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The Relationship between Food Habits and Chronic Lifestyle Diseases

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Abstract

Chronic lifestyle diseases have emerged as a major public health concern in India, largely driven by long-term changes in food habits and dietary patterns. This study examines the relationship between food consumption practices and the rising burden of chronic conditions such as cardiovascular diseases, type 2 diabetes mellitus, obesity, hypertension, and certain diet-related cancers. India's traditional dietary patterns, characterized by high intake of whole grains, pulses, vegetables, fruits, and minimally processed foods, have historically offered protection against many chronic diseases. However, rapid urbanization, economic growth, and lifestyle transitions have led to increased consumption of refined carbohydrates, saturated and Trans fats, sugars, and ultra-processed foods. These dietary shifts influence cardio metabolic risk through mechanisms involving glycaemic load, lipid quality, systemic inflammation, body composition, and insulin sensitivity. Significant regional, socio-economic, and rural–urban variations in food habits further shape disease prevalence across populations. Evidence highlights that urban populations experience higher disease risk due to sedentary lifestyles and altered food environments, while rural areas are undergoing accelerated nutritional transitions. The findings emphasize the importance of preserving culturally appropriate traditional diets, improving dietary diversity, and promoting healthier food environments. Strengthening nutrition-sensitive policies and public health interventions is essential to reduce the growing burden of chronic lifestyle diseases in India.

Keywords: Food habits; Chronic lifestyle diseases; Dietary patterns; Nutrition transition; Cardio metabolic risk; Urbanization; Public health nutrition

1. Introduction

Chronic lifestyle diseases are broadly defined as diseases associated with long-term lifestyle habits, that is, the manner of living that can be habitual to an individual. Diseases such as diabetes, obesity, heart problems, and stroke are chronic lifestyle diseases. The relationship between chronic lifestyle diseases and food habits is vital to understand preventive measures. The National Centre for Disease Control Report states that the poorest regions of India suffer the highest burden of chronic lifestyle diseases (Shridhar et al., 2018). The actual impacts on food choice and dietary patterns, factors influencing food intake and food quality at the macro level need to be empirically considered as chronic lifestyle diseases are highly sensitive to the food habits of the nation. At a population scale, it is imperative to study the regions where food habits alter the cause and spread of chronic lifestyle diseases. Cardiovascular disease, diabetes, obesity, hypertension, and even certain types of cancer are some acute chronic ailments associated with food habits (R Daniel et al., 2011).

2. Conceptual Framework: Diet, Lifestyle, and Chronic Disease

Diet encompasses the intake of energy and nutrients from food and beverages, while lifestyle refers to the collection of activities undertaken by an individual that constitute their way of life (Impacts of Food Environments, 2020). In a public health context, diet and lifestyle variables (such as physical activity) are considered risk factors for chronic diseases, with dietary patterns, energy balance, and physical activity identified as mediators (R Daniel et al., 2011). Chronic diseases of interest in the Indian context include cardiovascular diseases, type 2 diabetes, obesity/overweight, hypertension, and certain cancers (Shridhar et al., 2018).

Several conceptual models explain how nutrition influences cardiometabolic risk factors and chronic diseases. Dietary inputs are theorised to affect cardiometabolic risk through glycaemic load (total carbohydrate quality), lipid quality (saturation and trans fats), systemic inflammation, gut microbiota composition, and body composition (area under the curve) (Impacts of Food Environments, 2020). Other risk drivers include energy balance, the dietary energy distribution (proportions of carbohydrates, fats, and proteins), food cycle methods (the manner in which food is obtained, prepared, and consumed), meal timing (time intervals between meals), food choice motivations (cultural, economics, health concerns, and habit), and the coupled total dietary energy supply of animal-source and plant-source foods.

3. Dietary Patterns in India: Diversity and Implications

Diet is a major risk factor for many chronic diseases. On the one side, India enjoys a rich historical endowment of dietary traditions. On the other side, across many regions of the country, nutrition is undergoing a rapid transition from the traditional diet to the so-called Western dietary pattern or even to a more modernized combination of both (R Daniel et al., 2011).

