International Journal of Food Science and Nutrition
www.foodsciencejournal.com
ISSN: 2455-4898
Received: 06-08-2023, Accepted: 21-08-2023, Published: 07-09-2023
Volume 8, Issue 3, 2023, Page No. 60-65

A narrative review on association of food habits & diseases in eastern India

Manisha Chatterjee[1], Sweta Kumari[2]
[1] Assistant Professor, Department of Dietetics & Nutrition, NSHM Knowledge Campus Durgapur, West Bengal, India
[2] Department of Dietetics & Nutrition, NSHM Knowledge Campus Durgapur, West Bengal, India

Abstract
India is second largest populated country in the world which has different diversity in culture, religion and different socio-economic background. All over India suffering from double burden of malnutrition due to insufficiency of energy and different life style disorders like diabetes, obesity, hypertension, cardiovascular disease etc. The main reasons behind double burden of diseases are lack of proper knowledge, poor eating habits, lack of physical activity and different abuses like smoking and alcohol consumption. The objective of this study is to determine the causes and factors of diseases prevalent in the part of East India and to recognize the food habits with the prevalent diseases in the particular states of East India. The methodology which is used in this study is to collection & analysis of secondary data from google scholar, PubMed, Research gate etc. Study area is Eastern part of India. Findings was mostly about rural and urban population, tribal from Jharkhand, Odisha, Nagaland population are found mostly suffering from malnutrition and some are at risk of non-communicable disease. We found that life style diseases are very common among the four states Jharkhand, Odisha, Nagaland and West Bengal. These findings will help to generate awareness in the community and help to educate the people to get knowledge about nutrition.

Keywords: East India, food habits, non-communicable disease, obesity

Introduction

Now a day the dual burden of underweight and overweight/obesity is alarming situation throughout the world. Although India continues to see an increase in overweight/obesity, the country has the largest percentage of underweight adults in the world. As a result, the adult populations of developing countries, including India, face significant health issues. Poor dietary intake or deficiency of energy and essential micro & macro-nutrients are one of the factor for development of double burden of malnutrition (Edward Jay, 2017). Obesity and overweight have been linked to multiple chronic conditions including diabetes, cardiovascular disease, multi morbidity and impairment. These associations have been well documented. The link between being underweight and early mortality, disability, and poor self-rated health and well-being is also very robust and it is especially strong in developing nations. Socio-economic development, change in age structure, industrialization, urbanization, life style change has placed India in the position where the population is facing growing burden of non-communicable diseases (D. Ganguli, 2011) [13]. Non communicable diseases occur mainly because of improper physical activity & unhealthy dietary pattern like excessive consumption of oily foods, junk foods, trans fatty acids, excessive energy dense food, high sugar and salt in food (more than requirements of the body). So, intake of food & occurrence of diseases are often interconnected. Due to variation in cultural, geographic, economic and social factors, diets in India are extremely diverse (R Prakash Upadhyay, 2012) [23].

Tribal societies are the affected society in comparison to other societies of India. The processes of changes have been affected the tribal way of life positively as well as negatively. The diet of all Oraon and Munda groups was deficient in all food groups or in their diet. Cereal, milk and fruits was almost negligible in their meals. Their diet was supplemented by locally grown leafy vegetables like dheki saag and fermented left over rice. The energy available from diet for all age group of people was only 52-53% of the recommended dietary allowances of ICMR. Tribal population constitute 26-30% of the total population in Jharkhand, 24% in Odisha, 86.5% in Nagaland and 7% in Andhra Pradesh. Consumption of liquor made from mahua flower as well as smoking of tobacco by tribal population of Peninsular India and consumption of rice bear (Haria) by the tribal of Jharkhand region has been reported. Population of tribal were non-vegetarians and they prefer to consume pork, rat meat, beef and different birds (Sheeth Toppo, 2016).

In India, undernourishment is high among mothers & children. National Nutrition strategy pointed the need of strategies to improve infant and young child nutrition. Nearly 43% of the children with age group of 3-5 years are underweight in some of the worst performing district of India like Jharkhand, Odisha, West Bengal and Nagaland. Micronutrient deficiency prevalent among pre-school children of 3-5 years of age (Shantanu Sharma, may 2020) [27]. The states like Odisha, Chhattisgarh, Jharkhand and Bihar, which have a huge burden of poverty and undernourishment, also reported low consumption of micronutrients rich food like milk & milk products and fruits. In the states like Bihar, Jharkhand, Madhya Pradesh, and Chhattisgarh, anaemia and vitamin A deficiency is a serious problem in public health (Pura Rinya, 1 January 2017).

