Journal of Applied Horticulture, 27(3): 518-523, 2025

https://doi.org/10.37855/jah.2025.v27i03.94

Journal of Applied Horticulture
ISSN: 0972-1045

Phytochemical and antioxidant properties of elephant foot yam (*Amorphophallus paeoniifolius*) based RTC valorized product

G. Suba[1], S.K. Mathanghi[1], Rita Narayanan[2] and B. Murugan[3]

*[1]Department of Food Processing Technology, College of Food and Dairy Technology, Tamil Nadu Veterinary and Sciences University, Chennai- 600 052. [2]Department of Livestock Products Technology (Dairy Science), Madras Veterinary College, Tamil Nadu Veterinary and Sciences University, Vepery, Chennai- 600 007. [3]Department of Food Safety and Quality Assurance, College of Food and Dairy Technology, Tamil Nadu Veterinary and Animal Sciences University, Chennai- 600 052. *E-mail: mathanghisoma@gmail.com*

Abstract

Elephant foot yam (*Amorphophallus paeoniifolius*), often referred to as the "King of Tuber Crops" due to its high nutritive value and low cost, has recently gained attention for its valorization into a novel ready-to-cook product enriched with health-beneficial phytochemicals. Ready-To-Cook (RTC) valorized convenience product was prepared from elephant foot yam and packed in vacuum-pack frozen form. From the phytochemical analysis, flavonoid was detected in the ethanol extracts of the raw yam and the valorized frozen product of aqueous extract, but phenolic compounds were found in the raw and frozen as well as fried forms. Raw yam chloroform extracts did not have terpenoids, while frozen valorized chloroform extracts did not contain cardiac glycosides. Most extracts also revealed no detection results concerning tannins, except for two, whereas saponins were positive for approximately half of the extracts tested, and most were not detected for phlobatannins. Quantitative analysis of the changes showed a decrease of phenol (29.6 %), tannins (22 %) and phytic acid (15.74 %) in RTC Elephant foot yam valorized product after frying when compared to the fresh frozen product. The DPPH assay revealed a notably high potential for health benefits (IC50 value 75.28 µg/L). The other additional benefits were that this product contains 2.35 g/ 100 g of dietary fibre and a total protein value of 17 g/100 g. These findings suggest that the valorized RTC elephant foot yam is a nutrient-dense, phytochemical-rich functional food with significant health-promoting potential.

Key words: Elephant foot yam, phytochemical analysis, antioxidant activity, FRAP, phytic acid, valorized product

Introduction

Tuber and roots consumed as staple food are grown in tropical regions. They have remarkable amounts of starch, offering various vitamins and minerals (Moorthy *et al.*, 2018). After rice and corn, the tubers are considered as a source of carbohydrates. Among the tuber plants, *Amorphophallus paeoniifolius*, Elephant foot yam is recognized for its high-yielding and tasty tuber worldwide in sub-tropical and tropical regions, such as India, Indonesia, Malaysia and the Philippines. Tuber crop types can enhance profitable enterprises in the primary and secondary sectors of India's agricultural activities (Islam *et al*., 2023). This is a large herbaceous perennial taro plant, widely grown for its edible corms, which can weigh over 1 kg. This plant can be harvested after 1-year and produce around 30-40 tonnes per hectare with about 20 % (w/w) starch content of the tubers (Moorthy *et al.*, 2018).

The elephant foot yam (*A. paeoniifolius*), is known as oal in Hindi, kandha in Telugu, Senai kizhangu in Tamil, Suran in Marathi, chena in Malayalam, Oluo in Oriya. It is a prominent aroid tuber vegetable crop grown for its corms in tropical and subtropical areas of Africa, South Asia, Southeast Asia, and the tropical Pacific islands. It is commonly known as king of tuber crops, as it has a large underground tuber eaten as a vegetable.

In India, elephant foot yam is a majorly cultivated yam with major growing states including Andhra Pradesh, West Bengal, Gujarat, Kerala, Tamil Nadu, Maharashtra, Uttar Pradesh and Jharkhand, where Gajendra and Sree Padma are the popular cultivars. In traditional medicine, it is used to treat bronchitis, asthma, abdominal pain, vomiting, dysentery, enlargement of the spleen, haemorrhoids, elephantiasis, blood disorders and rhinophyma, and rheumatic swelling. Antioxidant and antitumor activities of the ethanol extract of corm of elephant foot yam (*A. paeoniifolius*) were observed in rats with mammary tumors induced by 7, 12-dimethylbenz(a) anthracene (DMBA) (Jagatheesh *et al.*, 2010).