Many traditional Indian food habits are advantageous for health. Such food habits emphasize the consumption of unrefined foods of plant origin (cereals, pulses/legumes, vegetables, fruits, etc.) and the minimization or even exclusion of refined/processed foods of animal origin (milk-fat, poultry, and red meat). Indian food habits include diverse combinations that provide a reasonably good balance of nutrients needed for health. For instance, a wheat-based diet can include a variety of dal (pulses), vegetables, and fruits to take care of nutritional adequacy; similarly a rice-based diet can provide sprouted legumes, gehu (wheat), vegetable salad, and fountain grass for wholesome fare.

These food habits protect people from communicable diseases and diet-related chronic diseases such as obesity, diabetes, cardiovascular diseases, and many cancers while still providing adequate nutrition for growth and development. The specific combinations and proportions of foods may vary between individuals and/or with the life cycle, but the overall diet pattern remains quite broadly similar. Dietary modifications from these traditional practices are now on the rise in the country.

3.1. Traditional Dietary Practices and Nutritional Transitions

India possesses one of the oldest and most diverse systems of food preparation worldwide, encompassing enormous regional variations. Alongside these rich culinary traditions, an unprecedented dietary transition is underway. Traditional food habits prevalent even a few decades ago are rapidly disappearing in metropolitan and many semi-urban areas. Studies show a marked rise in consumption of salt, sugar, refined carbohydrates, and fats during the past two decades (R Daniel et al., 2011). Certain protective elements, such as the intake of pulses, fruits, and vegetables — once considered inadequate — are now declining. People now have considerably less time to prepare food and other basic items.

Food habits differ substantially in rural and urban areas across the four southern states of India, but these regions have nevertheless shared several common elements: major cereal types (rice and ragi), legumes and pulses, milk and milk products, and common types of oil (groundnut, coconut, and palm oil). These food habits have thus far provided some degree of protection against

cardiovascular disease, diabetes, and overweight/obesity (S. Kumar et al., 2022). In metropolitan areas, a distinct shift has taken place, with considerable westernization of food habits and dramatic changes in meal patterns.

3.2. Regional Variations in Food Habits

Food habit variation is a major cultural and climatic characteristic differentiated by geography and seasons. In India, documented food habits vary in cereals, millets, legumes, tubers, vegetables, fruits, oil, and spices. Risk patterns correspond to staple and processing factors for chronic lifestyle diseases (R Daniel et al., 2011). Food habits influence chronic lifestyle diseases, with variations between North and South; rice or wheat differently impact nutrient adequacy.

3.3. Urbanization, Accessibility, and Dietary Change

India has been undergoing rapid urbanization since the 1990s, which has led to structural economic changes, a shift away from food staples, and a replacement of home-cooked with ultra-processed and pre-prepared foods (S. Kumar et al., 2022). Recent analyses seek to determine whether urbanization is more strongly correlated with the amount or variety of food consumed (Pandey et al., 2020). Overall, urbanization positively correlates with consumption among more processed items, greater access to 24-hour convenience and food delivery services, and increase in lipid-based energy intake for infants and young children. Most variation in food consumption appears to be attributable to broader trends in income and economic growth rather than demographic factors tied to urbanization and urban-rural migration.

4. Major Chronic Lifestyle Diseases in India Related to Diet

India is witnessing a remarkable epidemiological transition, where chronic diseases are overtaking infectious diseases as the leading cause of mortality. The chronic lifestyle disease epidemic is closely linked to dietary patterns and lifestyle behaviors, especially in the urban population (R Daniel et al., 2011). Cardiovascular diseases (CVDs), type 2 diabetes mellitus (T2DM), obesity and metabolic syndrome, hypertension, and cancers, known as the major chronic lifestyle diseases, are the focus of concern among nutritionists due to their alarming rise. India has one of the highest numbers of people suffering from CVDs, diabetes, and metabolic syndrome in the world. From the past few decades, the country has also experienced an increase in different cancers. A major diet-related risk factor for CVDs in Indian populations is the high intake of saturated fat and trans fats (for hydrogenated vegetable oils) (Shridhar et al., 2018). The per capita availability of edible oil has registered a rise from <5 kg in 1951 to >11 kg in 1998 and is still increasing. High consumption of refined carbohydrates (sugar and white rice) is also linked to CVDs. The proportion of people with diabetes is projected to reach 20–25% by 2030 in urban areas of India, with accompanying increases in ESRD (end stage renal disease), neuropathy, blindness, and other associated disorders. Rise in inflammatory markers (high sensitivity C-reactive protein, fibrinogen, and plasminogen activator inhibitor-1) along with the elevation of low-density lipoprotein (LDL) cholesterol contribute to the increase in CVDs and diabetes. Adiposity, rising very low-density lipoprotein (VLDL), and other lipoproteins early in life without an increase in body mass index (BMI) along with insulin intolerance and metabolic syndrome are associated with CVDs. Cancers related to diet in India include cancers of the esophagus linked to drinking of alcohol, and cancers of the mouth and pharynx associated with chewing of gutkha (betel quid + tobacco).

