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## RESEARCH ARTICLE

### DIETARY DIVERSITY AND FOOD VARIETY AS INDICATORS OF NUTRITIONAL STATUS OF THE ELDERLY KARBI POPULATION OF KAMRUP DISTRICT, ASSAM

Ritu Geu Goswami<sup>1,\*</sup> and Mini Bhattacharyya Thakur<sup>2</sup>

<sup>1</sup> Deputy Director, Savitribai Phule National Institute of Women and Child Development, Khanapara, Guwahati-781022.

<sup>2</sup> Professor, Department of Anthropology, Gauhati University, Guwahati-781014

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##### \*Corresponding author:

Ritu Geu Goswami

#### ABSTRACT

A study was conducted to assess the food variety and dietary diversity among elderly Karbi population of Kamrup district of Assam. The data was collected by using schedules for socio-demographic profile, food frequency, 24 hr-recall method and anthropometric measurements. A total of 154 elderly male and female population of Karbi tribe of Dimoria block of Kamrup district in the age group of 60 to 80 years were selected by using purposive random sampling method. Elderly with spinal curvatures was not encountered in the study population. Body Mass Index was determined by measuring the height and weight of the selected respondents by using standard procedures. Results revealed that the mean BMI were above 18.5 kg/m<sup>2</sup>. The results showed that the Karbi elderly population included variety of foods and dietary diversity was good. The food habits and consumption pattern, dietary intake and nutritional status of the studied Karbi elderly population was satisfactory in comparison to other tribal groups of India. Overall, it may be stated that the studied Karbi population were in good physical, mental and social health because of their conventional food habits, dietary diversity, consumption pattern and quantity of food consumed along with a conducive family environment.

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## INTRODUCTION

Individuals of 60 years and above constitute the elderly (WHO, 2011). According to Census 2011, India has 104 million older people (60+years), constituting 8.6% of total population. United Nations Population Fund (UNFPA, 2017) report that around 12.5 per cent of India's population will be 60 years and older by 2030 and by 2050, this will increase to one-fifth of the population. Amongst the elderly (60+), females outnumber males. Owing to better living standards and evolving healthcare in India, life expectancy has gone up significantly over the last few decades, resulting in the rise of the elderly population. India has nearly 138 million elderly persons, comprising 67 million males and 71 million females (ET Health World, 2023). With declining fertility, reduction in mortality and increasing survival at older ages, the shift in age structure from young to old is expected to be enormous over the next few decades. Hence, older persons need care and attention. They are vulnerable to malnutrition due to associated factors like low appetite as a result of loss of taste and smell perception, dental problems, and decreased physical activity. Good /healthy food habits and regular comfortable level of physical activity are required to minimise the ill effects of ageing and to improve the quality of life. Assam is described as the land of red rivers and blue hills. It is a land of indigenous tribal and non-tribal people staying together for centuries. The capital of Assam is Dispur which is located within the municipal area of Guwahati city. The state is divided into 34 districts with Kamrup district as one of the largest having wide plains with an area of 4111 sq kms. The state

is culturally rich with different ethnic groups, languages, literature and dialects spoken. A land of tropical climate having high rainfall, Assam is endowed with lush greenery which provides the region with a unique hydro-geomorphic and aesthetic environment. The mighty river Brahmaputra flows from east to west. The two largest rivers, Brahmaputra and Barak with their tributaries including swampy areas are breeding grounds for variety of fishes like *puthi*, *goroi*, *kawai*, *singri*, etc. From the ancient times, Assam has been a meeting point of tribes and races with their distinct rich cultural traditions and food practices. Though rice is the staple crop of all tribal and non-tribal people living in Assam, vegetables, non-vegetarian foods, green leafy vegetables, etc. are included. Dietary diversity is seen in a special Assamese plate which contains *khar*, *bhaji*, *tenga*, *dali*, *behuoa*, *mah guri*, *posola*, etc. which are prepared with less oil and spices. Dietary diversity is the variety or the number of different food groups people eat over the time given (Ruel, Marie T., 2003). Hence, the cuisines are soothing to the stomach. Due to easy availability of varieties of small and big fishes, Assamese people like to include fish in every day dietary. The demographic pattern of Kamrup district is a heterogenous one with tribals and non-tribals. Bodo, Dimasa, Kachari, Khamti, Tiwa, Karbi, Mising, etc. are living together for centuries and there exist a perceptible degree of mutual love, respect and inter-religious tolerance amongst them. Along with tribals the non-tribals as Hindu, Islam, Christian and Buddhism are staying together for many years in harmony in the district. According to the 2011 census, Kamrup district has a population of 1,517,202. Major