In terms of food processing, they can be used as a food thickener, but so far, the commercial use of these properties has not been fully explored (Reddy *et al.*, 2015). This tuber possesses anti-nutritional factors and calcium oxalate ions called "raphides" can irritate the mucous layers and exposed skin layers, making this vegetable a less preferred one for culinary and food processing purposes. Antinutritional factors can interfere with the metabolism of minerals and certain vitamins, making them unavailable to the body. Processing conditions can reduce these raphides and ANF substances and make the vegetable-based product palatable and nutritional. An attempt was made to valorize the elephant foot yam with other ingredients such as okara (soybean byproduct), masoor dhal (Lens culinaris), and potato starch using thermal and freezing techniques, as well as the effect of processing on the reduction of undesirable oxalates, the presence of phytochemicals, and the antioxidant capacity. A special significance was given to study the availability of the phytochemicals (qualitative and quantitative) and anti-oxidant properties in the Elephant foot yam (EFY) based valorized product.

Materials and methods

Preparation of vacuum-packed EFY-based valorized product: The vacuum-packed, ready-to-cook Elephant Foot Yam (EFY) valorized product was created using a standardized formulation and processing protocol to ensure product stability, convenience, and nutritional value. Elephant Foot Yam (60%) was the main ingredient in the formulation, followed by masoor dhal (15%), okara powder (8%), potato starch (7%), binding agents (6%), and a spice mixture (4%). Okara, a soy milk residue, contributed to the product's structural stability by containing polysaccharides such as pectin, cellulose, and xyloglucans, all of which help form a cohesive food matrix. Masoor dhal, known for its meat-like texture, was chosen to improve mouthfeel and serve as a viable plant-based alternative to meat products.

The Elephant Foot Yam was cleaned and cut before being steam blanched to reduce its raw flavor and microbial content. After blanching, the yam was combined with the remaining ingredients to form a homogeneous mixture. This mixture was then filled into cellulose casings with sausage filler equipment to ensure uniform size and shape. The filled casings were blast frozen at -30 °C to ensure rapid freezing and product preservation. The frozen units were then vacuum packed to prevent oxidation and microbial contamination, and stored at sub-zero temperatures to maintain product quality throughout storage and distribution. The product formulation was standardized through sensory evaluation, and the T2 formulation was chosen for further phytochemical analysis (Fig. 1).

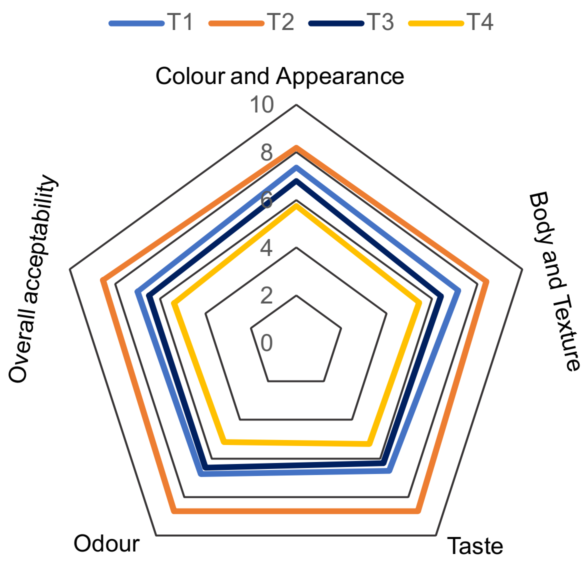

Fig. 1. Sensorial analysis of the product

Preparation of extract for qualitative and quantitative phytochemical analysis: The valorized product extract and raw yam extract was prepared by weighing the sample and solvent in the ratio of 10: 30 and kept for 8 hrs at room temperature as mentioned by Swain *et al.* (2021) and Vijayalakshmi *et al.* (2011).

Qualitative analysis of the samples: This was performed for aqueous, ethanol, and chloroform extracts of raw yam, frozen and fried valorized products.

Flavonoids: Ethanol, aqueous, and chloroform extracts were taken in test tubes and 5 mL of diluted ammonia was added and followed by sulphuric acid. The presence of flavonoids was indicated by the appearance of the yellow coloration which disappears gradually (Vijayalakshmi *et al.*, 2011).

Phenolics: Folin-ciocalteu reagent was used in the detection test for phenolic compounds. 5 mL of folin-ciocalteu and 4 mL of aqueous sodium carbonate were added to the product extracts. The presence was indicated by a blue color (Vijayalakshmi *et al.*, 2011).