4.1. Cardiovascular Diseases

India and the nations of the Southeast Asian region face loathsome lifestyle diseases attributable to rancid food habits. Among such intolerable epidemics, cardiovascular diseases (CVD) are predominant. CVD are the principal obstacle to life expectancy in Southeast Asian countries, interoperability is that CVD is still defined as a chronic and lifestyle disease. Finding relationships between food habits and chronic and lifestyle diseases is highly relevant to ongoing research. There is agreement that food habits inappropriate for the human species' biological evolution are responsible

for the accelerated deterioration of metabolic dysfunction; thus, specific attention has focused on saturated fats, and trans fatty acids; sugar, especially high fructose corn syrup; oils rich in omega-6 fatty acids; and industrially prepared, fast, chemicalised, and ultra-processed foods. If these aberrant food habits proliferate in India similar to populations in economically advanced countries, dire consequences for life expectancy are inevitable (Shridhar et al., 2018) ; (R Daniel et al., 2011)

4.2. Type 2 Diabetes Mellitus

Type 2 diabetes mellitus (T2DM) is steadily increasing in India, especially among urban populations. The estimated prevalence of T2DM among individuals aged 20–79 years is 9.2%, with 15% among urban adults (L. Colles et al., 2013). Incidence appears to increase with income, education, and urbanization (Agrawal, 2015). Urban settings promote a sedentary lifestyle, encourage consumption of high-fat and ultra-processed foods, and reduce adherence to traditional dietary patterns (Shukla et al., 2018).

Dietary changes are critical early interventions to prevent or delay T2DM, and high glycemic load, high consumption of ultra-processed foods high in sugar, and low intake of whole grains, legumes, and nuts have been identified as significant dietary drivers. Diabetic individuals show metabolic improvement when they reduce glycemic load through lower-refined carbohydrate intake or by enhancing fiber intake per kilojoule.

4.3. Obesity and Metabolic Syndrome

The incidence of obesity in India has reached alarming levels that parallel those in developed countries. In the past twenty years, the prevalence of overweight and obesity has increased significantly, particularly among affluent adolescents and adults (Nadiger et al., 2022). The overall prevalence of overweight and obesity was estimated to be 37.5% among Indian adults in a nationwide survey conducted in 2021 (Verma et al., 2018). The age-adjusted prevalence of overweight and obesity was reported to be 29.5% among Kolkata adolescents according to a cross-sectional survey conducted in 2020. About 14.3% of Indian adults were estimated to be centrally obese according to the same nationwide survey, with a notably higher prevalence among adults from eastern states compared to those from other regions (R Daniel et al., 2011). With the growing prevalence, obesity in India has attracted global attention and is of international concern as it increases the risk of various noncommunicable diseases.

According to WHO, obesity is defined as “abnormal or excessive fat accumulation that presents a risk to health,” and obesity is often measured by Body Mass Index (BMI). Obesity is the result of positive energy balance due to an increased sedentary lifestyle, greater consumption of high-calorie foods, and reduced physical activity. Ultra-processed foods, refined carbohydrates, large portion sizes, snacks, and sugar-sweetened beverages have been recognised as major contributors to positive energy balance in the Indian population and are driving the obesity epidemic. Long-term consumption of high glycemic index foods and high glycemic load are also linked to the increase of obesity in India.

4.4. Hypertension

Hypertension is a highly prevalent chronic lifestyle disease in India, with many urban and rural communities affected (Rajkumar & Romate, 2020). Salt consumption is closely associated with hypertension and the increase in prevalence-following the liberalisation of the Indian economy in the 1990s. Sodium intake is positively correlated with blood pressure, so higher sodium intake raises hypertension risk. On the other hand, potassium intake is negatively correlated with blood pressure. Thus, the dietary pattern and food habit of individuals in rural communities that promote potassium intake and contain excess sodium content influences hypertension (Raj Thout et al., 2023). The concern over hypertension in India is compounded by its association with other chronic lifestyle diseases-share visible features.

