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 C A R A S



Exploring the Indigenous Herbs and Spices used for Exotic Culinary Preparation by the *Karbi* Tribe of Assam, North-East, India

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ABSTRACT

Today when people are shifting their notion more towards the naturalness of food, they prefer food made up of natural and nutritious ingredients in their regular diets. *Karbi* a hilly tribe dwelling in the hilly regions of state Assam, India has been observed to have a very natural and flavorful culinary heritage. Their food choice and food-pairing include many indigenous herbs and spices as major ingredients, which gives the *Karbi* cuisines an exotic and palatable appearance with many health benefits. Yet research on these indigenous herbs and spices used by the *Karbi* tribe relating to its functional food properties is not done in the region. Therefore, the present paper is an attempt to explore and record the indigenous herbs and spices used by the *Karbi* tribe for their varieties of cuisines preparation. The study reported 22 plant species used as herbs and spices by the *Karbis*. The food significance index value and the salience index value of the reported herbs and spices showed varied differences.

Key words: Indigenous, Herbs, Spices, *Karbi* tribe

The search for exceptional and authentic herbs and spices is not new. Herbs and spices have a traditional history of use, with strong roles in cultural heritage, and in the appreciation of food and its link to health [1]. There is no proper definition of herbs and spices and are often used interchangeably. Spices are a group of esoteric food adjuncts, which have been in use for thousands of years, under their pleasing color, flavor, or pungency they can transform an otherwise bland and insipid preparation into an attractive and appetizing meal [2]. On the other hand “herbs” are subsets of spices, and are generally used to refer to any green leafy plant or parts thereof used to flavor or season food, or plant whose roots, leaves, or seeds, etc. are used in medicine [3]. From ancient times, spices have played a major role in the lifestyle of people from certain parts of the world [5]. Herbs and spices are valued not only for flavoring but also as medicine and preservative too and hence they are regarded as the first real “functional food”. All the mainstream spices used today are the signature herbs and spices of different ethnic cuisines prepared and cherished by different ethnic communities’ presents all around the world. Many of the spices that are popular today are indigenous to India, where they have been savored for thousands of years [5]. North East India houses around 130

ethnic tribal communities which exhibit unique traditions, dialects, and culture [6]. The *Karbi*, one of the ethnic tribe of north east India, residing for generations mainly in the hilly district of Karbi Anglong, of state Assam has unique and peculiar culinary heritage. The indigenous knowledge of the *Karbi*'s relating to the practice of using wild herbs and spices in their cuisines through trial and error methods is widespread among the *Karbi*'s since time immemorial which gives the traditional *Karbi* cuisines an authentic and ethnic flavor. The *Karbi* tribe uses a choice of herbs and spices to flavor and season their food which make the *Karbi* food rich with natural and healthy diets. Herbs and spices individually or in a combined formed are the main basis in *Karbi* cuisine. The values of indigenous herbs and spices are not limited to its culinary benefits but it is also seen to be used in traditional medicinal system. They consider cuisines cooked with combinations of the indigenous herbs and spices as medicinal cuisines and they still belief and depends on such medicinal cuisines extensively to prevent or treat certain health issues. In recent years it is observed that *Karbi* cuisines with their multidimensional properties are infiltrating the traditional cuisines of the other ethnic communities through cross cultural cooking practices which creating confusion about the originality of the *Karbi* cuisines with the cuisines of the other friendly tribes or groups; the original flavour and taste of the indigenous herbs and spices are lost because of fusion cooking trend that run through among the younger generation which is influenced by different cooking advertisement and shows, etc. and also there is no adequate documentation on the culinary and medicinal uses of these indigenous herbs and spices. Thus, the

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absence of any proper literature on the culinary use and consumption of the traditional herbs and spices in the region led us begin the study and gather knowledge about the culinary herbs and spices used in *Karbi* cuisine and its uses as functional food by the *Karbi*'s. This study aims to explore the indigenous herbs and spices used by the *Karbi*'s in their ethnic food preparations and its functional food properties as nowadays people love to sample cuisines which are healthy with new ingredients. Today the demand for herbs and spices are increasing not only in volume but also in variety and the presence of ethnic groups all around the world helps us fulfil these demands by providing us with increasing exposure to their respective food heritage. Thus, the study on the indigenous and exotic herbs and spices use by the *Karbi* tribe will be a value addition to present day demands for unique and nutritious ingredients.