language spoken natively is Kamrupi with pockets of Amri, a Tibeto-Burman language related with Karbi having 1,25,000 speakers (Paul, 2009). Karbi community [http://en.wikipedia.org/wiki/Kamrup\\_district#cite\\_note-districtcensus-5tribes](http://en.wikipedia.org/wiki/Kamrup_district#cite_note-districtcensus-5tribes) are no more restricted to any particular area or the hilly regions but are scattered over the entire Kamrup district. The tribe is more concentrated in Dimoria block of Kamrup district (Source: Personal communication with Block level functionaries). Dimoria block and the villages under the block are situated in the sides of National Highway. The connectivity to the main block is by private car, city bus, mini bus and trekker. The condition of the roads in the highway is good but to reach the interior villages it is very poor. The main means of transportation in the interior villages is walking or by hiring auto. The present study was carried out among elderly Karbi tribal population of Kamrup district of Assam.

## METHODOLOGY

The universe of this study is the elderly male and female population in the age group of 60 years and above. The sample population was selected from the villages which were under Dimoria block, Sonapur, Kamrup District, Assam, Pincode – 782402. These villages were selected as Karbi people were densely populated (Table 1). The households which belonged to Karbi community were taken from the data recorded in the Anganwadi centres. Thereafter, the respondents selected in the age group of 60 years and above were interviewed in their own homes. The total elderly male and female population in the age group of 60 years taken for the study was 154. Elderly with spinal curvatures was not included in the study population since the curvature will affect in accurate measurement of height. The data for the study was collected only from primary sources. The primary data was collected from elderly male and female population (60 years and above) by interviewing them. Face to face interview was conducted with the elderly using interview schedule and all the required information was thus collected. The schedule used for eliciting information regarding socio-economic background, food habits, methods of cooking, indigenous cuisines, dietary intake and nutritional status. The background information covered the age, educational status, marital status, religion, type of house, family income, occupation and family type. The information pertaining to food habits covered vegetarian/ non-vegetarian, methods of cooking, weekly pattern of consumption of all the food groups i.e. cereals, pulses, vegetables (roots and tubers, green leafy vegetables, other vegetables) and fruits, milk and milk products, egg, meat and fish, sugar and jaggery and fats and oils. In addition, data were collected on meal pattern (main meals), consumption of local rice beer and eating practices. Dietary intake of various foods was collected using 24 hour recall method and was assessed using standard procedures of Thimmayamma, 1987 (NIN) and Candance, 2006 (Texas and Iowa University). The food consumption adequacy was compared with Recommended Dietary Allowances (RDA) given by National Institute of Nutrition (NIN), 2023 for elderly population. Anthropometric measurements were recorded using stadiometer and weighing machine following standard techniques (Lohman *et al.* 1988) and Body Mass Index (BMI) was compared with Asian standards given by WHO (2004).

**The People: The Karbis of Kamrup district:** Karbis are an ethnic tribal group scattered in North East India with a majority of them living in Assam. Once they were believed to have lived on the banks of the rivers of Kalang and Kopili and the entire Kaziranga area, the famous National Park situated in Assam. Now they are spread in whole of Assam and they are staying in some pockets of Kamrup district. Racially the Karbis belong to the Mongoloid group and linguistically to the Tibeto-Burman group (Teronpi *et al.*, 2012). The Karbis, along with others entered Assam from Central Asia which was the first waves of migration. From the pattern of distribution or habitation, the Karbi are divided into three groups, viz, Chinthong, Ranghang and Amri. They prefer to call themselves “Karbi” or “Arleng” meaning “men” in the Karbi language (Lyall, 1997).

The Karbi houses are located in plain and semi hilly terrain. While going to the villages from the highway, paddy fields were seen on both sides of the roads which make the villages appear green and beautiful. The trees like jackfruit, drumstick, elephant apple, fig, berries, etc. were seen in the roadside connected to the Karbi villages. In some villages, stream or a small river are present. The Karbi tribe mentioned that during rainy season, they fetch small and big fishes from the over-flooded ponds and rivers. The fishes if collected in plenty are dried to be used in scarce seasons. The Karbi houses were built having a plinth of about one foot from the ground with bamboo wall plastered with mud and thatch roof. The floor is plastered with mud. All the Karbi houses looked very neat and clean due to mud plastering. *Pucca* houses were also seen. In some houses instead of thatch roof, tin roofing was used. All households had bamboo fencing and a gate. The gate was wide with bamboo posts inserted (*nongola*). In some households depending on the size of land holding, the kitchen was separate from the main house. A kitchen garden is seen in every household where indigenous crops were planted. In the backside of the house, washing area is present. Every Karbi household of Kamrup district had a homestead/ kitchen garden known as *bari* in Assamese as well as in Karbi language where indigenous vegetables like *kasu*, *dhekia*, *vedailota*, *mandhania*, *kasiduria matikaduri*, *mesta tenga*, *bhendi*, *jolokia*, *mora pat*, *nemo*, *dhania*, *kasiduria*, *haldi*, *kosu*, *dhekia*, *kat alo*, *kal*, *kothal*, *nariol*, *bogori*, *ponial*, *triphala*, etc. were grown.