Saponins: Forth, the foaming method for detection of starch content in the sample, 1 mL of extracts of the valorized product were taken in test tubes and 10 mL of distilled water was added and filtered (Whatman 42 filter paper) and shaken in a vortex shaker for 10 mins. The presence of a froth scum indicates the presence of starch (Swain *et al.*, 2021).

Tannins: The product extracts were taken (5 mL) and 5 drops of 10 % lead acetate was added. The presence of tannins was deducted by visualizing the light-yellow precipitate formed (Swain *et al.*, 2021).

Cardiac glycosides: The extracts were taken (5 mL each), mixed with glacial acetic acid of 2 mL with one drop of ferric chloride solution. Concentrated sulphuric acid was added along the side of the test tubes forming the ring structure of brown coloration due to the presence of deoxy sugar. The acetic acid layer, greenish color spreads gradually and completely. The violet ring forms between the green and brown layers (Vijayalakshmi *et al.*, 2011).

Alkaloids: Mayer's reagent method detected alkaloid compounds in the product extracts. Cream color indicates their presence post-addition of Mayer's reagent (De *et al.*, 2010).

Terpenoids: The extracts were measured at 5 mL each. 3 mL of H_2SO_4 and 2 mL of chloroform were mixed cautiously, forming a layer. The formation of reddish-brown pigmentation indicates the presence of terpenoids (Vijayalakshmi *et al.*, 2011).

Phlobatanins: Valorized product extract and raw yam extracts were boiled with 1 % aqueous HCl. The presence of the phlobotanin is indicated by red precipitate formation (Vijayalakshmi *et al.*, 2011).

Quantitative analysis: Quantitative analysis of phytochemicals was conducted on frozen and fried Valorized elephant foot yam products.

Total phenolic content: Total phenolic content was determined following Kupina *et al.* (2018). A 100 mg sample was ultrasonicated in 75 mL of water for 10 minutes, then diluted to a final volume of 100 mL. For analysis, 1 mL of the sample extract (or 40-200 mg/L gallic acid standards) was added to a mixture of 15 mL distilled water and 1 mL Folin-Ciocalteu reagent. After resting for 6 minutes, 3 mL of Na2CO3 was added. The mixture was incubated in the dark for 2 hours before measuring absorbance at 765 nm. Results were expressed as Gallic Acid Equivalents (GAE).

$$\text{Total phenols} = \frac{A-b}{m} \times \frac{V \times D}{W \times 1000} \times 100$$

A= the absorbance measured at 765 nm; b = y-intercept of the calibration curve; m= slope of the calibration curve; W = weight of the sample(mg); V = Volume of the sample test solution (100 mL); D = Dilution factor (20) and 1000 for the conversion to mL to L.

$$\text{Total phenols}\left(\%\frac{w}{w},\ \text{dry}\right)=\frac{\text{Total phenols value}}{M}$$

M = The dry weight fraction (100 - % moisture)/100

Phytic acid: Chen's reagent method was used to determine the phytate content in valorized products. A 0.5 gram of the valorized product was measured and extracted with 5mL 0.4 M HCl for 12 h. The Chen's reagent was prepared in the ratio of 1:1:1:2 with the chemicals 6N H_2SO_4, 2.5 % ammonium molybdate, 10 % ascorbic acid, and H_2O respectively. A 100 µL extract was mixed with the same volume of Chen's reagent. The mixture was left for 15 minutes to react. When it turned blue, absorbance was measured at 660 nm to determine the amount of free phosphorous in the valorized product.

Tannin: The tannin was extracted by weighing 0.5g of the powdered valorized product, transferring to 250 mL, and adding 75 mL of water. Heated the flask gently for half an hour. Centrifugation was conducted at 2000 rpm for 20 min and the supernatant in a 100 mL volumetric flask. A sample extract of 1 mL was taken in a volumetric flask containing 75 mL of water. Add 5 mL Folin Denis Reagent and 10 mL of 35 % sodium carbonate solution and make up to 100 mL. Read the absorbance at 700 nm after 30 mins and the calculations were expressed in tannic acid equivalents.

