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GENDER DIFFERENCES IN FOOD INTAKE AND DIETARY PATTERNS AMONG ADULTS ACROSS HOUSEHOLDS IN SOUTH INDIA

By

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MASTER OF PUBLIC HEALTH

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GENDER DIFFERENCES IN FOOD INTAKE AND DIETARY PATTERNS AMONG ADULTS ACROSS HOUSEHOLDS IN SOUTH INDIA

By

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BACHELOR OF SCIENCE IN HEALTH PROMOTION
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Abstract

Gender Differences in Food Intake and Dietary Patterns among Adults across Households in South India

By Apoorva Kommajosula

Objective

The objective of this study is to examine gender differences in food intake, dietary diversity, and dietary patterns across rural and urban households in a remote district in South India.

Methods

The sample is representative of adults living in Vijayapura district, Karnataka State, India. The Nutrition Transition Food Frequency Questionnaire (NT-FFQ) quantitative instrument was used to collect cross-sectional data on frequency of intake of 69 food items. Student t-tests were used to compare weekly food intake of food groups and food variety between men and women and urban and rural households. Principal components analyses were conducted to identify dietary patterns. Linear regression analyses were conducted to examine the association between weekly food consumption and gender as well as the association between demographic/socioeconomic characteristics and dietary patterns.

Results

Women had more frequent consumption of pulses, fruits, dairy, local sweets, and global food items, such as global breads, cereals, and sweets, and slightly less varied diets (49 vs. 50 food items) than men. Non-vegetarian items were more frequently consumed by men than women. Urban residents had frequent intake of more expensive food items, such as fruit and dairy, and slightly more varied diets (51 vs. 50 food items, for urban men and women; 49 vs. 48 food items, for rural men and women) than rural residents. Four dietary patterns were identified. The "Snacks, Cereals, and Sweets" dietary pattern was the dominating pattern for adults. Men were more likely to consume the "Non-Vegetarian" and "Vegetarian" dietary patterns whereas women were more likely to consume the "Dairy, Fruits, & Nuts" dietary pattern.

Conclusion

Food consumption, dietary diversity, and most dietary patterns were significantly different between men and women. Possible explanations for such differences include cultural and gender norms, access to food, and food availability. Findings emphasize the need to understand gender differences in food patterns to inform gender-appropriate diet recommendations and improve nutrition outcomes among adults in this nutrition transition context.

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INTRODUCTION

Background

Malnutrition, generally defined as the lack of, excess, or imbalance of essential nutrients in the body, has become a major public health concern among low- and middle-income countries in recent years [15]. Similar to other low- and middle-income countries, India too has been experiencing a double burden of malnutrition, with both a high prevalence of underweight and overweight individuals coexisting across the region and within households [1-3, 10, 15]. India itself has a Global Hunger Index (GHI) score of 27.2 on the 100-point GHI Severity Scale. A GHI score between 20.0 and 34.9 on the GHI Severity Scale places India in the serious category for hunger and malnutrition, with 14% of the population being undernourished and greater than 11.8% of the population being obese [17, 55]. Women are further affected by malnutrition than men [17]. Across Karnataka state, 31.8% of women ages 15-49 residing in urban regions were found to be overweight or obese in 2016 [7, 8, 16, 17]. Despite progress being made to meet the global nutrition targets, limited progress has been made in the last decade in reducing diet-related non-communicable diseases (NCDs), such as obesity and heart disease among adults at national and regional levels [17]. Furthermore, diet-related NCDs have been found to be associated with a high burden of healthcare utilization and out-of-pocket expenses in India [6].

Economic growth, urbanization, and globalization might be contributing to the increase of low nutritional quality, global foods across food markets. Traditional foods are being replaced with more unhealthy, fattening food options, such as refined carbohydrates, snacks, fried foods, and processed foods. This shift in diet across food markets is called nutrition transition [5, 39, 78, 82, 95]. Changes in food availability and accessibility have been noted to alter dietary quality and food choice as well as increase the risk of obesity, type II diabetes, atherogenic dyslipidemia,

subclinical inflammation, metabolic syndrome, and heart disease among other diet-related NCDs in adult populations [5, 9]. Research highlights differences in diet-related NCDs by gender, age, economic status, and wealth index, disproportionately affecting women, mothers, older adults, and poorer individuals [7, 8, 11-14]. These studies particularly draw attention to differences in food consumption and dietary diversity across gender. National findings show men have higher dietary diversity and consume more fruits and vegetables than women [4, 80, 98]. However, in this nutrition transition context, there is a substantial lack of research assessing food intake, dietary diversity, and dietary patterns across gender using household level data in south India.

For men and women, the Indian dietary guidelines strongly encourage less consumption of processed foods, high fat, oil, and sodium and regular consumption of fruits (at least 100 grams regularly) and vegetables (at least 300 grams/daily) as they are rich sources of micronutrients [12, 13, 38]. Having a diverse diet is also an essential public health recommendation to ensure adequate intake of essential nutrients and to ultimately reduce chronic disease risk among Indian adults [38]. Despite these recommendations, high burdens of nutrition deficiency and diet-related NCDs, varying across gender, along with the changing food environment shed a light on the need to understand gender-specific food consumption and variations in dietary patterns among adults in India. Additionally, studying food intake patterns between men and women may help identify gender-specific food choices, dietary habits, and risk of chronic disease.

Objective and Research Question

The present study evaluates whether there are differences in the frequency of food intake and dietary patterns between men and women. To contribute to existing dietary pattern research

in India, the primary research question of this study is the following: given the nutrition transition in India, what are the gender differences in food intake, dietary patterns, and dietary diversity among adults across urban and rural households in Vijayapura, Karnataka?

LITERATURE REVIEW

Indian Dietary Guidelines

National Institute of Nutrition identified six dietary goals specific to Indian populations: (1) maintain positive health, (2) reduce nutritional deficiency, (3) prevent chronic diet related disorders, (4) improve weight status among children and adolescents, and (5) ensure nutritional status and health of pregnant women and (6) elderly populations [38]. To meet these goals, the Indian dietary guidelines highlight that a balanced diet, meeting the recommended dietary allowance (RDA), typically includes 50-60% of total calories from carbohydrates, 20-30% from fat, and 10-15% from proteins, varying by physiological groups [38].

Most literature has described the need for Indian populations, specifically adult populations in India, to consume moderate amounts of oils, animal foods, and fats, particularly saturated fats and trans fatty acids and invest more in protein-rich foods, with minimal usage of ghee, butter, and Vanaspati [37, 39, 41]. Gupta et al. described that the National Consultative group by the Nutrition Chapter of the Indian Academy of Pediatrics (IAP) recommends avoiding consumption of junk foods, processed foods, and sugar-sweetened beverages, limiting the consumption to no more than one serving per week [41]. Additionally, to obtain adequate nutrients, the guidelines emphasize the importance in consuming vegetables, fruits, coarse/whole grains, and pulses for all populations [38]. Thus, the Indian dietary guidelines are also key in determining whether populations are meeting nutritional requirements.

Measuring Dietary Patterns

In order to understand whether populations are meeting dietary recommendations, many studies use food intake information such as portion size, average daily intake of foods, and

frequency of food group consumption as indicators to measure diet and nutrition adequacy [65-69]. Food pictures and booklets are further used as tools to assess portion size and food items consumed (or not consumed) within populations. Across nutrition and cancer epidemiology, common approaches to identify food consumption patterns are by employing advanced statistical procedures called cluster and exploratory factor analyses (EFA) [65-69]. Cluster analysis focuses on grouping individuals into subgroups based on food intakes while EFA groups food variables that are consumed together and share similar characteristics, providing correlations/factors between foods. These groupings help describe general dietary patterns and practices. EFA can be further used to assess heterogeneity in population characteristics (e.g., racial, gender, age groups) across dietary patterns. A combination of cluster analysis and EFA have been performed; however, more studies apply EFA methods to identify specific dietary patterns and foods that are related to one another [65-69].

Diet-Related Diseases

Double Burden of Malnutrition

Despite increased efforts to implement Indian dietary guidelines, nutrition education, and communication strategies, India was ranked 100 out of 119 countries for malnutrition across all age groups in 2017, with 14% of the population being undernourished [1, 44]. Consequences of malnutrition include heightened risk of diseases and health complications from weakened immune systems [1]. The World Health Organization (WHO) defines malnutrition as undernutrition or overnutrition, with a Z-score cut-off above and below two standard deviations to classify weight-for-height. For Asian cut-offs of body mass index (BMI), this is less than 18.5 kg/mg^2 and BMI greater than 23 kg/mg^2 [3, 15]. This coexistence of undernourished (or

underweight) and overnourished (or overweight) individuals can be attributable to this "double burden" of malnutrition [8, 49]. Several studies have examined malnutrition and double burden of malnutrition in India, but the study population, variables of interest, type of study, and settings vary from study to study [2, 8, 22, 45-49].

Malnutrition is deeply tied with the socioeconomic profile in India [2, 22, 46, 47, 49]. Recent documentation provides evidence that the burden of under- and over-nutrition is higher among lower socioeconomic groups and households in poverty [2, 49]. This complex relationship between socioeconomic factors and malnutrition differs across gender and age groups [2]. For example, using nationally representative data from the India Human Development Survey 2005, Kulkarni et al. found that women between the ages 22-49 years who are underweight/undernourished are of lower socioeconomic status than overweight/overnourished women [49]. On the other hand, more granular data from a 2018 study in Bangalore city, India showed that socioeconomic distance is reducing among undernourished and overnourished women [48]. Studies have also noted other factors such as lack of knowledge and poor sanitation associated with the double burden of malnutrition within Indian populations [8, 49].

Non-Communicable Disease

Variations in morbidity risk, prevalence, and rates across states and regions in India prove that disparities in chronic conditions exist within the country [3, 9, 25, 26, 55, 64]. 378 million individuals under the age of 54 were either overweight or underweight nationally [25]. Among adults aged 18 years or older, 21.6% of women and 17.8% of men were overweight while 24.2% of women and 23.1% of men were underweight in 2016 [76]. Nationally

representative surveys, the 2005-2006 National Family Health Survey and the 2004-2005 India Human Development Survey, revealed that rural areas had a wider range of underweight prevalence than urban areas, 12.5% - 30.0% and 10.6% - 42.4%, respectively. Conversely, urban areas had a wider range of overweight prevalence than rural areas, 2.4% - 41.9% and 1.0% - 14.5%, respectively [25]. Absolute burden of unhealthy weight (defined as both overweight and underweight) was found among individuals residing in rural and urban areas in India. Underweight was the primary type of unhealthy weight for all ages in rural areas whereas overweight was the main type of unhealthy weight for all ages in urban areas, especially individuals 30 years and older [25]. While these national trends identify an urban-rural difference, minimal differences in prevalence of overweight and obesity between urban and rural areas were found among states, such as Punjab and Kerala [26]. Moreover, weight differences were identified across age groups, with the adult population being more overweight (33%) and obese (25%) than younger populations in Punjab [26]. Similar findings were reported across households in Delhi, Mumbai and Trivandrum; 50% of individuals aged 35-69 years across these regions were overweight or obese [24].

Indian adults are also at a high risk for hypertension and/or diabetes. National data from 2012 to 2014 indicate crude prevalence rates of 25.3% for hypertension and 7.5% for diabetes [42]. Jayanna et al. reported that 11.9% of study participants had one or both of these diseases at the state and city levels [9]. State and national level gender differences were also described; prevalences of diabetes and hypertension were higher among men than women [9, 20]. Variations in these chronic conditions across regions can be attributable to differing dietary intake among adults [20]. Findings from the National Family Survey (2005-2006) suggested that vegetarian diet (including lacto vegetarian, lacto-ovo vegetarian, and semi-vegetarian) has a

protective effect from type II diabetes and hypertension [20]. For example, the odds of having positive diabetes status was lower among men who had a vegetarian diet than men who had a non-vegetarian diet (lacto-vegetarian diet (aOR): 0.66 and semi-vegetarian diet (aOR): 0.45). Similar results were found among women (lacto vegetarian diet (aOR): 0.70) [20].

Food Consumption Patterns and Nutrition

Cereals are a major component of the Indian diet [11, 28, 30]. In most eastern states and Maharashtra, cereal and vegetable consumption is more than two times higher than the Indian average, particularly among adolescents and adults [11, 30]. Thus, many populations within these regions meet recommendations for grains and vegetable consumption. From 2011 to 2012, median per capita per day of vegetable intake significantly reduced across both urban and rural households, from 145 to 99 grams and from 155 to 117 grams, respectively [13]. In a 2015 community based cross-sectional study, it was found that vitamin A rich vegetables and fruits were rarely consumed among individuals living in an urban slum in Delhi, showing that consumption of micronutrients (vitamin A, folate, and riboflavin) was insufficient in this population [12]. Adults in Maharashtra showed low vitamin A, riboflavin, calcium, and folate intake, similar to the urban slums in Delhi, while macronutrient intake along with thiamine and niacin were consumed more than 70% of the recommended levels [11]. Therefore, it should be emphasized to regularly consume more micronutrients among Indian adults, especially older adult groups and pregnant women [22, 79].

A study using data from the National Family Health Survey (2005-2006) found that a majority of the Indian population (80%) classify as non-vegetarian [20]. Rice, wheat, pulses (dal), milk products, salt, sugar, fats, and oils are also consumed frequently across the country as

well, but on varying levels [11, 12, 24, 28]. For example, households across urban cities such as Delhi, Mumbai, and Trivandrum noted having different dietary patterns. The primary and secondary patterns were found to be “fruit-dairy” and “vegetable-pulses” in Delhi, “fruit-vegetables" in Mumbai, and pulses-rice” and “sweet-snacks” in Trivandrum [24]. Despite lower fat intake in Trivandrum, populations within this region consume foods associated with abdominal adiposity, such as dairy, snacks, and sweets, more than populations in Delhi and Mumbai [24]. Other south Indian states had dietary patterns characterized by sweets and snacks [56]. Food quantity and diversity also influence weight status. According to Satija et al., obese individuals eat food items such as carbohydrates, sugars, fats, vegetables, pulse, etc. in large quantities [23]. Prior studies also suggest that low diversity of food is associated with low BMI among adults [11, 14, 27, 31].

Food Environment and Food Choice

Globalization and Nutrition Transition

With increases in urbanization, globalization, and economic development, low- and middle-income countries, such as India, are experiencing shifts in food consumption patterns. In India, this nutrition transition entails moving from consuming more traditional foods, such as whole grains, vegetables, fruits, and nuts towards consuming more sugar, fatty foods, refined carbohydrates, polished grains, processed foods, fried foods, animal products, and snack foods [5, 10, 12, 50, 51]. As a result of this shift, malnutrition (overnutrition and undernutrition) and nutrition-related NCDs have also been increasing across all socioeconomic strata at the individual and household levels [49, 52-54]. Many studies revealed a significant association between overnutrition/obesity and consumption of snack foods and fast foods [41, 51, 55-57].

Introduction of global foods not only in urban settings but also in lower-income settings and more recently, rural areas, have contributed to changes in the food consumer context in terms of food availability and accessibility in low- and middle-income countries [50]. Majority street vendors in low-socioeconomic, urban and rural areas in India are selling more packaged/branded snacks and deep-fried snacks, attributable to high demand, affordability, and convenience [41]. There are also cultural perceptions and beliefs related to decisions surrounding consumption of global foods. For example, adolescents linked global foods to modernity, prestige, and higher status whereas women recognized that outside snack foods were unclean and unhealthy [51, 84, 85].

Food Choice and Procurement

To understand dietary patterns across households, it is essential to determine factors that play a role in driving food choice. Higher family income and educational attainment were significantly associated with choosing healthier, more expensive food items across urban and rural households [59]. Decisions regarding food procurement were found to be associated with heavy family involvement within households [10, 28, 58]. For example, a 2018 mixed methods study conducted in Delhi, India revealed that primary drivers of food choice were women, husbands, children, and in-laws within households [58]. Women were more influential regarding food procurement decisions; they reported that their food choices were often driven by their food preferences of family members. For example, women claimed that their husbands' food patterns play a vital role in food item selection rather than their own [28, 58].

