	2017	Pooled	2016	2017	Pooled
Kaka	40.16	41.00	40.58	88.13	88.60	88.36
Garo	32.73	32.70	32.71	85.63	85.73	85.68
Makhuti	45.06	44.73	44.90	92.80	92.43	92.61
Ghoti	45.46	45.80	45.63	80.43	80.53	80.48
Boga Ahina	36.10	37.33	36.71	79.46	79.63	79.55
Koni	32.93	32.36	32.65	73.76	74.26	74.01
Red Garo	32.56	33.10	32.83	95.16	95.43	95.30
Karbi Anglong	34.80	35.30	35.05	76.50	76.60	76.55
Bor	28.80	29.66	29.23	90.80	90.76	90.78
AAU Col-46	49.43	49.60	49.51	84.80	85.06	84.93
Arunachal-2	48.66	48.44	48.50	86.46	86.16	86.31
Panch Mukhi	41.76	40.50	41.13	75.43	75.76	75.60
Naga	30.66	30.93	30.80	83.66	83.06	83.36
JCC-31	36.86	37.50	37.18	75.26	74.20	74.73
Damor Dema	50.33	50.03	50.18	82.73	81.73	82.23
AAU-Col-5	42.86	43.30	43.08	75.23	74.76	75.00
Ahina	31.76	30.36	31.06	79.06	78.50	78.78
AAU Col-32	51.70	51.83	51.76	81.16	80.16	80.66
Takali	38.80	39.26	39.03	77.23	77.00	77.11
AAU-Col-39	44.70	43.76	44.23	72.40	71.33	71.86
Muktakesh	36.56	37.13	36.85	72.90	73.56	73.23
Sree Kiran	38.93	38.96	38.95	74.76	74.76	74.76
C.D (0.05%)						
Cultivars	1.44	1.44	1.00	2.10	2.06	1.45
Environment	-	-	NS	-	-	NS
Interaction	-	-	1.42	-	-	2.05

Conclusion

The determination of nutritional and anti-nutritional compositions of taro will go a long way in providing substantive information on the crop. The study suggested that cultivars with important bio-chemical traits like Bor-Kochu with low moisture and oxalate content, AAU-Col-32 with highest starch content, Ghoti containing high crude protein, Muktakesh with high crude fibre, Red Garo with highest ash and iron content and AAU-Col-39 with lowest phytate content amongst the cultivars must be considered for future crop improvement programme. Taro production and consumption should be encouraged and popularized nationally as an additional tuber crop next potato, cassava and sweet potato, to help curb malnutrition and lower incidence of other diet related diseases. This will extend the utilization options for this underutilized tuber beyond its current use in India hence increase source of income for farmers.

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References

1. AOAC (Association of Official Analytical Chemists). Officials Method of Analysis Helriok Publisher, Washington D C. 1990; 1230.
2. Angami T, Jha AK, Buragohain J, Deka BC, Verma VK, Nath A. Evaluation of taro (*Colocasia esculenta* L.*)* cultivars for growth, yield and quality attributes. Journal of Horticultural Science. 2015; 10(2):183-189.
3. Aregheore EM, Perera D. Dry matter, nutrient composition and palatability/acridity of eight exotic