Antioxidant property of EFY-based valorized product

DPPH assay: DPPH assay was conducted with DPPH solution with 95 % methanol. The various concentrations of 20 µg/L to 100 µg/L were obtained by diluting 0.2-1.0 mL of the stock solution. The absorbance was measured after 10 mins at 517 nm.

$$\text{DPPH scavenging activity (\%)} = [(A_{Control} - A_{Test})/A_{Control}] \times 100$$

FRAP assay: The potassium ferric cyanide-ferric chloride method was used for determining the ferric reducing antioxidant power assay (Vijayalakshmi *et al.*, 2011). The extract of about 2 mL was added to 2.5 mL of Potassium ferricyanide and incubated for 20 min at 50 °C. Then 2.5 mL Trichloroacetic acid was added and centrifuged at 650 g for 10 mins. Ferric chloride of 0.5 mL, supernatant, and distilled water, each 2.5 mL, was added. The absorbance was read at 700 nm. Higher absorbance indicated greater reducing capacity. The calculation is as follows.

$$\text{Reducing power}=\frac{Am}{Ac}\times 100$$

Am = Absorbance of reaction mixture

Ac = Absorbance of control mixture (Distilled Water)

Antinutritional properties of EFY-based valorized product: The oxalate content of the sample was estimated according to the titrimetric method as reported by Lawal *et al.* (2014). 5 g of powdered sample was put into a 15 N sulphuric acid 150 mL using a magnetic stirrer for 30 min. The filtrate was passed through Whatman No. 1 filter paper. 25 mL of the filtrate was titrated with 0.05 M potassium permanganate ($KMnO_4$) solution. The end point was indicated by the time a pale pink color was still observed for at least 30 s.

For determination of the soluble oxalate, 0.2 g sample was added to a centrifuge tube with 10 mL 0.1 M phosphate buffer (pH 7.2). The mixture was vibrated on an orbital shaker table for 1 h and then centrifuged at 5000 rpm for 5 min. A 100 µL of the supernatant was suitably diluted to 1 mL using phosphate buffer. To each test tube, 2 mL of casein solution was added, and the tubes were put in a water bath of 37°C for 20 min. The reaction was stopped by the addition of 5% trichloracetic acid . The solution was vortexed for 1 min and incubated at room temperature for 1 h. Filtration was done with Whatman No.4 filter paper. The OD of the filtrate was detected at 515 nm with a spectrophotometer against the trypsin standard curve. The inhibition of trypsin as per the procedure of Hemamalini *et al.* (2023) was calculated and represented in terms of Units of Inhibited Trypsin (UIT) per g of Elephant foot yam product.

Statistical analysis: Two-way ANOVA was applied using Microsoft Excel to analyze data at a probability level of $p \geq 0.05$. All experiments were performed in triplicates.

Results and discussion

Standardization of EFY valorized product: The standardization of the Elephant Foot Yam (EFY)-based valorized ready-to-cook (RTC) convenience product was guided by consumer preference through organoleptic evaluation. Among the various formulations tested, Treatment T-2 was rated highest in overall acceptability by the institute's semi-trained sensory panel. The growing consumer interest in environmental sustainability, animal welfare, and health-conscious eating further supports the increasing demand for innovative plant-based food products like the one developed in this study.

Table 1. Treatments used for consumer sensorial analysis based on raw material proportions (%)

Raw material	Treatment			
	1	2	3	4
Blanched yam	50	60	70	80
Masoor dhal	20	15	10	5
Okara powder	10	8	6	4
Potato starch	10	7	4	1
Spice mixture	4	4	4	4
Binding agent	6	6	6	6
Total	100	100	100	100

Qualitative phytochemical analysis of EFY based valorized product: Qualitative analysis of phytochemical screening is portrayed in Table 2. Flavonoid content was found only in frozen aqueous samples. The chloroform extracts showed no phenolic compounds and tannins in frozen and fried valorized products. The frozen valorized product indicated the presence of saponins in chloroform and aqueous extracts. Cardiac glycosides were absent in frozen chloroform extracts. Aqueous extracts of frozen and fried samples and the ethanol extracts of fried samples showed alkaloids presence. Phlobatanins were absent in all the sample extracts. Raw yam showed the presence of saponin and cardiac glycosides in all sample extracts. Tannins were present in the distilled water sample extract of raw yam. Terpenoids were absent in raw yam chloroform extract. The phytochemicals in frozen samples were also in fried samples in different solvent extracts.