4.5. Certain Cancers Linked to Diet

Several types of cancer exhibit a marked relationship with dietary habits and contribute to the high incidence of related mortalities, especially in North India. A typical Indian diet emphasizes whole grains, legumes, vegetables, fruits, and spices while minimizing or entirely excluding items deemed carcinogenic, particularly red or processed meats and alcohol (Shridhar et al., 2018). In the presence of such protective dietary factors, a significant association between diet and various cancers remains evident, as does the observation that the role of diet varies according to local food habits. Case-control studies conducted in five urban centers of North India have found that large-scale, multicentric epidemiological inquiries into diet and cancer are feasible and identified clear dietary correlates for breast, cervical, and colorectal cancers (Sinha et al., 2011).

5. Nutrients, Food Groups, and Health Outcomes

Methodological constraints limit causal analysis in the Indian context while underlining the policy relevance of national dietary patterns and chronic disease outcomes (Shridhar et al., 2018). Food habits in school-aged children and adolescents affect nutrient intake, growth patterns, intelligence and academic performance, as well as psychosocial and emotional development (Singh et al., 2015). In adults, the quantity and quality of food consumed both outside and within the home, along with meal timings, have direct effects on type and amount of food intake—prolonging intervals between meals can reduce energy intake (Srivastava, 1999). Food habits in older populations influence nutrient intake, meal consumption frequency, and desirable organoleptic properties, all of which vary significantly with age and gender (Shukla et al., 2017).

Urgent action is needed to curb the rising burden of cardiometabolic diseases in India, considering that the multi-faceted nature of the food-steps-energy-travel connection requires straightforward public guidance. India's struggles with having a significant proportion of its population being under-nourished remains a challenge amidst ongoing nutritional transitions, especially urbanisation exposing individuals more to fast food and ultra-processed industries. Consumption preferences can be affected by family members' food choices, job stability, and occupation—agri-based jobs are generally leading more people towards vegetarian food preferences.

Food habit studies and changing nutritional patterns can help evolve integrated cross-disciplinary methodologies to maximise stakeholder involvement and develop culturally-informed food systems policy frameworks. Much of the literature studying food habits concentrates solely on the food sources, plant and crop production systems, without integrating consumption facets, raw, processed or prepared food levels, or point of view of consumers towards food habits. Contemporary food habit studies should address those current glaring gaps in knowledge to develop broader food system approaches and sufficient situational assessments to foundationward future food environment modelling expenditures.

5.1. Carbohydrates, Glycemic Load, and Insulin Sensitivity

Carbohydrate intake affects diabetes risk through a glycemic-load mechanism (Pavithran et al., 2020). The glycemic index of a food or diet is defined as the blood glucose increment, expressed as a percentage of the glucose increment produced by a reference food, per gram of available carbohydrate. Consequently, glycemic load is the glycemic index multiplied by the number of digestible carbohydrate grams consumed.

Following carbohydrate intake, blood glucose rises and triggers insulin secretion. Insulin-promoted transport of glucose into tissues—particularly muscle, fat, and liver—reduces circulating glucose. When insulin action is impaired, as in insulin resistance, glucose concentration remains elevated unless pancreatic insulin output increases. If pancreatic compensation falters, prediabetes or diabetes develops. High-glycemic-index foods can provoke larger postprandial glucose spikes than low-glycemic-index foods, and larger spikes induce greater insulin-secretion increments. Lower glycemic load is thus believed to counteract diabetes risk through less-severe postprandial stimulation of insulin secretion and insulin action.

5.2. Fats: Quality, Sources, and Cardiometabolic Risk

The intake of fats is positively associated with cardiometabolic risk, particularly when diets are rich in saturated and/or trans fats and low in unsaturated fatty acids (R Daniel et al., 2011) ; (Shridhar et al., 2018) ; (Verma et al., 2018). Epidemiological studies from Western countries suggest that the risk of cardiovascular disease and diabetes rises as saturated fat consumption exceeds about 10% of total energy. In India, the use of hydrogenated fats and oils during preparation increases the intake of trans fats. Table 4.2 illustrates the prevailing cooking oils used across four South Asian regions: Northern and Eastern regions typically employ refined groundnut oil, while Southern and Western regions incorporate palm oil, vanaspati, and other oils such as coconut, rice bran, sesame, and mustard. Indian diet preparation also involves the use of commonly processed oils; vanaspati is used to prepare a variety of foods, leading to high caloric intake and raising total and low-density lipoprotein cholesterol levels;.