**Demographic Characteristics of the Elderly:** Socioeconomic profile of the population in any study describing the age, occupation and number of family members of the respondents and household characteristics are some of the influential and important variables. Majority (100%) of the households belonged to Hindu religion. In general, Karbi houses are built on wooden stilts and are rectangular in shape. They prefer to use bamboo, sun grass and wood. The *kutch* houses were made with bamboo, straw and plastered with mud and the *pacca* houses were cemented. The semi *pacca* houses were those where there was half wall with bricks and remaining portion were prepared with bamboo and plastered with mud. In some semi-*pacca* houses tin sheets were used according to the income level of the respondent's family. Sometimes, they get government aid to make the houses. The study shows the type of houses of the Karbi elderly population. *Kutch* and *pacca* houses were almost same i.e. 46 per cent and 44.25 per cent and the remaining 9.75 per cent were having semi-*pacca* houses. The Karbis prefer to live in a joint family system but they form new unit as nuclear family due to socio-economic condition. The nuclear family consist of the husband, wife and married children. The joint family has the parents along with the married children, their uncles, aunts and children. In the present study, it was found that 55 per cent were living in nuclear families and 45 per cent belonged to joint family system. The average number of family members present in nuclear families is five and joint is 10. The traditional occupation of the Karbis was jhuming, weaving, livestock keeping but from tradition, some Karbis have shifted to salaried jobs and business. In the present study, the respondents family whose sole source of income from agriculture is 66.67 per cent followed by 30 per cent of the family were working as daily wage earner or doing business like grocery shops, tea shops, vegetable sellers, etc. and 3.33 per cent retired government job.

**Karbi meals:** Rice is the staple crop among the Karbi community. They prefer to take rice in all the three main meals viz. breakfast, lunch and dinner. Dietary Diversity was observed in the Karbi community as they eat a range of vegetables, green leafy vegetables, fish (dry and fresh) and meat. Pork and dry fish are considered to be the favourite food among the Karbis. Depending on the family member's reunion in the house in the evening time, the meal time is fixed. So the time of meals vary from family to family. But the timing of first meal preference was early morning and in the morning meal rice was preferred among all Karbi population. The first meal which was taken at around 7 am to 8 am referred as *pratham haz*, lunch at around 12 noon to 1 pm referred as *duporia haz* and dinner before 8 pm referred as *rati haz*. The Karbi tribe never preferred late dinner after eight o'clock. Lyall (1997) mentioned traditionally, it was

observed that the Karbis take first meal at around 7 am to 8 am and consists of rice and the evening meal is cooked after the day's field work.

**Dietary Diversity and Food Frequency of the Studied Population:** Dietary diversity is associated with household or individual food availability and intake of nutrients from different food groups and is an important component of nutritional outcome (D. J. Nithya and R. V. Bhavani, 2017). The study covered several aspects related to health and nutrition of elderly Karbi tribe. The data collected on food frequency, consumption pattern, dietary diversity, medium of cooking, nutritional status, etc. The results obtained are presented in the following sections.

**Consumption of cereals:** North eastern people's staple food is rice. The Karbi populations in the studied area were rice eaters and all mentioned that staple food of Karbi was rice. In all the three meals as breakfast, lunch and dinner they prefer to take rice. Some of the elderly Karbi tribe mentioned that if they avoid lunch they prefer taking other rice products like puffed rice *laddu* prepared with jaggery and black tea without sugar. So cereals which formed the bulk of their dietaries were taken every day. A study conducted by Marak (2007) reported that staple food of Garos, a tribe of Meghalaya was rice.

**Consumption of pulses:** The pulses are the major sources of protein. A third or more of our protein requirement is met with the pulses and non-vegetarian foods. The elderly Karbi population included all types of dals like red gram, green gram, black gram, lentil, etc. but they prefer to have non-vegetarian foods. Pulses are termed as protein sources for poor people. It was observed that almost half (51%) of the elderly Karbi tribe have pulses almost every day. Among the respondents it was seen that the percentage of elderly Karbi who have pulses once or twice per week was 28.25 per cent followed by 20.75 per cent who consumed pulses thrice to five times per week. In a study by Quamra *et. al* (2007) found Bhil tribe of Madhya Pradesh consume pulses like moong and urad frequently. The dal which was prepared was semi thick but not too thin. The Karbis prefer to have the dal prepared without oil or they prepared with alkali (*khar*). In the half boil dal, the Karbi women put vegetables like papaya, white gourd, plantain flower, drumstick leaves, pumpkin leaves, etc. along with *khar*. *Khar* is prepared by burning the peel of banana or banana stem and dipping the ash in water. After straining, the water is used as *khar*.