MATERIALS AND METHODS

The Karbi Anglong district is situated in the central part of Assam, bounded by the state of Nagaland and Golaghat district in the east, Hojai district in the west, Golaghat, and Nagaon district in the north, and Dima Hasao district and Nagaland in the south. The district with dense tropical forest covered with hills and flat plains is situated between 23°33'-26°35' north latitude and 92°10'-93°50' east longitudes. Due to variation in the topography, the hill zone experience different climate in different parts. The winter commences from October and continues till February. During summer the atmosphere becomes sultry. About 75% of the region is covered with forest. The main vegetation is tropical semi-evergreen with patches of moist deciduous and wet evergreen forests in certain areas [7]. *Karbi* group is the predominant tribe in the region. They belong to mongoloid group and linguistically they belong to the Tibeto-Burman group [8]. The agriculture systems in Karbi Anglong include both *Jhum* cultivation and paddy field system of cultivation. Availability of bio-resources in the region helps the people of the region in the selection of many peculiar and exotic herbs and spices [Fig 1].

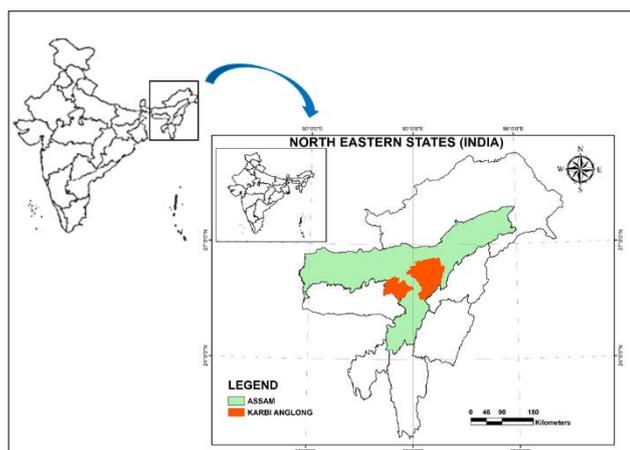


Fig 1 District map of Karbi Anglong of state Assam, India

Data collection

Before starting the field survey, a pilot survey was conducted by visiting the rural weekly markets of the district to get a general knowledge and observe the categorization of wild food plants sold in the districts, such as wild food plants sold as vegetables, medicines, herbs, and spices, additives, etc. A base question like:

1. Do you sell plant species which is used only as a spice?
2. Could you tell me the names of the spices sold?

Was used to obtain general knowledge about the indigenous herbs and spices used as a functional food and its blurry information relating to its food and medicine transitional difference. A field survey was started in January 2017 and lasted till December 2018. Information was obtained through open and semi-structured interviews with randomly selected 150 respondents from both rural and urban areas of the district. Respondents with a piece of good traditional knowledge on the use of the indigenous herbs and spices were interviewed with the help of pre-established questions where the respondents were asked using a questionnaire, the respondents were asked to do free-listing of the local indigenous herbs and spices used by them for culinary preparations. Further, they were asked about the consumption pattern, ways of consumption and preparation, time of collection and the places from where they are gathered, plant parts collected, and used to gain insight into their present-day use. Voucher specimens were collected using the information gathered from the informants from the field. Further identification of the specimens was done in the Department of Life science and Bioinformatics Assam University, Diphu Campus (AUDC).

Data analysis

Descriptive statistics that is frequency and percentage were used to analyse the botanical data of the reported indigenous herbs and spices using Microsoft Office Excel 2016. Food Significance Index (FSI) adopted by Pioleon *et al.* (2017) was used to evaluate the significance of indigenous herbs and spices with a little modification for calculating the CV parameters. It's defined by the following equation:

$$FSI = CV * CrV$$

Where, CV and CrV are cultural value and crop value sub-indices.

