

Dietary intake and its association with the socio-economic status of the Angami Naga of northeast India

Ingesta dietética y su asociación con el estatus socioeconómico de los Angami Naga del nordeste de la India

Ingestão dietética e sua associação com o status socioeconômico dos Angami Naga do nordeste da Índia

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Abstract

Dietary intake is the daily pattern of food and drink consumed by an individual, including their types, quantities, and nutrient content. It is generally influenced by age, sex, physical activity, health status, cultural practices, and lifestyle factors. Evaluating dietary intake helps identify nutrient deficiencies and excesses, as well as the overall quality of the diet. This paper aims to analyse dietary intake and its association with socio-economic factors among the Angami Naga of Nagaland, northeast India. The staple diet of the Angami Naga primarily consists of carbohydrate and protein-rich foods. Rice and meat are the core components of their diet, accompanied by vegetables and fermented condiments such as *king* chili chutney. The adaptive advantage of this traditional diet is evident within this indigenous community, as disease prevalence is relatively low. Therefore, traditional dietary practices and indigenous knowledge of food preparation may provide health benefits to the community. Rev Arg Antrop Biol 28(2), e131, 2026. <https://doi.org/10.24215/18536387e131>

Keywords: Angami Naga; dietary intake; nutrition; socio-economic status; traditional diet

Resumen

La ingesta dietética es el patrón diario de alimentos y bebidas consumidos por un individuo, incluyendo los tipos, cantidades y contenido de nutrientes. Generalmente está influenciada por la edad, el sexo, la actividad física, el estado de salud, las prácticas culturales y los factores del estilo de vida. Evaluar la ingesta dietética ayuda a identificar deficiencias y excesos de nutrientes, así como la calidad general de la dieta. El presente artículo tiene como objetivo analizar la ingesta dietética y su asociación con factores socioeconómicos entre los Angami Naga de Nagaland, en el noreste de India. La dieta básica de los Angami Naga consiste principalmente en alimentos ricos en carbohidratos y proteínas. El arroz y la carne son los componentes fundamentales de su dieta, acompañados de verduras y condimentos fermentados como el chutney de chile *king*. La ventaja adaptativa de esta dieta tradicional es evidente dentro de esta comunidad indígena, ya que la prevalencia de enfermedades es relativamente baja. Por lo tanto, las prácticas dietéticas tradicionales y el conocimiento indígena sobre la preparación de alimentos pueden aportar beneficios para la salud de la comunidad. Rev Arg Antrop Biol 28(2), e131, 2026. <https://doi.org/10.24215/18536387e131>

Palabras Clave: Angami Naga; ingesta dietética; nutrición; estatus socio-económico; dieta tradicional

Resumo

A ingestão alimentar é o padrão diário de alimentos e bebidas consumidos por um indivíduo, incluindo os tipos, quantidades e conteúdo de nutrientes. Geralmente, é influenciada por idade, sexo, atividade física, estado de saúde, práticas culturais e fatores de estilo de vida. Avaliar a ingestão alimentar ajuda a identificar deficiências e excessos de nutrientes, bem como a qualidade geral da dieta. O presente artigo tem como objetivo analisar a ingestão alimentar e sua associação com fatores socioeconômicos entre os Angami Naga de Nagaland, no nordeste da Índia. A dieta básica dos Angami Naga consiste principalmente em alimentos ricos em carboidratos e proteínas. Arroz e carne são os componentes centrais de sua dieta, acompanhados de vegetais e condimentos fermentados como o chutney de pimenta *king*. A vantagem adaptativa dessa dieta tradicional é evidente dentro dessa comunidade indígena, já que a prevalência de doenças é relativamente baixa. Portanto, as práticas alimentares tradicionais e o conhecimento indígena sobre a preparação de alimentos podem trazer benefícios à saúde da comunidade. Rev Arg Antrop Biol 28(2), e131, 2026. <https://doi.org/10.24215/18536387e131>

Palavras-chave: Angami Naga; ingestão alimentar; nutrição; status socioeconômico; dieta tradicional