This review study aims to determine the cause and factors of diseases prevalent in East India
& to recognize the food habits with the prevalent diseases.

Methodology

Methodology is a way of doing research based on the particular principles and methods that

we have used in the study.

Study design

This systematic review is conducted between the month of January to March, 2023.

Study Tool

The literature study was conducted on electronic databases (Google scholar, PubMed, Research Gate) and was limited to the articles in English. The search words included: Food Habits, dietary pattern, diseases, risk factors, East India, geographical areas etc. This process yielded 35 references, including reports from national and international organizations, government reports, review articles and research studies. These 35 references include all the states of East India that have already been mentioned. Structured questionnaires were used in the reference studies to collect data from the participants. The research questions included their food choices, decision making of food choices, frequency of diseases, eating pattern etc. The reviewed data were used to understand the relationship between the food habits and the diseases.

Duration of the study

Duration of this study was for 3 months. For 3 months the secondary data has been collected and the information was gathered.

Area of study

The study was conducted for a specific geographical area, East India. The states included were Tripura, Meghalaya, Nagaland, Arunachal Pradesh, Sikkim, Odisha, Jharkhand and West Bengal.

Results and discussion

Different studies on these states show that some life style disorders like diabetes, hypertension, obesity are very common in these states of eastern India. The states like Odisha, Jharkhand, Nagaland, Arunachal Pradesh & Tripura are mainly having Tribal people who suffer from malnutrition. Their diet is deficient in essential micro and macronutrients.

Food habits & diseases of Jharkhand

The chronic diseases or non-communicable diseases are very much prevalent in Jharkhand due to physical inactivity, sedentary life style & lack of nutritional education.

Tribal people have shifted their lifestyle from traditional to modern. Earlier they were fond of eating saag like Bathua, Gandhari, Karami sag, koynar sag which are enriched with essential micro nutrients like iron, folic acid, vitamin C, B complex etc. But now they tend to eat mostly junk foods, processed foods, samosa, kochuri etc. These foods contain saturated fatty acids, trans fatty acids, high amount of sodium & monosodium glutamate. These causative factors are mainly responsible for complications like headache, face pressure or tightness, chest pain, feeling of nausea & weakness (Toppo S., 2016).

Perception & practices at community level is very important to prevent the occurrence of malnutrition as well as diseases. Poor nutrition, lack of exclusive breastfeeding up to 6 months, & delayed onset of complementary feeding are all related with poor growth of child & ultimately increases the mortality rate. Tribal mothers who give birth of child in their home normally starts breastfeeding within 2-3 hours of post-delivery. Some starts complementary feeding before 6 months without effective breast feeding. Due to this poor feeding practices children under 1-3 years are seen malnourished and deficient in essential nutrients which is very important for the baby's mental and physical growth (Chaand I., 2019) [17].

Food habits & diseases of Odisha

In Odisha dietary pattern varies place to place, due to variety in culture, religions, different socio-economic factors and literacy. Malnutrition is common in the pre-schooler children of Odisha. Mothers from low socio-economic background were mostly illiterate and they provide only boiled vegetables and rice to the children as a meal. In other hand mothers from high economic background mostly provide non- vegetarian diet to their children. Their di*et al*so includes different types of fast food which contain trans fats, cholesterol and low effective nutrients. Consumption of these food may lead to childhood obesity (Sharma S., 2020) [27].

According to body mass index (BMI) of males and females of Odisha, it is found that males are more obese (21.73%) than females (11.39%). Females are at a great risk of obesity and also at risk to develop chronic diseases than males. It is also observed that Carbohydrates and sugar-oriented foods intake is high in the meals of females. Most often females are taking their foods in hotels which are highly rich in saturated, trans fatty acids and excess oil. These types of food habits and dietary pattern lead to obesity and associated chronic or other life style diseases (Das Kumar C., 2018) [10].

According to the study (BR ABHA Ayushree, 2021) [7], Around 58.0 percent of teenagers had a urinary tract infection, 13.34 percent had heart disease and roughly 18.5 percent had anaemia. The causal cause for high blood pressure has been identified as a high salt level in the meals of teenager. Sodium is known to alter the renin-angiotensin system in the kidneys which causes arterioles to contract, and also lead to elevated blood pressure in the body.

