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Nutritional Value and Anti-nutritional Factor's Analyses of Five Indigenous Spices used by the *Karbi* Group of Assam, India

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ABSTRACT

Background: Uses of indigenous herbs and spices have become ubiquitous on modern culinary systems. But to date literatures on nutritional aspects of these group of plants are limited. Therefore the present study was done to evaluate the nutritional and anti-nutritional compositions of five indigenous spices commonly used in *Karbi* cuisines. The present study will help identify long forgotten multifunctional food resources which was previously neglected due to its low quantity in use.

Methods: The nutritional compositions were determined according to procedures established by Association of official Analytical chemists 1990 and the anti-nutritive factors of the samples were determined according to the procedure described in the reported scientific publications.

Result: The results showed appreciable amount of nutrients in *Citrus macroptera* Montrouz., *Litsea cubeba* (Lour.) Pers., *Ocimum citriodorum* Vis., *Perilla frutescens* (L.) Britton. and *Zanthoxylum armatum* DC. The energy value of these five spices showed remarkable values, with the highest value observed in *Ocimum citriodorum* Vis. (354.08 Kcal) and lowest in *Litsea cubeba* (Lour.) Pers. (108.67 Kcal). The moisture, ash, crude protein, crude fats, total carbohydrate and crude fibre content of the studied spices vary from 0.85-7.45%, 3.30-14.25%, 1.85-25.30%, 1.80-43.09%, 7.03-32.32% and 1.39-72.55% in range respectively. The vitamin C content was estimated highest in *Perilla frutescens* (L.) Britton. (34 mg/100 g) and lowest in *Citrus macroptera* Montrouz. (22 mg/100 g). The phytate (17.22-18.85 mg/100 g), oxalate (10.15-12.42 mg/100 g), tannin (9.45-11.61 mg/100 g) and saponin (8.82-10.55 mg/100 g) contents were very low and hence these spices are less toxic for human consumptions.

Key words: Anti-nutrients, Culinary system, Indigenous spices, Nutrients.

INTRODUCTION

Nutrition is the most important basic need, being a major determinant of health, labour, productivity and mental development (Imran *et al*. 2007). Today a complete nutrition means a diet with both micro-nutrients and macro-nutrients, with permissible concentration of anti-nutrients as every component contribute to a balance diet for a healthy lifestyle. Marco-nutrients include carbohydrates, proteins and lipids, whereas micronutrient include minerals, vitamins and organic acids (Warne, 2014). Major anti-nutrients are nitrates, phytates, tannins, saponins, oxalates and cyanogenic glycosides (Natesh *et al.* 2017). Herbs and spices have been known since early human civilization for their flavouring, preservation and medicinal value. Herbs and spices, once neglected for their nutritional contribution for being used in smaller quantity in food preparation are currently being investigated for their multifunctional benefits, as both nutritional and anti-nutritional sources are present in abundant in them. They are the major ingredients which enhances flavour, aroma and taste of the food by adding an extra elements to the food prepared though by themselves they may not taste good. The leaf, root, bark, berry, bud, seed, stigma of a plant or flower used for the purpose of cooking are commonly referred to as herbs and spices (Opara and Chohan, 2014). Spices and herbs are an essential component of human nutrition and have a place in the cultures of various part of the world (Borquaye *et al.* 2017). Today many ethnic cuisines are recognized for their reliance on signature herbs and spices (Kaefer and Milner, 2008). India having the largest concentrations of tribal population in the world is inhabited by a number of small and large group of indigenous tribes (Agrahar-Murugkar and Subbulakshmi, 2005), North-Eastern region of India in comparison to the rest of India has largest number of ethnic group settlement where 75% of its population in the region belongs to different indigenous groups. The *Karbi* group of people is one among the tribal groups of the region. They are high landers residing for generations mainly in the hilly district of Karbi Anglong of state Assam, North East India. They have their own unique food habits, dialects and cultural homogeneity. They are observed to have a very exotic and colourful culinary heritage which is very nutritious and belief