Cultural Value (CV) is calculated as $CV = ci + a + pr$. Where: *ci* is the citation index, *a* is the availability index of the indigenous herbs and spices and *pr* is the preference rank of the herbs and spices. Availability index (*a*) express the availability of the herbs and spices perceived by the *Karbi* tribes and corrected by a factor that considers if the use of the plant is ubiquitous or localized within the studied area [Error! Reference source not found.]. Preference rank (*pr*) was calculated as $pr = [(p1/t)/1] + [(p2/t)/2] + [(p3/t)/3]$, where *p1*, *p2*, *p3* are the number of people who cite a specific plant as their first, second and third choice and *t* is the total number of participants. The maximum theoretical value of *pr* for a species is 1 and the minimum is 0.

Table 1 Availability index value of the indigenous herbs and spices

Availability	Index value
Very common	4.0
Common	3.0
Middle	2.0
Rare	1.0
Localisation of the index value	
Ubiquity	-
Localised	-0.5
Very localised	-1.0

Crop value sub-index (CrV) was calculated as $CrV = pl + pp + nep$. Where *pl* is the postharvest shelf life of the food under ambient conditions; three levels of *pl* were defined: non-perishable (point value 1), medium perishable (point value 0.5), and highly perishable (point value 0). *Pp* is a processed product with market potential; food having a *pp* attribute was assigned a value of 1, otherwise, it is 0. And *nep* is the number of edible

organs/ parts of the plant. Many maximum four edible organs were established: underground organs, leaves, flowers, fruits, and seeds. For every edible part, a value of 0.25 was given.

Saliency Index (SI) proposed by Smith (1993) was used to analyse the free list surveys. SI is calculated as:

$$SI = \frac{\text{Total number of species in the interview} - \text{Rank order position of the species}}{\text{total number of species cited in the interview}}$$

RESULTS AND DISCUSSION

Demographic information

A total of 150 respondents belonging to the age group of 21 years to above 60 years of age participated in the interview. Out of the 150 respondents 76 were male (51%) and 74 female (49%) (Table 2). It was observed that the women group were more knowledgeable than the male group of respondents. From the demographic study, we observed that the 150 respondents irrespective of their literacy level and occupations, though they use both indigenous and non-indigenous herbs and spices in their culinary preparations they prefer to use indigenous herbs and spices most in their cuisines. That is 94% of the total respondents gave positive answers for the indigenous herbs and

spices and only 6% gave no answers to the questionnaire (Fig 2).

Table 2 Demographic information of the respondents

Variables	Parameter	No. of respondents	Percentage
Age	21-30 years	64	43
	31-40 years	22	15
	41-50 years	30	20
	51-60 years	25	17
	Above 60	9	6
	Total		150
Gender	Male	76	51
	Female	74	49
	Total	150	100
Types of herbs and spices used	Traditional	0	0
	Non traditional	0	0
	Both	150	100
	Total	150	100
Most preferred herbs and spices	Traditional	141	94
	Non traditional	9	6
	Total	150	100