An individual's daily nutritional habits, including the types and amounts of calories consumed, are referred to as dietary intake (Adewole & Oluwajuyitan, 2022). A balanced diet is essential for good nutrition and health outcomes throughout life (Goswami *et al.*, 2017). An unhealthy diet is one of the leading causes of all forms of malnutrition and various diseases. However, socioeconomic status (SES), ethnic background, and geographic location can also influence dietary habits. Individuals from lower socioeconomic backgrounds often have li-

mitted access to healthy food options compared to those in higher socioeconomic groups. This may also lead to increased intake of processed and high-calorie foods among higher-SES groups. A study suggests that Indian cuisine is unhealthy, regardless of geographical location or socioeconomic status, because whole-grain intake exceeds the EAT-Lancet recommendations. Meanwhile, consumption of fruits, vegetables, legumes, meat, fish, and eggs falls short. The share of calories from protein sources is only 6 – 8% in India compared to 29% in the reference diet (Sharma *et al.*, 2020). India is experiencing a significant shift in dietary patterns, with a large portion of the population relying heavily on cereal-based staples and consuming fewer micronutrient-rich foods, leading to inadequate intake of essential macro- and micronutrients (Sharma *et al.*, 2020). At the same time, there is a rising trend of consuming high-calorie, high-fat, and high-sugar foods, increasing the prevalence of overweight and obesity. This also edges out healthier options that provide essential nutrients, resulting deficiencies in iron and folic acid, which cause anemia and increase the risk of non-communicable diseases (NCDs) (Indian Council of Medical Research [ICMR] and National Institute of Nutrition [NIN], 2024). Due to globalization, India is undergoing a nutritional transition, shifting from traditional staple diets to Western-style processed foods (bread, cake, and cookies) and broadening consumer access to a variety of convenience foods, including processed, instant options with preservatives, such as deep-fried foods. This transition has contributed to a rise in obesity, diabetes, and heart disease, alongside undernutrition (Misra *et al.*, 2011). Indigenous communities in northeast India are no exception. Northeast India, particularly Nagaland, has experienced substantial socio-economic development over the past century, including the construction of highways, hotels, restaurants, and fast-food outlets across urban and rural areas (Ghosh & Peseyie, 2022). This development may have accelerated the nutritional transition in the region, leading to improvements in nutritional adequacy through emerging markets. As a result, the dietary habits of the Angami Naga have changed from those of previous generations, as has been the case with neighboring indigenous communities.

Individuals with lower SES tend to skip breakfast more often, have a poorer-quality diets that include processed meat and sugary drinks, and have a higher rate of obesity. Meanwhile, individuals with high income tend to eat more nutritious foods, such as vegetables and fibre-rich foods (Hulshof *et al.*, 2003). It has been reported that the juice of green leafy vegetables may help maintain healthy blood sugar levels and reduce the risk of chronic diseases such as diabetes and cardiovascular disease (Tiwari *et al.*, 2013). On the other hand, inadequate consumption of vegetables and fruits may increase the risk of developing diabetes, and low consumption of milk and milk products may increase the risk of hypertension (Hemalatha *et al.*, 2023). According to the U.S. Department of Agriculture and the U.S. Department of Health and Human Services (2010), eating five or more servings of fruits and vegetables daily is a key component of a healthy and balanced diet. Many adults and older people are not drinking enough milk, despite its nutritional value. Those who consume milk five or more times a week tend to have better diets and overall health than those who do not drink milk often (Luz *et al.*, 2021). Low-fat milk consumption is relatively low, especially among certain socioeconomic groups (Luz *et al.*, 2021). High consumption of animal-based foods may increase the risk of health problems, such as dyslipidemia, due to their high cholesterol and fat content (Wolfram *et al.*, 2015), which is positively associated with higher income (Vranken *et al.*, 2014).