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to be healthy. Their diets consists of mainly rice, meat, potatoes, fruits grown wild and in home garden, locally grown wild and semi-wild greens, herbs and spices. In Karbi Anglong consumption of locally available indigenous herbs and spices is in majority in their kitchen. The locally available indigenous spices namely *Citrus macroptera* Montrouz., *Litsea cubeba* (Lour.) Pers., *Ocimum citriodorum* Vis., *Perilla frutescens* (L.) Britton. and *Zanthoxylum armatum* DC. are ever present in *Karbi* cuisines and has been used for centuries to satisfy their gustatory pleasure and medicinal requirements. Every spices used in *Karbi* cuisines has a unique aroma and flavour but to date there has been no systematic study and presentation on nutritional and anti-nutritional contents of these indigenous spices from this ethnic tribe. In spite of their importance as key ingredients in *Karbi* cuisines, there are only a few published studies on ethnomedicinal values of these indigenous spices. Therefore present study is an attempt to untapped significant nutritional and anti-nutritional values of these five selected spices widely used in ethnic food preparation by the *Karbis*. The present data would be useful for the evaluation of dietary pattern of the region and also popularised the generally overlooked spices of the region.

MATERIALS AND METHODS

Sample collection

All the process of sample collection, preparation and analyses was done in the year 2019-2020. Spices samples in the form of leaves, seeds and peels used as spices were collected from the field with the help of the locals, some also bought from the rural market from different areas of Karbi Anglong district according to their availability and brought to the Department of Life Science and Bioinformatics, Assam University Diphu Campus where all the chemical analyses were done. Those spices samples were firstly washed thoroughly under running water to remove the foreign materials and then kept in a clean *beleng* (a large plate like traditional hand crafted tool made of bamboo used by the locals for drying veggies and fishes). All the plant materials was then dried under sunlight for one hour and shade dried for some days. The dried material was pounded with a mortar and pestle into coarse powder and stored in the airtight containers for the chemical analysis.

Nutritional analysis

The nutritional compositions were determined according to procedures established by Association of official Analytical chemists (AOAC, 1990). Moisture content (%) was determined by oven drying at 100±5°C to constant weight, ash content (%) by incineration in muffle furnance at 580°C for 4 hours, crude protein (%) by Macro Kjeldahl method, crude fats (%) by soxhlet extraction with petroleum ether, crude fibre (%) was determined by non-enzymatic gravimetric method and total carbohydrate was calculated by difference. That is Carbohydrate = [100- (moisture+ ash+ protein+ fat+ fibre)] %. Vitamin C (mg/100 g) was determined by 2,6,-dichloroindophenol titrimetric method. The total energy value Kcal/100 g was estimated by the method described by Brahma *et al.* (2014). It is calculated as follows: Nutritive value = 4 × percentage of protein + 9 × percentage of fats + 4 × percentage of carbohydrates.

Anti-nutritional analyses

The anti-nutritive factors of the samples were determined following the established procedures. Methods adopted by Borquaye *et al*. (2017) was followed for determination of phytate and oxalate. Tannin was determined by the method described by Sarkiyayi and Agar (2010). Saponin content was determined by double extraction gravimetric method described by Ezeabara (2014).

RESULTS AND DISCUSSION

Hampur (*Citrus macroptera* Montrouz.), Ing-ing [*Litsea cubeba* (Lour.) Pers.], Lopong (*Ocimum citriodorum* Vis.), *Nempi* [*Perilla frutescens* (L.) Britton.] and Hanjor (*Zanthoxylum armatum* DC.) were the five studied spices with their local and botanical name which are regularly used in *Karbi* cuisines. These studied spices were available in the region between May through December. Spices were used in either fresh form or dried form. Apart from its culinary uses spices were also observed to be used in local ethnomedicinal system. A brief ethnobotanical descriptions of the studied spices are depicted in Table 1 which includes its botanical name, local name, families, parts used and culinary uses. The nutritional and anti-nutritional compositions of five indigenous spices were investigated and the results of nutritional compositions are shown in Table 2 and that of anti-nutritional compositions are shown in Table 3. The results of analyses showed that these spices have wide ranging differences in their nutritional and anti-nutritional compositions. Differences in nutritional and anti-nutritional compositions may be due to the factors like age and stage of harvesting or collecting the spices, differences in parts used as spices, spices belonging to different plant families and also the agro-climatic conditions of the region.