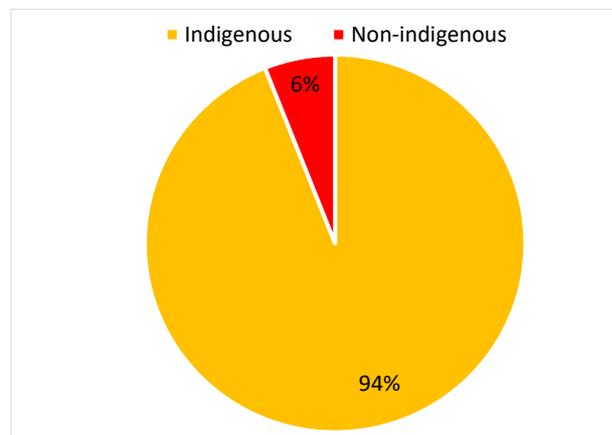
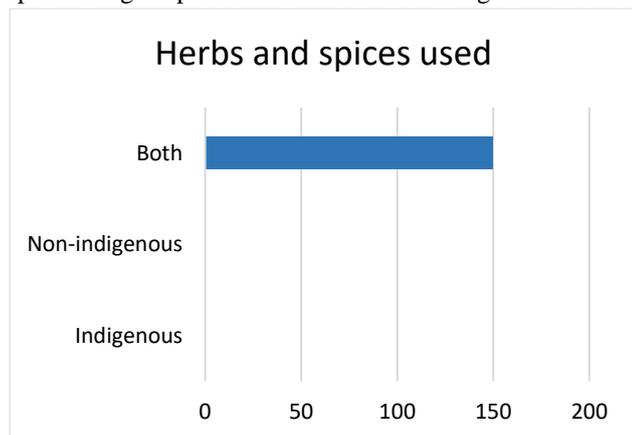


Fig 2 (a) Graphical representation of most used herbs and spices and (b) Percentage of most preferred herbs and spices

Taxonomic diversity, parts used, growth forms, and uses of the reported indigenous herbs and spices

A total of 22 plant species belonging to 18 genera and 11 families were reported to be used as indigenous herbs and spices. Of the 11 reported families, Zingiberaceae (7) has the highest number of species followed by Rutaceae (3) and Lamiaceae (3) as second-highest and Amaryllidaceae (2) as third highest. The remaining families Compositae, Apiaceae,

Araceae, Saururaceae, Verbenaceae, Lauraceae, and Pedaliaceae have one species each (Table 3). The largest number of growth forms were found to be herbs (68%) followed by shrubs (18%) and trees (14%). Regarding parts used, a total of 6 edible parts were recorded to be used as herbs and spices. Of these bulbs (7%), flower (7%), fruits (11%), leaves (39%), seeds (14%), and rhizomes (22%). With regards to uses, the species were mostly used flavoring (44%), condiment (31%), seasoning (23%), and colorant (2%).

Table 3 List of reported indigenous herbs and spices used by the Karbi tribe

Local name	Scientific name	Family	Organ/parts used	Growth form	Uses
Jirlang	<i>Allium chinense</i> G. Don	Amaryllidaceae	Bulbs and leaves	Herbs	Condiment and seasoning
Harsun	<i>Allium sativum</i> L.	Amaryllidaceae	Bulbs	Herbs	Flavouring and condiment
Mahabir	<i>Alipinia galangal</i> (L.) Willd.	Zingiberaceae	Rhizomes	Herbs	Flavouring
Hanmoiso	<i>Blumea lanceolaria</i> (Roxb.) Druce	Compositae	Leaves	Shrubs	Flavouring
Tihaso	<i>Boesenbergia rotunda</i> (L.) Mansf	Zingiberaceae	Rhizomes	Herbs	Flavouring
Hampur	<i>Citrus hystrix</i> DC.	Rutaceae	Fruits	Trees	Flavouring
Tharve hanso	<i>Curcuma amada</i> Roxb.	Zingiberaceae	Rhizomes	Herbs	Condiment
Tharmit	<i>Curcuma longa</i> L.	Zingiberaceae	Rhizomes	Herbs	Flavouring, colorant and condiment