Similarly, the tuber crop (Githi kanda), a type of yam, experimented for the qualitative phytochemical analysis exhibited the same phytochemicals as that of elephant foot yam (Marandi *et al.*, 2016). The cooking process and duration induce various phytochemical changes in food, indicating similar changes found on fried valorized elephant foot yam-based products and revealed that the phytochemical changes did not significantly affect the nutritional value of the food product. The elephant

Table 2. Qualitative phytochemical screening of the raw yam, frozen product and fried valorized product

Samples/Tests	Qualitative analysis							
	Flavonoids	Phenol	Saponin	Tannin	Cardiac glycoside	Alkaloids	Terpenoids	Phlobatanin
Raw Yam								
Chloroform	-	-	+	-	+	-	-	-
Ethanol	+	+	+	-	+	+	+	-
Aqueous	-	-	+	+	+	-	+	-
Frozen Valorized Product								
Chloroform	-	-	+	-	-	-	+	-
Ethanol	-	+	-	+	+	-	+	-
Aqueous	+	+	+	+	+	+	+	-
Fried Valorized Product								
Chloroform	-	-	-	-	+	-	+	-
Ethanol	-	+	-	+	+	+	+	-
Aqueous	-	+	-	+	+	+	+	-

foot yam product showed various qualitative phytochemicals that contribute to health benefits, which were similar to Rahman *et al.* (2021).

Total phenolic content EFY-based valorized product: Gallic acid was used to obtain the standard curve. The results were mentioned in gallic acid equivalents expressed as mg/g at an absorbance of 765nm. The frozen elephant foot-based valorized product contained a total phenolic content of 11.89 mg/100g. Still, the fried valorized product was 8.37 mg/100g, which showed a 29.6 % reduction between frozen and fried valorized products. Murador *et al.* (2018) found that the heat treatments, such as frying, affect the presence of phenolic compounds depending on the duration of cooking time. Longer cooking times resulted in a decreased amount of phenolic content. Similarly, Gómez-Alonso *et al.* (2003) also observed a reduction in phenolic contents in French-fries after frying.

Table 3. Quantitative tests on frozen and fried EFY-based valorized product

Quantitative Tests	Frozen valorized product	Fried valorized product
Phenolic content (mg/100g)	11.89±0.17	8.37±0.09
Tannin content (µg/100g)	6.32±0.04	4.93±0.01
Phytic acid (mg/100g)	709.65±0.22	597.93±0.20

Tannin in Frozen EFY-based valorized product: The tannin content was determined using a standard curve from different tannic acid concentrations. The frozen valorized product had a tannin concentration of 6.32 µg/100g. While fried valorized product decreased to 4.93 µg/100g after frying, indicating a 22 % decrease. Adegunwa *et al.* (2011) observed a similar trend that showed that the tannin content before and after frying is greatly influenced by both pre-treatment and heat treatment. When consumed in larger amounts, the phenolic substances called tannins decrease iron's bioavailability.

In contrast, a study by Lawal *et al.* (2014) revealed that tannins in condensed form have several health advantages, including kidney protection and relief from ailments including sore throat, dysentery, diarrhea, skin ulcers and wound healing. Fresh yam had the highest tannin content, whereas pre-treated or heat-treated yam had the lowest levels. Frying reduces the amount of tannin content, with improved bioavailability of the vital elements (Lawal *et al.*, 2014).

Phytic acid content in EFY based valorized product: Based on dipotassium hydrogen phosphate standards, a study of valorized products found that the fried valorized product had 597.93 mg of phytic acid per 100 g. In contrast, the frozen valorized product had 709.65 mg (Table 3). A reduction of 15.79 % was observed after frying. Numerous bioactive substances, such as saponins, phenolic compounds, glycoalkaloids, phytic acids, carotenoids, and ascorbic acid, are abundant in tropical tuber crops (Bansode *et al.*, 2021). Elephant foot yam has 0.165 % phytic acid, according to Koni *et al.* (2017). These results were in context with those of Coe and Spiro (2022), who observed that frying and cooking reduce antinutritional factors in tubers and other vegetables, increasing the GI tract's ability to absorb minerals and vitamins. The bioactive ingredients of tropical tuber crops, such as carotenoids, phenolic compounds, and saponins, have several potential health advantages, such as immune system support, anti-inflammatory effects, and antioxidant qualities. A decrease in phytic acid that occurs during cooking positively impacts the absorption of minerals, especially calcium, zinc, and iron.

Antioxidant activity in EFY-based valorized product

DPPH assay of frozen vacuum-packed valorized product: The value of antioxidants in the frozen valorized EFY-based product was shown to have an IC50 value of 75.28 µg/L. The most recommended type of cooking the EFY based RTC valorized product was shallow frying, toasting than deep frying to preserve the antioxidant capacity of the product. The reduction in antioxidant qualities occurs when elephant foot yam is cooked or steamed which can be rectified with improved heat treatments and maintain the nutritional value of the yam. Okara powder addition enhances the antioxidant properties of the product. Lentils also have a good amount of antioxidant levels and that can be coped with the phenolic content of the pulses (Liu *et al.*, 2020). The standardized EFY based RTC valorised product contains good amounts of phytochemicals and antioxidant capacity. Intake of high-fiber products and phytochemical-rich food reduces the risk factors for the onset of numerous chronic illnesses, and many research studies pointed out the mechanism of reducing the contributing factors to the incidence of the oesophagus, throat, and oral cancers (Fiedor and Burda, 2014).