**Consumption of non-vegetarian foods:** All the elderly Karbi tribe under the study were non-vegetarians (Moitra and Choudhury 1991; Mittal and Srivastava, 2006; Saikia, 2012). They prefer eating non-vegetarian items like fish, mutton, chicken, pork, egg, dry fish and meat. Many studies have found that most of the tribals are non-vegetarians (Mittal and Srivastava, 2006; Saikia, 2012). The liking for non-vegetarian food is found among tribes of North India. Table 2 reveals the frequency of consumption of flesh foods viz. egg, fish and meat among Karbi population of Kamrup district. Data reveals that more than half (56.25 %) of respondents has meat i.e. chicken, mutton, pork, etc. six to seven times per week or almost every day. Almost similar percentage of 22.5 and 21.25 preferred meat one to two days/week and three to five days/ week respectively. All the elderly Karbi reported that irrespective of the size and quantity of non-vegetarian food, a small piece satisfies their satiety level and they can have enough rice without any other curries or vegetable. They cook non-vegetarian with spices and oil like the restaurant delicacies but large majority prefer boil meat prepared with vegetables like colocasia tubers, potatoes and green leafy vegetables. Although research reveals that all tribal population are non-vegetarians but no data were found on the frequency of consumption of non-vegetarian foods (Quamra, 2007; Mittal and Srivastava, 2006). Basumatary (2012) studied traditional food habits of Bodos and mentioned meat especially pork is highly prized item of diet and an essential item in the Bodo society.

Among all elderly Karbi tribe, highest (70.5%) of respondents take egg once or twice per week followed by 16.5 per cent ate egg thrice to five times per week. Very less (13%) mentioned that they take egg six to seven times per week. They all prefer to have boil egg or prepared as curry. There was no special cuisine for preparation of egg among the Karbis. Karbis like fresh as well as dry fish. They prepare fish with bamboo shoot and green leafy vegetables (*mesta tenga pat*). Dry fish is prepared with chillies, onion, garlic and tomato. Another delicacy mentioned was dry fish prepared with alkali (*khar*). The Karbi prepare dry fish by putting it in boil water with white gourd, garlic and ginger and adding *khar* to it. They do not use turmeric while preparing delicacies with *khar*. All alkaline preparations are known as *kang-moi*. A delicious cuisine of dry fish is prepared by roasting the dry fish and making it into paste with red chillies, ginger and garlic. This dry fish chutney is very hot and it is liked by one and all. Regarding fish consumption, the current study finds a majority (82%) respondents had fish six to seven times/week. Fish ranked highest among the other two non-vegetarian foods viz. meat and egg. This is so because of easy availability of fish in nearby ponds and flooded paddy fields. The elderly Karbi tribe who had fish three to five times/ week were 18 per cent. Dry fish is relished by all the tribal population of northeastern region including the Karbi tribe. Marak (2010) in a study of *jagua nakam* (dry fish) mentioned that inclusion of the dry fish lies in gastronomic appreciation and habitual consumption. Fresh fish and dry fish are included in the meals.

**Consumption of milk and milk products:** The elderly Karbi tribe have no liking for milk. Even if they have a domesticated cow in their family they prefer to sell the milk in market. Of the total respondents, 98 per cent of respondents have milk or milk products once or twice per week followed by 2 per cent consumed milk thrice to five times/week. The milk products other than curd such as paneer, khoya, channa, etc were never found in the dietary of studied Karbi population. Mittal and Srivastava (2006) also found milk and milk products almost missing in the diet of all age groups of Oraon tribes of West Bengal.