Vorek jokasu	<i>Eryngium foetidum</i> L.	Apiaceae	Leaves	Herbs	Flavouring, condiment and seasoning
Okhi atehang	<i>Homalomena aromatica</i> (Spreng.) Schott	Araceae	Leaves	Herbs	Condiment
Hankungphi	<i>Houttuynia cordata</i> Thunb.	Saururaceae	Leaves	Herbs	Condiments
Bithi phakno	<i>Kaempferia galangal</i> L.	Zingiberaceae	Rhizomes	Herbs	Flavouring and condiment
Naga lopping	<i>Lippia alba</i> (Mill.) N.E.Br.ex Britton & p. Wilson	Verbenaceae	Leaves	Shrubs	Flavouring, condiment, and seasoning
Ing ing	<i>Litsea cubeba</i> (Lour.) Pers.	Lauraceae	Fruits	Trees	Flavouring
Lopping	<i>Ocimum basilicum</i> L.	Lamiaceae	Leaves	Herbs	Flavouring, condiment and seasoning
Nempi	<i>Perilla frutescens</i> (L.) Britton	Lamiaceae	Seeds	Herbs	Flavouring and seasoning
Hanbipo	<i>Pogostemon benghalensis</i> (Burm.f.) Kuntze	Lamiaceae	Leaves	Shrubs	Condiment and seasoning
Nempo	<i>Sesamum indicum</i> L.	Pedaliaceae	Seeds	Herbs	Seasoning and flavouring
Hanjor	<i>Zanthoxylum avicennae</i> (Lam) DC.	Rutaceae	Leaves and seeds	Shrubs	Flavouring and seasoning
Teng nang	<i>Zanthoxylum rhetsa</i> DC.	Rutaceae	Leaves and fruits	Trees	Flavouring and seeds
Phikangnek	<i>Zingiber chrysanthum</i> Roscoe	Zingiberaceae	Flower	Herbs	Seasoning
Hanso	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Rhizomes, Leaves and flower	Herbs	Flavouring and condiment

Food significance Index (FSI) and Salience Index (SI) of reported herbs and spices

FSI and SI values of reported herbs and spices were calculated and listed in (Table 4-5) according to their decreasing order. FSI value varied between 0.35 and 12.87, and SI from 0.000 and 0.955. Differences were observed among FSI and SI values. This difference was because SI value takes into account only citation parameters whereas FSI includes both cultural value and crop value parameters of the indigenous herbs and spices. The SI values show that people opt for herbs and spices that are more easily available to their respective locality. The highest SI value was observed in *Zingiber officinale* Roscoe (0.955) and lowest in *Alpinia galangal* (L.) Willd. (0.000). FSI values of the indigenous herbs and spices can be classified into high significance (1.23 to 12.87), medium significance (0.87 to 1.12), and low significance (0.35 to 0.86). High significance group includes *Zingiber officinale* Roscoe,

Allium sativum L., *Curcuma longa* L., *Sesamum indicum* L., *Allium chinense* G.Don, *Curcuma amada* Roxb., *Boesenbergia rotunda* (L.). They are most frequently cited and are common in local gastronomy. *Lippia alba* (Mill.) N.E.Br.ex Britton and p. Wilson, *Citrus hystrix* DC., *Litsea cubeba* (Lour.) Pers., *Ocimum basilicum* L., *Perilla frutescens* (L.) Britton, *Zanthoxylum rhetsa* DC., *Eryngium foetidum* L., and *Zanthoxylum avicennae* (Lam) DC. are grouped into medium significance groups. Species of these groups are mostly seasonal and are rare in their availability. And species like *Zingiber chrysanthum* Roscoe, *Alpinia galangal* (L.) Willd., *Kaempferia galangal* L., *Pogostemon benghalensis* (Burm.f.) Kuntze, *Blumea lanceolaria* (Roxb.) Druce, *Houttuynia cordata* Thunb., *Homalomena aromatica* (Spreng.) Schott is grouped under low significance group. These species have a limited role in the kitchen as a spice but are mostly used as medicinal food at a time of certain illness.