Geographical location may also influence meat consumption. For example, populations in coastal areas tend to consume more fish/seafood, while inland groups tend to consume more meat (Vranken *et al.*, 2014). It has been observed that people with hig-

her education tend to eat healthier and more sustainable diets, including less processed meat and more fish/seafood (Klink *et al.*, 2022). Food prices also play a crucial role in socioeconomic inequality in healthy food choices. For example, higher-income groups tend to spend more on food and make healthier choices than lower socioeconomic groups, because the latter prioritize price over healthiness (Pechey & Monsivais, 2016; Sharma *et al.*, 2020). Analysis of the 66th round of the National Sample Survey (NSS) reveals that rural India shows notable regional differences in intake of calories, protein, and fat. For instance, people from the northern states of India (e.g., Rajasthan, Punjab, Haryana) show a high level of nutritional intake. In contrast, people from northeast India (Nagaland, Manipur, Assam, etc.), eastern India (West Bengal), and central India (Chhattisgarh, Madhya Pradesh) exhibit lower nutritional intake. However, this study focuses on the typical Indian diet, which heavily relies on cereals and dairy products. People from the northeast region have the highest carbohydrate intake, driven by higher cereal and sugar intake (Gupta & Kumar, 2015). On the contrary, another study showed that northeast India spends the highest share of its budget on eggs, fish, and chicken/meat—20–25% of total food expenditure—compared to other parts of India (Suresh, 2025). The Indian Council of Medical Research (ICMR)-National Institute of Nutrition (NIN) found that northeast India has the highest daily calorie and carbohydrate intake and also relies heavily on pulses and legumes for protein (Hemalatha *et al.*, 2021).

Consumption of fruits and vegetables is relatively low in Nagaland (Tushi *et al.*, 2018). Nagaland ranks first in India in per capita meat and pork consumption (Singh *et al.*, 2021). Microbiological contamination, along with high consumption of pork, may increase the risk of various food-borne illnesses, such as gastrointestinal infections and neurocysticercosis (Deka *et al.*, 2011; Fahrion *et al.*, 2014; Grace *et al.*, 2009). Considering this, the present paper aims to examine dietary habits, with respect to food group consumption and food frequency among the Angami Nagas of north-east India, with special emphasis on their association with socioeconomic factors, including education, monthly income, occupation, and family size.

MATERIALS AND METHODS

The study population

The Angamis (Angami Naga people) are the fourth-largest Naga ethnic group in Nagaland, north-east India, commonly known as Tenyimia, and currently reside in the Kohima and Dimapur districts (Kekhriengunuo, 2022). The Angami Naga speak the *Tenyidie* language, which is of Tibeto-Burman origin and belongs to the Mongoloid group (Peseyie & Ghosh, 2022). For generations, the Angami Naga have preserved their unique food system and culinary traditions, and are well known for traditional dishes such as *galho*, *tathu*, *ghabe*, etc. These dishes are generally prepared using natural ingredients, wild edibles, and distinctive cooking techniques (Singh & Teron, 2017). Rice is their staple food, and rice beer (*zu*) is their traditional beverage, brewed in almost every household. Their diet mainly consists of carbohydrate- and protein-rich foods, including rice and red or lean meats with fat. They are primarily farmers practicing both dry and wet rice cultivation.

Sample

Cross-sectional data were collected from 214 adults (84 males and 130 females) of the Angami Naga community in Kohima district, Nagaland. The age range of the participants

was 18 – 60 years. A random sampling method was used to select participants within age and sex strata. Data was collected following standardised structured and unstructured interview methods. Prior informed consent was obtained from each participant before conducting the interview.

Socio-economic and dietary data

Data on individual socioeconomic status, including family type, monthly household income, educational level, occupation, and primary sources of cooking fuel, lighting, and drinking water, were collected for each participant using a structured questionnaire.

Family type: Family types were categorised as nuclear, joint, and extended family, if they fulfilled the following conditions in each case. A nuclear family typically consists of a married couple and their dependent children living together. A joint family consists of a group of individuals from a unilineal descent line (where descent is traced through either the male or the female line) who live together with their spouses and children in a common household under the authorship of a single-family head (Bansal *et al.*, 2014). Whereas, extended family includes the nuclear family, as well as other relatives such as grandparents, aunts, uncles, cousins, and siblings who live together or are closely connected.