cultivars of cocoyams – taro (*Colocasia esculenta*) in Samoa. Plant Foods for Human Nutrition. 2003; 58:1-8.
4. Barooah H. Collection, screening and evaluation of some local colocasia (*Colocasia esculenta* L. Schott) and Xanthosoma (*Xanthosoma sagittifolium* L. Schott) cultivars of Assam. M.Sc. (Agri.) Thesis, AAU, Jorhat. 1982.
5. Bradbury J, Sylvia V. Cyanide Content of the Leaves and Stems of Edible Aroids. Phytochemical Analaysis. 1995; 6:268-271.
6. Buragohain J, Angami T, Choudhary BU, Singh P, Bhatt BP, Thirugnanavel A, *et al*. Quality evaluation of indigenous taro (*Colocasia esculenta* L.) cultivars of Nagaland. Indian Journal of Hill Farming. 2013; 26(2):16-20.
7. Burlingame B, Charrondiere R, Mouille B. Food composition is fundamental to the cross-cutting initiative on biodiversity for food and nutrition. Journal of Food Composition and Analysis. 2009; 22(5):361-365.
8. Deo PC, Tyagi AP, Taylor M, Becker DK, Harding RM. Improving taro (*Colocasia esculenta* var. *esculenta*) production using biotechnological approaches. South Pacific Journal of Natural Science. 2009; 27:6-13.
9. Deshpande SS, Sathe SK, Salunkhe DK, Cornforth DP. Effects of dehulling on phytic acid, polyphenols, and enzyme inhibitors of dry beans (*Phaseolus vulgaris* L.). Journal of Food Science. 1982; 47:1846-1850.
10. Food and Agriculture Organization (FAO). Taro cultivation in Asia and the Pacific, Food and Agriculture Organization of the United Nations (FAO), Rome, Italy. 1999.
11. FAOSTAT. FAO Statistical Database: Agricultural production of primary crops. Available from http://apps. fao.org/default.htm. 2016.
12. Gemede HF, Ratta N. Antinutrional factors in plant foods: Potential health benefits and adverse effects. International Journal of Nutrition and Food Sciences. 2014; 3(4):284-289.
13. Goenaga R, Chardon U. Growth, yield and nutrient uptake of taro grown under upland conditions. Journal of Plant Nutrition. 1995; 18:1037-1048.
14. Huang C, Chen W, Wang CR. Comparison of Taiwan paddy- and upland-cultivated taro (*Colocasia esculenta* L.) cultivars for nutritive values. Food Chemistry. 2007; 102:250-256.
15. James CS. Analytical Chemistry of food. Chapmen and Hall. London. 1995; 64-65.
16. Jones DA. Why are so many food plants cyanogenic?. Phytochemistry. 1998; 47(2):155-162.
17. Kaushal P, Kumar V, Sharma HK. Utilization of taro (*Colocasia esculenta*): A review. Journal of Food Science and Technology. 2015; 52(1):27-40.
18. Latta M, Eskin M. A simple and rapid colorimetric method for phytate determination. Journal of Agricultural and Food Chemistry. 1980; 28:1313-1315.
19. Lebot V, Prana M, Kreike N, Heck VV, Pardales J, Okpul T, *et al*. Characterisation of taro (*Colocasia esculenta* (L.) Schott) genetic resources in Southeast Asia and Oceania. Genetic Resources and Crop Evolution. 2004; 51:381-392.
20. Lewu MN, Adebola PO, Afolayan AJ. Effect of cooking on the mineral contents and anti-nutritional factors in seven accessions of *Colocasia esculenta* (L.) Schott growing in South Africa. Journal of Food Composition and Analysis. 2010; 23:389-393.
21. Libert B, Franceschi VR. Oxalate in crop plants. Journal of Agricultue and Food Chemistry. 1987; 35:926-938.
22. Matikiti A, Allemann J, Kujeke G, Gasura E, Masekesa T, Chabata I. Nutritional composition of cocoyam (*Colocasia esculenta*), grown in Manicaland province in Zimbabwe Asian. Journal of Agriculture and Rural Development. 2017; 7(3):48-55.
23. Mwenye OJ, Labuschagne MT, Herselman L, Benesi IRM. Mineral composition of Malawian cocoyam (*Colocasia esculenta* and *Xanthosoma sagittifolium*) genotypes. Journal of Biological Sciences. 2011; 11:331-335.
24. Omoruyi FO, Dilworth L. Anti-nutritional factors, zinc, iron and calcium in some Caribbean tuber crops and the effect of boiling or roasting. Journal of Nutrition and Food Science. 2007; 1:8-15.
25. Sadasivam S, Manickam A. Biochemical methods for agricultural sciences. Wiley Eastern Limited, New Delhi. 1992; 11-12.
26. Standal BR. Nutritive value of taro. In: J.K. Wang, (ed). Taro: A review of *Colocasia esculenta* and its potentials. Honolulu, Hawaii: University of Hawaii press. 1983; 141-147.
27. Temesgen M, Retta N. Nutritional potential, health and food security benefits of Taro *Colocasia esculenta* (L.): A Review. Food Science and Quality Management. 2015; 36:23-30.
28. Udo EJ, Ogunwele DA. Laboratory Manual for Analysis in Soil, Plants and Water Analysis 3rd Edition. Ilorin, University of Ilorin, Kwara State Nigeria. 1986; 131-152.
29. Ukpabi UJ, Ejidoh JI. Effect of deep oil frying on the oxalate content and the degree of itching of cocoyams (*Xanthosoma and Colocasia* spp). Technical Paper presented at the 5th Annual Conference of the Agricultural Society of Nigeria, Federal University of Technology, Owerri, Nigeria. 1989; 3-6.
30. Vaintraub IA, Lapteva NA. Colorimetric determination of phytate in unpurified extracts of seeds and the products of their processing. Analytical Biochemistry. 1988; 175:227-230.
31. Wiesler F, Gerendas J, Sattelmacher B. Influence of mineral fertilizers on nutritional quality of staple foods crops. Encyclopedia of Life Support Systems (EOLSS). 2002; 1:201-211.
32. Wills RB, Lim JS, Greenfield H, Bayliss-Smith T. Nutrient composition of taro (*Colocasia esculenta*) cultivars from the Papua New Guinea Highlands. Journal of the Science of Food and Agriculture. 1983; 34:1137-1142.
33. Wong SY. Journal of Biological Chemistry. 1928; 77:409.