FRAP assay for frozen vacuum-packed valorized product: The ferric reducing capacity of ethanolic extracts of valorized convenience food was showing an increasing trend from 96.25 at 20 µg/mL concentration to 97.35 at 100 µg/mL concentration. (Fig. 2). Blanching or other moist heat treatments, like steaming,

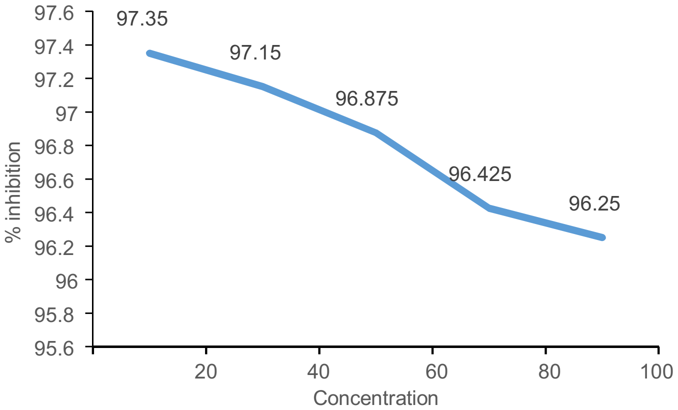

Fig. 2. FRAP assay with the % inhibition

tend to lower the antioxidant potential of foods, which also resulted in a decrease in total phenolic compounds and vitamin C, stated by Suriya *et al.* (2022). On the other hand, the heat treatment before processing the EFY-based convenience foods reduced the antinutritional factors and stabilized the antioxidant potential of the final product. The antioxidant activity of okara polysaccharides may also be attributed to the pectin found (Yao and Ren, 2011).

Anti-nutritional factors present in elephant foot yam-based convenience food products: The analysis of anti-nutritional factors in Elephant foot yam-based convenience food products focused on the trypsin inhibitor content, a significant anti-nutritional factor affecting protein digestibility since pulses are added as major ingredients. The standard curve for trypsin inhibitor content showed a positive linear relationship between absorbance and trypsin inhibitor content, with a correlation coefficient of 0.99. This high R^2 value indicates a very strong linear relationship, meaning that the absorbance readings can reliably predict the trypsin inhibitor content in the samples. The equation of the line, $y = 0.0505x - 0.0304$, can be used to determine the trypsin inhibitor content in elephant foot yam-based RTC convenience food products. The analysis for the masoor dhal was conducted due to the presence of a higher amount of trypsin inhibitor content in pulses, leading to digestive disorders and reduced mineral bioavailability. Also, the trypsin inhibitor content in the standardized samples was compared to masoor dhal to observe the reduction in antinutritional factors after processing (Table 4). The mean trypsin inhibitor content for the elephant foot yam-based convenience food was 0.664 mg/g, while for masoor dhal it was slightly higher at 0.747 ± 0.00 mg/ g, which showed a reduction of 11 % and it was highly significant. The trypsin inhibitor content was reduced after cooking compared to the raw masoor dhal. Increased trypsin inhibitor content leads to the high secretion of pancreatic fluid, which leads to the malfunction of the pancreas when consumed in larger quantities. The trypsin inhibitor content was reduced due to steaming the developed, standardized product, which was in correlation with the research work of Zhou *et al.* (2024), where a study was conducted on steaming cowpea paste.

Elephant foot yam contains high oxalate content, which combines with the calcium oxalate and forms calcium oxalate stones. It was analyzed to detect the amount of oxalate content in yam and determine the cooking effect. The oxalate content in raw elephant foot yam and elephant foot yam-based convenience food product revealed significant differences between the masoor dhal and

Table 4. Trypsin inhibitor content and oxalate content of EFY-based valorized product

Samples	Trypsin inhibitor (g/100 g)		Oxalate content (g/100 g)	
	Masoori Dhal	Elephant foot yam-based convenience food product	Elephant foot yam	Elephant foot yam-based convenience food product
Mean ± SD	0.7473 ± 0.01	0.6646 ± 0.01	0.301 ± 0.01	0.1702 ± 0.00
t-value	296.65**	215.02**	63.39**	134.31**