Household income: Household income was calculated as the total earnings of all revenue-generating family members, without regard to household size. Monthly family income was classified by percentile rank using the formula $P = p \times (N+1)$, where P is the position, p is the percentile, and N is the sample size (Frost, 2019). Based on percentile ranks (25%, 50%, and 75%), households were categorized into three income groups: low-income ($\leq 6,999$), middle-income (7,000 - 24,999), and high-income ($\geq 25,000$).

Education level: Education level was classified into five categories based on data on the highest attainable formal education from each participant. Individuals who are unable to read or write are considered “illiterate”, those who completed up to class 1 - 5 are “primary”, class 6 - 10 are “secondary”, class 11 - 12 are “higher secondary”, and those who have attained education beyond class 12 are “graduate and above”.

Occupational status: Each participant’s occupation was classified into five categories after interviews on their subsistence patterns and livelihoods. Individuals who are self-employed or run their own business, employed by the government, and retired or receive a pension are categorised as “Business/Government service/ Pensioner”; those who engage in agricultural activities as “Cultivator/Farmer”; those who perform manual or basic tasks and earn a daily wage as “Labourer/ Class IV worker”; those who manage household work and family responsibilities without earning as “Housewife” and those who are pursuing education, job seekers as “Student/Unemployed”.

Sources of fuel: Based on data on fuel sources, cooking fuel types were categorised as follows: wood (firewood), electricity (electric stove, cooker), LPG (liquefied petroleum gas), and other (cow dung, stove, etc.). It is then classified based on the participant’s cooking fuel use. For example, wood + electricity, wood + LPG, etc.

Sources of water and light: Sources of water, as evident from the interview, included tap water, a public well, and other sources such as rivers, ponds, and streams. For lighting the house, the sources were categorised as: electricity (power from the grid), solar (power from photovoltaic panels), and others (kerosene lamp, candle, etc.). It is then classified according to the participant’s usage. For example, solar + other, electricity + solar, etc.

Data on dietary intake: A combination of open-ended and closed-ended questionnaires was used to record food frequency, expressed as the number of times per week. Par-

ticipants reported how frequently they consumed staple foods, pulses, green veggies, meat, and milk over a specific period. Standardized frequency categories were applied across food groups to ensure consistent, comparable data collection and analysis. Milk consumption was initially collected as a dichotomous variable to distinguish consumers from non-consumers, and, among those who reported milk intake, consumption frequency was also classified weekly to provide a more detailed assessment of habitual intake. A 24-hour dietary recall method was used to collect nutritional intake for the preceding two consecutive days (yesterday and the day before yesterday), and the average intake for the two days was analysed to assess their daily nutrient intake. Dietary data were grouped into predefined food and nutrient categories as follows: beverages and vitamin-rich foods (tea, juice, fruit, vegetable, chutney, bamboo shoot, etc.), carbohydrate-rich foods (rice, potatoes, snacks, etc.), and protein-rich foods (meat, beans, dal, egg, etc.). It was then classified based on the combinations of these nutrient categories consumed during each recall period. Participants who reported no food consumption during a particular time of the day were categorized as “skipped meal”.

Statistical analysis

IBM SPSS Statistics version 20 was used to analyse the collected data (IBM., 2011). Descriptive statistics, including percentage distributions, were calculated for each socio-economic and dietary parameter. Multivariate multiple regression analysis was performed to examine the relationship between socioeconomic factors and dietary intake, with meal intake per day, pulse, meat, green vegetable, and milk intake per week as dependent variables and family type, income, occupation, and education as independent variables. A significance level of 5% ($p < .05$) was used for all statistical analyses.