Fishermen community is a large community of Odisha. A high deficiency level of iron (above 65%) and Calcium (19.46%) was seen in the diet of the fishermen community. The reason of this deficiency may be contributed by the negligible intake of fruits and vegetables. However, the liberal consumption of small fish with their bones may be attributed to the Calcium deficiency to some extent. There is a huge deficit of vitamin intake has among them. 730.56 µg of intake was observed against the 4800 µg recommended level, indicating about 85% deficient of β-carotene. Minimum intake of carotene containing food like green leafy vegetables, coloured fruits and vegetables consumption is negligible by the fishermen community. It was observed that 13.53%, 13.33% and 18.71% deficit intake of thiamine, riboflavin and niacin respectively. As well as, the deficiency of folic acid and ascorbic acid was about 57.77% and 66.02% respectively. Their diet is deficient in protein intake that would have resulted due to the lower consumption of other sources of protein e.g., pulses, milk, eggs, meat, chicken etc. (Patro S., 2020) [28].

Food habits & diseases of Nagaland

Communicable diseases

Communicable or food borne diseases are highly prevalent in Nagaland. Pork occupies an important place in the diet of

the Nagaland people. Food borne diseases due to *Taenia Solium* is very much prevalent in Nagas. T. Solium complete their reproductive cycle in the pork body and forms immature cysts which gets mature in the human body and causes diseases. T. Solium cysts can results in establishment of Tapeworm in the gut and it can cause gastrointestinal symptoms and significant health impacts is neurocysticercosis (This is the pork Tapeworm infection that affects the brain, muscle and other tissues). It is also called pork borne diseases and this is more contagious due to improper meat processing and improper hygiene practice by the Nagaland people. Apart from T. Solium Salmonellosis and Enterobacteriaceae also cause serious health impact. Enterobacteriaceae mainly affects young, old, pregnant lady & person with immune suppressed conditions. This led to the development of gastro Intestinal illness (Anna Sophie Fahrion *et al*, 2014).

Non-communicable diseases (NCDs)

Tobacco use and alcohol consumption are more frequent risk factors for NCDs among rural tribal adults in Mokokchung district of Nagaland. Current smoking was recorded up to 38.1% in males and 0.8% in females (Aonungdok Tushi *et al*, 2018) [2]. The common type of tobacco smoked by current smokers was beedi (91.3%). The frequent use of tobacco can lead to oral cancer and lung cancer respectively because it contains carcinogenic components like hydrocarbons, nitrogen containing components etc. These components can lead to DNA damage and cause cancer (Rodgman and Perfetti, 2013).

Hypertension is elevated in these population because of smoking. The Prevalence of hypertension was nearly double among older persons (aged 45–64 years) than among younger persons (aged 25–44 years).

There is high prevalence of inadequate intake of fruits and vegetables among Naga's. The reasons behind the lower intake of fruits & vegetables are - sociocultural preference for eating rice and pork meat, lower cultivation of fruits & vegetables as commercial crops (Tushi A., 2018) [2].

Food habits & diseases of Arunachal Pradesh

Food transition and globalization

Traditional dish in tribal population (Aptanis) of the Arunachal Pradesh is highly popular. 42.8% of aptanis reported to eat pika or pila: this is kind of pickle which is not spicy but made up of bamboo shoot and pork fat. It is found that 88.9% reported to use pila or tapioca (sodium carbonate) in their diet (Rinya R, 2017). Pork fat or pork meat contains high amount of saturated fatty acids (SFAs), which can increase the SFAs level in in the human body and also considered as a precursor of hypertension and hyperlipidaemia. Frequent intake of pork fat can lead to cardiovascular and cerebrovascular diseases (Zhu W., 2021) [33].