5.3. Proteins and Dietary Diversity

High protein intakes in both animal- and plant-based diets are associated with increased insulin levels, elevated IGF-1 concentrations and insulin resistance, suggesting consumption should be moderated (Shridhar et al., 2018). Furthermore, cereal-based vegetarian diets generally offer lower protein quality than non-vegetarian or diverse diets. Areas where cereals are the main staple are associated with a lower protein quality and greater prevalence of bang, namely Haryana and Western Uttar Pradesh in North India-Rajasthan, Andhra Pradesh and Maharashtra in West India and Chhattisgarh in East-Central India. Dietary diversity is primarily determined by the nature of staples consumed. Specific nutrients differ widely among food groups and therefore dietary diversification is expected to improve nutrient intake adequacy. Regular and diversified consumption of common foods categories such as pulses, fruits and vegetables, milk and milk products, nuts, edible oil, sugar, grain genres and cooking methods such as boiling, roasting, steaming along with the commonest oil (other than palm) are found to maintain a healthy body mass index (R Daniel et al., 2011).

5.4. Micronutrients and Antioxidants

A balanced micronutrient intake is essential in controlling key chronic diseases in India. Micronutrient deficiencies are highly prevalent in India and hence there is a strong link between micronutrients and chronic lifestyle diseases. Approximately 75% of Indians suffer from micronutrient deficiency. This is especially important for lacto-vegetarian populations as most staples consumed (cereal, roots, and tubers) are very low in vitamins and minerals (Ajit Chiplonkar & Vilas Agte, 2007). Common micronutrients of concern include iron, folate, vitamin A, iodine, zinc, and the consumption of antioxidant-rich fruits and vegetables. Both deficiency and excess of micronutrients can affect health (Javier Clemente-Suárez et al., 2024).

5.5. Dietary Fiber and Gut Health

High dietary fiber intake is essential for healthy growth and development, and is also critical for lifelong maintenance of health (Ioniță-Mîndrican et al., 2022). Important positive effects on many chronic diseases, especially cardiometabolic diseases like heart disease, obesity and diabetes, have been attributed to high dietary fiber intake. A diet containing dietary fibers and prebiotics modifies the gut microbiome and supports the growth of beneficial microorganisms (R. Lyon & Kacinik, 2012) , which helps in the secretion of short-chain fatty acids following fermentation; excessive amounts of these acids leads to metabolic acidosis, obesity and type 2 diabetes. Fiber intake therefore plays an important role in the promotion of health and prevention of chronic diseases.

6. Food Habits across Life Stages in India

The relationship between food habits and chronic lifestyle diseases (CLDs) is a growing concern in India. Food habits in childhood, adulthood, and old age affect health and functional status throughout life. The risk of CLDs also depends on the age of onset of dietary risk factors (R Daniel et

al., 2011). Children and adolescents have specific dietary needs for energy and nutrients for optimal growth. Their food habits may be influenced by the availability of school meals, and eating habits will change during the transition to adulthood. Adults experience shifts in food habits, often leading to conditions such as nutritionally vulnerable. In old age, physiological changes and the loss of a partner may lead to changes in dietary habits that can affect health and functional ability.

Children and adolescents require needed nutrients are supplied by a balanced diet. Children and adolescents are exposed to packaged foods, fast-food outlets, peer pressure and stressful lifestyles, which build improper eating habits during childhood. Picky eating habits among children can also affect long-term dietary habits. Nutritional deficiencies of calcium, iodine, iron and vitamin A are widespread and remain the most common forms of undernutrition. The consumption of school meals has been positively linked with better diet quality (Shridhar et al., 2018). Prevalence of overweight/obesity among children and adolescents has increased due to the rising consumption of processed, energy-dense foods and sedentary lifestyles. Studies reveal a direct correlation between obesity and junk food intake.