Data are mean ± SD; n=6; ** highly significant

product. The mean oxalate content in raw elephant foot yam was 0.301 ± 0.00 g/100 g, while in the frozen elephant foot yam-based convenience food product, it was significantly reduced to 0.17102 ± 0.001 g/100 g (Table 4). This substantial reduction in oxalate content through processing is significant, as high levels of oxalates can interfere with calcium absorption in the human body, potentially leading to health issues such as kidney stones. The processing of EFY into its final product significantly enhances its nutritional profile by lowering the oxalate content, making it safer for consumption. The cooking technique optimization helps reduce the oxalate content (Kumar *et al.,* 2017). After the elephant foot yam pretreatment for 10 mins, oxalate reduction was observed at 35.39 percent. Boiling or steaming significantly reduces the ANF in pulse-based products and helps maintain gut health.

The standardized value-added food product made from EFY was packed in ready-to-cook units that were convenient and possessed health benefits. The prepared product was stored in freezing and vacuumed conditions and stayed good for 120 days without adding any preservatives. Simulated shelf-life analysis also iterated the same days of storage. The finished valorized product had shown the presence of phytochemicals such as flavonoids, phenolic compounds, saponins, tannins, cardiac glycosides, alkaloids, and terpenoids and they possess many health benefits such as reducing the risk for lifestyle diseases and neoplastic diseases. The deep-fried RTC product also showed the presence of phenolics, tannins, and phytic acids, but the levels were low during quantification techniques. The antioxidant test with the DPPH analysis showed its strong antioxidant ability, which supports health. The addition of bio-preservatives may increase the shelf life of this standardized product. The organoleptic evaluation was also determined for 120 days. The overall acceptability score was 8.51 ± 0.03 (9-pt hedonic rating), which showed that consumer preference was met and product stability materialized throughout the study. This convenience RTC elephant foot yam-based product will satisfy the palatability for meat texture and taste with goodness of nutritional and health benefits.

Acknowledgements

The authors thank Tamil Nadu Veterinary and Animal Science University and Tamil Nadu Science and Technology Council (TNSCST- Student Project Scheme 2023-24) for providing funds and facilities to conduct this research work.

Conflict of Interest: The author(s) declare(s) that there is no conflict of interest regarding the publication of this manuscript.

Reference

Adegunwa, M.O., E.O. Alamu and L.A. Omitogun, 2011. Effect of processing on the nutritional contents of yam and cocoyam tubers. *J. Appl. Biosci.*, 46: 3086-3092.

Bansode, V., M. Nedunchezhiyan, N. Giri, M.S. Sajeev, T. Krishnakumar, V.B.S. Chauhan and K. Pati, 2021. Functional Foods from Tropical Tuber Crops: 459-467. In book: *Current Horticulture: Improvement, Production, Plant Health Management and Value-Addition*. B. Singh, A.K. Singh, B.S. Tomar and J.K. Ranjan (eds.). Brillion Publishing.

Coe, S. and A. Spiro, 2022. Cooking at home to retain nutritional quality and minimise nutrient losses: A focus on vegetables, potatoes and pulses. *Nutrition Bulletin*, 47(4): 538-562.

De, S., Y.N. Dey and A.K. Ghosh, 2010. Phytochemical investigation and chromatographic evaluation of the different extracts of tuber of Amorphaphallus paeoniifolius (Araceae). *Int. J. Pharm. Biol. Res.*, 1(5): 150-157.

Fiedor, J. and K. Burda, 2014. Potential role of carotenoids as antioxidants in human health and disease. *Nutrients*, 6(2): 466-488.

Gómez-Alonso, S., G. Fregapane, M.D. Salvador and M.H. Gordon, 2003. Changes in phenolic composition and antioxidant activity of virgin olive oil during frying. *J. Agric. Food Chem.*, 51(3): 667-672.

Hemamalini, S., V. Perasiriyan, S.K. Mathanghi, R. Ramani and S. Sunil Raj, 2023. Optimization of young jackfruit-based meat analogue using sensory profile by d-optimal mixture design. *Biological Forum-An International J.*, 15(1): 92-100.

Islam, F., R.K. Labib, M.S. Lami, R. Das, L.P. Singh, J.R. Mandhadi, P. Balan, J. Khan, S.L. Khan, F. Nainu, M.H. Nafady, S.O. Rab, T.B. Emran and P. Wilairatana, 2023. Genus Amorphophallus: A comprehensive overview on phytochemistry, ethnomedicinal uses, and pharmacological activities. *Plants*, 12(23): 3945.