Nutritional composition

The variation in proximate compositions of the studied spices are observed in Table 2. The moisture content of the spices reported were of low ranged between 0.85% to 7.45% on dry weight basis, with the highest value observed in *Ocimum citriodorum* Vis. (7.45%) and lowest in *Citrus macroptera* Montrouz. (0.85%) which indicates that the shelf-life of these spices is long and microbial deterioration of these spices is limited. The ash content of the spices were appreciable with a range of 3.30% to 14.25%. The highest value of ash content was observed in *Zanthoxylum armatum* DC. (14.25%) and lowest in *Perilla frutescens* (L.) Britton. (3.30%) on dry weight basis. Ash content generally reflects the inorganic or mineral concentrations and also some impurities

Table 1: Ethnobotanical details of the spices used in *Karbi* cuisines.

Botanical name	Localname	Family	Parts used	Culinary uses
Citrus macroptera Montrouz.	Hampur	Rutaceae	Dried peels	Used for flavouring meats with fats
Litsea cubeba (Lour.) Pers.	Ing-ing	Lauraceae	Fresh and dried fruits	Used for flavouring meats
Ocimum citriodorum Vis.	Lopong	Lamiaceae	Leaves and young shoots	Flavouring and condiments
Perilla frutescens (L.) Britton.	Nempi	Lamiaceae	Seeds	Used as condiments
Zanthoxylum armatum DC.	Hanjor	Rutaceae	Young shoots and leaves	Used for flavouring curries

Table 2: Nutritional value of spices (per 100 g on dry weight basis).

Name of spices	Moisture (%)	Ash (%)	Crude protein (%)	Crude fat (%)	Crude fibre (%)	Total carbohydrate (%)	Total energy (Kcal)	Vitamin C (mg)
Citrus macroptera Montrouz.	0.85	5.25	1.85	6.2	57.54	28.39	176.76	22
Litsea cubeba (Lour.) Pers.	1.85	7.22	2.85	8.5	72.55	7.03	108.67	26
Ocimum citriodorum Vis.	7.45	6.45	14.82	1.80	37.16	32.32	354.08	30
Perilla frutescens (L.) Britton.	5.8	3.30	25.30	43.09	1.39	21.12	296.84	34
Zanthoxylum armatum DC.	3.75	14.25	12.85	9.08	67.55	7.48	163.04	29

Table 3: Anti-nutritional factors in spices (on mg/100 g dry weight basis).

Anti-nutrients	Name of spices				
	Citrus macroptera Montrouz.	*Litsea cubeba* (Lour.) Pers.	*Ocimum citriodorum* Vis.	*Perilla frutescens* (L.) Britton.	*Zanthoxylum armatum* DC.
Phytate	18.4	17.85	17.22	18.85	17.66
Oxalate	12.37	12.42	11.25	10.45	10.15
Tannin	11.61	11.12	9.85	10.82	9.45
Saponin	9.85	9.45	10.42	8.82	10.55