The rate of Diabetes, obesity, kidney problem, hypertension and chronic non-communicable diseases are highly increasing among tribal population. According to the report of ICMR (Indian Council of Medical Research), 2016 that Arunachal Pradesh had the most elevated number of liver Cancer, also known as hepatic cancer. The traditional food such as smoked meat aggravates the chronic diseases. It has been found that 42.8% of people consume smoke meat 2 or 3 times in a week and 54.4% of the people take this traditional dish almost daily (Rinya P., Jan 2017). When meat is cooked in the very high temperatures it forms the chemical substances called Polycyclic Aromatic Hydrocarbons (PHAs) and Heterocyclic Amines (HCAs). Grilled and pan-fried meats can also lead to the formation of PHAs and HCAs. Smoking leads to very high level of contamination. The National Cancer Institute reported that both HCAs and PAHs are mutagenic substances that can induce DNA damage, gene mutations, and other alterations in the DNA that can result in specific types of cancer e.g.- intestinal tract cancer, colon and stomach cancer. Recently few researches suggested that red and processed meats, including smoked meats may also increase the risk of breast and prostate cancer (Cleveland Clinic, March 4, 2022) [11].

The tribal people normally consume a two-meal pattern diet with high carbohydrate, low fat content, low vitamin A, thiamine, riboflavin, niacin, B12, vitamin C, calcium and iron. Anthropometric analysis shows that one fourth of children under age of 2-9 years old were underweight and 7% were stunted. Cultural barriers are one of the factor for malnutrition during pregnancy. Normally they tend to avoid papaya, pine-apple, twin fruits, and iron supplementation. Mothers discard the colostrum milk after delivery just because they belief that colostrum is bad milk and not good for baby. There is no appropriate age for the complementary feeding practice. These are the reasons of malnutrition in children under the age of 2-9 years old. Insufficient meals, only two meals pattern are leading the people at risk of chronic diseases such as diabetes, hypertension among tribal people (Wright L., 2017) [18]

Food habits & diseases of Tripura

Traditional foods and dietary habits

Tripura is a tribal state where the majority of the population relies on traditional meals such as fermented foods, fermented Elephant yam, fermented fish, dried or fermented fish, and banana shoots and their products (Devananda Uchoi, July 2015) [14]. The most important and famous dish of the Tripura is Godak. It is prepared by the fermented fish or dry fish & commonly used for the preparation of the curry. The other foods like dried or smoked meat, fish or vegetables are also used commonly. Other foods, such as dried or smoked meat, fish, or vegetables, are also frequently used. However, these culinary items are now rarely consumed due to their exorbitant price. The average Godak consumption is 28.3% (three times per week). Fruits are only consumed by 33.3% (once every week) (Roy S., 2017) [15].

Vitamin D3 deficiency and association with type 2 diabetes mellitus

Organ meats, milk, milk products, cereals, and eggs are all good sources of vitamin D but the consumption is very low in Tripura. Overall, 65% Vitamin D3 deficiency is observed in the population in a study. According to different studies insufficiency of vitamin D in the blood is directly associated with type 2 diabetes mellitus. Low level of Vitamin D in blood may lead to insulin resistance (American Diabetes Association). About 98.3% and 52.3% of people had been observed with insufficiency of vitamin D (< 30 ng/ ml) in the diabetic and non-diabetic population, respectively according to a study (Bidhan Goswami, July 12, 2019).

Food habits & diseases of Sikkim

Most Sikkimese people love spicy food and a non-vegetarian diet. Traditional fermented food consumption is particularly common among them (Gajamer Rani V.,2014) [32]. Spicy food is inversely associated with oesophageal and stomach cancer risk (Wing Ching Chan, 2021) [34]. Experts reported that consumption of such foods items are linked with stomach and oesophageal cancer. Salt-preserved fish, meat, and vegetables, as well as processed, grilled, or charcoal-cooked meats, are items that may raise the risk of stomach cancer (Zia Sherrell, 2023). Sikkimese are very fond of eating spicy foods like Phagashapa, dumplings, thukpa etc which are very spicy because dry red chillies are used abundantly (Malik U., 2023) [31]. The compound Capsaicin**,** present in chillies and red peppers are responsible for the spicy sensation in foods. It can irritate the stomach lining and increase stomach acid production. This can harm and inflame the stomach, raise the chance of stomach cancer as well as oesophageal cancer over time (Sherrell Z., 2023). The prevalence of gastrointestinal disease in Sikkim is 57.5%. Moreover, the people suffering from gastroenteritis, dysentery, food poisoning, amoebiasis and peptic ulcer aere 18%, 3%, 3% and 1% respectively. It was observed that in females' gastrointestinal illnesses is more common in females (78.8%) compared to males (50%).