The work environment exerts an influence on the food intake of an employee. Shift work disrupts the circadian rhythm altering hormonal secretion, which in turn alters energy intake and expenditure. In many occupations, corporate lunches or catering food is supplied. Such diets are a major contributor to obesity. Rushed mealtimes at workplaces can lead to frequent snacking and grazing for meals at the worksite which can promote overeating, abandonment of main meals and excess weight gain. Besides, quick–eating transitions toward energy-dense processed foods high in added sugars, unhealthy fats, and refined grains and low in whole grains, fruits, and vegetables have been documented. In middle-aged and elderly people, loss of appetite is documented and leads to unintentional weight loss and dietary deficiency. In addition, nutrient intakes among elderly men and women decrease from middle age, implying increased attention to diet composition. Loneliness may also alter eating habits among elderly following the death of a spouse.

Public health interventions and policy landscape in India are focused on national nutrition strategy and dietary guidelines. The objectives are to transform food systems to achieve a smooth transition towards healthy diets across the lifecycle that enable all individuals to reach their full growth potential. To facilitate this, targets have been set on sustenance, nutritional deficiency, malnutrition, overweight and obesity and micronutrient deficiency. Increasing food accessibility through price subsidy policy, public distribution systems and the use of nutrition-sensitive agricultural practices is a key implementation challenge. Propagating affordable, healthy diets and managing demand for unhealthy food products is an essential step. Information dissemination on nutritional content of food products through various means, including health-marketing boards is insufficient. Also, programmes directed at increasing the focus on diet-related health, design options of food systems and cultural sensitivities and specific behaviour changes is seriously deficient. There are attempts to link agricultural policies and systems to improved healthy diets and nutritional outcomes.

6.1. Adulthood and Working Age

Dietary habits and nutritional intake are increasingly being understood as factors influencing disease susceptibility and health outcomes (Emmanuel Adaji et al., 2017). Ageing in India is characterised by an extended life expectancy of 68 years and a marked increase in the absolute number of adults aged 60 years and older (Shaikh & Khan, 2021). This raises concerns as age has a robust association with the risk of chronic diseases. Physical fitness needs to be improved by engaging in recreational activities and avoiding junk food in working-age adults who lead a sedentary lifestyle. Eating outside the home at the workplace has become a common habit. Fast-food consumption is increasing rapidly and is strongly linked with unhealthy lifestyle habits. Stress-related eating is also common due to increased responsibilities on individuals and is observed more among working-age women.

Reports suggest an increase in lifestyle-related diseases among younger adults and urban population. In addition to traditional issues such as undernutrition, eating disorders and overweight/obesity have emerged as important public health problems. Prediction models indicate that

Indians born in 1990 and later are at higher risk of premature mortality and morbidity caused by non-communicable diseases (NCDs) owing to persistent and new lifestyle risk factors.

6.2. Elderly Populations

Older people are more prone to lifestyle-related chronic diseases, prompting concern for the health of this population subset in India (Emmanuel Adaji et al., 2017). Research indicates that the chronic disease burden has grown in older people, and that lifestyle factors impact chronic diseases less than in younger demographics and do not significantly explain the increase. The influential chronic disease among the elderly is multimorbidity, which measures the co-occurrence of multiple diseases or health conditions rather than the number of diseases. While an increase in lifestyle-related chronic disease among the elderly raises concern, the situation is more alarming in the younger population, where policy-makers can play a crucial role to prevent the root cause of lifestyle-related chronic diseases and multimorbidity from developing and reaching a pinnacle stage. Though public health interventions should be directed towards the early diagnosis and management of chronic diseases rather than targeting individual lifestyle factors, awareness of these risk factors is most critical for policy-making.

Older people experience a decline in appetite due to loss of taste, dentition problems, and chronic diseases (Jyothi, 2015). A study highlighted that the elderly in semi-arid tropical villages in the Mahaboobnagar district of Telangana exhibit inadequate micronutrient intake. Even though older people tend to consume more meals per day than younger groups, there is a notable gap in the intake of micronutrients, especially iron, calcium, vitamin C, and folic acid. The average edible food oil intake is insufficient when compared with the recommended intake, but there has been a constant trend of increase in edible oil consumption during the past few years. Communication campaigns targeting older people, emphasizing the significance of micronutrient adequacy, could drastically improve their health and well-being.

7. Public Health Interventions and Policy Landscape in India

India's rapid economic growth has improved food security and household consumption, yet the significant burden of nutrition-related non-communicable diseases remains (Reddy, 2015). In light of the public health transition and structural socio-economic changes in the food and nutrition environment, it is imperative to understand the ongoing transition in dietary patterns, the role of food as a central feature of culture and a major determinant of health, and its interactions with food systems and policies. Indian households exhibit substantial regional, socio-economic, and demographic variations in food consumption patterns, and substantial shifts are underway between rural and urban settings.