Proximity to stores played an important role in these decisions, particularly with fruits and vegetables. Purchasing variety of foods was associated to time and demands of work of the

women purchasing [58]. Bailey et al. further mentioned that the majority of participants reported convenience and food price as other factors associated with food choice [58]. Despite increase in food production in recent years, growing demands and increases in income have resulted in rising food prices. In 2011, it was reported that 63%-76% of Indians living in rural households were unable to afford healthy, recommended food items, such as dairy, vegetables, and/or fruits [75]. Additionally, literature identifies a strong association between fruit and vegetable prices and seasonality in India, with seasonal variations explaining differences in expenditure and consumption pattern of food [28, 75]. Food prices were found to be the highest during the beginning of monsoon season and remain high till October specially for fruits and vegetables while lowest food prices are observed in the last third of the calendar year. On the other hand, oils, fats, dairy, and other staple items were found to have weak association with seasonality [75].

Major Sources of Food Supply

The Public Distribution System (PDS), a food security system operated collaboratively by the national and state governments, contributes to dietary patterns across regions in India, as it distributes subsidized essential foods for households below the poverty line (BPL) and households with an Antyodaya Anna Yojana (AAY) card [14, 18, 82]. This policy and implemented system is one of the main strategies by the Indian government to tackle the high rates of undernutrition among the poor [18]. Food items which are subsidized or free through PDS include rice, pulses, oil, salt, and kerosene; these items are distributed through Fair Price Shops [82]. In the state of Uttar Pradesh, it was reported that households in rural areas utilized PDS more regularly than those in urban settings [19]. The odds of PDS utilization was also

higher among households with more food insecurity (aOR: 1.06) and less wealth/income (aOR: 1.05) [19]. Similarly, Parappurathu et al. found that reliance on PDS was higher among households with smaller land categories in eastern India villages, indicating successful coverage of PDS among BPL households within this region [30]. The states of Odisha and Jharkhand displayed heavy dependence on PDS, especially for cereal products, unlike the state of Bihar [30]. On the contrary, a 2013 household study reported women from PDS-eligible households purchasing food items from nearby shops, markets, and supermarkets regularly with no mention of PDS stores in low-resource areas of Delhi [28]. These regional (including state and village) disparities in PDS dependence can be associated with PDS performance, quality of foods, household dietary patterns/food selection, and/or household socioeconomic status [30]. For example, a higher proportion of urban households reported PDS rice was lower quality than nearby stores/markets [19]. Coverage failures among other barriers, such as corruption and leakage, pollute PDS, prevent PDS from performing optimally and having positive effects in certain regions [18].

Influential Factors for Dietary Diversity

PDS access is a major contributing factor to household dietary diversity [29, 30]. It was found that PDS usage allows households to save money and spend it on other food items, such as fresh fruit, vegetables, edible oil, milk, as well as non-vegetarian items [30]. Age, gender, education of the household head, household size, food security level of the household, religion, caste, and access to PDS are determinants of dietary diversity [28, 29, 30, 75]. For example, a positive association was reported between dietary diversity and household members; as the number of household members increases, so does the diet diversity score [30]. Also, mild to

severe food insecure households had lower diet diversity scores, particularly among children, than food secure households in Maharashtra [14]. In Mysore, Karnataka, poor diet was common among all education, age, gender, and caste groups [9]. National studies further reported low diversity in fruit and vegetable intake among rural and urban households [13, 27]. Household income/food budget, food prices, seasonality, storage facility, and food preference of household members also influence the variation in food items purchased and consumed [28, 58, 75]. Specifically, food prices deterred individuals from choosing more expensive, healthy food options, decreasing selection of diverse food items and consumption of a balanced diet [58].

Differences in Nutrition and Dietary Intake Patterns

Age

Previous studies have noted differences in food consumption by age [20, 29]. A 2014 study using data from a nationally representative household consumption expenditure survey revealed that compared to younger age groups, older age groups of household members were more likely to consume a variety of food, indicating that dietary diversity increased consistently with age [29]. On the contrary, the same study found that the age of the household head was not significant on the consumption patterns [29]. A 2016 systematic review focusing on dietary variations across India determined that dietary patterns did not differ by age groups [56]. As a result of inconsistent findings regarding the role of age on dietary intake patterns, it is crucial to include age as a variable when studying food consumption patterns.

Gender

Singh et al., Daniel et al., and Patel et al. reported that women were more obese and overweight than men in both rural and urban settings, particularly higher among older women in the 40 to 49 years age group [12, 24, 25]. Nation-wide, approximately 145 million men were underweight while 132 million women were underweight; approximately 46 million men were overweight while 55 million women were underweight [25]. Prominent gender differences in obesity were among adults ages 40 to 49 years (PR: 0.34) [25]. When comparing urban and rural regions, women living in urban areas exhibited higher prevalence of obesity than rural women (34.3% and 23.2%, respectively), even among states that are considered "overweight", such as Kerala, Punjab, and Delhi [26]. These trends are increasing among women living in urban areas and among mothers in India [27, 31, 40].

Gender disparities in overweight/obesity prevalence could be attributable to varying levels of dietary diversity and consumption of healthy and unhealthy foods [27, 31]. Majority of women faced poorer diets and either extremes of dietary diversity, resulting in higher chronic energy deficiency and undernutrition than men [4, 10, 11, 99]. Mothers particularly experienced lower dietary diversity [31]. Prior studies also note lower fruits, vegetables, and dairy consumption among women than men [11-13, 79, 80, 98]. Unlike women, men were found to have low chronic energy deficiency and moderate dietary diversity [11].

On the other hand, a 2016 systematic review, which included studies on adult and children populations from diverse geographical regions across India, revealed that dietary patterns and types of foods consumed were not significantly different by gender in India [56]. Despite these findings, evidence shows gender differences in diet-related risk factors, NCDs, and nutrition status, indicating that underlying food patterns might be a contributor to such

differences [11, 12, 24-27, 93]. Since there is a lack of research studying gender differences in food intake patterns in south India, this study focuses on gender as a main variable.

Rural and Urban Areas

Urban and rural differences in dietary intake should be considered as rapid urbanization is occurring in India. Collectively, current research on urban and rural differences in dietary intake is inconclusive [27, 60, 61]. Carbohydrates are still a major source of energy for individuals residing in both urban and rural areas [58]. A cross-sectional study using WHO STEPwise Approach to NCD Risk Factor Surveillance (STEPS) survey results further showed that there were minimal to almost no urban-rural differences in dietary habits, particularly in fruit and vegetable consumption. The study found an average consumption of 2.3 servings of fruits and 2.2 servings of vegetables/day in urban and rural areas. It is also worth noting that these differences were not statistically significant when comparing food intake differences between men and women [27]. Within this study, the only significant difference between urban and rural contexts was in dietary salt intake, showing that rural residents (15.6%) consume more salt than urban residents (9.1%) [27]. Conversely, findings from Consumer Expenditure Surveys and a community based comparative survey point towards urban-rural differences in dietary intake [13, 60]. Among women residing in South India, the odds of consuming a higher caloric diet was greater among urban women than rural women (OR = 1.92) [60]. Similarly, nationwide, while diversity in vegetable and fruit intake was poor in both urban and rural settings, a significant difference in fruit and vegetable intake was noted among rural and urban households [13]. In the same study, rural households consumed an average of 145 g/capita/day of vegetables and 15 g/capita/day of fruits while urban households were found to consume an average of 155

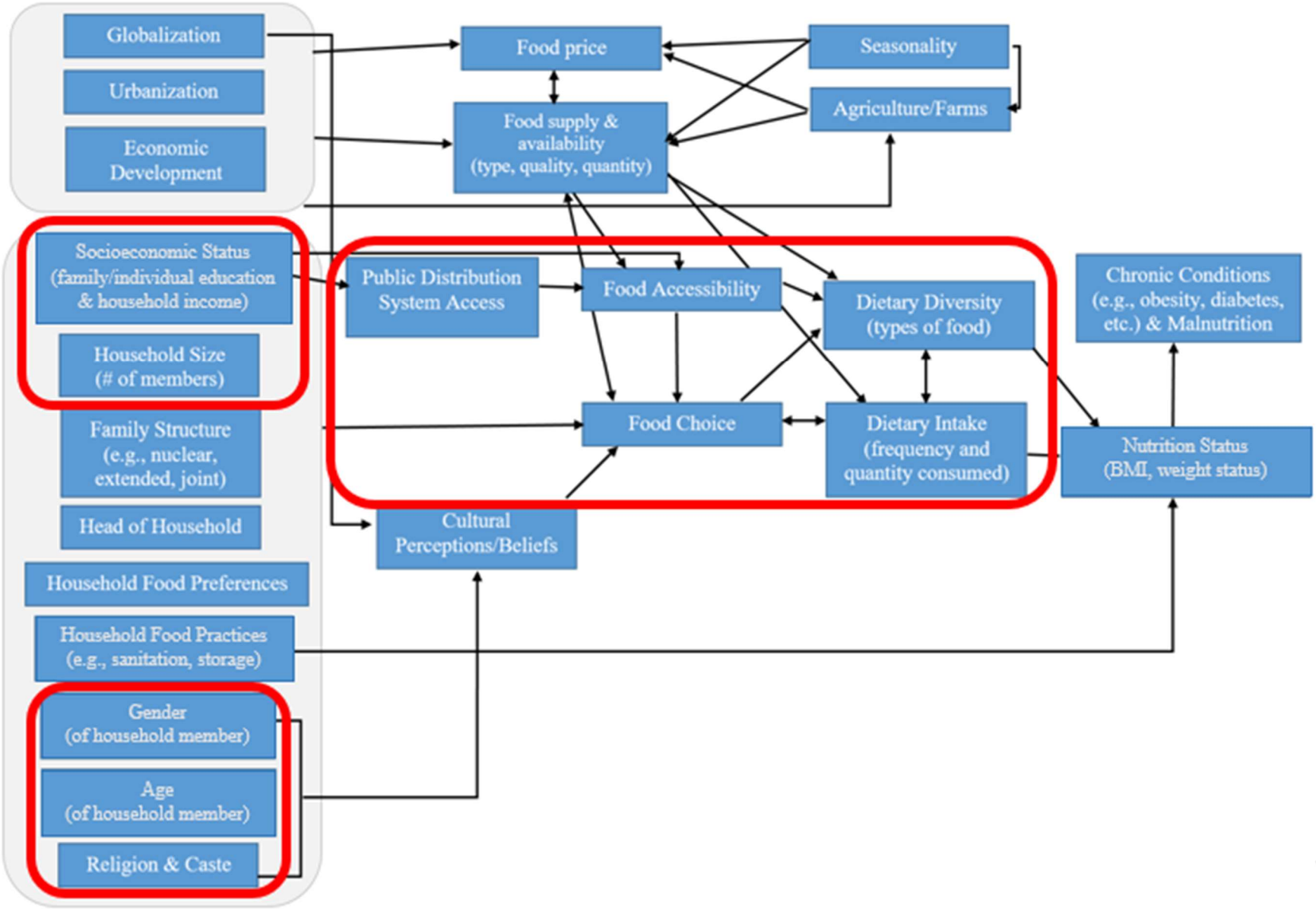
g/capita/day of vegetables and 29 g/capita/day of fruits. Furthermore, from 2011 to 2012, 21% of rural households reported not consuming any fruits whereas 10% of urban households reported not consuming any fruits [13]. Discrepancies across literature regarding dietary diversity and intake between urban and rural areas show the need to study regional differences in food consumption.

Household and Family Environment

Family environment has been established as a contributing factor in dietary intake and nutrition outcomes among Indian populations [10, 14, 21, 22, 62]. A study conducted in Vijayapura, Karnataka reported variations in body weight within households, suggesting that income, household resources, family food practices, food-related gender norms, and other family-level characteristics influence nutrition status and dietary intake [10]. This study also looked at weight status between siblings of opposite genders and between mothers and children. A positive association was found between mother's BMI and child's BMI and weight status, as dual burden pairs (underweight child and overweight/obese mother) were found and every overweight child had an overweight mother among this population [10]. This is similar to the findings in Swaminathan et al. BMIs between parents within a household were correlated and child BMI was associated with the parent's BMI; however, mother's weight status was identified as not being a significant determinant of the child's weight status [21]. Parents' fat, oil, and sugar intake was found to influence parent and child weight status within the same household [21]. At the district and state levels, lack of dietary diversity determines child stunting as well as mother and child nutrition/weight statuses. Stunting and weight status were both determined by household income-level and wealth across the country [22]. Additionally, statistically significant

associations in dietary intakes (consumption of protein, carbohydrates, fats and oils, and sugars and sweets) between spouses was identified, indicating how household environment and characteristics play a role in food consumption among families [21]. Many studies also indicated household size as an influential factor in household dietary intake and diversity as households with more members had higher dietary diversity [30, 62].

Figure 1. Representation of Conceptual Framework



Narrative Description

Figure 1 is a representation of the conceptual framework. In the grey boxes are national-, household-, and individual-level predictors for dietary patterns, dietary diversity, and intake of food groups. The main variables and pathways focused in this study are circled in red. The main outcomes for this study are dietary diversity and dietary intake, with a focus on dietary patterns. Nutrition status and chronic conditions (obesity, diabetes, hypertension, etc.) are distant outcomes, not of direct interest in this study, but are deeply rooted in the implications of studying food intake and dietary patterns. Globalization, urbanization, and economic development are national level predictors potentially driving the nutrition transition in India. These predictors are related to food pricing, food availability/supply, and the agricultural industry in India. Globalization is also correlated to a population's cultural perceptions and beliefs regarding food consumption. Seasonality is directly related to agricultural productivity. Both seasonality and agricultural industry play a role in food pricing and availability. Supply of food is associated to food accessibility and food choice while demand for food in the markets is a major determinant of food supply and availability. Education level, gender, age, and religion & caste are individual-level predictors while household income, household size, family structure, head of household, household food preferences are household-level predictors. PDS access is dependent on household income and education level, both socioeconomic indicators, which is related to food accessibility. It should be noted that PDS, all individual-level predictors, and only household income, household residence (urban vs. rural household), and household size will be included in this study due to data availability and variables collected from the study population.

DATA & METHODS

Study Background

Study Population and Data Source

The study included households with adults, adult women and adult men, and an adolescent between the ages of 10 and 19. In some households, only one adult was available to participate in the study. The data for this study were collected in 2019 from Vijayapura (Bijapur) district, a rural district in the State of Karnataka, India for a larger study on drivers of food choice. Two study sites within this district were selected, one representing households in an urban community, Vijayapura city, and another representing households in a rural community, Ukkali village. Vijayapura city, the district capital of the district, has a total population of 327,427. Ukkali village is located 18 km from Vijayapura and has a population of 8,519 individuals (approximately 1,759 houses) [77]. Both regions in Vijayapura district are experiencing a changing food environment in conjunction with globalization of food options and economic development across the district in recent years. There have been increases in food retail such as grocery stores/supermarkets, bakeries, and street food eateries [78].

Data Collection

The study sample is a representative sample of households in both the urban and rural communities in Vijayapura district. The urban sampling frame included households from an existing cohort of 404 households with school-going adolescents between the ages 10 and 19 years of age in 2012 in Vijayapura City. The rural sampling frame included a list of school-going adolescents between the ages 10 to 19 years from a 2019 school roster of seven schools in Ukkali

village. School rosters were merged and students from classes 6 to 12 were randomly selected using simple random sampling techniques. For both urban and rural samples, households of these school-going adolescents were visited to recruit and interview two adults, male and female. For the urban sample, households with no adolescents, households that shifted to another city, households that were unable to be contacted due to migration to a new city, or adolescents who lived outside Vijayapura for education/work were excluded from the study. For the rural sample, adolescents were excluded if they were attending one of the seven schools but lived in a different village, had a number of absenteeism in school, or if there was a family dispute in the adolescents' household. A total of 273 urban and 225 rural households were selected, with response rates of 97% and 98.6%, respectively. Of the 273 urban households, data were collected from 265 households (265 adult females, 245 adult males, and 265 adolescents) and of the 225 rural households, data were collected from 222 households (222 adult females, 222 adult males, and 237 adolescents). Study instruments were developed and pre-tested prior to implementing them within households. Survey instruments include: (1) socioeconomic status and PDS questionnaire; (2) nutrition transition food frequency questionnaire; (3) food choice questionnaire; (4) adolescent health questionnaire. Adults were only asked questions from the Socioeconomic, Food Choice, and Nutrition Transition Food Frequency Questionnaire Modules (NT-FFQ). All data collected were self-reported and were collected in 2019.

Variables

Outcome Variables

The main outcome variable used for analyses is average consumption per week of identified food items. Studying these variables also help determine whether adults are consuming

a combination of foods from all food groups, or dietary diversity. 69 food and beverage items were sorted into 10 categories: (1) global foods; (2) Indian snack foods ; (3) sweets, mithai, desserts; (4) dairy products; (5) beverages; (6) fruits; (7) seasonal fruits; (8) vegetables; (9) common Indian foods; (10) non-vegetarian foods . Each food item was also coded for frequency of consumption (daily, few times per week, once per week, 2-3 times per month, once per month, sometimes, never).