**Consumption of vegetables and fruits:** Vegetables and fruits are known as protective foods as they are rich sources of vitamins and minerals. Food variety was present in the meals of Karbi elderly in terms of vegetables and fruits. Vegetables are grouped into three categories viz. roots and tubers, green leafy vegetables and other vegetables. Under roots and tubers category all types of underground vegetables such as potatoes, onions, colocasia bulbs, carrots, radish, beetroot, etc. are present which are rich sources of energy, carbohydrate, vitamins and minerals. Data reveals that 74.25 per cent of elderly Karbi include roots and tubers six to seven days per week followed by 16.5 per cent who include three to five days per week. Only 9.25 per cent of the respondents include roots and tubers once or twice per week. The Karbi like potato and colocasia bulb (*kasu*) and these vegetables were seen very frequent in Karbi kitchen. The meat is cooked mostly with colocasia bulb and this is a delicacy among Karbis of Kamrup district of Assam. Local green leafy vegetables are very rich in nutrients viz. pro-vitamin A as well as iron and calcium. The leafy vegetable category includes dark green vegetables as amaranthus, spinach, fenugreek, colocasia leaves, etc. and light green vegetables such as cabbage, spring onions, lettuce leaves, etc. Data shows that 80.75 per cent of the elderly Karbi include six to seven times per week followed by 19.25 per cent who have green leafy vegetables three to five times per week. The Karbis prefer to eat green leafy vegetables which are grown in their homestead gardens. They also go the hilly terrain to collect the vegetables. Goswami (2012) mentioned that each 100 g of curry leaves contain energy (108 kcal), protein (6g), calcium (830mg), phosphorus (57mg), iron (0.93mg), magnesium (44mg) and vitamin C (4mg). Karbis prepare pulses or dal with green leafy vegetables. Nutritionally, colocasia leaves and bulb are excellent sources of vitamins, dietary fiber, thiamin, copper, potassium, niacin, zinc, and iron (Goswami, 2014). It may be boiled, stewed, baked or even fried and is also prepared in many other ways, with respect to the regional delicacies.

**Table 1. Elderly Population Size**

Name of the Village	Number of Households	Total population of the villages		60 years & above	
		Males	Females	Males	Females
Goriaghuli	81	210	217	20	14
Gomoria	60	195	170	19	17
Malobari	95	217	212	22	24
Malobarigaon	72	220	231	18	20
<b>Total</b>	<b>308</b>	<b>842</b>	<b>830</b>	<b>79</b>	<b>75</b>

**Table 2. Frequency of consumption of foods/week**

Frequency/ week	1-2 days	3-5 days	6-7 days
Pulses	28.25%	20.7%	51%
Egg	70.5%	16.5%	13%
Fish	-	18%	82%
Meat	22.5%	21.25%	56.25%
Milk and milk products	98%	2.0%	-
Roots and tubers	9.25%	16.5%	74.25%
Green leafy vegetable	-	19.25%	80.75%
Other vegetable	23.5%	44.75%	31.75%
Fruits	91.5%	8.5%	-
Sugar and jaggery	80.75%	-	19.25%
Oils and fats	87.25%	-	12.75%

**Table 3. Dietary intake of the Karbi population**

Food groups						
	Average intake	Suggested intake*	% adequacy	Average intake	Suggested intake*	% adequacy
Cereals	300.6	140	214.71	383.65	180	213.13
Pulses + flesh foods	59.35	70	84.78	64.55	80	80.69
Milk & milk products	20	400	5	25	400	6.25
Roots and tubers	135	100	135	140	100	140
Green leafy vegetables	106	100	106	112	100	112
Other vegetables	99	200	49.5	95	200	47.5
Fruits	39.5	150	26.33	42.5	150	28.33
Fats and oil	14	15	93.33	14	20	70

\*ICMR. EAR (2023)

**Table 4. Nutritional status of Karbi elderly population according to Asian standard**

Respondents Age								
	Underweig ht (<18.5)	Normal (18.5-23.00)	Increased risk (23.00-27.5)	High risk (≥ 27.5)	Underweight (<18.5)	Normal (18.5-23.00)	Increased risk (23.00-27.5)	High risk (≥ 27.5)
60 years & above	16.67	66.67	16.67	-	-	61.11	38.89	-

The inclusion of other vegetables was low as compared to green leafy vegetables and roots and tubers. The Karbi people make an effort to include green leafy vegetables in every day meals. The indigenous green leafy vegetables/ herbs included are *silpat*, *panajari*, *gorjiva*, *semerang tenga*, *bahekatita*, *mayong sak*, *mandhania*, etc. Some types of green leafy vegetables such as *mayong/mehek* is dried and kept for use within three months. Other green leafy vegetables collected from hilly areas are eaten fresh or within two to three days after plucking. Karbis use herbs like coriander, herb of grace, asiatic pennywort, mint, lemon leaves, etc for flavor and taste. All herbs are very nutritious and their inclusion in regular diet of Karbis gives them immunity to health. The presence of iron and vitamin C in the leaves strengthen the immune system and helps to prevent anaemia. Herb-of-Grace contains vitamin A, B and high amounts of sodium, potassium and significant amounts of manganese, copper and zinc. Mint leaves contains protein, fat, minerals such as calcium, phosphorus and iron.