India's 2018 National Nutrition Strategy sets out a national vision to attain nutrition security, particularly for women, children, and adolescent girls. The intervention strategy recognizes traditional food systems, diets, and behaviours as integral to addressing anaemia and malnutrition (Bhattacharya & Kumar, 2020). The government is encouraged to commission large-scale, representative longitudinal studies to thoroughly understand the connections among food systems, traditional diets, contemporary consumption, health, food sovereignty, food culture, regional priorities, and public health interventions on food safety, nutrition, and health (Shaikh & Khan, 2021). Such studies should also account for the cropping and dietary diversity linked to India's biocultural heritage and the cultural and culinary preferences that shape food systems, transmission, and consumption across life stages through family kitchens and wedding events. Regional populations may experience the globalisation of food systems differently, allowing the exploration of temporal and spatial changes on a wider scale beyond merely concentrically moving inward to further metropolitan areas.

7.1. National Nutrition Strategy and Dietary Guidelines

India launched its pioneering National Nutrition Strategy in 2017, grounded in the twin objectives of attaining optimal nutrition "for all, from the womb to the tomb" and promoting a holistic

approach to nutrition beyond the conventional focus on food composition. Spearheaded by the NITI Aayog, the policy emphasises five strategic themes: a) supplying sufficient food; b) enhancing nutrition quality, including sanitation, hygiene, and health care; c) generating awareness; d) facilitating capacity building; and e) engaging multi-sectoral efforts across agriculture, health, education, and other related areas. Accompanying the Strategy, India's first food-based Dietary Guidelines aim to inform dietary practices across the food supply chain, recommend food types, and encourage their availability, and consumption according to regional, cultural, and seasonal contexts. Though complementary, the National Nutrition Strategy and the Dietary Guidelines are distinct instruments and their implementation remains constrained by capacity and coordination (R Daniel et al., 2011).

7.2. Food Systems, Subsidies, and Accessibility

Countries often exhibit considerable geographical heterogeneity, influenced by climatic conditions, natural resources, socio economic disparities, and population density among others. This is reflected in the difference in economical and agricultural systems across the states and union territories. The economic setup of India can be broadly classified into agriculture based, subsidy based and non-agriculture. Countries with higher subsidy based systems consume substantially more subsidized products than countries with non-agricultural systems. In India the northern, western and some southern states have a non-agrarian based economy while southern and eastern states are dominated by subsidy based systems. In this subsidy driven economy the staple cereal products provide most of the energy for the diet, leading to a decrease in diet diversification while maintaining a low environmental pressure (Ramchandra Athare et al., 2022). Nutritious products are often poorly consumed in the subsidy based system.

8. Methodological Considerations in Indian Contexts

Nutritional epidemiology in India bears unique methodological challenges that underscore the need for a nuanced interpretation of the existing evidence. Broadly defined dietary items and patterns coalesce into systematically different foods and meals across the country. Each ingredient bears distinct provenance and preparation techniques tied to socio-cultural and geo-climatic aspects, resulting in substantial variations in energy, macronutrient, and bioactive content that transcend conventional food group-based frameworks (R Daniel et al., 2011). A variety of socio-economic, environmental, and lifestyle factors associated with chronic disease constitute potential confounders that frequently remain unmeasured or inadequately captured—elevating the risk of spurious correlations. Likewise, the combination of India's large population and considerable diversity permits local patterns to emerge regionally and, in some instances, even to household or individual levels; a parallel proliferation of approaches is thus evident in dietary and lifestyle studies concerning chronic disease. Instrumental-variable analyses targeting these environmental determinants provide a means of cautions causal inference whenever longitudinal data is lacking. Societal transitions—whether rural–urban migration, upward economic mobility, digitisation, or climate change—raise parallel questions about the potential distributional effects of national or state-level public policies on chronic-disease-promoting dietary and lifestyle risk factors (Shridhar et al., 2018).