Covariates

Covariates covered two domains: individual and household characteristics. Adults were categorized as male or female. For the purposes of this study, sex is the main independent variable. Other covariates of interest include age (continuous variable), education of the adult household member, number of family members, religion, caste, household income, and PDS usage. Education of household members was categorized by five categories: never attended, pre-primary school, high school, PUC/Diploma, degree and above. Adults also reported number of family members, which is a continuous variable. For religion, the variable was categorized into five groups: Hindu, Muslim, Christian, Jain, and Buddhist. For analysis purposes, only four categories were used for religion: Hindu, Muslim, Christian, and Jain. No respondents reported that they were Buddhists, therefore it was not included in analyses. Caste was categorized into four groups: General Caste, Other Backward Class, Scheduled Caste, and Scheduled Tribe. All four groups were used for analysis. Participants also reported monthly household income, which has been categorized into five categories: Less than 5,000 INR, Between 5,000 to 10,000 INR, Between 10,001 to 20,000 INR, Between 20,001 to 30,000 INR, and More than 30,000 INR. The variable for whether participants hold/use a PDS card was categorized into 5 groups: no

card, card that was not used in the past 12 months, AAY, BPL, and APL. For analysis, PDS use was dichotomized as yes/no. The region variable were included for analysis and were used to distinguish between urban and rural households.

Data Preparation

Data Cleaning and Coding

All data from the Socioeconomic Status Module and the Nutrition Transition Food Frequency Module were cleaned for purposes of research and analysis. In the Socioeconomic Status Module, all categorical variables were coded numerically in order. “Refused” and “Don’t Know” options were coded 98 and 99, respectively. All dichotomous variables within this module were coded as 1 for “yes” and 0 for “no”. All missing data were coded with a period (.). For the Nutrition Transition Food Frequency Module, food consumption/week for each food item was coded according to days in a week and weeks in a month. Binary data for consumption of food groups were coded as 1 for “yes” and 0 for “no”.

Statistical Analyses

All analyses were conducted using SAS version 9.4. All results from analyses were representative of men and women in urban and rural households in Vijayapura district, Karnataka. Full cohort of respondents were sampled from January to October 2019.

Descriptive Analyses

Table 1 provides results for the descriptive analysis of each socio-demographic variable for all adult respondents and for each gender group, men and women. Socio-demographic

variables derived from a quantitative survey instrument under the Socioeconomic Status Module. Using literature review findings and conceptual framework, the following individual and household socio-demographic variables were included in descriptive analyses: age, gender, religion, caste, education, household monthly income (INR), number of household members, region (rural and urban), and PDS usage. 'PROC FREQ' and 'PROC MEANS' statements were used in SAS to obtain these values. Binomial statements were performed to retrieve p-values and 95% confidence intervals for each socio-demographic variable for all adult respondents. Cross-tabulations were used to estimate means and standard deviations for continuous variables and frequencies as percentages for categorical variables by gender. Chi-square tests and Fisher analyses (when the assumption that individual cell counts were > 5 was not met) were performed to evaluate the difference in socio-demographic characteristics across gender. Additionally, descriptive analyses were performed using results from dietary pattern analyses (see Dietary Pattern Analyses section below) to capture variations in demographic and socioeconomic characteristics across dietary patterns (Table 7 & 8 in Appendices).

Food Consumption Frequency

Food frequency data were collected via a quantitative survey instrument under the Nutrition Transition Food Frequency Questionnaire (FFQ) Module. Adults, both men and women, within each household with an adolescent were asked "On average, how frequently did you consume _X_ food?" Frequencies of food item consumption were coded as daily consumption = 7, consumption few times per week = 3.5, consumption once per week = 1, consumption 2-3 times per month = 0.58, consumption once per month = 0.23, consumption sometimes = 0.12, never consumed = 0. Participants were also given the answer choice "don't

know". This option choice was also coded as '0' to signify no familiarity or reach with the food item. Grouping this with the 'never' option was done as many adults in this population either do not recognize the food item due to its lack of commonality in food markets or these individuals are not aware of how many times they consume the food item. For the purposes of this study, based on experts and scholars studying nutrition in India, 69 food items were categorized into 21 food groups: (1) global breads and cereals, (2) global savory foods and snacks, (3) global sweets, (4) non-local savory snacks, (5) non-local sweets, (6) rice and rice-based dishes, (7) pulses, (8) wheat, Pearl millet, and sorghum, (9) fruits, (10) vegetables, (11) savory foods and snacks, (12) nuts, (13) local sweets, (14) sweeteners, (15) red meat, (16) lean meat, (17) eggs, (18) dairy, (19) tea and coffee, (20) fruits and juices, and (21) soda and energy drinks. Chi-square tests and student t-tests were performed and food variety score was calculated (sum of the food items consumed), was used to capture differences between men and women in frequency of intake of these food groups and diversity of diet (Table 2). Furthermore, these differences were compared across regions among urban and rural households (Table 3).

Linear Regression Modeling for Food Consumption Patterns

The association between frequency of food consumption and gender was determined by linear regression analyses. Normality is a requirement for the outcome variables for linear regression analysis. Therefore, using the 'PROC UNIVARIATE' function, skewed outcome data were identified. Outcome variables with skewed distributions (either left or right skewed) were log transformed as this allows for the distribution to be more symmetric and nearing a normal distribution [43]. The following food group outcome variables were log transformed: Global breads and cereals, global savory foods and snacks, global sweets, non-local savory snacks, non-

local sweets, wheat, pearl millet, and sorghum, fruits, local sweets, sweeteners, red meat, lean meat, egg, fruit juice, and soda and energy drinks. Also, the gender variable was re-coded, 1 for female and 0 for male. Parameter estimates (β) and 95% confidence intervals for the parameter estimates were found for each regression model using 'PROC REG'. Gender was included as the independent variable and the continuous frequency of consumption of food items were included as outcome variables (Y). The same food groups from the food consumption frequency analyses were used, accounting for 21 outcome variables and 21 linear models (Table 4). The adjusted/full model includes the following variables: gender, age, religion, caste, education, household income, total number of household members, region (urban and rural households), and household PDS usage. The equation for adjusted linear regression model is the following:

$$Y = \alpha + \beta_1 GENDER + \gamma_1 AGE + \gamma_2 RELIGION + \gamma_3 CASTE + \gamma_4 EDUCATION + \gamma_5 INCOME + \gamma_6 TOTAL\_HOUSEHOLD\_NO + \gamma_7 REGION + \gamma_8 PDS\_USE$$

β_1 is a regression coefficient, providing an estimate of change for the outcome variable while adjusting for the confounding variables listed as gammas (γ)**.** Among the confounding variables, all are categorical variables, including dichotomous variables, aside from age and the total number of members within a household.

Dietary Pattern Analyses

Exploratory factor analysis (EFA), specifically principal components analysis (PCA), was used to identify how food groups are consumed in patterns among Vijayapura adults (Table 5). Food groups were entered into the principal components analysis as frequency of

consumption for 21 food groups, as established before in the food consumption frequency analyses. The 'PROC FACTOR' function helped carry out this multivariate statistical technique. Number of factors/patterns was determined by eigenvalues and scree plots; an eigenvalue cut-off of 1.0 was given, based on the Kaiser criterion. Factor loadings were calculated after varimax rotation was employed and were assessed for communality. Food groups with factor loadings ≥ 0.40 were retained per factor/pattern. 4 factors/patterns explained the most amount of variability in the datasets.

Multiple linear regression analyses were conducted to capture the association between demographic and socioeconomic characteristics and dietary patterns derived from the Principal Components Analysis (Table 6). Demographic and socioeconomic variables were independent variables. The same demographic and socioeconomic variables used in the descriptive analyses were also used in these regression models (age, gender, religion, caste, education, household monthly income, number of household members, region, and PDS usage). Factor loadings for each dietary pattern were continuous. These values served as the outcome variable (Y). Similar to the linear regression modeling for food consumption patterns, the gender variable was re-coded, 1 for female and 0 for male. Parameter estimates (β) and 95% confidence intervals for the parameter estimates were found for each regression model using 'PROC REG'. Four dietary patterns were identified and four linear regression models were run. The equation for the multiple linear regression model is the following:

$$Y = \alpha + \beta_1 GENDER + \beta_2 AGE + \beta_3 RELIGION + \beta_4 CASTE + \beta_5 EDUCATION + \beta_6 INCOME + \beta_7 TOTAL\_HOUSEHOLD\_NO + \beta_8 REGION + \beta_9 PDS\_USE$$

RESULTS

Population Characteristics

Table 1 shows the characteristics of all adult respondents stratified by gender. Of the 925 respondents, respondents were on average 45 years old. Women were significantly younger than men (42 vs. 49 years old; $p < 0.001$). The majority of respondents practiced Hinduism (75%) and were part of Other Backwards Class[1] (56%). Similar distributions for religion and caste were found among men and women. About half the respondents (55%) had less than high school education. More women had less than a high school education than men (64% vs. 45%; $p < 0.001$). More men held a degree and above than women (23% vs. 11%; $p < 0.001$). The majority of adult respondents were from families in the second poorest income group (34%) with a household monthly income of INR 5,001 – 20,000 ($US 98 – 196).

Overall Food Consumption Patterns

Table 2 shows the average frequency of intake per week of all respondents. Adults consumed fruits (15.0 times/week), pulses (10.0 times/week), and dairy (13.8 times/week) more frequently than other foods and beverages. The least frequently consumed foods and beverages ($\leq$ 0.5 times/week) were soda, energy drinks, non-local Indian sweets, and red meat. Vegetables, savory foods and snacks, wheat, pearl millet, and sorghum, and rice and rice-based dishes were consumed more than once per day ($\geq$7.0 times/week). Tea and coffee were the most frequently consumed beverage (6.4 times/week). Nuts (3.8 times/week), non-local Indian savory snacks (3.7 times/week), global sweets (3.6 times/week), sweeteners (2.6 times/week), and global breads and

[1] Other Backwards Class is an educationally and socially disadvantaged group of the population classified by the Government of India.

cereals (2.1 times/week) were consumed few times per week. Adults consumed eggs (1.7 times/week), fruit juices (1.5 times/week), global savory foods and snacks (1.4 times/week), and local sweets (1.2 times/week), on average, once per week.

Local savory foods and snacks were consumed more frequently than non-local and global savory foods and snacks. Yet, global sweets were consumed more frequently than non-local (3.6 vs. 0.5 times per week) and local sweets (3.6 vs. 1.2 times per week). It also appears that respondents frequently consumed local foods, such as PDS- and non-PDS-supported staples, produce, snacks, and tea and coffee (>6 times/week). Non-vegetarian foods and non-local/global foods were consumed infrequently in comparison to local foods; however, non-local and global foods, except for non-local sweets, were consumed 1-4 times per week, more frequent than non-vegetarian foods.

Food Consumption Patterns by Gender

Table 2 shows the average frequency of intake per week by gender. Compared to men, women had a significantly higher intake of fruits (16.8 vs. 13.1 times/week), dairy (14.4 vs. 13.2 times/week), global sweets (4.1 vs. 2.9 times/week), sweeteners (3.0 vs. 2.3 times/week), nuts (4.1 vs. 3.5 times/week), global breads and cereals (2.3 vs. 1.8 times/week), pulses (10.1 vs. 9.8 times/week), and local sweets (1.3 vs. 1.1 times/week) ($p < 0.05$). On the other hand, men had a significantly higher intake of fruit juices (1.7 vs. 1.3 times/week), soda and energy drinks (0.5 vs. 0.2 times/week), lean meat (0.8 vs. 0.6 times/week), wheat, pearl millet, and sorghum (7.9 vs. 7.7 times/week), and red meat (0.4 vs. 0.3 times/week) than women ($p < 0.01$).

Men had significantly higher food variety score than women (50 vs. 49 food items; $p < 0.01$). However, this difference is only by one food item, which is less than the difference

between urban and rural residents. A higher food variety score does not indicate that men consumed more nutritious diets, as men could have consumed more "unhealthy" food items, such as snacks, sweets, and packaged foods than women, contributing to differences in food variety score between men and women. The food variety score ranges were 19 to 65 food items for men and 27 to 62 food items for women, indicating men were exposed to higher numbers of foods than women.

Findings generally show that women consumed pulses, nuts, fruit, dairy, and global breads, cereals, and sweets, more frequently than men. These results suggest that women frequently consumed food items from both traditional and global/modern diets. On the other hand, men had higher dietary diversity with more frequent intake of non-vegetarian foods, beverages (fruit juices and soda/energy drinks), and wheat, pearl millet, and sorghum than women. These results may be attributable to accessibility/exposure to food, food-related gender norms, and eating habits.

Food Consumption Patterns by Gender and Region

Table 3 shows the average frequency of intake per week between men and women across urban and rural settings. Urban men consumed dairy (15.7 vs. 10.2 times/week) and fruits (15.3 vs. 10.5 times/week) more frequently than rural men. These food groups accounted for the largest regional differences in frequency of food intake among men ($p < 0.001$). Additionally, compared to rural men, urban men significantly consumed rice and rice-based dishes (9.1 vs. 8.1 times/week), vegetables (10.7 vs. 8.6 times/week), savory foods and snacks (9.6 vs. 8.0 times/week), global sweets (3.5 vs. 2.3 times/week), fruit juices (2.1 vs. 1.3 times/week), local sweets (1.2 vs. 0.8 times/week), non-local Indian sweets (0.6 vs. 0.4 times/week), global savory

foods and snacks (1.5 vs. 1.1 times/week), nuts (3.8 vs. 3.2 times/week), and sweeteners (2.6 vs. 1.9 times/week) more frequently ($p < 0.05$). Conversely, rural men consumed lean meat (1.0 vs. 0.7 times/week) more frequently than urban men ($p < 0.05$).

When comparing urban and rural women, urban women significantly consumed vegetables (10.1 vs. 9.2 times/week), sweeteners (3.4 vs. 2.4 times/week), fruit juices (1.6 vs. 1.0 times/week), rice and rice-based dishes (8.6 vs. 8.2 times/week), and nuts (4.4 vs. 3.8 times/week) more frequently than rural women ($p < 0.05$). Similar to the difference between urban and rural men, dairy (16.8 vs. 11.6 times/week) and fruits (19.8 vs. 13.4 times/week) consumption accounted for the largest regional differences in frequency of consumption between urban and rural women, as urban women had a higher intake of these food groups than rural women ($p < 0.001$). Rural women had significantly consumed savory foods and snacks (9.2 vs. 8.3 times per week) and global breads and cereals (2.7 vs. 1.9 times per week) more frequently than urban women ($p < 0.05$).

The food variety score was significantly higher for urban residents than for rural residents. There is approximately a three-item difference between both urban and rural men (51.1 vs. 48.8 food items; $p < 0.001$) as well as urban and rural women (50.3 vs. 47.4 food items; $p < 0.001$). Among men, the food variety score ranges were 19 to 65 food items for urban men and 30 to 60 food items for rural men whereas among women participants, the ranges were 27 to 62 food items for urban women and 32 to 59 food items for rural women. These ranges suggest that urban populations may be exposed to more types of food than rural populations. Among urban participants, men had a higher food variety score than women, but the difference was only by one item. This is similar to rural participants as well.

Compared to urban women, urban men had significantly more frequent intake of rice and rice-based dishes (9.1 vs. 8.6 times/week), wheat, pearl millet, and sorghum (7.9 vs. 7.7 times/week), vegetables (10.7 vs. 10.1 times/week), red meat (0.5 vs. 0.3 times/week), fruit juices (2.1 vs. 1.6 times/week), and soda and energy drinks (0.6 vs. 0.2 times/week) ($p < 0.05$). On the contrary, urban women significantly consumed fruits (19.8 vs. 15.3 times/week), nuts (4.4 vs. 3.8 times/week), global sweets (4.3 vs. 3.5 times/week), and sweeteners (3.4 vs. 2.6 times/week) more frequently than urban men ($p < 0.05$).