The collected data on socio-economic factors were converted into dummy variables by using coding numbers for further analysis. Coding was also performed for dietary intake and food frequency before using them in the regression models. In addition to socioeconomic and dietary intake, self-reported morbidity for the past three months and during data collection was also recorded and coded. Multivariate multiple regression analyses were conducted to examine the effects of various socio-economic parameters on dietary intake and food frequency.

RESULTS

Dietary intake and food frequency of the Angami Naga

The results of the study on the dietary intake and food frequency of the Angami Naga are displayed in [Table 1](#). The staple diet of the Angami Naga is rice (data not shown in the table). Most of them eat twice a day (73.36%), 24.3% eat three times a day, and only 2.34% have one meal daily. About 67.29% consume pulses (beans, lentils, peas, etc.) 1 - 5 times a week, while 21.96% do not eat pulses at all. A small percentage (10.75%) eat pulses more than 6 times a week. Nearly 45.79% of participants eat green vegetables more than 10 times a week, 35.51% 6 - 10 times, and 18.69% 1 - 5 times. The majority of Angami Nagas are non-vegetarians, with 74.77% consuming meat 1 - 5 times weekly, indicating regular meat consumption. Only a negligible percentage (2.34%) do not eat meat ([Table 1](#)). Regarding milk, nearly 77.1% of the population does not consume it, while 22.9% do. Of those who consume milk, 46 drink it 1 - 7 times a week, and only 3 drink it more than 7 times a week.

TABLE 1. Dietary intake of Angami Naga of Nagaland.

Food frequency	N = 214	%
<i>No. Of Meals Taken / Day</i>		
Once	5	2.34
Twice	157	73.36
Thrice	52	24.3
<i>No. Of Pulse Taken / Week</i>		
0	47	21.96
1-May	144	67.29
6-Oct	16	7.48
> 10	7	3.27
<i>No. Of Green Veg. Taken / Week</i>		
1-May	40	18.69
6-Oct	76	35.51
> 10	98	45.79
<i>No. Of Meat Intake / Week</i>		
0	5	2.34
1-May	160	74.77
6-Oct	32	14.95
> 10	17	7.94
<i>Milk Intake</i>		
Yes	49	22.9
No	165	77.1
<i>No. Of Milk Intake / Week</i>		
	N = 49	%
1-Jul	46	93.88
> 7	3	6.12

In terms of their nutritional intake (Table 2), based on the average food consumption over the past two days, it is found that for both morning (44.4%) and evening (47.2%), the majority of individuals had a full meal which includes carbohydrate (in terms of rice, and potato), protein (in terms of meat, bean, pure milk, etc.), vitamins (vegetables, chutney, banana etc.), and beverage (tea, juice, etc.), followed by those individuals who opted a combination of beverage, vitamins, and carbohydrate in the morning (37.8%) and evening (31.8%). In the evening, fewer participants (17.8%) had other combinations of food intake, such as carbohydrate and protein. Meanwhile, during the daytime, a majority (38.3%) of participants skipped meals, followed by those who had only beverages and vitamins (28.5%), including tea and juices. 16.4% had beverages, vitamins, and carbohydrates, and only 12.6% had a full meal with all food composition categories.

Socio-economic status of the Angami Naga

The socio-economic profile of the Angami Naga shows that most of them live in nuclear families (85.05%), with joint families accounting for 14.02%. In contrast, extended families comprise only 0.93% (Supplementary Table S1). Their monthly income indicates that the majority belong to the middle-income group (45.79%), while the lower income group (28.5%) and the higher income group (25.7%) are relatively similar. In this study, 40.19% of the Angami Naga are engaged in business, government service, or are pensio-

TABLE 2. Detailed nutritional consumption of Angami Naga of Nagaland.