Jagatheesh, K., V. Arumugam, N. Elangovan and P. Pavankumar, 2010. Evaluation of the anti-tumour and antioxidant activity of Amorphophallus paeoniifolius on DMBA induced mammary carcinoma. *J. Chem. Pharm. Sci.*, 1(2): 40-50.

Koni, T., N.I. Rusman, C. Hanim and Zuprizal, 2017. Nutritional composition and anti-nutrient content of elephant foot yam (Amorphophallus campanulatus). *Pak. J. Nutr.*, 16: 935-939.

Kumar, A., A.A. Patel and V.K. Gupta, 2017. Reduction in oxalate, acridity, phenolic content and antioxidant activity of Amorphophallus paeoniifolius var. Gajendra upon cooking. *Int Food Res J.*, 24(4).

Kupina, S., C. Fields, M.C. Roman and S.L. Brunelle, 2018. Determination of total phenolic content using the Folin-C assay: single-laboratory validation, first action 2017.13. *J. AOAC. Int.*, 101(5): 1466-1472.

Lawal, B., P.C. Ossai, O.K. Shittu and A.N. Abubakar, 2014. Evaluation of phytochemicals, proximate, minerals and anti-nutritional compositions of yam peel, maize chaff and bean coats. *Appl. Biol. Res.*, 6(2): 21-37.

Liu, Y., S. Ragaee, M.F. Marcone and E.S.M. Abdel-Aal, 2020. Composition of phenolic acids and antioxidant properties of selected pulses cooked with different heating conditions. *Foods*, 9(7): 908.

Marandi, R.R., S.J. Britto, M. George and E. Minj, 2016. Pharmacognostic, fluorescent, antibacterial and phytochemical analysis of tuber of Dioscorea bulbifera L. from Jharkhand. *J. Pharmacogn. Phytochem.*, 5(1): 08-14.

Moorthy, S.N., M.S. Sajeev and R.J. Anish, 2018. Functionality of tuber starches. p. 421-508. In: *Starch in Food (Second Edition) Structure, Function and Applications*, M. Sjöö and L. Nilsson (eds.). Woodhead publishing.

Murador, D., A.R. Braga, D. Da Cunha and V. De Rosso, 2018. Alterations in phenolic compound levels and antioxidant activity in response to cooking technique effects: A meta-analytic investigation. *Crit. Rev. Food Sci. Nutr.*, 58(2): 169-177.

Rahman, S.S., M.M. Muhsin, M.R. Karim, M. Zubaer, M.H. Rahman and S.M. Rouf, 2021. Proximate composition, phytochemical screening and anti-hyperglycemic effect of elephant foot yam (Amorphophallus paeoniifolius) tuber on alloxan induced diabetic rats. *Progress in Nutrition*, 23(2): 1-9.

Reddy, C.K., M. Suriya, P.V. Vidya, K. Vijina and S. Haripriya, 2015. Effect of y-irradiation on structure and physico-chemical properties of Amorphophallus paeoniifolius starch. *Int. J. Biol. Macromol.*, 79: 309-315.

Suriya, M., S. Haripriya, K. Meera and C.K. Reddy, 2022. Influence of blanching treatment and drying methods on the nutritional composition, functional, and antioxidant properties of elephant foot yam (Amorphophallus paeoniifolius) flour. *J. Food Process. Preserv.*, 46(10): p.e16920.

Swain, J., P. Pradhan, S.K. Biswal and P.K. Jena, 2021. Ethnopharmacological values of Amorphophallus paeoniifolius (Dennst.) Nicolson. *Medico-bio wealth of India Volume 2*. R.S. Devi, S. Kumar, R.S. Hamdy, A.S. Khalkho (eds.). 129-139. APRF Publishers.

Vijayalakshmi, K., V. Vanitha, R. Sumija, P. Ramya and K.J. Umadevi, 2011. A comparative study of phytochemicals, antioxidants potential and free radical scavenging activity of Psidium guajava and Malus domestica-An in vitro study. *Int. J. Pharm. Res. Dev.*, 3(7): 38-46.

Yao, Y. and G. Ren, 2011. Effect of thermal treatment on phenolic composition and antioxidant activities of two celery cultivars. *LWT-Food Sci. Tech.*, 44(1): 181-185.

Zhou, J., M. Li, Q. Bai, T.S. de Souza, C. Barrow, F. Dunshea and H.A. Suleria, 2024. Effects of different processing methods on pulses phytochemicals: An overview. *Food Rev. Int.*, 40(4): 1138-1195.

Received: March, 2025 ; Revised: April, 2025 ; Accepted: May, 2025