Similar to the urban population, fruit consumption (13.4 vs. 10.5 times/week) accounted for the largest gender difference between rural men and women, as rural women consumed this food group more frequently than rural men ($p < 0.001$). Rural men had significantly more frequent intake of wheat, pearl millet, and sorghum (7.9 vs. 7.6 times/week), lean meat (1.0 vs. 0.6 times/week), fruit juices (1.3 vs. 1.0 times/week), and soda and energy drinks (0.4 vs. 0.1 times/week) than rural women. On the other hand, rural women had significantly more frequent consumption of pulses (10.2 vs. 9.8 times/week), nuts (3.8 vs. 3.2 times/week), local sweets (1.2 vs. 0.8 times/week), dairy (11.6 vs. 10.2 times/week), sweeteners (2.4 vs. 1.9 times/week), vegetables (9.2 vs. 8.0 times/week), global breads and cereals (2.7 vs. 1.6 times/week), global sweets (4.0 vs. 2.3 times/week), and tea and coffee (6.6 vs. 6.3 times/week) than rural men.

Higher dietary diversity and more frequent intake of staples/local foods and expensive food items, such as fruits and dairy, among urban adults compared to rural adults could be related to regional differences in food environment and accessibility of such foods. Both urban and rural women frequently consumed more global breads, cereals, sweets as well as traditional foods such as fruits and nuts than urban and rural men. These findings suggest that global foods are also being incorporated within diets among women not only in urban but rural settings. Rural

women in fact consumed more global breads and cereals than rural men and urban women. In addition, both urban and rural men consumed more meat (red meat among urban men and lean meat among rural men) than urban and rural women, possibly due to higher exposure of these items among men than women. Gender differences were observed in the consumption of pulses, wheat, pearl millet, and sorghum, tea and coffee, and soda/energy drinks. Both urban and rural men consumed soda/energy drinks and wheat, pearl millet, and sorghum food items more frequently than urban and rural women. Rural women had more frequent intake of pulses and tea and coffee as opposed to rural men. It should be noted that only regional differences were found in the consumption of local and global savory foods and snacks as well as non-local Indian sweets; urban men consumed these food items more than rural men.

Adjusted Linear Regression Models of Food Intake and Gender

Table 4 presents linear regression models evaluating the association between gender and frequency of food intake, while adjusting for covariates. Based on literature, age, household religion, caste, education, income, household members, region, and PDS use are associated with food consumption and dietary patterns. Thus, these variables were controlled for in all linear regression models. Men were selected as the referent group. Among the food groups, a significant relationship was found between gender and frequency of consumption of rice and rice-based dishes, wheat, pearl millet, and sorghum, fruits, nuts, local sweets, sweeteners, dairy, global sweets, non-local Indian savory snacks, fruit juices, and soda and energy drinks. It was found that women were significantly less likely to frequently consume rice and rice-based dishes (β = -0.33; 95% CI -0.64, 0.03; $p < 0.05$), wheat, pearl millet, and sorghum (β = -0.04; 95% CI -0.04, 0.60; $p < 0.001$), non-local savory snacks (β = -0.18; 95% CI -0.34, 0.20; $p < 0.05$), fruit

juices (β = -0.36; 95% CI -0.52, 0.20; $p < 0.001$), and soda and energy drinks (β = -0.54; 95% CI -0.72, 0.37; $p < 0.001$) than men within the same population. Women were less likely to have a higher food variety score than men (β = -1.30; 95% CI -2.06, -0.55: $p < 0.001$). On the contrary, men were significantly less likely to frequently consume fruits (β = 0.30; 95% CI 0.21, 0.40: $p < 0.001$), nuts (β = 0.72; 95% CI 0.36, 1.07, $p <0.0.001$), local sweets (β = 0.25; 95% CI 0.12, 0.38; $p < 0.001$), sweeteners (β = 0.44; 95% CI -0.23, 0.64; $p < 0.001$), dairy (β = 1.63; 95% CI 0.62, 2.65; $p < 0.01$), and global sweets (β = 0.40; 95% CI 0.23, 0.58; $p < 0.001$) than women within the same population. These findings are consistent with results comparing food consumption patterns between men and women, where women had lower food variety scores and consumed fruits, dairy, global and local sweets, nuts, and sweeteners more frequently than men. Men consumed wheat, pearl millet, and sorghum, fruit juices, and soda and energy drinks more frequently than women. Moreover, men were more likely to have frequent intake of rice and rice-based dishes than women, aligning with differences found in food intake patterns between urban men and women. Food intake patterns also showed significant gender differences in red meat, lean meat, and global breads and cereals. These results were not supported by findings from adjusted linear regression analyses.

Dietary Pattern Analyses

A review of scree plots and eigenvalues from principal components analysis (PCA) suggested that a four-factor solution was the best fit to the frequency data for adults. A total of 9.34% of the variance was explained in four components for respondents. Final factor loadings were determined using PCA with varimax rotation of four-factors. Names of dietary patterns were assigned based on the factor loadings that contributed most highly to each pattern.

Table 5 demonstrates factor loadings and dietary patterns for adults, derived from PCA. Factor 1 loaded on savory foods and snacks, local sweets, and all non-local and global food groups (global breads and cereals, global savory foods and snacks, global sweets, non-local savory snacks, non-local sweets). This dietary pattern was named "Snacks, Cereals, and Sweets." Of the 9.34% of the total variance from the four-factor solution, the "Snacks, Cereals, and Sweets" dietary pattern explains 2.97% of the variance, higher than the other three dietary patterns. Factor 2 had high factor loadings for fruits, nuts, sweeteners, and dairy. This dietary pattern was named "Dairy, Fruits, & Nuts." Factor 3 loaded on red meat, lean meat, and eggs. This pattern was named "Non-Vegetarian." Factor 4 had high factor loadings for rice and rice-based dishes, pulses, wheat, pearl millet, and sorghum, vegetables, savory foods and snacks, and fruit juices. This dietary pattern was named "Vegetarian."

Table 6 presents regression coefficients and 95% confidence intervals from multiple linear regression models evaluating independent associations between demographic and socioeconomic characteristics and the four identified dietary patterns. Significant gender differences were found among adults who had "Dairy, Fruits & Nuts", "Non-Vegetarian", and "Vegetarian" dietary patterns. Women were significantly more likely to have the "Dairy, Fruits & Nuts" dietary pattern ($\beta = 0.40$; 95% CI 0.22, 0.58; $p < 0.001$) whereas men were significantly more likely to have the "Non-Vegetarian" ($\beta = -0.49$; 95% CI 0.66, -0.32; $p < 0.001$) and "Vegetarian" ($\beta = -0.39$; 95% CI -0.59, -0.19; $p < 0.001$). Adults who had the "Snacks, Cereals, and Sweets" dietary pattern were more likely to be younger ($\beta = -0.02$; 95% CI -0.03, -0.01; $p < 0.001$), urban residents ($\beta = 0.45$; 95% CI 0.20, 0.70; $p < 0.001$), and PDS users ($\beta = 0.27$; 95% CI 0.01, 0.53; $p < 0.05$) than those who did not have the "Snacks, Cereals, and Sweets" dietary pattern. Adults who had the "Dairy, Fruits, and Nuts" dietary pattern were more likely to be in

higher caste/social groups (β = -0.16; 95% CI -0.29, -0.03; p <0.05), such as the General Caste, have higher education (β = 0.13; 95% CI 0.06, 0.21; p <0.001) and income (β = 0.26; 95% CI 0.17, 0.35; p <0.001), and live with fewer household members (β = -0.04; 95% CI -0.07, -0.05; p <0.05) than those who did not have the "Dairy, Fruits, and Nuts" dietary pattern. Additionally, adults who had the "Non-Vegetarian" dietary pattern were less likely to be Hindu (β = 0.23; 95% CI 0.11, 0.36; p <0.001) and General Caste members (β = 0.79; 95% CI 0.67, 0.91; p <0.001) and more likely be younger (β = -0.01; 95% CI -0.02, -0.003; p <0.01), PDS users (β = 0.24; 95% CI 0.04, 0.44; p <0.05) and reside in the urban area (β = 0.38; 95% CI 0.17, 0.58; p <0.001) than those who did not have the "Non-Vegetarian" dietary pattern. Adults who had the "Vegetarian" dietary pattern were more likely to be younger (β = -0.02; 95% CI -0.03, -0.003; p <0.05), non-PDS users (β = -0.26; 95% CI -0.51, -0.02; p <0.05), and urban residents (β = 0.59; 95% CI 0.35, 0.82; p <0.001) as well as have higher education (β = 0.12; 95% CI 0.04, 0.20; p <0.01) and live with more household members (β = 0.05; 95% CI 0.01, 0.09; p <0.01) than those who did not have the "Vegetarian" dietary pattern.

DISCUSSION

The aim of this study is to investigate gender differences in food consumption, dietary diversity, and dietary patterns in the context of nutrition transition across rural and urban households in Vijayapura, Karnataka. We also explored differences in food consumption among rural and urban men and women, as urban and rural areas may be exposed to different food environments [82]. Data were from 245 men and 265 women residing in urban households and 222 men and 222 women residing in rural households. We found men had more varied diets and were exposed to more food items than women. Women had more frequent consumption of nutrient-rich food sources, such as fruits and dairy than men whereas men had more frequent consumption of non-vegetarian items than women. Local sweets and global food items, such as global breads, cereals, and sweets, were more frequently consumed by women than men. Additionally, four primary dietary patterns were identified among adults: “snacks, cereals, and sweets”, “dairy, fruits, & nuts”, “non-vegetarian”, and “vegetarian” dietary patterns. Women were more likely to have the “dairy, fruits, & nuts” dietary patterns whereas men were more likely to have the “non-vegetarian” and “vegetarian” dietary patterns.

Indian dietary guidelines recommend eating plenty of vegetables, fruits, and food grains (cereal/millets/pulses) among adult populations to prevent nutrition deficiencies and chronic conditions [38]. In this study, adults consumed fruits, vegetables, dairy, and pulses more than once a day or greater than 10 times per week. These findings are unlike studies suggesting low intake of micronutrient-rich foods, such as fruits, vegetables, and grains among adult populations in India [11-13, 27, 79].

The National Family Health Survey from 2015-2016 found that men are slightly more likely to consume fruits and dairy more regularly than women [80]. Previous studies have also

identified low intake of these food groups among Indian women [11-13, 79, 98]. In comparison, we found that dairy and fruits consumption accounted for the largest gender differences in frequency of consumption between men and women, as women consumed these food items more frequently than men. Daily consumption of vegetables and wheat, pearl millet, and sorghum intake was found among both men and women, suggesting the accessibility and availability of these food items within households as well as food markets. Animal source foods, except for dairy, were consumed more frequently by men than women, 1-2 times a month, aligning with national findings and reports [80]. These findings may be a result of gender and cultural norms, as men tend to travel outside of the home more often than women, giving them access to more non-vegetarian items [51, 78, 82, 93]. Non-vegetarian foods are also perceived as masculine and strength-providing, which may explain frequent consumption of such foods by men [78].

Evidence further suggests that women perceive outside snack foods and sweets as unclean and unhealthy [51, 84, 85]. We found that many of the global foods were more commonly consumed by women than men, particularly global breads, cereals, savory foods, snacks, and sweets, which were consumed a few times per week by women. Rolls & Guthrie further explain that women tend to experience more conflicts with food consumption. Despite perceiving them as less healthy, they like and consume more fattening foods than men [85]. Furthermore, this frequent consumption of global breads, cereals, and sweets among women may be explained by the accessibility and affordability of these foods in food markets, even in remote rural areas [41, 50, 82]. We found rural women consumed global breads and cereals more than urban women. Some of the global and non-local foods identified in this study, such as bread, oats, multigrain biscuits, chocolate, ice cream, cake*, gulab jamun*, may not be so uncommon within the food environments in Vijayapura [10, 82]. Women play essential roles in choosing

types and amount of food consumed within households [10, 28, 58]. It was reported that proximity to stores and food prices played a role in food procurement and consumption, possibly explaining the increased frequency of consumption of low-cost and accessible global foods among this gender group [28, 58]. Across both genders, global sweets, such as chocolate, were consumed a few times in a week as opposed to local sweets and non-local sweets, which were consumed approximately once per a week. This difference between global and local sweet consumption may be due to increasing preference for global sweets over traditional sweets and easy accessibility of international brands of sweets [92]. Frequent intake of sugar and fattening foods may be an indication of decreasing dietary quality among women [38].

Across both genders, tea and coffee consumption was high, being consumed almost daily. These results are to be expected as tea consumption is heavily rooted in the Indian culture. Both tea and coffee are also affordable and easily accessible in food markets, even for low-income households [90]. Non-traditional drinks, such as sodas, energy drinks, and fruit juices, are not as frequently consumed as tea and coffee, being consumed less than once a week; however, men did consume these drinks more frequently than women. A possible explanation to this gender difference is that these "cold" drinks are consumed outside of the home, in roadside eateries, street vendor, or restaurants, which men access more than women [51, 78].

Among urban and rural residents, adults living in urban areas consumed staples and local foods more frequently than rural residents, possibly as a result of less food options and variety in rural areas [81, 82]. Expensive foods, such as fruits, vegetables, and dairy were more frequently consumed by urban residents. Previous studies have found an association between food consumption patterns and urbanization; this pathway is mediated by household income growth [81, 83]. Thus, it is not surprising that urban households, who may have larger food budgets,

frequently consume more expensive items [81, 83]. Urban residents also consumed cold beverages more frequently than rural residents, particularly fruit juices, agreeing with results from two studies conducted in India, a 2020 study on urbanization and food consumption as well as national findings from 2016 [81, 86]. Additionally, frequency of consumption of global and non-local foods was similar between rural and urban residents. These findings may be a result of the nutrition transition. With the increase of global foods in rural food markets, rural food environments are beginning to resemble urban food environments [5, 78, 82].

Previous studies have shown gender differences in dietary diversity, with women, particularly mothers, experiencing low dietary diversity, and men experiencing moderate dietary diversity [4, 10, 11, 31, 99]. This particular study also shows a gender difference in food diversity, as women show a slightly lower food variety score than men. We also found that men may be exposed to a greater variety of food items than women, which may explain this gender difference. Nonetheless, the difference in food variety score is only by one item, indicating a small difference between the men and women in variety of foods consumed. Intake of more food items does not necessarily mean a healthier variety of food is consumed among men than women. Therefore, it is difficult to conclude that a higher food variety score indicates better nutrition status.

Another major aspect of this study is capturing dietary patterns between men and women in Vijayapura. Previous research has shown that there were no gender differences in dietary patterns in India [56]. Reports have indicated that women's choice in food and their dietary patterns heavily depend on their husband's or family's food patterns [28, 58]. Thus, it was hypothesized that men and women, within this population, do not have different dietary patterns. We derived 4 dietary patterns for each gender using principal components analysis among a

sample of adults in Vijayapura district. These dietary patterns further reflect dietary habits of men and women. The study findings suggest that there were no gender differences in "snacks, cereals, and sweets" dietary pattern, as both men and women tend to consume local snacks and sweets with non-local/global food items. It was found that women were more likely to have "dairy, fruits, & nuts" dietary pattern, choosing to consume fruits, nuts, dairy, and sweeteners more than men. Men were more likely to have the "non-vegetarian" and "vegetarian" dietary patterns than women. Vegetarian dishes, such as *chapatis*, *rotis*, and vegetable curries, and meats are commonly found in roadside eateries and restaurants in Northern Karnataka, shaping men's food choices and increasing accessibility of these foods to men who tend to eat outside of the home [51, 78, 82, 93].

Across all four of these dietary patterns, the "dairy, fruits, & nuts" and the "vegetarian" dietary patterns were consistent with results from previous studies which show these two dietary patterns as traditional and healthy [24]. Savory snacks were grouped together with vegetables and pulses, which had high loadings in the "vegetarian" dietary patterns. These results align with findings from household-level studies done in other parts of India, such as Delhi, Mumbai, and Trivandrum [24]. This dietary pattern consisting of wheat, pearl millet, sorghum, rice, pulses, and vegetables is consistent with findings from an Indian Migration Study [87]. The "snacks, cereals, and sweets" dietary pattern explained the greatest amount of variance among adults (2.97%); these findings show consumption of more "unhealthy" foods as there has been an increased availability of global, non-local, as well as local snacks and sweets in food markets [5, 50, 51]. This dietary pattern had high loadings for all global/non-local foods as well as savory foods and snacks and local sweets. Furthermore, local savory snacks were loaded on the "snacks, cereals, and sweets" and "vegetarian" dietary patterns. A possible explanation for this might be

that local savory snacks are often vegetarian friendly and available inside homes as well as with other outside snack foods [51, 82]. Consumption of grains, cereals, and savory snacks is consistent with results from 2005-2007 Indian Migration Study, which identified a "cereal-savoury" dietary pattern with high loadings of rice and rice-based dishes, grains, and snacks among adults [94].