Food habits & diseases of Meghalaya

Food habit of Meghalaya people may vary according to different nutritional status of the individuals. Rice is the staple food of this state along with meat or fish preparations. Goats, pig, ducks, fowls, fish, crabs, prawns, dry fishes also form a major part of the dietary habits of Meghalaya people. Food recipes made up of pork, for example dried pork or smoked meat are very common in this region people which can also lead to different types of cancers (Das P., 2021). A characteristic habit of the Meghalaya people is chewing of Betel leaf and unripe betel nut. In fact, after eating the main course of their meal, people use to have betel leaf, along with dried tobacco and lime (Das P.,2021). Betel nuts have harmful effects on oral soft tissues. Betel-induced lichenoid lesions mainly on buccal mucosa has been observed. Betel nuts chewing results in occurrence of oral sub mucous fibrosis (OSF). It's use along with tobacco can cause leucoplakia. Both of these are potentially malignant & can damage oral cavity. Betel nuts contain several alkaloids, including arecoline, arecaidine, guvacoline and guvacine. Oral cancer often arises from such precancerous changes (Anand, 2014) [5].

Anaemia and malnutrition in children and women

High rates of childhood under-nutrition or malnutrition is found with 28.9% underweight, 43.8% stunting, 15.3% wasting, and 71% of children under five years with anaemia (L. Anne D. Chyne, 2018). Among the women, prevalence of anaemia is 52 per cent and the percentage is higher in the women who are breastfeeding. The nutrient intake of women and adolescent girls, found to be too much below as compared to Indian recommended levels for energy, protein, fat, calcium, iron, and carotene. It is also reported that malnourished mother is at high risk of giving birth to a low-birth-weight baby. Low birth weight is often linked with growth failure during infancy and early childhood. It increases risk of morbidity and early death. Iron deficiency anaemia results from low dietary intake of iron, chronic conditions that causes chronic blood loss (e.g. worms, ulcers, etc.). Initially anaemia can be asymptomatic but eventually it can cause weakness, fatigue, pallor, breathlessness, palpitations and headaches. Iron is found in their diet but, ability of the body to absorb it as a nutrient is hampered by the immediate drinking of tea with meal. Hills region of Garo, addition of soda in their diet is a threatening practice which reduces the total absorption of iron from the blood of the body. Researches also showed that over-use of sodium bicarbonate in food causes damage of nutrients like Vitamin C, D, riboflavin, thiamine and iron. Some studies have shown that the use of sodium bicarbonate in the flour fermentation process causes the phytic acid present in the flour to enter without breakdown and decreases the absorption of metals such as iron, zinc, calcium, etc (Das P., 2021).

Food habits & diseases of West Bengal

Reports of West Bengal show poor dietary pattern of rural, urban areas people, school going adolescent and working adults of Kolkata city mainly. The staple food of Kolkata is rice but along with that people tend to eat high calorie foods.

Food pattern of urban and rural areas

A study shows that the dietary pattern of rural & urban people of Kolkata include high visible fats, added sugar and dietary salt. It is observed that the dietary pattern, physical activity and anthropometric profile act as an indicators of obesity related cardia metabolic risks in the both the population (Sarkar P.,2 021) [19]. This is due to intake of faulty snacks, processed and ready to eat or cooked foods or sweet beverages (Lahiri A., 2019) [4]. These food items contain bad cholesterol, high calories and salt so, it can lead to obesity and coronary arteries diseases due to plaque formation in arteries (Ganguli D., 2011) [13]. It is also reported in the study that both the population had drastically low consumption of dairy products, pulses, all vegetables, fruits and nuts (Bose C., 2022).

Another study showed recording of total 2320 (1348 males and 972 females) deaths of a population over a period of a time. Over half of all deaths (1176 deaths, 50.7%) occurred due to non-communicable diseases (NCDs), with nearly 30% of deaths due to circulatory system disorders. 24.2% and 3.9% deaths were attributed to cerebrovascular diseases and ischaemic heart disease, respectively. 13% of males died from external causes like infectious and parasitic diseases, and 11% died from respiratory system-related diseases. Among females, 12% died from infectious and parasitic diseases (Rai Kumar R., 2012-2017).