Nutritional Intake	Morning		Day		Evening	
	N = 214	%	N = 214	%	N = 214	%
Beverage + Vitamins	15	7	61	28.5	2	0.9
Carbohydrate	1	0.5	-	-	2	0.9
Protein	2	0.9	2	0.9	-	-
Beverage+ Vitamins + Carbohydrate	81	37.8	35	16.4	68	31.8
Beverage+ Vitamins + Protein	1	0.5	-	-	1	0.5
Carbohydrate + Protein	18	8.4	7	3.3	38	17.8
Carbohydrate + Protein+ Vitamins+ Beverage	95	44.4	27	12.6	101	47.2
No Meal	1	0.5	82	38.3	2	0.9

ners. 28.04% work in agriculture, followed by the non-earning group, including students and the unemployed (15.89%), and housewives (12.15%). Regarding education and literacy, most are at the secondary level (32.71%), followed by those with a graduate or higher level of education (28.97%). The illiteracy rate is 17.29%, higher than at the primary (12.15%) and higher secondary (8.88 %) levels.

For cooking, most families use LPG (45.33%) as their fuel. Meanwhile, 39.25% use a combination of LPG and wood, and only a few (7.01%) rely solely on wood for cooking ([Supplementary Table S1](#)). Regarding water sources, the majority of households depend on public wells (42.06%), while 32.71% use tap water, and about 20.09% rely on other sources, such as purchasing water or alternative options. As for household lighting, the majority use electricity (98.13%).

Self-reported morbidity among the Angami Naga

Regarding morbidity over the past three months ([Supplementary Table S2](#)), it was observed that out of 214 participants, only 45 individuals suffered from hypertension, diabetes, and other conditions such as joint pains, gastritis, tonsillitis, breathing problems, and skin allergies. During fieldwork, only 92 experienced illness. Among them, 69.57% suffered from joint pains, gastritis, tonsillitis, breathing problems, and skin allergies, while a small percentage (5.43%) of the Angami Naga were found to have diabetes. Meanwhile, 13.04% of them were diagnosed with hypertension ([Supplementary Table S2](#)).

Influence of socio-economic factors on the dietary and nutritional intake

The effect of socioeconomic factors on dietary intake is shown in [Table 3](#), which presents results from multivariate multiple regression analysis. The general model captures all the confounding variables used in the study, whereas the most parsimonious model only captures the significant independent parameters. The most parsimonious model indicates that income ($\beta = -0.1856$; $p < .01$) is significantly negatively associated with green vegetable consumption. The negative association suggests that as income increases, consumption of green vegetables tends to decrease. Other variables show no significant impact on the green vegetable consumption among the Angami Naga ([Table 3](#)). The most

TABLE 3. Multivariate multiple regression results: association of socioeconomic factors on dietary intake.

Dependent Variable	Socio-economic Parameters	General model (GM)		Most parsimonious model	
		β coefficient	p-value*	β coefficient	p-value*
Green veg/ week	Occupation	-0.037	.282		
	Income/month	-0.162	.037	-0.186	.008
	Educational status	-0.038	.465		
	Type of family**	0.071	.619		
Multiple R ²		4.20%		4%	
Pulse intake/ week	Occupation	0.004	.883		
	Income/month	0.052	.420		
	Educational status	0.077	.078		
	Type of family**	-0.410	< .0001	-0.429	< .0001
Multiple R ²		8.60%		5.90%	
No. of meals/ day	Occupation	0.002	.928		
	Income/month	-0.111	.022	-0.144	.001
	Educational status	-0.051	.119		
	Type of family**	-0.073	.414		
Multiple R ²		6.20%		5.10%	
Meat/fish/egg per week	Occupation	0.155	.016		
	Income/month	-0.026	.372	0.213	< .0001
	Educational status	0.091	.035		
	Type of family**	0.085	.469		
Multiple R ²		8.40%		6.40%	
Milk intake/ week	Occupation	-0.007	.756		
	Income/month	-0.029	.531		
	Educational status	0.066	.039	0.057	.047
	Type of family**	0.185	.033	0.185	.032
Multiple R ²		3.80%		3.60%	

*Significant p-values are highlighted in bold

**Type of family = Nuclear family vs. joint /extended family

parsimonious model also shows a significant inverse effect of family type on pulse intake ($\beta = -0.4293$; $p < .001$). The model explains around 6% of its variance. The inverse association suggests that pulse consumption is significantly higher in nuclear families than in joint or extended families. Other variables do not significantly influence pulse intake.