Possibly due to access, globalizing diets, or cultural norms, previous research has noted individuals who are Hindu consuming more meat-based diet [78]. On the contrary, we did not find similar results. In this study, individuals who were Hindu were less likely to consume the non-vegetarian diet, agreeing with findings from a 2020 community-based cross-sectional study [97]. PDS-users were more likely to have the "non-vegetarian" dietary pattern, as many PDS users are from social groups which often consume non-vegetarian foods [82]. In addition, we found adults with higher monthly income and education were more likely to have the "fruits, dairy, & nuts" dietary pattern, which consists of more expensive food items; adults with higher education were more likely to have the "vegetarian" dietary pattern. Prior studies have found that individuals who had higher monthly income and more education consumed vegetarian diets and healthier, balanced diets, such as the "fruit and dairy" dietary pattern [59, 65, 75, 88]. Similar to a 2015 study conducted in Hyderabad and Bangalore, urban residents were more likely to consume the "snacks, cereals, and sweets" and "vegetarian" dietary patterns than rural residents, likely due to urban food markets having more variety of foods [81, 82, 96].

Strengths and Limitations

This study has many strengths and limitations. A central strength of this study is that it is the first to evaluate food consumption and dietary patterns using PCA between men and women

in urban and rural areas of Northern Karnataka. Other strengths include the fact that the sample used for this study had a very high response rates (97% for urban households and 98.6% for rural households) and frequency of intake per week was captured for a variety of food items. In addition, conducting linear regression models allows for deeper understanding of how food consumption and dietary patterns changes based on gender and other population characteristics.

There are some limitations to this study. The FFQ dataset used in this study does not measure caloric intake, therefore a direct comparison to the Indian dietary guideline's recommendations cannot be made. Also, lack of caloric intake limits the ability to compare findings across similar studies. Frequency of consumption of food items was also self-reported by the population. Respondents may have had difficulties recalling and estimating how frequent they consumed each food item. For example, consumption of commonly seen food items in Indian households could have been over-estimated. There could have also been underlying gender differences in reporting food consumption patterns as well. Other considerations are that the study uses cross-sectional data, which makes it difficult to explore temporal relationships or draw any causal inferences from the data. Moreover, study findings cannot be generalized to the entire Karnataka state as the study only sampled from adults living in rural and urban communities in Vijayapura, Karnataka. Finally, another limitation of this study is that the method which determines the number of factors or dietary patterns, screeplots and eigenvalues, is subjective.

Conclusion

Overall, this study sought to identify gender differences in types of foods consumed via dietary pattern analysis and capture food consumption patterns by quantifying gender differences

in frequency of food intake. We found significant differences in dietary diversity and dietary patterns between men and women, which might be attributable to food culture, gender norms, access/exposure to foods items, and food availability. Food consumption and dietary patterns also capture food choice. Women often reported frequently consuming more fruits, dairy, global foods, snacks, and sweets than men whereas men often reported frequently consuming more meat items, rice/rice-based dishes, wheat products, and beverages than women. It appears that food items classified as non-traditional and outside foods are being consumed among men and women on a weekly basis. Non-local and global snacks, cereals, and sweets are being incorporated into diets, possibly due to easy access; however, these food items are not replacing traditional food items. Men and women are still frequently consuming traditional foods and healthier food items, such as fruits, vegetables, nuts, dairy, and food grains.

Vijayapura is a fast-growing city that is undergoing the nutrition transition. Research has shown how men and women in India face similar and different burdens of chronic diseases, such as obesity, diabetes, and hypertension [9, 12, 20, 24-26]. Studying dietary intake and patterns, like in this study, informs efforts to develop more gender-appropriate diet recommendations and promote dietary diversity/balanced diet. These public health interventions can ultimately help improve nutrition outcomes and reduce risk of diet-related NCDs among adults. Future research should capture nutrient intake of food items to see if adults from Vijayapura are meeting Indian dietary recommendations and study the association between dietary patterns and cardio-metabolic disease risk factors.

REFERENCES

1. *Country nutrition profiles*. Global Nutrition Report | Country Nutrition Profiles - Global Nutrition Report. (2020). https://globalnutritionreport.org/resources/nutrition-profiles/asia/.
2. Singh, Shrikant, Srivastava, S., & Upadhyay, A. K. (2019). Socio-economic inequality in malnutrition among children in India: An analysis of 640 districts from National Family Health Survey (2015-16). *International Journal for Equity in Health*, *18*(1). https://doi.org/10.1186/s12939-019-1093-0
3. World Health Organization. (2019, September 26). *Malnutrition is a world health crisis*. World Health Organization. https://www.who.int/news/item/26-09-2019-malnutrition-is-a-world-health-crisis.
4. Sharma, M., Kishore, A., Roy, D., & Joshi, K. (2020). A comparison of the Indian diet with the EAT-Lancet reference diet. *BMC Public Health*, *20*(1). https://doi.org/10.1186/s12889-020-08951-8
5. Misra, A., Singhal, N., Sivakumar, B., Bhagat, N., Jaiswal, A., & Khurana, L. (2011). Nutrition transition in India: Secular trends in dietary intake and their relationship to diet-related non-communicable diseases. In *Journal of Diabetes* (Vol. 3, Issue 4, pp. 278–292). J Diabetes. https://doi.org/10.1111/j.1753-0407.2011.00139.x
6. Joshi, A., Mohan, K., Grin, G., & Perin, D. M. P. (2013). Burden of healthcare utilization and out-of-pocket costs among individuals with NCDs in an Indian setting. *Journal of Community Health*, *38*(2), 320–327. https://doi.org/10.1007/s10900-012-9617-1
7. Siddiqui, M. Z., & Donato, R. (2017). Undernutrition among adults in India: The significance of individual-level and contextual factors impacting on the likelihood of

underweight across sub-populations. In *Public Health Nutrition* (Vol. 20, Issue 1, pp. 130–141). Cambridge University Press. https://doi.org/10.1017/S1368980016001968

8. Dutta, M., Selvamani, Y., Singh, P., & Prashad, L. (2019). The double burden of malnutrition among adults in India: evidence from the National Family Health Survey-4 (2015-16). *Epidemiology and Health*, *41*, e2019050. https://doi.org/10.4178/epih.e2019050
9. Jayanna, K., Swaroop, N., Kar, A., Ramanaik, S., Pati, M. K., Pujar, A., Rai, P., Chitrapu, S., Patil, G., Aggarwal, P., Saksena, S., Madegowda, H., Rekha, S., & Mohan, H. L. (2019). Designing a comprehensive Non-Communicable Diseases (NCD) programme for hypertension and diabetes at primary health care level: Evidence and experience from urban Karnataka, South India. *BMC Public Health*, *19*(1). https://doi.org/10.1186/s12889-019-6735-z
10. Raskind, I. G., Patil, S. S., Haardörfer, R., & Cunningham, S. A. (2018). Unhealthy Weight in Indian Families: The Role of the Family Environment in the Context of the Nutrition Transition. *Population Research and Policy Review*, *37*(2), 157–180. https://doi.org/10.1007/s11113-017-9455-z
11. Nithya, D. J., & Bhavani, R. v. (2018). Dietary diversity and its relationship with nutritional status among adolescents and adults in rural India. *Journal of Biosocial Science*, *50*(3), 397–413. https://doi.org/10.1017/S0021932017000463
12. Singh, A., Gupta, V., Ghosh, A., Lock, K., & Ghosh-Jerath, S. (2015). Quantitative estimates of dietary intake with special emphasis on snacking pattern and nutritional status of free living adults in urban slums of Delhi: Impact of nutrition transition. *BMC Nutrition*, *1*(1). https://doi.org/10.1186/s40795-015-0018-6

13. Minocha, S., Thomas, T., & Kurpad, A. v. (2018). Are “fruits and vegetables” intake really what they seem in India? *European Journal of Clinical Nutrition*, *72*(4), 603–608. https://doi.org/10.1038/s41430-018-0094-1

14. Chandrasekhar, S., Aguayo, V. M., Krishna, V., & Nair, R. (2017). Household food insecurity and children’s dietary diversity and nutrition in India. Evidence from the comprehensive nutrition survey in Maharashtra. *Maternal & Child Nutrition*, *13 Suppl 2*(Suppl 2). https://doi.org/10.1111/MCN.12447

15. Elia M. (2017). Defining, Recognizing, and Reporting Malnutrition. *The International Journal of Lower Extremity Wounds*, *16*(4), 230–237. https://doi.org/10.1177/1534734617733902

16. IIPS. (2016). National Family Health Survey (NFHS-4) 2015-16 Mumbai, India. International Institute for Population Sciences, & Macro International. https://dhsprogram.com/pubs/pdf/FR339/FR339.pdf

17. *India*. Global Hunger Index (GHI) - peer-reviewed annual publication designed to comprehensively measure and track hunger at the global, regional, and country levels. (2020). https://www.globalhungerindex.org/india.html#:~:text=In%20the%202020%20Global%20Hunger,See%20overview%20of%20GHI%20calculation%5D.

18. George, N. A., & McKay, F. H. (2019). The public distribution system and food security in India. In *International Journal of Environmental Research and Public Health* (Vol. 16, Issue 17). MDPI AG. https://doi.org/10.3390/ijerph16173221

19. Cyriac, S., Haardörfer, R., Neufeld, L. M., Girard, A. W., Ramakrishnan, U., Martorell, R., & Mbuya, M. N. N. (2020). High Coverage and Low Utilization of the Double

Fortified Salt Program in Uttar Pradesh, India: Implications for Program Implementation and Evaluation. *Current Developments in Nutrition*, *4*(9). https://doi.org/10.1093/cdn/nzaa133

20. Agrawal, S., Millett, C. J., Dhillon, P. K., Subramanian, S., & Ebrahim, S. (2014). Type of vegetarian diet, obesity and diabetes in adult Indian population. *Nutrition Journal*, *13*(1). https://doi.org/10.1186/1475-2891-13-89
21. Swaminathan, S., Thomas, T., Yusuf, S., & Vaz, M. (2013). Clustering of diet, physical activity and overweight in parents and offspring in South India. *European Journal of Clinical Nutrition*, *67*(2), 128–134. https://doi.org/10.1038/ejcn.2012.192
22. Varghese, J. S., & Stein, A. D. (2019). Malnutrition among women and children in India: Limited evidence of clustering of underweight, anemia, overweight, and stunting within individuals and households at both state and district levels. *American Journal of Clinical Nutrition*, *109*(4), 1207–1215. https://doi.org/10.1093/ajcn/nqy374
23. Satija, A., Taylor, F. C., Khurana, S., Tripathy, V., Khandpur, N., Bowen, L., Prabhakaran, D., Kinra, S., Reddy, S., & Ebrahim, S. (2012). Differences in consumption of food items between obese and normal-weight people in India. *National Medical Journal of India*, *25*(1), 10–13. https://pubmed.ncbi.nlm.nih.gov/22680313/
24. Daniel, C. R., Prabhakaran, D., Kapur, K., Graubard, B. I., Devasenapathy, N., Ramakrishnan, L., George, P. S., Shetty, H., Ferrucci, L. M., Yurgalevitch, S., Chatterjee, N., Reddy, K. S., Rastogi, T., Gupta, P. C., Mathew, A., & Sinha, R. (2011). A cross-sectional investigation of regional patterns of diet and cardio-metabolic risk in India. *Nutrition Journal*, *10*(1). https://doi.org/10.1186/1475-2891-10-12

25. Patel, S. A., Narayan, K. M. V., & Cunningham, S. A. (2015). Unhealthy weight among children and adults in India: Urbanicity and the crossover in underweight and overweight. *Annals of Epidemiology*, *25*(5), 336-341.e2. https://doi.org/10.1016/j.annepidem.2015.02.009

26. Sengupta, A., Angeli, F., Syamala, T. S., Dagnelie, P. C., & Schayck, C. P. van. (2015). Overweight and obesity prevalence among Indian women by place of residence and socio-economic status: Contrasting patterns from "underweight states" and "overweight states" of India. *Social Science and Medicine*, *138*, 161–169. https://doi.org/10.1016/j.socscimed.2015.06.004

27. Tripathy, J. P., Thakur, J. S., Jeet, G., Chawla, S., Jain, S., & Prasad, R. (2016). Urban rural differences in diet, physical activity and obesity in India: Are we witnessing the great Indian equalisation? Results from a cross-sectional STEPS survey. *BMC Public Health*, *16*(1). https://doi.org/10.1186/s12889-016-3489-8

28. Pradhan, M., Taylor, F., Agrawal, S., Prabhakaran, D., & Ebrahim, S. (2013). Food acquisition and intra-household consumption patterns: A study of low and middle income urban households in Delhi, India. *Indian journal of community health*, *25*(4), 391–402.

29. Das, M. (2014). Measures, Spatial Profile and Determinants of Dietary Diversity: Evidence from India. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2511823

30. Parappurathu, S., Kumar, A., Bantilan, M. C. S., & Joshi, P. K. (2015). Food consumption patterns and dietary diversity in eastern India: evidence from village level studies (VLS). *Food Security*, *7*(5), 1031–1042. https://doi.org/10.1007/s12571-015-0493-2

31. Rammohan, A., Goli, S., Singh, D., Ganguly, D., & Singh, U. (2019). Maternal dietary diversity and odds of low birth weight: Empirical findings from India. *Women and Health*, *59*(4), 375–390. https://doi.org/10.1080/03630242.2018.1487903

32. Tapsell, L. C., Neale, E. P., Satija, A., & Hu, F. B. (2016). Foods, nutrients, and dietary patterns: Interconnections and implications for dietary guidelines. In *Advances in Nutrition* (Vol. 7, Issue 3, pp. 445–454). American Society for Nutrition. https://doi.org/10.3945/an.115.011718

33. Montagnese, C., Santarpia, L., Iavarone, F., Strangio, F., Sangiovanni, B., Buonifacio, M., Caldara, A. R., Silvestri, E., Contaldo, F., & Pasanisi, F. (2019). Food-Based dietary guidelines around the World: Eastern Mediterranean and Middle Eastern Countries. In *Nutrients* (Vol. 11, Issue 6). MDPI AG. https://doi.org/10.3390/nu11061325

34. Montagnese, C., Santarpia, L., Buonifacio, M., Nardelli, A., Caldara, A. R., Silvestri, E., Contaldo, F., & Pasanisi, F. (2015). European food-based dietary guidelines: A comparison and update. In *Nutrition* (Vol. 31, Issues 7–8, pp. 908–915). Elsevier Inc. https://doi.org/10.1016/j.nut.2015.01.002

35. Binns, C. W., Lee, M. K., Kagawa, M., Low, W. Y., Liqian, Q., Guldan, G. S., Hokama, T., Nanishi, K., Oy, S., Tang, L., & Zerfas, A. (2017). Dietary guidelines for the Asia Pacific Region: Report of the Asia Pacific academic consortium for public health workshop 2016. *Asia-Pacific Journal of Public Health*, *29*(2), 98–101. https://doi.org/10.1177/1010539517694295

36. Iqbal, R., Tahir, S., & Ghulamhussain, N. (2017). The need for dietary guidelines in Pakistan. In *Journal of the Pakistan Medical Association* (Vol. 67, Issue 8, pp. 1258–1261). Pakistan Medical Association. https://pubmed.ncbi.nlm.nih.gov/28839315/

37. Krishnaswamy, K. (2008). Developing and implementing dietary guidelines in India. In *Asia Pacific Journal of Clinical Nutrition* (Vol. 17, Issue SUPPL. 1, pp. 66–69). Asia Pac J Clin Nutr. https://doi.org/10.6133/apjcn.2008.17.s1.16

38. Indian Council for Medical Research (2011) Dietary Guidelines for Indians—A Manual. 2nd Edition, National Institute of Nutrition, Hyderabad, India, 89. https://www.nin.res.in/downloads/DietaryGuidelinesforNINwebsite.pdf

39. Shetty, P. (2013). Nutrition transition and its health outcomes. *Indian Journal of Pediatrics*, *80 Suppl 1*. https://doi.org/10.1007/s12098-013-0971-5

40. Swaminathan, Soumya, Hemalatha, R., Pandey, A., Kassebaum, N. J., Laxmaiah, A., Longvah, T., Lodha, R., Ramji, S., Kumar, G. A., Afshin, A., Gupta, S. S., Kar, A., Khera, A. K., Mathai, M., Awasthi, S., Rasaily, R., Varghese, C. M., Millear, A. I., Manguerra, H., … Dandona, L. (2019). The burden of child and maternal malnutrition and trends in its indicators in the states of India: the Global Burden of Disease Study 1990–2017. *The Lancet Child and Adolescent Health*, *3*(12), 855–870. https://doi.org/10.1016/S2352-4642(19)30273-1