The other vegetables which were covered in this category were ash gourd, bottle gourd, pumpkin, french beans, cucumber, cauliflower, brinjal, etc. These vegetables are also good sources of minerals, vitamins and fibre. The banana stem of some varieties of banana which is called *posola* in Assamese and rich in fibre is taken by Karbi elderly. They cook the banana stem without oil with dals or putting alkali and grams. It was observed that the percentage of other

vegetables included by Karbis for six to seven days was less (31.75%) than the frequency of inclusion three to five days i.e. 44.75 per cent. Less than one fourth of the respondents (23.5%) included other vegetables once to twice per week. Bamboo shoot is also an integral part of Karbi community. Both tribal and non-tribal populations of north-eastern region consume bamboo shoot either fresh or fermented. The sour dishes are prepared with vegetables which are known as *han-thor* and predominate among Karbi traditional cooking. Bamboo shoot contains valuable nutrients. Nongdam and Leimapokpam (2014) studied the nutritional facts of bamboo shoot and found that shoot contains high content of useful proteins, amino acids, carbohydrates, and many important vitamins and minerals and low in fat. Fruits are categorized under one category but their sources of nutrients differ. The yellow fruits like oranges, mango, ripe papaya, water melon, wood apple, etc. are very good sources of pro-vitamin A. The vitamin C rich fruits include amla (Indian gooseberry), carombola, guavas, lime, berries, pears, etc. The Karbis consume the locally available fruits such as wood apple (*bael*), pineapple, ambarella (*omora*), olive (*jalphai*), carissa carandas (*korja*), mango, litchi, etc. Data depicts the frequency of consumption of fruits was seen very less among Karbis then vegetables and other food groups. Maximum (91.5%) of the Karbi elderly included fruits for once or twice per week and only 8.5 per cent consume fruits for three to five times per week. None of the respondents mentioned that they include fruits every day. Some fruits like jackfruit, banana, mango, litchi, etc. were found in almost every Karbi household.

Jackfruit both fresh and ripe is liked by studied Karbi respondents. Immature jackfruit is prepared with dry fish and alkali. Goswami (2013) mentioned that ripe jackfruit is very nutritious and has energy value of 94 Kcal per 100g.

**Consumption of sugar and oil:** Sugar and oil are two major classes of food which are required in very small quantity but are essential as they are the major sources of energy. Sugar and oil add taste to the food for which the food becomes acceptable to one and all. The use of sugar and jaggery by the Karbi population was not regular as they prefer to have black tea without sugar or with little salt. The Karbi elderly mentioned that in morning they prefer a cup of black tea with little salt and a piece of jaggery for taste is taken. Of the total respondents, it was observed that maximum (80.75%) consumed sugar and jaggery one to two days per week and remaining (19.25%) included three to seven times per week. In Karbi gastronomy, the use of oil is very less in traditional dishes. They prefer boil foods but it was observed that the use of oil in the studied Karbi population was present and they preferred it. The oils category covers all types of oil as mustard oil, refine oil, butter, ghee, cheese, etc. but in Karbi community use of only mustard oil was higher than other sources. Among the studied population, it was observed that maximum (87.25%) included oil one to two days per week and 12.75 per cent included three to seven days per week. The elderly Karbi women mentioned instead of oil they use *khar* to cook the cuisines and so use of oil was very less.

**Consumption of traditional liquor (rice beer):** Consumption of traditional rice beer (*hor*) is a custom among all tribal populations. Teron (2006) in a study mentioned use of *horlank* in marriage and worship is customary and mandatory among Karbi people. Highly concentrated rice beer in small quantities is used among rural masses to cure dysentery, pharyngitis and cholera. The present study found that traditional rice beer (*hor*) was consumed everyday by 92 per cent of elderly Karbi male and 38 per cent female respondents. The remaining consumed only on festivals and rituals. The preparation of *Hor* may differ from region to region among Karbis for availability of resources. Traditional home made rice beer of the tribals is nutritious. *Judima* a local tribal beer of Dimasa tribe was analysed for its nutrients and found that the beer contains good amounts of protein, carbohydrate and free amino acids with high antioxidant activity (Arjun *et. al.* 2014). Home made rice beer (*hor*) is rich in macronutrients (carbohydrate, protein, fat) and micronutrients (calcium, sodium, potassium, iron, phosphorus).

**Medium used for cooking:** Most cuisines were prepared using alkali (*khar/ phelo*), sour foods (*upthor*) and oil. The cuisines prepared by using alkali and acid as a medium of cooking is known as *kangmoi* and *hanthor* respectively. Although use of oil is less among the Karbi tribe yet in some indigenous cuisines oil is used. Chicken, fresh fish, vegetables, etc are prepared with oil.

**Cooking methods among the Karbis:** Tribal cooking methods differ slightly from non-tribal people. Tribal prefer cooking with less oil whereas non-tribals prefer oil. Present study among the Karbis found that the most common methods used for cooking was boiling, steaming and roasting in bamboo tubes and banana leaf. Present study among the Karbi found that the most common methods used for cooking were *kangthu* (wrapped in banana leaves), *ki-mung* (cooked in bamboo tubes), *kangdang* (grilling in wire mesh), *ki-up* (boil in salt and spices/steam), *hang-langdung* (boil in salt), *ka-bhaji* (frying with oil), *ki-phi* (roasting in stick). All Karbi irrespective of their financial status prefer foods cooking without oil. Teronpi *et. al.* (2013) studied indigenous knowledge of management of fish resources and revealed that hill Karbi cook fish by *kangthu* and *ki-mung* method. Another study by Saikia (2013) on food habits in pre-colonial Assam mentioned common modes of cooking among the tribals were boiling, steaming, frying, grilling and baking in banana leaf and minimum use of oil.