Table 4 Food Significance Index (FSI) of the reported indigenous herbs and spices used in Karbi cuisines

Name of species	CV					CrV			FSI
	Ci	A	Pr	CV	pl	Pp	nep	CrV	
<i>Zingiber officinale</i> Roscoe	0.940	4	0.78	5.720	0.5	1	0.75	2.25	12.87
<i>Allium sativum</i> L.	0.920	4	0.86	5.780	0.5	1	0.25	1.75	10.12
<i>Curcuma longa</i> L.	0.867	4	0.86	5.727	0.5	1	0.25	1.75	10.02
<i>Sesamum indicum</i> L.	0.933	3	0.79	4.723	0.5	0	0.25	0.75	3.54
<i>Allium chinense</i> G.Don	0.800	1.5	0.81	3.110	0.5	0	0.5	1	3.11
<i>Curcuma amada</i> Roxb.	0.480	1.5	0.71	2.690	0.5	0	0.25	0.75	2.02
<i>Boesenbergia rotunda</i> (L.)	0.653	0	0.98	1.633	0.5	0	0.25	0.75	1.23
<i>Lippia alba</i> (Mill.) N.E.Br.ex Britton & p. Wilson	0.267	3.5	0.7	4.467	0	0	0.25	0.25	1.12
<i>Litsea cubeba</i> (Lour.) Pers.	0.113	0	0.74	0.853	1	0	0.25	1.25	1.07
<i>Citrus hystrix</i> DC.	0.533	0	0.79	1.323	0.5	0	0.25	0.75	0.99
<i>Ocimum basilicum</i> L.	0.833	2	0.88	3.713	0	0	0.25	0.25	0.93
<i>Perilla frutescens</i> (L.) Britton	0.453	0	0.78	1.233	0.5	0	0.25	0.75	0.93
<i>Zanthoxylum rhetsa</i> DC.	0.213	0	0.72	0.933	0.5	0	0.5	1	0.93
<i>Eryngium foetidum</i> L.	0.807	2	0.88	3.687	0	0	0.25	0.25	0.92
<i>Zanthoxylum avicennae</i> (Lam) DC.	0.187	0	0.68	0.867	0.5	0	0.5	1	0.87
<i>Zingiber chrysanthum</i> Roscoe	0.253	2.5	0.67	3.423	0	0	0.25	0.25	0.86
<i>Alpinia galangal</i> (L.) Willd.	0.080	0	0.7	0.780	0.5	0	0.5	1	0.78

<i>Kaempferia galangal</i> L.	0.333	0	0.66	0.993	0.5	0	0.25	0.75	0.75
<i>Pogostemon benghalensis</i> (Burm.f.) Kuntze	0.300	2	0.67	2.970	0	0	0.25	0.25	0.74
<i>Blumea lanceolaria</i> (Roxb.) Druce	0.273	2	0.66	2.933	0	0	0.25	0.25	0.73
<i>Houttuynia cordata</i> Thunb.	0.287	1.5	0.92	2.707	0	0	0.25	0.25	0.68
<i>Homalomena aromatica</i> (Spreng.) Schott	0.233	0.5	0.66	1.393	0	0	0.25	0.25	0.35

Ci= citation index, a= availability, pr= preference, CV= cultural value, nep= number of edible parts or organs, pl= postharvest shelf life, pp=processed product, CrV= crop value, FSI= food significance index

Table 5 Saliency Index of the reported indigenous herbs and spices used by Karbi tribe

Name of plant species	Average citation	Saliency index (SI)
<i>Zingiber officinale</i> Roscoe	0.940	0.955
<i>Sesamum indicum</i> L.	0.933	0.909
<i>Allium sativum</i> L.	0.920	0.864
<i>Curcuma longa</i> L.	0.867	0.818
<i>Ocimum basilicum</i> L.	0.833	0.773
<i>Eryngium foetidum</i> L.	0.807	0.727
<i>Allium chinense</i> G.Don	0.800	0.682
<i>Boesenbergia rotunda</i> (L.) Mansf	0.653	0.636
<i>Citrus hystrix</i> DC.	0.533	0.591
<i>Curcuma amada</i> Roxb.	0.480	0.545
<i>Perilla frutescens</i> (L.) Britton	0.453	0.500
<i>Kaempferia galangal</i> L.	0.333	0.455
<i>Pogostemon benghalensis</i> (Burm.f.) Kuntze	0.300	0.409
<i>Houttuynia cordata</i> Thunb.	0.287	0.364
<i>Blumea lanceolaria</i> (Roxb.) Druce	0.273	0.318
<i>Lippia alba</i> (Mill.) N.E.Br.ex Britton & P. Wilson	0.267	0.273
<i>Zingiber chrysanthum</i> Roscoe	0.253	0.227
<i>Homalomena aromatic</i> (Spreng.) Schott	0.233	0.182
<i>Zanthoxylum rhetsa</i> DC.	0.213	0.136
<i>Zanthoxylum avicennae</i> (Lam) DC.	0.187	0.091
<i>Litsea cubeba</i> (Lour.) Pers.	0.113	0.045
<i>Alpinia galangal</i> (L.) Willd.	0.080	0.000