41. Gupta, V., Downs, S. M., Ghosh-Jerath, S., Lock, K., & Singh, A. (2016). Unhealthy Fat in Street and Snack Foods in Low-Socioeconomic Settings in India: A Case Study of the Food Environments of Rural Villages and an Urban Slum. *Journal of Nutrition Education and Behavior*, *48*(4), 269-279.e1. https://doi.org/10.1016/j.jneb.2015.11.006

42. Geldsetzer, P., Manne-Goehler, J., Theilmann, M., Davies, J. I., Awasthi, A., Vollmer, S., Jaacks, L. M., Bärnighausen, T., & Atun, R. (2018). Diabetes and hypertension in India a nationally representative study of 1.3 million adults. *JAMA Internal Medicine*, *178*(3), 363–372. https://doi.org/10.1001/jamainternmed.2017.8094

43. Afifi, A. A., Kotlerman, J. B., Ettner, S. L., & Cowan, M. (2007). Methods for improving regression analysis for skewed continuous or counted responses. *Annual Review of Public Health*, *28*, 95–111. https://doi.org/10.1146/annurev.publhealth.28.082206.094100

44. Grebmer, K. von, Towey, O., Foley, C., Patterson, F., Sonntag, A., Zimmermann, S.-M., & Hossain, N. (2017). *2017 Global Hunger index: The inequalities of hunger*. International Food Policy Research Institute. https://doi.org/10.2499/9780896292710

45. Gulati, A., Ganesh-Kumar, A., Shreedhar, G., & Nandakumar, T. (2012). Agriculture and malnutrition in India. *Food and Nutrition Bulletin*, *33*(1), 74–86. https://doi.org/10.1177/156482651203300108

46. Mishra, C. P. (2017). Malnutrition-free India: Dream or reality. *Indian Journal of Public Health*, *61*(3), 155–162. https://doi.org/10.4103/ijph.IJPH_217_17

47. Narayan, J., John, D., & Ramadas, N. (2019). Malnutrition in India: status and government initiatives. In *Journal of Public Health Policy* (Vol. 40, Issue 1, pp. 126–141). Palgrave Macmillan Ltd. https://doi.org/10.1057/s41271-018-0149-5

48. Mittal, N., & Vollmer, S. (2020). The Double Burden of Malnutrition in Bangalore, India. *World Review of Nutrition and Dietetics*, *121*, 138–148. https://doi.org/10.1159/000507521

49. Kulkarni, V. S., Kulkarni, V. S., & Gaiha, R. (2017). "double Burden of Malnutrition": Reexamining the Coexistence of Undernutrition and Overweight among Women in India. *International Journal of Health Services*, *47*(1), 108–133. https://doi.org/10.1177/0020731416664666

50. Turner, C., Kalamatianou, S., Drewnowski, A., Kulkarni, B., Kinra, S., & Kadiyala, S. (2020). Food Environment Research in Low- and Middle-Income Countries: A

Systematic Scoping Review. In *Advances in Nutrition* (Vol. 11, Issue 2, pp. 387–397). Oxford University Press. https://doi.org/10.1093/advances/nmz031

51. Maxfield, A., Patil, S., & Cunningham, S. A. (2016). Globalization and Food Prestige among Indian Adolescents. *Ecology of Food and Nutrition*, *55*(4), 341–364. https://doi.org/10.1080/03670244.2016.1181064

52. Gupta, R., Gupta, V. P., Sarna, M., Prakash, H., Rastogi, S., & Gupta, K. D. (2003). Serial epidemiological surveys in an urban Indian population demonstrate increasing coronary risk factors among the lower socioeconomic strata. *The Journal of the Association of Physicians of India*, *51*, 470–477.

53. Tzioumis, E., & Adair, L. S. (2014). Childhood dual burden of under- and overnutrition in low- and middle-income countries: A critical review. *Food and Nutrition Bulletin*, *35*(2), 230–243. https://doi.org/10.1177/156482651403500210

54. Joshi, R., Cardona, M., Iyengar, S., Sukumar, A., Raju, C. R., Raju, K. R., Raju, K., Reddy, K. S., Lopez, A., & Neal, B. (2006). Chronic diseases now a leading cause of death in rural India - Mortality data from the Andhra Pradesh Rural Health Initiative. *International Journal of Epidemiology*, *35*(6), 1522–1529. https://doi.org/10.1093/ije/dyl168

55. Ahirwar, R., & Mondal, P. R. (2019). Prevalence of obesity in India: A systematic review. In *Diabetes and Metabolic Syndrome: Clinical Research and Reviews* (Vol. 13, Issue 1, pp. 318–321). Elsevier Ltd. https://doi.org/10.1016/j.dsx.2018.08.032

56. Green, R., Milner, J., Joy, E. J. M., Agrawal, S., & Dangour, A. D. (2016). Dietary patterns in India: A systematic review. In *British Journal of Nutrition* (Vol. 116, Issue 1, pp. 142–148). Cambridge University Press. https://doi.org/10.1017/S0007114516001598

57. Kirkpatrick, S. I. (2017). Foods and beverages available to children in settings outside of the home: Research, policy, and monitoring considerations. In *Canadian Journal of Public Health* (Vol. 108, Issue 4, pp. e339–e341). Canadian Public Health Association. https://doi.org/10.17269/cjph.108.6371

58. Bailey, C., Garg, V., Kapoor, D., Wasser, H., Prabhakaran, D., & Jaacks, L. M. (2018). Food Choice Drivers in the Context of the Nutrition Transition in Delhi, India. *Journal of Nutrition Education and Behavior*, *50*(7), 675–686. https://doi.org/10.1016/j.jneb.2018.03.013

59. Hardcastle, S. J., Thøgersen-Ntoumani, C., & Chatzisarantis, N. L. D. (2015). Food choice and nutrition: A social psychological perspective. In *Nutrients* (Vol. 7, Issue 10, pp. 8712–8715). MDPI AG. https://doi.org/10.3390/nu7105424

60. Gopichandran, V., Jayamani, V., Lee, P., Prasad, J., Alexander, G., & Christopher, S. (2013). Diet and physical activity among women in urban and rural areas in south India: A community based comparative survey. *Journal of Family Medicine and Primary Care*, *2*(4), 334. https://doi.org/10.4103/2249-4863.123782

61. Kinra, S., Carson Mallinson, P. A., Cresswell, J. A., Bowen, L. J., Lyngdoh, T., Prabhakaran, D., Reddy, K. S., Vaz, M., Kurpad, A. v., Smith, G. D., Ben-Shlomo, Y., & Ebrahim, S. (2020). Relative contribution of diet and physical activity to increased adiposity among rural to urban migrants in India: A cross-sectional study. *PLoS Medicine*, *17*(8). https://doi.org/10.1371/JOURNAL.PMED.1003234

62. Govindaraj, G. N., & Suryaprakash, S. (2013). Determinants of Edible Oil Choice by Households in Tamil Nadu, India. *Ecology of Food and Nutrition*, *52*(6), 497–514. https://doi.org/10.1080/03670244.2012.748458

63. Ramachandran, A., Mary, S., Yamuna, A., Murugesan, N., & Snehalatha, C. (2008). High prevalence of diabetes and cardiovascular risk factors associated with urbanization in india. *Diabetes Care*, *31*(5), 893–898. https://doi.org/10.2337/dc07-1207

64. Yadav, K., & Krishnan, A. (2008). Changing patterns of diet, physical activity and obesity among urban, rural and slum populations in north India. *Obesity Reviews*, *9*(5), 400–408. https://doi.org/10.1111/j.1467-789X.2008.00505.x

65. Xu, S. H., Qiao, N., Huang, J. J., Sun, C. M., Cui, Y., Tian, S. S., Wang, C., Liu, X. M., Zhang, H. X., Wang, H., Liang, J., Lu, Q., & Wang, T. (2016). Gender differences in dietary patterns and their association with the prevalence of metabolic syndrome among Chinese: A cross-sectional study. *Nutrients*, *8*(4). https://doi.org/10.3390/nu8040180

66. Newby, P. K., Muller, D., Hallfrisch, J., Andres, R., & Tucker, K. L. (2004). Food patterns measured by factor analysis and anthropometric changes in adults. *The American Journal of Clinical Nutrition*, *80*(2), 504–513. https://doi.org/10.1093/ajcn/80.2.504

67. Venkaiah, K., Brahmam, G. N. V., & Vijayaraghavan, K. (2015). Identification of dietary patterns by factor analysis and study of the relationship with nutritional status of rural adolescents using factor scores. *Journal of Health, Population and Nutrition*, *34*(1). https://doi.org/10.1186/S41043-015-0009-X

68. Venkaiah, K., Brahmam, G. N. V., & Vijayaraghavan, K. (2011). Application of factor analysis to identify dietary patterns and use of factor scores to study their relationship with nutritional status of adult rural populations. *Journal of Health, Population and Nutrition*, *29*(4), 327–338. https://doi.org/10.3329/jhpn.v29i4.8448

69. Randall, E., Marshall, J. R., Graham, S., & Brasure, J. (1990). Patterns in food use and their associations with nutrient intakes. *American Journal of Clinical Nutrition*, *52*(4), 739–745. https://doi.org/10.1093/ajcn/52.4.739

70. Powell, B., Bezner Kerr, R., Young, S. L., & Johns, T. (2017). The determinants of dietary diversity and nutrition: Ethnonutrition knowledge of local people in the East Usambara Mountains, Tanzania. *Journal of Ethnobiology and Ethnomedicine*, *13*(1). https://doi.org/10.1186/s13002-017-0150-2

71. Agrawal, S., Kim, R., Gausman, J., Sharma, S., Sankar, R., Joe, W., & Subramanian, S. v. (2019). Socio-economic patterning of food consumption and dietary diversity among Indian children: evidence from NFHS-4. *European Journal of Clinical Nutrition*, *73*(10), 1361–1372. https://doi.org/10.1038/s41430-019-0406-0

72. Singh, Sukhwinder, Jones, A. D., & Jain, M. (2020). Regional differences in agricultural and socioeconomic factors associated with farmer household dietary diversity in India. *PLoS ONE*, *15*(4). https://doi.org/10.1371/journal.pone.0231107

73. Ochieng, J., Afari-Sefa, V., Lukumay, P. J., & Dubois, T. (2017). Determinants of dietary diversity and the potential role of men in improving household nutrition in Tanzania. *PLoS ONE*, *12*(12). https://doi.org/10.1371/journal.pone.0189022

74. Sathyamala, C. (2019). Meat-eating in India: Whose food, whose politics, and whose rights? *Policy Futures in Education*, *17*(7), 878–891. https://doi.org/10.1177/1478210318780553

75. Raghunathan, K., Headey, D., & Herforth, A. (2021). Affordability of nutritious diets in rural India. *Food Policy*, *99*. https://doi.org/10.1016/j.foodpol.2020.101982

76. Thacker, H. (2021, March 25). *India's stand in global MALNUTRITION Report 2020*. The CSR Journal. https://thecsrjournal.in/india-global-malnutrition-report-2020/.

77. *Ukkali*. Ukkali Village in Basavana Bagevadi (Bijapur) Karnataka. (2021). https://villageinfo.in/karnataka/bijapur/basavana-bagevadi/ukkali.html.

78. Shaikh, N. I., Patil, S. S., Halli, S., Ramakrishnan, U., & Cunningham, S. A. (2016). Going global: Indian adolescents' eating patterns. *Public Health Nutrition*, *19*(15), 2799–2807. https://doi.org/10.1017/S1368980016001087

79. Nunn, R. L., Kehoe, S. H., Chopra, H., Sahariah, S. A., Gandhi, M., di Gravio, C., Coakley, P. J., Cox, V. A., Sane, H., Shivshankaran, D., Marley-Zagar, E., Margetts, B. M., Jackson, A. A., Potdar, R. D., & Fall, C. H. D. (2019). Dietary micronutrient intakes among women of reproductive age in Mumbai slums. *European Journal of Clinical Nutrition*, *73*(11), 1536–1545. https://doi.org/10.1038/s41430-019-0429-6

80. IIPS. (2017). National Family Health Survey (NFHS-4) 2015-16 India. *International Institute for Population Sciences (IIPS) and ICF*, 1–192. http://www.rchiips.org/nfhs

81. Pandey, B., Reba, M., Joshi, P. K., & Seto, K. C. (2020). Urbanization and food consumption in India. *Scientific Reports*, *10*(1). https://doi.org/10.1038/s41598-020-73313-8

82. Cunningham, S. A., Shaikh, N. I., Datar, A., Chernishkin, A. E., & Patil, S. S. (2021). Food subsidies, nutrition transition, and dietary patterns in a remote Indian district. *Global Food Security*, *29*, 100506. https://doi.org/10.1016/j.gfs.2021.100506

83. Henderson, J. V. (2003). Urbanization and economic development. *Annals of Economics and Finance, 4*(2), 275–342 (2003).

84. Grogan, S. C., Bell, R., & Conner, M. (1997). Eating sweet snacks: Gender differences in attitudes and behaviour. *Appetite*, *28*(1), 19–31. https://doi.org/10.1006/appe.1996.0067

85. Rolls, B. J., Fedoroff, I. C., & Guthrie, J. F. (1991). Gender differences in eating behavior and body weight regulation. In *Health psychology : official journal of the Division of Health Psychology, American Psychological Association* (Vol. 10, Issue 2, pp. 133–142). Health Psychol. https://doi.org/10.1037/0278-6133.10.2.133

86. Statista Research Department. (2016, January 19). *India - rural and urban beverage market share by type 2016*. Statista. https://www.statista.com/statistics/670716/rural-and-urban-beverage-market-share-by-type-india/.

87. Joy, E. J. M., Green, R., Agrawal, S., Aleksandrowicz, L., Bowen, L., Kinra, S., MacDIarmid, J. I., Haines, A., & Dangour, A. D. (2017). Dietary patterns and non-communicable disease risk in Indian adults: Secondary analysis of Indian Migration Study data. *Public Health Nutrition*, *20*(11), 1963–1972. https://doi.org/10.1017/S1368980017000416

88. Sun, J., Buys, N. J., & Hills, A. P. (2014). Dietary pattern and its association with the prevalence of obesity, hypertension and other cardiovascular risk factors among Chinese older adults. *International Journal of Environmental Research and Public Health*, *11*(4), 3956–3971. https://doi.org/10.3390/ijerph110403956

89. Wirfält, E., Midthune, D., Reedy, J., Mitrou, P., Flood, A., Subar, A. F., Leitzmann, M., Mouw, T., Hollenbeck, A. R., Schatzkin, A., & Kipnis, V. (2009). Associations between food patterns defined by cluster analysis and colorectal cancer incidence in the NIH-AARP diet and health study. *European Journal of Clinical Nutrition*, *63*(6), 707–717. https://doi.org/10.1038/ejcn.2008.40

90. Statista Research Department. (2021, June 9). *Topic: Tea market in India*. Statista. https://www.statista.com/topics/4652/tea-market-in-india/.