**Indigenous cuisines:** Indigenous methods of food preparations and the type of food consumed, has long been a part of intangible heritage

of any culture. Beypi and Biswas (2012) in a study of the Karbi tribe mentioned that Karbi tribe is culturally very rich and unique having some of the cultural markers such as dress, food, festivals, myths and language. Eating habits and the methods of preparation of food among the Karbi is unique as the Karbi of Kamrup district is able to conserve the cultural heritage in terms of food. The indigenous preparations of cuisines which were very traditional and have come down from generations are still prevalent among the Karbi. The food cuisines are prepared by using foods available in and around them and also by using simple methods of cooking. Few examples of indigenous cuisines are Colocasia with dry fish powder (*Hendru Fule Along Kitoon Aahan*), Broad beans vegetable with small dry fish (*Thepa Ahaan*), Curry leaf curry with dry fish (*Norosingho aru sukan maas*), Boil red gram dal with flower (*Langdung pihuk*), Colocasia chutney (*Gun kasu asatoni*), etc.

**Feeding pattern:** Consumption of food depends on the quantity of food cooked for the whole family and distribution of food among the family members. The portion of food taken by the family members depends on the age, sex and physiological condition of the person. It is often believed that women have food after serving food to the whole family as she has to see whether food cooked is sufficient for all. It was mostly seen in many studies that the women takes her food after serving food to the entire family with whatever is left out is always undernourished (Faveau, 1990; Warriar, 1992; Miller, 1992). But, in Assam and north eastern regions a different outlook is seen for feeding practices. The women are given importance and the neglect for food is not seen in Assam. It was observed during the survey that, elderly people in the home are given food at the same time. It was also observed that even the elderly Karbi woman may have her food in the last but the quantity of food taken in the meals was adequate. Lyall (1997) revealed that Karbi men and women eat together, within the house. Data reveals that one-third (74.75%) of elderly Karbi have her food along with the other family members followed by 17.75 per cent who have their food after serving food to the family members and very less (7.5%) have food alone. The women respondents of the family mentioned that they take food after serving to the family if there is elderly person in the family or a small child who has to be fed first. The researcher observed that the quantity of food cooked was always sufficient for all the members of the family.

**Dietary intake of the Karbi elderly population:** The dietary intake of studied Karbi population gave a different picture among different food groups (Table 3). The average intake of cereals and green leafy vegetables were significantly higher than the recommended level given by ICMR (2023) in both male and female elderly age groups. The intake of cereals, roots & tubers and green leafy vegetables can be mentioned as excellent as it was more the 100 per cent than the Estimated Average Requirements (EAR - 2023 for elderly). Moreover, the variety of vegetables plucked from homestead garden are plenty so the quantity of green leafy vegetables included in Karbi dietary is adequate and as per EAR given by ICMR. These green leafy vegetables also provide requisite nutrition needed for the body. Consumption of pulses and flesh foods, fats and oil can be mentioned as good as it was more the 70 per cent than the EAR. The intake of qualitative foods like milk and milk products, other vegetables and fruits can be stated as poor as it was significantly lower than the recommended levels (50%). Marak (2010) reported high consumption of rice, roots and tubers and meat and lesser intake of green leafy vegetables, milk, fats and oil than the recommended dietary intake among Garo tribe of Meghalaya. The food habits and adequacy of some foods among Karbis were found to be very good. The food habits were a blessing of healthy life for Karbi tribals. Two interesting observation were made in the study regarding adequacy of food. The consumption of cereals was much higher than the EAR in both male (213.13%) and female (214.71%) elderly population. In case of female it was much higher than the males. It was observed that the quantity of cereals served to the elderly male and female were same. Although the EAR for female is lower than the males. Hence, adequacy level was higher in females than males. The second observation was that the adequacy of pulses and flesh foods were