present in the samples of spices. Crude protein content of the spices studied shows varied differences. The crude protein content ranged from 1.85% to 25.30% on dry weight basis. Crude protein content of *Citrus macroptera* Montrouz. (1.85%) and *Litsea cubeba* (Lour.) Pers. (2.85%) were quite similar and observed to have low crude protein value. Whereas *Zanthoxylum armatum* DC., *Ocimum citriodorum* Vis. and *Perilla frutescens* (L.) Britton. were observed to have a high value of crude protein (12.85%, 14.82% and 25.30% respectively) which indicate that these spices can be grouped into food plants category with good protein source. The crude fats content of the spices are remarkable because of its oily characteristic like the other conventional spices and ranged from 1.80% to 43.09% on dry weight basis. The crude fat content of the four spices *i.e. Ocimum citriodorum* Vis. (1.80%), *Citrus macroptera* Montrouz. (6.2%), *Litsea cubeba* (Lour.) Pers. (8.5%) and *Zanthoxylum armatum* DC. (9.08%) were observed to have an adequate fat content and can be recommended as a low-fat diet for human consumption. Whereas *Perilla frutescens* (L.) Britton. was observed to have a very high value of crude fat content (43.09%). Crude fibre content was estimated lowest in *Perilla frutescens* (L.) Britton. (1.39%) followed by *Ocimum citriodorum* Vis. (37.16%), *Citrus macroptera* Montrouz. (57.54%), *Zanthoxylum armatum* DC. (67.55%) and highest in *Litsea cubeba* (Lour.) Pers. (72.55%). The fibre content in food though don't contribute in nutritive value of food but a food with good source of fibre in always recommended for proper digestion and for elimination of waste from our body. Total carbohydrate content estimated in the spices shows varied differences ranging from 7.03% to 32.32%. The carbohydrate content was observed to be highest in *Ocimum citriodorum* Vis. and lowest in *Litsea cubeba* (Lour.) Pers. High carbohydrate content in spices is an indicative features that these spices has high energy content. Of the five spices studied the highest energy value was observed in *Ocimum citriodorum* Vis. (354.08 Kcal/100 g) and lowest in *Litsea cubeba* (Lour.) Pers. (108.67 Kcal/100 g). The other spices *Perilla frutescens* (L.) Britton., *Citrus macroptera* Montrouz. and *Zanthoxylum armatum* DC. has energy value of 296.84 Kcal/100 g, 176.76 Kcal/100 g and 163.04 Kcal/100 g respectively. The results of vitamin C estimated vary in ranged from 22 mg/100 g to 34 mg/100 g. The highest value was estimated in *Perilla frutescens* (L.) Britton. (34 mg/100 g) and lowest value was estimated in *Citrus macroptera* Montrouz. (22 mg/100 g). Vitamin C one of the most essential vitamin which plays a hefty role in hundreds of body functions.

Anti-nutritional compositions

Four anti-nutritional factors phytate, oxalate, tannin and saponin were determined (Table 3). Phytate content was highest in *Perilla frutescens* (L.) Britton. (18.85 mg/100 g) and lowest in *Ocimum citriodorum* Vis. (17.22 mg/100 g). Phytates was reported to prevent kidney stone formation, protect against diabetes mellitus, coronary heart diseases and as well as help against a variety of cancer (Habtamu, 2014). Oxalate was highest in *Litsea cubeba* (Lour.) Pers. (12.42 mg/100 g) and lowest in *Zanthoxylum armatum* DC. (10.15 mg/100 g). The consumption of high oxalate-rich food

can negatively impact our kidney but low concentration of oxalate is less harmful and can be reduced by cooking and blanching methods Hemmige *et al.* 2017. Tannin was highest in *Citrus macroptera* Montrouz. (11.61 mg/100 g) while it was reported lowest in *Zanthoxylum armatum* DC. (9.45 mg/100 g). Recent studies have explored and confirmed numerous health benefits of tannins like antioxidant, anti-cancerous, anti-allergic, anti-inflammation, anti-helminthic and anti-microbial activities Sharma *et al.* (2019). Saponin was reported highest in *Zanthoxylum armatum* DC. (10.55 mg/100 g) and lowest in *Perilla frutescens* (L.) Britton. (8.82 mg/100 g). There are many scientific publications reporting on health benefits of saponins. These studies illustrated that saponins help in reducing blood cholesterol level, saponin have anti-mutagenic and anti-tumor properties, protect bones and helps in the stimulation of immune systems.

Conclusion

The present study provide us an up-to-date information about the nutritional and anti-nutritional compositions of five indigenous spices used by the *Karbi* tribe. The data reported from the present research suggest that these indigenous spices used in *Karbi* cuisines have a remarkable amount of nutrients present in them in addition to their role as flavouring agents. Thus we can recommend these spices as a good human diet with high nutritive value. We can used these spices as an immunity booster due to the presence of an adequate quantity of phytochemicals present in them which provide protections against different chronic diseases because today phytochemicals are known as "vitamins of 21st century".

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