8.1. Data Sources and Measurement of Diet

Relatively few studies have investigated the links between diet and chronic lifestyle diseases in India compared with developed countries (R Daniel et al., 2011). Nonetheless, diets rich in saturated fats, trans-fats, high glycemic index carbohydrates, undue sugar and salted foods are associated with an increased prevalence of cardiovascular diseases and type-2-diabetes. In contrast, traditional Indian diets emphasizing the consumption of millets/self-cultivated foods, vegetables, fibre rich staples and nuts have been shown to have favourable effects on cardiovascular health, deviation from which has increased risk factors for chronic diseases (Shridhar et al., 2018). Diets, physical activity and energy balance are key lifestyle determinants associated with chronic diseases and their related complications. Energy balance, dietary patterns and physical activity constitute the three pivotal multiple mediators in influencing the association between other lifestyle variables and chronic disease burden.

8.2. Confounding Factors and Causality

Dietary patterns represent a key pillar of lifestyle and health, as demonstrated in previous studies showing a direct association between dietary patterns, cardio-metabolic risk factors, and blood pressure levels (Shridhar et al., 2018). A cross-sectional investigation of dietary patterns in India highlights considerable regional differences in diet and obesity, yet cross-sectional data limit the prospect of establishing causal relationships. Empirical evidence continues to mount regarding the connection between chronic disease and lifestyle factors, including diet, physical activity, tobacco use, and alcohol consumption. The increased prevalence of cardiovascular disease and type-II diabetes, often clustered together, is a significant public health challenge. Agricultural policy, food availability, food prices, and biofortification – both in terms of convenience and cost – represent influencing factors on healthy eating patterns. Lifestyle changes and dietary patterns impact rising levels of physical inactivity and unhealthy dietary habits and are catalysts for growth on diet-related chronic disease risk in many societies evidence indicates the diet-disease relationship is evident across lifecycle stages, from early childhood development to geriatric nutritional security.

8.3. Equity, Regionality, and Social Determinants

Diet is one among a myriad of risk factors implicated in chronic lifestyle diseases, but it is widely acknowledged as the major modifiable factor in both developed and developing countries. The relationship between dietary habits and chronic diseases in India has been a topic of keen interest for the scientific community, especially after the 1998 Monograph publication on Diet and Coronary Heart Disease – the first monograph to provide evidence on the relationship between diet, lifestyle, and chronic diseases for the Indian population. The relationship is complex with many interrelated risk factors influencing specific diseases, and several epidemiological studies have been conducted across India to investigate these relationships. Epidemiological data from the Adult Indian Migration (AIMS) study in 2015 indicated a high occurrence of diabetes, hypertension, and dyslipidaemia among Indians even at an early age. The increased prevalence of diabetes was consistently evident even with a lower Body Mass Index (BMI) as compared to BMI levels in the West. The various chronic cardiovascular diseases prevalent in India illustrate the impact of food habits on health; namely coronary heart disease, diabetes, hyperlipidaemia, and hypertension have been recognized as the four main dietary diseases, several studies have also documented a strong association between dietary patterns and other chronic lifestyle diseases. Aggarwal et al. (Shridhar et al., 2018) reported the possibility of establishing Dietary Guidelines based on local foods in various states of India for adults. The report noted a general trend onwards increased consumption of energy-dense food and decreased consumption of low fat-high carbohydrate foods across all states.

9. Conclusion

India faces challenges in addressing diet-related chronic diseases due to its rapid demographic transitions, urbanization, population density, cultural diversity, and changing lifestyles. A substantial burden of diseases affected by diet has already emerged, and the demand for evidence-based public health solutions is evident. Chronic diseases such as cardiovascular diseases, type 2 diabetes, obesity, metabolic syndrome, and certain cancers are becoming increasingly prevalent through dietary transition across all population strata. Early transitions have occurred in urban regions, while rural and semi-urban areas are experiencing fast-moving transitions. Diet includes patterns of food and beverage consumption and other habits of food choice preparation, cooking, processing, and eating. Nutrition behaviour refers to diet-related life circumstances, health knowledge, attitudes toward health, lifestyle demands, and dieting patterns. Lifestyle encompasses interactions with the physical, social, cultural, and economic environment. While life stages can be identified, these descriptors are more comprehensive when observed in an Indian context. Food habits comprise food intake, including food avoided, when to eat, how much, food sources, processing techniques, and other family restrictions. Hence, diet broadly denotes each constituent of food consumed, while lifestyle classifies nutrients and energy consumed and considers the extended consequences of those habits on the quality of life.

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