Conclusion

This study is based on the secondary data so; data is collected from the different Journals of the particular states of the selected area. After going through the journals, we found that life style diseases or disorders and non-communicable diseases (NCDs) are very common among the selected states in the study. It has been observed that diseases like hypertension, obesity, TD2(type 2 diabetes), CVD (cardiovascular diseases) are common in states like Jharkhand, Odisha, Nagaland and West Bengal. Tribal states like Odisha, Jharkhand and Nagaland, have switched from their traditional food to fast foods or junk food, which are

dense in calorie, saturated fat, trans fat and LDL (low density lipo-protein). Therefore, people are highly susceptible for developing non-communicable diseases. So, there is high need to focus on traditional foods which are much healthier than the modern fast food. Traditional foods should be promoted to limit the consumption of fast foods.

In another hand, Arunachal Pradesh, Meghalaya, Sikkim and Tripura follow their food pattern in a traditional way but their diet includes smoked meat like smoked pork, smoked fish, smoked and dried fish, beef etc. which can lead to the different types of cancer & chronic diseases like ulcerative colitis, GI tract infections. It is important to have traditional foods but the components of foods also a top priority. The balanced diet should meet the Recommended Dietary Allowance (RDA). It can be possible by the program of Nutrition education by the health promoting unit or Health care provider. Health education and nutritional education and its promotion is very important in the different region of the particular states, because many people are illiterate and don't know about the importance of nutrition. Even expecting mothers and lactating women are very less curious about their health and nutritional requirement. They don't have knowledge about the importance of breast feeding and complementary feeding. This is the reason of delayed growth of child.

References

1. Fahrion AS, Jamir L, Richa K, Begum S, Rutsa V, Ao S, *et al*. Food-Safety Hazards in the Pork Chain in Nagaland, North East India: Implications for Human Health. International Journal of Environmental Research and Public Health,2013:11(1):403–417.
2. Tushi A, Rao S, Pattabi K, amp Kaur P. Prevalence of risk factors for non- communicable diseases in a rural tribal population of Mokokchung, Nagaland, India. The National Medical Journal of India,2018:31(1):11.
3. Kar A, Kundu S. The changing perspective of food habits in Kolkata: a case on Monginis Kolkata. International Journal of Business Performance Management,2014b:15(1):64. https://doi.org/10.1504/ijbpm.2014.
4. Lahiri A, Chakraborty AK, Dasgupta U, Roy AKS, amp Bhattacharyya K. Effect of dietary habit and physical activity on overnutrition of school going adolescents: A longitudinal assessment in a rural block of West Bengal. Indian Journal of Public Health, 2019.
5. Anand R, Dhingra C, Prasad S, amp Menon I. Betel nut chewing and its deleterious effects on oral cavity. PubMed,2014:10(3):499-505. https://doi.org/10.4103/0973-1482.137958
6. Low Vitamin D and Insulin Resistance | ADA. (n.d.). https://diabetes.org/healthy-living/recipes-nutrition/vitamins-diabetes/low-vitamin-d-insulin resistance#:~:text=Many%20studies%20have%20looked%20at,2%20diabetes%20and%20its%20complication.
7. BR Abha A, Tarai A. Junk Food Intake Among Teenagers in Odisha, and its Impact in Health, International Journal of Agro Nutri food Practices,2021:1(2):19-23.
8. https://www.bibliomed.org/mnsfulltext/67/67-1558344222.pdf?1686326335
9. https://rjptonline.org/AbstractView.aspx?PID=2022-15-9-17
10. Das CK, amp Nayak JK. Prevalence of obesity among adults of Koraput district, Odisha: An anthropological study. ResearchGate, 2018. https://www.researchgate.net/publication/325058932_Prevalence_of_obesity_among_adults_of_Koraput_district_Odisha_An_anthropological_study
11. Kaput K. Are Smoked Meats Bad for Your Health? Cleveland Clinic, 2022. https://health.clevelandclinic.org/is-smoked-meat-bad-for-you/
12. file:///C:/Users/mymot/Downloads/8281%20(3).pdf
13. Ganguli D, Das N, Saha I, Biswas P, Datta S, Mukhopadhyay B, *et al*. Major dietary patterns and their associations with cardiovascular risk factors among women in West Bengal, India. British Journal of Nutrition,2011:105(10):1520-1529. https://doi.org/10.1017/s0007114510005131
14. Uchoi D, Roy D, Majumdar RK, amp Debbarma P. Diversified traditional cured food products of certain indigenous tribes of Tripura, India. ResearchGate, 2015. https://www.researchgate.net/publication/282794773_Diversified_traditional_cured_food_products_of_certain_indigenous_tribes_of_Tripura_India
15. Chyne DaL, Meshram II, Rajendran A, Kodali V, Getti N, Roy P, *et al*. Nutritional status, food insecurity, and biodiversity among the Khasi in Meghalaya, North-East India. Maternal and Child Nutrition,2017:13:e12557. https://doi.org/10.1111/mcn.12557
16. Joy EJM, Green R, Agrawal S, Aleksandrowicz L, Bowen L, Kinra S, *et al*. Dietary patterns and non-communicable disease risk in Indian adults: secondary analysis of Indian Migration Study data. Public Health Nutrition,2017:20(11):1963-1972. https://doi.org/10.1017/s1368980017000416
17. Chaand I, Horo M, Burza S, Harshana A, Mahajan R, Kashyap V, *et al*. Malnutrition in Chakradharpur, Jharkhand: an anthropological study of perceptions and care practices from India. BMC Nutrition, 2019, 5(1). https://doi.org/10.1186/s40795-019-0299-2
18. Wright L, amp Gupta P. Situational Nutritional Analysis of Idumishmi Tribes of Arunachal Pradesh, North-East India. Journal of Food Security, 2017. https://doi.org/10.12691/jfs-5-4-1
19. Sarkar P, Mitra S, amp Basu R. Food consumption patterns of the urban adult population in the field practice area of a teaching hospital in Kolkata, using food frequency questionnaire. Journal of Family Medicine and Primary Care,2021:10(9):3395. https://doi.org/10.4103/jfmpc.jfmpc_431_21
20. http://me-jaa.com/Feb2016/Nagaland.pdf
21. IKCEST. (n.d.). https://old.ikcest.org/journal-5182496.htm
22. https://www.ijcmas.com/10-12021/Puspita%20Das%20and%20Shipra%20Nagar.pdf
23. Upadhyay RP. An Overview of the Burden of Non-Communicable Diseases in India. PubMed Central (PMC), 2012. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3481705/
24. Kumar R, Barik A, Mazumdar S, Chatterjee K, Kalkonde Y, Mathur P, *et al*. Non-communicable