The number of meals eaten per day is significantly influenced by family income ($\beta = -0.1437$; $p < .05$), accounting for about 5.1% of the variance. The negative association suggests that higher-income individuals tend to have fewer meals per day than lower-income individuals. In the general model, occupation ($\beta = 0.1551$; $p < .05$) and education ($\beta = 0.0910$; $p < .05$) were positively associated with meat/fish/egg intake (Table 3). On the other hand, the most parsimonious model shows that income ($\beta = 0.2127$; $p < .001$) has a significant impact on the consumption of meat/fish/egg among the Angami Naga. The model explains 6.4% of the variance in animal protein intake. The positive association suggests that higher income, education, and skilled job status are associated with higher animal protein consumption. Educational status ($\beta = 0.0570$; $p < .05$) and family type

($\beta = 0.1848$; $p < .05$) have a significant impact on milk intake. The positive association suggests that better-educated Angami Nagas are more aware of the health benefits of milk, leading them to consume it more frequently than illiterate individuals. Similarly, large and/or extended families tend to consume milk more frequently than nuclear-family households (Table 3).

DISCUSSION

The central aim of the present study is to explore consumption patterns of various food groups and dietary frequencies among the Angami Naga of Nagaland, with a special focus on their associations with socioeconomic factors. The daily diet of the Angami consisted mainly of carbohydrate- and protein-rich foods; however, moderate consumption of vegetables, which contribute to fibre, was also observed. Rice and meat are the core elements of their diet, eaten in large portions with a small quantity of secondary elements like vegetables and fermented beans or *king* chilli chutney, which is also seen in other parts of northeast India like Manipur and Meghalaya, indicating regional similarities (Agrahar-Murugkar *et al.*, 2004; Loukrakpam *et al.*, 2020).

In line with previous findings of low fruit and vegetable consumption in Nagaland (Şanlıer *et al.*, 2019), our study confirms that fruit consumption is indeed low. However, it contradicts the finding that vegetable consumption is also low. Our research shows that the Angami Naga of Nagaland consume vegetables with every meal. Compared to other parts of India, especially the North and South (Ganpule *et al.*, 2023), which rely on dairy and added fats for protein energy, the Angami Naga depend heavily on meat for their animal protein intake. Interestingly, dairy products and added fats are rarely consumed among the Angami Naga. Fried foods are uncommon; vegetables are mostly eaten boiled, with some eaten raw. Fermented foods, including *axone* made from soybeans, rice beer, and pickled items, are common among this indigenous group. The literature reports the health benefits of these foods, such as boosting the immune system and reducing the risk of hypertension, diabetes, obesity, and cardiovascular diseases when eaten in moderation (Şanlıer *et al.*, 2019), although these outcomes were not measured directly in the present study. Smoked meat, especially pork, is also common among the Angami Naga and is often cooked with *axone*, bamboo shoots, and other ingredients.

Bamboo shoots are a popular traditional delicacy, enjoyed fresh or fermented, and are recognized as a nutraceutical medicine, rich in fibre, protein, carbohydrates, minerals, and vitamins, while being low in fat (Chongtham *et al.*, 2011). Studies suggest that although bamboo shoot consumption may provide several health benefits, such as lowering blood pressure, excessive consumption can lead to toxicity (Nongdam & Tikendra, 2014; Thakur *et al.*, 2016). According to the World Bank (2019) report for Nagaland, 62% of households have two meals daily, and 38% reported three meals; this pattern is also observed in the present study among the Angami Naga, with the majority of participants having two meals daily. In contrast to the ICMR-NIN guidelines (2024), our findings suggest that most individuals tend to have a heavy breakfast and dinner but skip or have a lighter lunch. Interestingly, Angami in the middle- and higher-income groups tend to skip lunch or eat fewer meals per day than those in the lower-income group.