91. Office of the Registrar General & Census Commissioner India. (2011). *Age structure and marital status*. Census of India: Age Structure And Marital Status. https://censusindia.gov.in/census_and_you/age_structure_and_marital_status.aspx

92. Sondhi, N., & Chawla, D. (2021). Positioning Implications for Chocolate Brands: An Attribute-based Approach. *Global Business Review*, *22*(1), 184–196. https://doi.org/10.1177/0972150918795360

93. Barker, M., Chorghade, G., Crozier, S., Leary, S., & Fall, C. (2006). Gender differences in body mass index in rural India are determined by socio-economic factors and lifestyle. *Journal of Nutrition*, *136*(12), 3062–3068. https://doi.org/10.1093/jn/136.12.3062

94. Shridhar, K., Satija, A., Dhillon, P. K., Agrawal, S., Gupta, R., Bowen, L., Kinra, S., Bharathi, A. v., Prabhakaran, D., Srinath Reddy, K., & Ebrahim, S. (2018). Association between empirically derived dietary patterns with blood lipids, fasting blood glucose and blood pressure in adults - The India migration study. *Nutrition Journal*, *17*(1). https://doi.org/10.1186/s12937-018-0327-0

95. Meshram, I. I., Balakrishna, N., Sreeramakrishna, K., Rao, K. M., Kumar, R. H., Arlappa, N., Manohar, G., Reddy, C. G., Ravindranath, M., Kumar, S. S., Brahmam, G. N. V., & Laxmaiah, A. (2016). Trends in nutritional status and nutrient intakes and correlates of overweight/obesity among rural adult women (≥18-60 years) in India: National Nutrition Monitoring Bureau (NNMB) national surveys. In *Public Health Nutrition* (Vol. 19, Issue 5, pp. 767–776). Public Health Nutr. https://doi.org/10.1017/S1368980015002268

96. Satija, A., Hu, F. B., Bowen, L., Bharathi, A. v., Vaz, M., Prabhakaran, D., Reddy, K. S., Ben-Shlomo, Y., Davey Smith, G., Kinra, S., & Ebrahim, S. (2015). Dietary patterns in India and their association with obesity and central obesity. *Public Health Nutrition*, *18*(16), 3031–3041. https://doi.org/10.1017/S1368980015000312

97. Sharma, S., Akhtar, F., Kumar Singh, R., & Mehra, S. (2020). Dietary Patterns and Determinants of Pregnant and Lactating Women From Marginalized Communities in India: A Community-Based Cross-Sectional Study. *Frontiers in Nutrition*, *7*. https://doi.org/10.3389/fnut.2020.595170

98. Shankar, B., Agrawal, S., Beaudreault, A. R., Avula, L., Martorell, R., Osendarp, S., Prabhakaran, D., & Mclean, M. S. (2017). Dietary and nutritional change in India: implications for strategies, policies, and interventions. *Annals of the New York Academy of Sciences*, *1395*(1), 49–59. https://doi.org/10.1111/nyas.13324

99. Gupta, S., Sunder, N., & Pingali, P. L. (2020). Are Women in Rural India Really Consuming a Less Diverse Diet?. *Food and nutrition bulletin*, *41*(3), 318–331. https://doi.org/10.1177/0379572120943780

TABLES

Table 1. Demographic and socioeconomic profile of men and women adults in Vijayapura, Karnataka, India

Characteristic†	Overall (n = 925)	Men (n = 448)	Women (n = 477)	P-value
Age (in years)‡	45.0 ± 9.9	48.5 ± 9.9	41.7 ± 8.7	**<0.0001**
Religion				0.99
Hindu	75.0 (72.3, 77.6)	73.2 (69.1, 77.3)	73.4 (69.4, 77.3)	
Muslim	22.3 (19.8, 24.9)	23.7 (19.7, 27.6)	23.6 (19.9, 27.5)	
Christian	0.2 (0.0, 0.5)	0.2 (0.0, 0.7)	0.2 (0.0, 0.6)	
Jain	2.5 (1.6, 3.5)	2.9 (1.4, 4.5)	2.7 (1.3, 4.2)	
Caste*				0.96
General	23.6 (21.0, 23.0)	24.1 (20.2, 28.1)	23.1 (19.3, 26.8)	
Other Backward Class	56.1 (53.1, 59.1)	57.6 (53.1, 62.2)	58.1 (53.6, 62.5)	
Scheduled Caste	19.6 (17.2, 22.1)	18.1 (14.5, 21.6)	18.7 (15.2, 22.2)	
Scheduled Tribe	0.7 (0.2, 1.2)	0.2 (0.0, 0.7)		
Education				**<0.0001**
Never attended	31.9 (28.9, 24.9)	25.7 (21.6, 29.7)	37.7 (33.4, 42.1)	
Pre-Primary school	22.6 (19.9, 25.3)	18.8 (15.1, 22.4)	26.2 (22.3, 30.2)	
High school	16.2 (13.8, 18.6)	14.7 (11.5, 18.0)	17.6 (14.2, 21.0)	
PUC/Diploma	12.4 (10.3, 14.6)	17.9 (14.3, 21.4)	7.3 (5.0, 9.7)	
Degree and above	16.9 (14.5, 19.3)	23.0 (19.1, 26.9)	11.1 (8.3, 13.9)	
Household Monthly Income (INR) ($US)§				0.96
< 5000 (< $US 98)	15.6 (13.4, 17.8)	13.0 (9.8, 16.1)	14.7 (11.5, 17.9)	
5,001 – 10,000 ($US 98 – 196)	33.5 (30.6, 36.3)	32.4 (28.0, 36.7)	32.3 (28.1, 36.5)	
10,001 – 20,000 ($US 196 – 392)	23.6 (21.0, 26.2)	24.8 (20.8, 28.8)	24.3 (20.5, 28.2)	
20,001 – 30,000 ($US 392 – 588)	9.9 (8.1, 11.7)	10.7 (7.9, 13.6)	10.3 (7.6, 13.0)	
≥ 30,001 (≥ $US 98)	17.4 (15.1, 19.7)	19.2 (15.6, 22.8)	18.5 (15.0, 21.9)	
Number of Household Members‡	5.7 ± 2.3	5.9 ± 2.4	5.7 ± 2.4	0.31
Rural	50.3 (47.2, 53.4)	46.0 (41.4, 50.1)	45.9 (41.4, 50.4)	0.98
PDS Users	62.9 (59.8, 66.0)	63.0 (58.5, 67.4)	62.9 (58.6, 67.2)	0.99

PDS, Public Distribution System is India's food security system which provides free or subsidized rice and pulses for households living below the poverty line

Comparing demographic and socioeconomic characteristics by gender using Students t-tests for continuous variables and Chi Square and Fisher's exact test for categorical variables

* Other Backwards Class, Scheduled Caste, and Scheduled Tribe are educationally and socially disadvantaged groups of the population classified by the Government of India.

† Data are presented as frequency in percentage (%) and 95% confidence intervals unless indicated otherwise

‡ Continuous variables presented as mean and standard deviation

§ $US 1 = 51.0 Indian Rupees (INR), April 2012

Table 2. Food consumption patterns (times per week) and Food Variety Score of households between men and women in Vijayapura, Karnataka, India

	Overall (n = 937)	Men (n = 448)	Women (n = 477)	Difference (Men – Women)_
Staples and local foods				
PDS-supported staples				
Rice and rice-based dishes [a]	8.5 ± 2.1	8.6 ± 2.5	8.4 ± 1.8	0.2
Pulses [b]	10.0 ± 2.2	9.8 ± 2.2	10.1 ± 2.2	-0.3*
Non-PDS-supported staples				
Wheat, pearl millet, and sorghum [c]	7.8 ± 0.9	7.9 ± 1.0	7.7 ± 0.7	0.2***
Produce				
Fruits [d]	15.0 ± 9.8	13.1 ± 8.9	16.8 ± 10.2	-3.7***
Vegetables [e]	9.7 ± 3.2	9.8 ± 3.5	9.7 ± 2.8	0.1
Snacks, sweets and condiments				
Savory foods and snacks [f]	8.8 ± 4.4	8.9 ± 4.8	8.8 ± 4.1	0.1
Nuts	3.8 ± 2.5	3.5 ± 2.5	4.1 ± 2.5	-0.6***
Local sweets [g]	1.2 ± 1.5	1.1 ± 1.5	1.3 ± 1.6	-0.2**
Sweeteners [h]	2.6 ± 2.9	2.3 ± 2.9	3.0 ± 2.9	-0.7***
Animal-source foods				
Red meat [i]	0.4 ± 0.7	0.4 ± 0.9	0.3 ± 0.6	0.1**
Lean meat [j]	0.7 ± 1.2	0.8 ± 1.3	0.6 ± 1.1	0.2**
Eggs	1.7 ± 1.9	1.8 ± 1.9	1.7 ± 2.0	0.1
Dairy [k]	13.8 ± 8.0	13.2 ± 7.8	14.4 ± 8.2	-1.2*
Non-local foods: Global and Indian				
Global breads and cereals [l]	2.1 ± 2.5	1.8 ± 2.4	2.3 ± 2.6	-0.5**
Global savory foods and snacks [m]	1.4 ± 2.0	1.3 ± 1.9	1.5 ± 2.1	-0.2
Global sweets [n]	3.6 ± 3.4	2.9 ± 3.0	4.1 ± 3.6	-1.2***
Non-local Indian savory snacks [o]	3.7 ± 3.7	3.8 ± 4.0	3.5 ± 3.4	0.3
Non-local Indian sweets [p]	0.5 ± 0.8	0.5 ± 0.8	0.6 ± 0.8	-0.1
Drinks				
Tea and coffee	6.4 ± 1.8	6.3 ± 1.9	6.5 ± 1.7	-0.2
Fruit juices [q]	1.5 ± 1.8	1.7 ± 1.9	1.3 ± 1.6	0.4***
Soda and energy drinks	0.3 ± 0.9	0.5 ± 1.1	0.2 ± 0.6	0.3***
Food Variety Score mean ± SD (min-max)	51.0 ± 5.8 (19 - 67)	50.0 ± 5.7 (19 - 65)	49.0 ± 5.3 (27 - 62)	**

Values are mean ± SD

*P<0·05, **P<0·01, ***P<0·001.

Comparing food consumption patterns between men and women

Differences in food consumption between men and women were tested using Students t-tests

[a] Rice, curd rice, veg pulao, idli, dosa, uttapa
[b] Dal, sambar, peas, chana, soybean, sprouts
[c] Chapati, roti, poori, paratha, puran poli
[d] Bananas, apples, citrus, pomegranate, gooseberries, watermelon, grapes, mango, custard apple
[e] Green leafy vegetables, potatoes, yams, other vegetables
[f] Wadas, bhajji, bonda, papad, poha, upma, chooda
[g] Peda, barfi, laddoo, halwa, and kheer, shrikhand
[h] Sugar, jaggery, honey, and sweeteners
[i] Mutton
[j] Chicken and fish
[k] Curd, raita, paneer, cheese, butter, ghee, milk, lassi, milkshake, flavored milk, buttermilk
[l] Bread, multigrain biscuits, cereal, muesli, oats, masala oats
[m] Burgers, pizzas, pasta, noodles, potato chips, popcorn, puffs
[n] Chocolate, chocolate spreads, pancakes, waffles, biscuits, and ice cream
[o] Samosa, wada pav, gobi Manchurian, chaat, Pav bhaji, khaari, rusk
[p] Cakes, pastries, kulfi, gulab jamun
[q] Fresh and packaged

Table 3. Frequency of food consumption (times per week) and Food Variety Score, with comparison between men and women across rural and urban residence in Vijayapura, Karnataka, India

	Men n=448		Urban v. rural	Women n=477		Urban v. rural	Urban Men v. Women	Rural Men v. Women
	Urban n=242	**Rural** n=206		**Urban** n=258	**Rural** n=219			
Staples and local foods								
PDS-supported staples								
Rice and rice-based dishes [a]	9.1 ± 2.3	8.1 ± 2.5	***	8.6 ± 2.0	8.2 ± 1.4	*	**	
Pulses [b]	9.9 ± 2.3	9.8 ± 2.0		10.1 ± 2.3	10.2 ± 2.1			*
Non-PDS-supported staples								
Wheat, pearl millet, and sorghum [c]	7.9 ± 0.9	7.9 ± 1.1		7.7 ± 0.8	7.6 ± 0.5		**	***
Produce								
Fruits [d]	15.3 ± 9.6	10.5 ± 7.1	***	19.8 ± 11.3	13.4 ± 7.5	***	***	***
Vegetables [e]	10.7 ± 3.7	8.6 ± 2.9	***	10.1 ± 3.0	9.2 ± 2.6	***	*	*
Snacks, sweets and condiments								
Savory foods and snacks [f]	9.6 ± 5.1	8.0 ± 4.3	***	8.3 ± 3.8	9.2 ± 4.3	*		
Nuts	3.8 ± 2.6	3.2 ± 2.5	*	4.4 ± 2.4	3.8 ± 2.5	*	**	**
Local sweets [g]	1.2 ± 1.7	0.8 ± 1.1	**	1.5 ± 1.7	1.2 ± 1.4			**
Sweeteners [h]	2.6 ± 3.3	1.9 ± 2.4	*	3.4 ± 3.3	2.4 ± 2.3	***	*	**
Animal-source foods								
Red meat [i]	0.5 ± 0.8	0.4 ± 0.9		0.3 ± 0.7	0.3 ± 0.5		*	
Lean meat [j]	0.7 ± 1.3	1.0 ± 1.4	*	0.6 ± 1.2	0.6 ± 1.0			**
Eggs	1.7 ± 1.8	1.9 ± 1.9		1.7 ± 2.0	1.7 ± 2.0			
Dairy [k]	15.7 ± 7.8	10.2 ± 6.7	***	16.8 ± 8.3	11.6 ± 7.2	***		*
Non-local foods: Global and Indian								
Global breads and cereals [l]	1.9 ± 2.6	1.6 ± 2.0		1.9 ± 2.7	2.7 ± 2.5	**		***
Global savory foods and snacks [m]	1.5 ± 2.1	1.1 ± 1.6	*	1.7 ± 2.2	1.4 ± 2.0			
Global sweets [n]	3.5 ± 3.4	2.3 ± 2.4	***	4.3 ± 3.6	4.0 ± 3.7		**	***
Non-local Indian savory snacks [o]	4.0 ± 4.4	3.6 ± 3.5		3.7 ± 3.5	3.4 ± 3.2			
Non-local Indian sweets [p]	0.6 ± 0.9	0.4 ± 0.5	**	0.6 ± 1.0	0.5 ± 0.7			
Drinks								
Tea and coffee	6.4 ± 1.9	6.3 ± 1.9		6.4 ± 1.9	6.6 ± 1.3			*
Fruit juices [q]	2.1 ± 2.1	1.3 ± 1.4	***	1.6 ± 1.7	1.0 ± 1.5	***	**	*
Soda and energy drinks	0.6 ± 1.3	0.4 ± 0.9		0.2 ± 0.8	0.1 ± 0.4		***	***
Food Variety Score Mean ± SD (min-max)	51.1 ± 6.1 (19 - 65)	48.8 ± 5.0 (30 - 60)	***	50.3 ± 5.5 (27 - 62)	47.4 ± 4.7 (32 - 59)	***		

Values are mean ± SD

*P<0·05, **P<0·01, ***P<0·001.

Comparing food consumption patterns between urban and rural men and women

Differences in food consumption between urban and rural men and women were tested using Students t-tests

[a] Rice, curd rice, veg pulao, idli, dosa, uttapa

[b] Dal, sambar, peas, chana, soybean, sprouts

[c] Chapati, roti, poori, paratha, puran poli
[d] Bananas, apples, citrus, pomegranate, gooseberries, watermelon, grapes, mango, custard apple
[e] Green leafy vegetables, potatoes, yams, other vegetables
[f] Wadas, bhajji, bonda, papad, poha, upma, chooda
[g] Peda, barfi, laddoo, halwa, and kheer, shrikhand
[h] Sugar, jaggery, honey, and sweeteners
[i] Mutton
[j] Chicken and fish
[k] Curd, raita, paneer, cheese, butter, ghee, milk, lassi, milkshake, flavored milk, buttermilk
[l] Bread, multigrain biscuits, cereal, muesli, oats, masala oats
[m] Burgers, pizzas, pasta, noodles, potato chips, popcorn, puffs
[n] Chocolate, chocolate spreads, pancakes, waffles, biscuits, ice cream
[o] Samosa, wada pav, gobi Manchurian, chaat, Pav bhaji, khaari, rusk
[p] Cakes, pastries, kulfi, gulab jamun
[q] Fresh and packaged

Table 4. Associations between frequency of food intake and gender among adults in Vijayapura, Karnataka, India†

Outcome Variables	β	95% CI
Staples and local foods		
PDS-supported staples		
Rice and rice-based dishes [a]	-0.33*	-0.64, 0.03
Pulses [b]	0.28	-0.04, 0.60
Non-PDS-supported staples		
Wheat, pearl millet, and sorghum ‡, [c]	-0.04***	-0.056, -0.03
Produce		
Fruits ‡, [d]	0.30***	0.21, 0.40
Vegetables [e]	0.04	-0.41, 0.48
Snacks, sweets and condiments		
Savory foods and snacks [f]	-0.29	-0.93, 0.35
Nuts	0.72***	0.36, 1.07
Local sweets ‡, [g]	0.25***	0.12, 0.38
Sweeteners ‡, [h]	0.44***	0.23, 0.64
Animal-source foods		
Red meat ‡, [i]	-0.12	-0.31, 0.08
Lean meat ‡, [j]	-0.13	-0.31, 0.04
Eggs ‡	0.14	-0.04, 0.33
Dairy [k]	1.63**	0.62, 2.65
Non-local foods: Global and Indian		
Global breads and cereals ‡, [l]	0.12	-0.09, 0.33
Global savory foods and snacks ‡, [m]	-0.07	-0.24, 0.10
Global sweets ‡, [n]	0.40***	0.23, 0.58
Non-local Indian savory snacks ‡, [o]	-0.18*	-0.34, 0.02
Non-local Indian sweets ‡, [p]	0.03	-0.08, 0.14
Drinks		
Tea and coffee	0.20	-0.06, 0.46
Fruit juices ‡, [q]	-0.36***	-0.52, 0.20
Soda and energy drinks ‡	-0.54***	-0.72, 0.37
Food Variety Score	-1.30***	-2.06, -0.55