higher in females (84.78%) than in males (80.69%) although the pulses and flesh foods served in the elderly population of the family were same. A possible reason could be that, the elderly woman folk of the village attends for traditional rituals such as puja, bhuj, birth of new born, menarche, pregnancy, arrangements of marriage, birthday, annaprashan, etc. where prasad (soaked Bengal gram and green gram) are served which are good sources of plant protein. In this way, consumption of pulses is higher among female elderly. The present study revealed inadequacy in milk and milk products and fruits as which is similar to findings of other research studies. Actually, the tribals have no liking for milk and fruits which has come down from generations. They liked flesh foods and green leafy vegetables and so their diet was adequate in green leafy vegetables, pulses and flesh foods. Region specific food disparities are present all over India. Although milk and milk products, fruits, etc. were inadequate among Karbis still food habits of Karbis were rich due to consumption of non-vegetarian foods, cereals and local green leafy vegetables and nutritional status was much better than other tribal groups. A study conducted by Reddy (2010) concluded that nutritional intake depended on food habits of a particular region and not on the production and consumption of food items. Food habits among Karbis were adequate in terms of calorie and protein intake. These two nutrients are contributing factors of protein-energy malnutrition and as these two nutrients were taken in ample amounts in the diet of elderly Karbis, hence undernutrition was seen less among the studied population. From the analysis of dietary intake, it may be mentioned that Karbi elderly adequacy of food was good in all food groups except milk and milk products and fruits. Milk and milk products which are a good source of protein and vitamins can be balanced from flesh foods and green leafy vegetables which are good sources of protein and vitamins. Similarly, fruits are good sources of micronutrients which can be balanced from green leafy vegetables, roots and tubers and other vegetables which are taken by Karbi elderly in adequate quantity. As a whole it may be stated that Karbi respondent's dietary intake was good as compared with recommended levels.

**Nutritional Status of the Studied Population:** Nutritional status is the condition of the body which can be determined by the intake of balanced diet and the capacity of our bodies to digest, absorb and use those nutrients properly. The simplest method of assessing nutritional status in a community is by measuring individual height and weight and calculating the Body Mass Index (BMI). It is defined as the weight in kilograms divided by the square of the height in metres ( $\text{kg/m}^2$ ). Nutritional status is categorized as undernutrition and overnutrition which together is known as malnutrition. World Health Organization defines malnutrition as a term used to refer to a number of diseases, each with a specific cause related to one or more nutrients and each characterized by cellular imbalance between the supply of nutrients and energy on the one hand, and the body's demand for them to ensure growth, maintenance, and specific functions, on the other. The WHO expert consultation, 2004 recommended that for many Asian populations, additional trigger points for public health action were identified as  $23 \text{ kg/m}^2$  or higher, representing increased risk, and  $27.5 \text{ kg/m}^2$  or higher as representing high risk. Table 4 depicts the nutritional status of studied Karbi elderly population, it is observed that among the total studied population of 75 females and 79 males in age group of 60 years and above only 16.67 per cent were underweight ( $\text{BMI} < 18.5$ ) females. Maximum (66.67% females and 61.11% males) of the respondents had a normal BMI ranging from 18.5 to 23.00 and very few (16.67%) females were in increased risk (23.00-27.5). However, in case of males, 38.89 per cent were in increased risk. The reason for overweight during later years may be perhaps due to lack of intense activity as conducted during the early years of life. The Karbi women of higher age group reported that, a womans work load is higher due to upbringing of the children, household chores and working in paddy fields. As children grow up, they get married and the mothers who become mother-in-law have reduced activity. The new daughter-in-law takes up the responsibility of the household. Thus reduced activity in the higher age group is the leading cause of overweight among some elderly population. Similar findings were reported by

Musaiger (2011) in a study of overweight and obesity in Eastern Mediterranean region and the study gave possible factors determining obesity were inactivity, urbanization, long duration of television viewing and subsidized food policy.

Nutritional status depends on lifestyle and dietary intake. If work output is more than the food intake a person will be at normal nutritional level. Basu (1993) reported that tribals living in remote areas have a better overall status and eat a more balanced diet than tribals living in less remote, forest-free areas. This has been attributed to better utilization of available natural resources. Contrary to the reports of Basu (1993), the present study was conducted in less remote area of Kamrup district but still the study found the nutritional status of the elderly population was good and very less Karbi elderly women were undernourished. Good nutritional status may be attributed to the reasons that all Karbi elderly respondents included a variety of food items and dietary diversity was present in the meals. The non-vegetarians especially fish and included green leafy vegetables everyday collected from homestead garden or from hilly terrain.

## CONCLUSION

It was observed that the elderly Karbi of the village enjoyed the conducive environment in the family and the community. The respondents as well as the family members reported that there was no abuse among the elderly in terms of physical, verbal, emotional or financial abuse. The conducive environment was attributed to the facts viz. non-interference in the work among the family members, busy schedule of work, involved in preparation of bamboo works (dola, saloni, etc), kitchen garden, paddy fields, etc. Consumption of nutritious foods rich in micronutrients including antioxidants, vitamins & minerals and fibre, sedentary lifestyle enabled the elderly to live active and meaningful healthy lives, without being a burden on society and their family members.

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