Researchers suggest that education level is positively related to pulse consumption (Mitchell *et al.*, 2009; Reddy, 2004); however, our study contradicts this, showing that pulse consumption is linked to family size. Specifically, the larger the family, the lower the pulse intake, and we found no connection with education level. Additionally, unlike a

previous study (Lakshmi *et al.*, 2020), which indicated that education, income, and socioeconomic level do not affect green vegetable consumption, our research reveals a significant negative relationship between income and green vegetable intake, with higher income associated with lower consumption. This may be because, as income rises, people can afford a wider variety of fruits, meats, and baked goods, including items beyond green vegetables. A study by Vranken *et al.* (2014) also found that income influences meat consumption. Our findings confirm that animal protein intake is linked to income; higher income levels correspond with increased meat consumption among the Angami people. Animal protein consumption is also affected by occupation, with higher-skilled jobs correlating with greater meat intake. For instance, government employees tend to eat more meat than class IV workers, possibly because higher-paying jobs enable greater consumption of animal protein.

Furthermore, the economic transition *vis-à-vis* the epidemiological and nutritional transitions has also played a crucial role in this population's dietary practices. In this regard, our study supports the ICMR-NIN finding that northeast India has the highest daily consumption of calories and carbohydrates (Hemalatha *et al.*, 2021). However, they do not rely heavily on pulses and legumes for protein; instead, they also rely on meat for protein. Researchers found that milk consumption is positively associated with education and negatively associated with occupation (Sanchez-Villegas *et al.*, 2003). Our study also shows a positive association between the educational status of a person and milk intake, but does not show any association with occupation. Nevertheless, a positive association of milk intake with family size is observed in the present study.

The limitation of this study is that we could not calculate the nutritional status of the participants from their self-reported height and weight, due to the lack of awareness about this information. Nevertheless, such information can be used in future research as nutritional status can be influenced by dietary practices, which in turn can influence the occurrence of different lifestyle diseases. Therefore, nutrient analysis and physical measurement can provide a more comprehensive understanding of diet-related health outcomes in this community.

CONCLUSION

In summary, the study shows diverse food habits among the Angami Naga of Nagaland. Their diet mainly consists of carbohydrate- and protein-rich foods, with regular consumption of vegetables. On average, the community consumes relatively low amounts of pulses, fruits, milk, and other dairy products. Traditional food habits, such as consuming fermented foods, bamboo shoots, and smoked meat, are crucial to the Angami diet and show strong cultural continuity. Meals are usually two times a day, with large servings at breakfast and dinner. Several socioeconomic factors relate to dietary practices in this community. For example, family size affects pulse consumption, while income and occupation are positively associated with meat intake. The consumption of green vegetables decreases with income, perhaps due to excessive meat consumption. These findings suggest that the dietary habits of the Angami Naga are influenced by both cultural traditions and socioeconomic factors. It is a well-established fact that nutritional intake is closely connected to environmental adaptation, cultural practices, and regional factors. Angami Nagas are no exception to this. The high consumption of animal protein among them, perhaps, has been inculcated in their daily diet since ancient times, when their ancestors were hunter-gatherers (Ghosh & Peseyie, 2022). Different populations have different nutritional profiles. The Angami Naga's

preference for fermented foods and meat established cultural practices observed in the study. Therefore, the study provides significant insight into the dietary habits of the Angami Naga, thereby enhancing understanding of regional dietary patterns in northeastern India.

ROLES AND CONTRIBUTIONS OF AUTHORS

Conceptualization- SG; Data curation- AL & SL; Formal analysis- AL, SL & SG; Funding acquisition- SG; Investigation- AL, SL & SG; Methodology- SG; Project administration- SG; Resources- SG; Supervision- SG; Validation- SG; Visualization-AL, SL & SG; Writing – original draft- AL, Writing – review & editing- AL, SL & SG.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data samples mentioned in this study can be found using the following resource: <https://doi.org/10.7910/DVN/SPFJSN>, Harvard Dataverse, V1

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