Functional food properties of traditional herbs and spices

The Karbi group of people lives a simple life and depends on nature for sustaining day-to-day activities. They used a group of plants that are underutilized and lesser-known but offer an opportunity for good health maintenance. The

belief that the bitter and pungent a plant is, the best is its medicinal properties. The Karbi's especially the old group of people believes that the traditional herbs and spices, when used in cooking, stimulate the appetite and help to be healthy. (Table 6) is a record of the functional food properties of indigenous herbs and spices.

Table 6 Traditional functional food properties of the herbs and spices

Scientific name	Traditional belief
<i>Allium chinense</i> G.Don	Regular consumption prevents diarrhoea and dysentery
<i>Allium sativum</i> L.	Prevent high blood pressure and gastritis
<i>Alpinia galanga</i> (L.) Willd.	Prevent cough and fever
<i>Blumea lanceolaria</i> (Roxb.) Druce	Stomachic
<i>Boesenbergia rotunda</i> (L.) Mansf.	Stomachic and carminative
<i>Citrus hystrix</i> DC.	Stimulant
<i>Curcuma amada</i> Roxb.	Appetizer and carminative
<i>Curcuma longa</i> L.	Blood purifier and febrifuge
<i>Eryngium foetidum</i> L.	Helps in constipation and use as stimulant
<i>Homalomena aromatica</i> (Spreng.) Schott	Stimulant, diarrhea and stomach pain
<i>Houttuynia cordata</i> Thunb.	Treat diarrhea and tight cough
<i>Kaempferia galanga</i> L.	Constipation and stomach ache
<i>Lippia alba</i> (Mill.) N.E.Br. ex Britton & P.Wilson	Stomachic
<i>Litsea cubeba</i> (Lour.) Pers.	Diarrhea and indigestion
<i>Ocimum basilicum</i> L.	Prevent gastric and constipation and used as stimulant
<i>Perilla frutescens</i> (L.) Britton	Control blood pressure
<i>Pogostemon benghalensis</i> (Burm.f.) Kuntze	Stimulant
<i>Sesamum indicum</i> L.	Diuretic
<i>Zanthoxylum avicennae</i> (Lam.) DC.	Stomachic and carminative
<i>Zanthoxylum rhetsa</i> DC.	Diarrhea and dysentery and stimulant
<i>Zingiber chrysanthum</i> Roscoe	Gastric and piles
<i>Zingiber officinale</i> Roscoe	Prevent common cold and cough

CONCLUSION

Traditional herbs and spices used in ethnic cuisines of the Karbi's have shown indispensable health benefits in the region. They are mostly gathered or collected from the wild and add a peculiar taste to the ethnic cuisines. But now a day's people are seen growing these herbs and spices in their kitchen garden or home gardens. From the present-day reviews of various scientific findings, we observed that many different bioactive compounds beneficial for health have been isolated from the herbs and spices supporting the use of these traditional

herbs and spices in our diet. The Karbi's gathered these herbs and spices only during the spring and summer months from the nearby forest areas for its multifunctional uses in local gastronomy. It was also observed that all the reported herbs and spices are very pungent and exotic in taste. From the survey conducted we find that though the people of the region prefer to use indigenous spices more than the non-traditional spices, many factors led them to use non-indigenous spices in their food preparations, these are seasonality, preservability, not easily available in the market, reluctant to go to the forest for gathering and influence of the present food trends.

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