Men are the referent group
*P<0·05, **P<0·01, ***P<0·001.
Association between food variety score and frequency of consumption of food groups (outcome variables) and gender (exposure variable) using linear regression models

‡ Outcome variable was log-transformed to make distribution of outcome data closer to being symmetric
† Adjusted for respondent age, religion, caste, education, income, total household members, region, and PDS use
[a] Rice, curd rice, veg pulao, idli, dosa, uttapa
[b] Dal, sambar, peas, chana, soybean, sprouts
[c] Chapati, roti, poori, paratha, puran poli
[d] Bananas, apples, citrus, pomegranate, gooseberries, watermelon, grapes, mango, custard apple
[e] Green leafy vegetables, potatoes, yams, other vegetables
[f] Wadas, bhajji, bonda, papad, poha, upma, chooda
[g] Peda, barfi, laddoo, halwa, and kheer, shrikhand
[h] Sugar, jaggery, honey, and sweeteners
[i] Mutton
[j] Chicken and fish
[k] Curd, raita, paneer, cheese, butter, ghee, milk, lassi, milkshake, flavored milk, buttermilk
[l] Bread, multigrain biscuits, cereal, muesli, oats, masala oats
[m] Burgers, pizzas, pasta, noodles, potato chips, popcorn, puffs
[n] Chocolate, chocolate spreads, pancakes, waffles, biscuits, ice cream
[o] Samosa, wada pav, gobi Manchurian, chaat, Pav bhaji, khaari, rusk
[p] Cakes, pastries, kulfi, gulab jamun
[q] Fresh and packaged

Table 5. Dietary patterns derived from NT-FFQ among adults in Vijayapura, Karnataka, India*

Food Groups	Snacks, Cereals, and Sweets Dietary Pattern	Dairy, Fruits, & Nuts Dietary Pattern	Non-Vegetarian Dietary Pattern	Vegetarian Dietary Pattern
Staples and local foods				
PDS-supported staples				
Rice and rice-based dishes [a]				0.58
Pulses [b]				
Non-PDS-supported staples				
Wheat, pearl millet, and sorghum [c]				0.46
Produce				
Fruits [d]		0.69		
Vegetables [e]				0.56
Snacks, sweets and condiments				
Savory foods and snacks [f]	0.44			0.50
Nuts		0.62		
Local sweets [g]	0.53			
Sweeteners [h]		0.66		
Animal-source foods				
Red meat [i]			0.65	
Lean meat [j]			0.79	
Eggs			0.72	
Dairy [k]		0.65		
Non-local foods: Global and Indian				
Global breads and cereals [l]	0.60			
Global savory foods and snacks [m]	0.72			
Global sweets [n]	0.64			
Non-local Indian savory snacks [o]	0.66			
Non-local Indian sweets [p]	0.66			
Drinks				
Tea and coffee				
Fruit juices [q]				0.48
Soda and energy drinks				
Variance Explained (%)	2.97	2.24	2.12	2.01

* Food groups with absolute values < 0.40 are excluded from the table for simplicity

NT-FFQ, Nutrition Transition Food Frequency Questionnaire

Food group correlations and loadings were found using Principal components analysis and employing varimax rotation

Data representative of 925 adults across urban and rural households in Vijayapura, Karnataka

[a] Rice, curd rice, veg pulao, idli, dosa, uttapa
[b] Dal, sambar, peas, chana, soybean, sprouts
[c] Chapati, roti, poori, paratha, puran poli
[d] Bananas, apples, citrus, pomegranate, gooseberries, watermelon, grapes, mango, custard apple
[e] Green leafy vegetables, potatoes, yams, other vegetables
[f] Wadas, bhajji, bonda, papad, poha, upma, chooda
[g] Peda, barfi, laddoo, halwa, and kheer, shrikhand
[h] Sugar, jaggery, honey, and sweeteners
[i] Mutton
[j] Chicken and fish
[k] Curd, raita, paneer, cheese, butter, ghee, milk, lassi, milkshake, flavored milk, buttermilk
[l] Bread, multigrain biscuits, cereal, muesli, oats, masala oats
[m] Burgers, pizzas, pasta, noodles, potato chips, popcorn, puffs
[n] Chocolate, chocolate spreads, pancakes, waffles, biscuits, and ice cream
[o] Samosa, wada pav, gobi Manchurian, chaat, Pav bhaji, khaari, rusk
[p] Cakes, pastries, kulfi, gulab jamun
[q] Fresh and packaged

Table 6. Associations between demographic and socioeconomic characteristics and dietary patterns derived using Principal Components Analysis among adults in Vijayapura, Karnataka, India

Characteristic	Snacks, Cereals, and Sweets Dietary Pattern		Dairy, Fruits, & Nuts Dietary Pattern		Non-Vegetarian Dietary Pattern		Vegetarian Dietary Pattern	
	β	95% CI	β	95% CI	β	95% CI	β	95% CI
Gender (Men vs. Women)	0.18	-0.03, 0.39	0.40***	0.22, 0.58	-0.49***	0.66, -0.32	-0.39***	-0.59, -0.19
Age (in years)	-0.02***	-0.03, -0.01	-0.007	-0.02, -0.002	-0.01**	-0.02, -0.003	-0.02*	-0.03, -0.003
Religion	-0.04	-0.20, 0.11	0.05	-0.08, 0.18	0.23***	0.11, 0.36	-0.09	-0.23, 0.04
Caste	0.08	-0.08, 0.24	-0.16*	-0.29, -0.03	0.79***	0.67, 0.91	-0.03	-0.17, 0.10
Education	-0.05	-0.14, 0.04	0.13***	0.06, 0.21	-0.07	-0.04, 0	0.12**	0.04, 0.20
Household Monthly Income (INR) ($US)[§]	-0.06	-0.17, 0.04	0.26***	0.17, 0.35	-0.07	-0.15, 0.02	-0.03	-0.12, 0.07
Number of Household Members[‡]	-0.01	-0.05, 0.03	-0.04*	-0.07, -0.001	-0.03	-0.06, 0.006	0.05**	0.01, 0.09
Region (Rural vs. Urban)	0.45***	0.20, 0.70	0.062	-0.15, 0.27	0.38***	0.17, 0.58	0.59***	0.35, 0.82
PDS Use (Non-User vs. Users)	0.27*	0.01, 0.53	-0.17	-0.39, 0.04	0.24*	0.04, 0.44	-0.26*	-0.51, -0.02

PDS, Public Distribution System is India's food security system which provides free or subsidized rice and pulses for households living below the poverty line

Men, rural residents, and PDS non-users are the referent groups

*P<0·05, **P<0·01, ***P<0·001.

Evaluating the association between demographic and socioeconomic characteristics and dietary patterns derived from principal components analysis among adults, using multiple linear regression analyses

[§] $US 1 = 51.0 Indian Rupees (INR), April 2012

APPENDICES

Table 7. Demographic and socioeconomic profile of men in Vijayapura, Karnataka, India based on dietary patterns derived using Principal Components Analysis

Characteristic†	Snacks, Cereals, and Sweets Dietary Pattern	Dairy, Fruits, & Nuts Dietary Pattern	Non-Vegetarian & Tea/Coffee Dietary Pattern	Vegetarian Dietary Pattern
Age (in years)‡	44.3 ± 9.8	44.4 ± 9.6	44.5± 9.7	44.3 ± 9.8
Religion				
Hindu	74.3 (71.4, 77.2)	74.6 (71.7, 77.4)	76.4 (73.6, 79.2)	75.2 (72.4, 78.0)
Muslim	23.1 (20.3, 25.9)	22.5 (19.8, 25.2)	20.9 (18.2, 23.5)	22.1 (19.4, 24.8)
Christian	0.1 (0.0, 0.34)	0.2 (0.0, 0.5)	0.1 (0.0, 0.6)	0.2 (0.0, 0.5)
Jain	2.5 (1.5, 3.5)	2.7 (1.7, 3.8)	2.6 (1.6, 3.7)	2.4 (1.4, 3.5)
Caste				
General	23.1 (20.3, 25.9)	23.5 (20.7, 26.2)	24.9 (22.1, 27.7)	23.7 (20.9, 26.4)
Other Backward Class	56.8 (53.6, 60.1)	56.4 (53.2, 59.7)	54.9 (51.7, 58.1)	55.3 (52.1, 58.6)
Scheduled Caste	19.4 (16.8, 22.1)	19.3 (16.8, 21.9)	19.4 (16.9, 22.0)	20.2 (17.6, 22.9)
Scheduled Tribe	0.7 (0.1, 1.2)	0.8 (0.2, 1.3)	0.8 (0.2, 1.3)	0.8 (0.2, 1.4)
Education				
Never attended	33.2 (29.9, 36.5)	32.7 (29.5, 36.0)	31.7 (28.5, 34.9)	32.9 (29.6, 36.1)
Pre-Primary school	23.4 (20.4, 26.3)	24.0 (21.1, 27.0)	23.2 (20.3, 26.1)	21.7 (18.9, 24.6)
High school	16.7 (14.1, 19.4)	15.9 (13.3, 18.4)	16.1 (13.5, 18.6)	16.7 (14.1, 19.3)
PUC/Diploma	10.6 (8.5, 12.8)	11.0 (8.9, 13.2)	12.3 (10.1, 14.6)	11.8 (9.5, 14.0)
Degree and above	16.1 (13.5, 18.7)	16.4 (13.8, 18.9)	16.7 (14.1, 19.3)	16.9 (14.3, 19.6)
Household Monthly Income (INR) ($US)§				
< 5000 (< $US 98)	15.8 (13.4, 18.2)	16.4 (14.0, 18.8)	15.4 (13.0, 17.7)	16.4 (14.0, 18.9)
5,001 – 10,000 ($US 98 – 196)	33.5 (30.4, 36.6)	33.2 (30.1, 36.2)	32.9 (29.9, 26.0)	33.1 (30.0, 36.3)
10,001 – 20,000 ($US 196 – 392)	23.6 (20.8, 26.4)	23.0 (20.3, 25.8)	23.3 (20.5, 26.0)	23.3 (20.6, 26.1)
20,001 – 30,000 ($US 392 – 588)	9.9 (7.9, 11.9)	10.0 (8.1, 12.0)	10.4 (8.4, 12.4)	9.4 (7.5, 11.4)
≥ 30,001 (≥ $US 98)	17.1 (14.6, 19.5)	17.3 (14.8, 19.7)	17.9 (15.4, 20.4)	17.6 (15.1, 20.0)
Number of Household Members‡	5.7 ± 2.4	5.7 ± 2.3	5.7 ± 2.4	5.6 ± 2.3
Rural	50.6 (47.3, 53.9)	50.4 (47.2, 53.7)	50.3 (47.0, 53.6)	50.1 (46.8, 53.4)
PDS Users	62.4 (59.0, 65.8)	62.5 (59.1, 65.8)	61.7 (58.4, 65.1)	61.2 (59.0, 65.8)

PDS, Public Distribution System is India's food security system which provides free or subsidized rice and pulses for households living below the poverty line
Describing differences in demographic and socioeconomic characteristics across dietary patterns derived from principal components analysis among men
* Other Backwards Class, Scheduled Caste, and Scheduled Tribe are educationally and socially disadvantaged groups of the population classified by the Government of India.
† Data are presented as frequency in percentage (%) and 95% confidence intervals unless indicated otherwise
‡ Continuous variables presented as mean and standard deviation
§ $US 1 = 51.0 Indian Rupees (INR), April 2012

Table 8. Demographic and socioeconomic profile of women in Vijayapura, Karnataka, India based on dietary patterns derived using Principal Components Analysis

Characteristic†	Snacks, Cereals, and Sweets Dietary Pattern	Dairy, Fruits, & Nuts Dietary Pattern	Non-Vegetarian Dietary Pattern	Vegetarian & Savory Snacks Dietary Pattern
Age (in years)‡	45.6 ± 9.9	45.9 ± 10.1	45.7± 10.0	45.5 ± 10.1
Religion				
Hindu	74.7 (71.8, 77.6)	75.0 (72.1, 77.9)	75.9 (73.1, 78.7)	75.7 (72.9, 78.6)
Muslim	22.7 (19.9, 25.5)	22.4 (19.6, 25.1)	21.3 (18.7, 24.0)	21.4 (18.7, 24.1)
Christian	0.1 (0.0, 0.3)	0.2 (0.0, 0.5)	0.1 (0.0, 0.3)	0.2 (0.0, 0.6)
Jain	2.5 (1.5, 3.5)	2.4 (1.4, 3.4)	2.6 (1.6, 3.7)	2.6 (1.6, 3.7)
Caste				
General	22.9 (20.1, 25.7)	24.1 (21.3, 26.9)	25.2 (22.3, 28.0)	24.2 (21.3, 27.0)
Other Backward Class	56.0 (52.7, 59.3)	55.1 (51.8, 58.4)	55.5 (52.2, 58.7)	54.9 (51.6, 58.2)
Scheduled Caste	20.4 (17.7, 23.1)	20.1 (17.4, 22.7)	18.7 (16.2, 21.2)	20.2 (17.5, 22.8)
Scheduled Tribe	0.7 (0.1, 1.2)	0.7 (0.1, 1.2)	0.7 (0.1, 1.2)	0.8 (0.02, 1.4)
Education				
Never attended	30.3 (27.1, 33.6)	30.8 (27.5, 34.0)	29.6 (26.5, 32.8)	30.2 (27.0, 33.5)
Pre-Primary school	22.8 (19.8, 25.8)	20.9 (18.0, 23.7)	22.3 (19.4, 25.1)	21.6 (18.7, 24.5)
High school	15.2 (12.7, 17.8)	16.3 (13.7, 18.9)	16.6 (14.1, 19.2)	17.0 (14.4, 19.7)
PUC/Diploma	13.4 (11.0, 15.8)	13.3 (10.9, 15.7)	13.3 (10.9, 15.6)	13.5 (11.1, 15.9)
Degree and above	18.2 (15.5, 21.0)	18.8 (16.0, 21.5)	18.3 (15.6, 20.9)	17.7 (15.0, 20.4)
Household Monthly Income (INR) ($US) §				
< 5000 (< $US 98)	15.1 (12.7, 17.4)	15.9 (13.5, 18.3)	14.9 (12.5, 17.2)	15.8 (13.4, 18.2)
5,001 – 10,000 ($US 98 – 196)	33.4 (30.3, 36.5)	33.2 (30.1, 36.3)	33.8 (30.7, 37.0)	33.5 (30.3, 36.6)
10,001 – 20,000 ($US 196 – 392)	23.8 (21.0, 26.7)	23.9 (21.0, 26.7)	23.5 (20.8, 26.3)	23.8 (21.0, 26.7)
20,001 – 30,000 ($US 392 – 588)	10.2 (8.2, 12.2)	9.1 (7.2, 11.0)	10.2 (8.3, 12.2)	9.9 (7.9, 11.8)
≥ 30,001 (≥ $US 98)	17.5 (14.9, 20.0)	17.8 (15.3, 20.3)	17.5 (15.0, 20.0)	17.0 (14.5, 19.4)
Number of Household Members‡	5.7 ± 2.4	5.6 ± 2.4	5.7 ± 2.4	5.7 ± 2.4
Rural	49.8 (46.5, 53.2)	50.9 (47.6, 54.3)	49.7 (46.5, 53.0)	51.6 (48.2, 54.9)
PDS Users	63.7 (60.3, 67.1)	62.3 (58.9, 65.8)	61.8 (58.4, 65.1)	62.6 (59.1, 66.0)

PDS, Public Distribution System is India's food security system which provides free or subsidized rice and pulses for households living below the poverty line

Describing differences in demographic and socioeconomic characteristics across dietary patterns derived from principal components analysis among women

* Other Backwards Class, Scheduled Caste, and Scheduled Tribe are educationally and socially disadvantaged groups of the population classified by the Government of India.

† Data are presented as frequency in percentage (%) and 95% confidence intervals unless indicated otherwise

‡ Continuous variables presented as mean and standard deviation

§ $US 1 = 51.0 Indian Rupees (INR), April 2012