diseases are the leading cause of mortality in rural Birbhum, West Bengal, India: a sex-stratified analysis of verbal autopsies from a prospective cohort, 2012–2017. BMJ Open,2020:10(10):e036578. https://doi.org/10.1136/bmjopen-2019- 036578
25. https://www.ijsr.net/archive/v8i2/ART20194956.pdf
26. http://researchjournal.co.in/upload/assignments/7_207-216.pdf
27. Sharma S, Akhtar F, Singh R, amp Mehra S. Dietary Intakes, Patterns, and Determinants of Children Under 5 Years from Marginalized Communities in Odisha: A Cross-sectional Study. Journal of Epidemiology and Global Health,2020:10(4):315. https://doi.org/10.2991/jegh.k.200515.002
28. https://www.ijcmas.com/9-12-2020/Suryamani%20Patro,%20et%20al.pdf
29. https://core.ac.uk/download/pdf/219473792.pdf
30. https://jemds.com/data_pdf/TARANGA%20REANG,nov%2020%20,.pdf
31. Malik U. 20 Local Sikkim Food Options You Must Try In, 2023. https://traveltriangle.com/blog/sikkim-food/
32. Gajamer VR, amp Tiwari HK. Prevalence of Gastrointestinal Disease and Its Associated Risk Factors in Sikkim and Darjeeling Districts. Journal of Community Health,2014:39(4):767–774. https://doi.org/10.1007/s10900-014-9826-x
33. Zhu W, Xu Y, Liu J, Chen D, Zhang H, Yang Z, *et al*. Effects of Dietary Pork Fat Cooked Using Different Methods on Glucose and Lipid Metabolism, Liver Inflammation and Gut Microbiota in Rats. Foods,2021:10(12):3030. https://doi.org/10.3390/foods10123030
34. Chan CY, Millwood IY, Kartsonaki C, Du H, Guo Y, Chen YP, *et al*. Spicy food consumption and risk of gastrointestinal-tract cancers: findings from the China Kadoorie Biobank. International Journal of Epidemiology,2021:50(1):199-211. https://doi.org/10.1093/ije/dyaa275.