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Unveiling Diet Quality in Kerala: A Study on Healthy Food Diversity and Socio-Economic Influences

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Abstract: *This study explores the diet quality in Kerala by generating the healthy food diversity index and investigates the socio-economic factors that influence household consumption of nutritious foods. It relies on unit-level data obtained from three rounds of the NSSO household consumer expenditure surveys: the 50th (1993-94), 61st (2004-05), and 68th (2011-12).The findings demonstrate a suboptimal diet quality in Kerala highlighting the need for improved healthy food diversity and dietary practices. Factors affecting food diversity include income, education, gender of the household head, landholding size, and consumption of milk and pulses. These results underscore the influence of socio-economic factors in shaping dietary patterns and emphasize the importance of targeted interventions to encourage healthier food choices and enhance overall nutrition.*

Keywords: Healthy food diversity; consumption pattern; Simpson Healthy Food Diversity Index; Kerala; India

JEL Classification: I10; I15

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1. Introduction: Food holds a paramount role in promoting the physical and emotional well-being of individuals, transcending social class differentiations. An optimal dietary regimen is indispensable for individuals starting from the early stages of their lifespan to facilitate adequate growth, development, and holistic health. Scientific investigations in the field of nutrition have consistently demonstrated the significance of dietary diversity in attaining and maintaining good health. Researchers concur that an expanded repertoire of food choices leads to enhanced nutrient intake across the board (Randall et al. 1985). A nourishing diet comprises approximately 50-60 per cent of total caloric intake from carbohydrates, 10-15 per cent from proteins, and 20-30 per cent from both discernible and non-discernible fats (National Institute of Nutrition in 2011). Increasing food diversity is associated with fewer macro vascular diseases (Wahlqvist et al., 1989) and reduces the risk of gastric cancer, breast cancer, and colon cancer (Jansen et al., 2004). Kant et al. (1993) have underscored a compelling linear trend wherein diminishing food diversity corresponds to escalating mortality rates. Appreciating the pivotal role of food diversity, nutritionists have long advocated for its integration as a cornerstone element within high-quality dietary practices. International Food Guidelines consistently underscore the consumption of a broad array of foods to satisfy the human inclination for more than mere essential nutrients. The Dietary Guidelines for Indians meticulously crafted by the Indian Council of Medical Research (ICMR) under the auspices of the National Institute of Nutrition (NIN), advocate for embracing dietary diversity to ensure a balanced nutritional profile and effectively address the multifaceted burden of malnutrition gripping the nation. India's dietary transition comprises two distinct stages closely linked to economic growth, with the first stage characterized by income-driven food diversification wherein shift from lower-quality to higher-quality goods, replacing some traditional staples with main food products (Karunakaran N, 2013. Pingali and Khwaja, 2004).

During the second phase, consumers in India show a pronounced inclination toward meat or fish, temperate foods like apples, and extensively processed convenience foods and beverages, following the initiation of the initial stage of income-induced diet diversification in the 1980s amid substantial economic growth which was succeeded by the commencement of the second phase of worldwide diet diversification in the 1990s subsequent to economic reforms (Pingali and Khwaja, 2004). In the presence of dietarydiversification, India confronts a triple challenge encompassing malnutrition, which includes a high prevalence of undernutrition, widespread deficiencies in micronutrients, and an increasing incidence of

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obesity.Economic development has brought about significant changes in diet composition and a decline in physical activity, leading to a nutrition transition (Popkin et al., 2001; Misra et al., 2011).The transition in dietary and lifestyle patterns contributes significantly to the prevalence of non-communicable diseases, leading to considerable disability and premature mortality in developing and newly developed counties (World Health Organization, 2003). Kerala is a unique state in India known for its exceptional achievements in health, education, and living standards despite a limited industrial base and economic infrastructure. It boasts the highest literacy rate in India, with 96.2 per cent and leading life expectancies (Economic Review, 2020). Household consumption in Kerala, observed in both rural and urban settings, surpasses the national average (Padma et al., 2018). Furthermore, Kerala stands as a leading state in terms of monthly per capita food consumption. Following the period of liberalization, there has been noteworthy growth in monthly per capita expenditures on both food and non-food items in Kerala (Padma et al., 2018), fostering heightened anticipations for enhancements in dietary quality. The inhabitants of Kerala have observed alterations in their dietary behaviours, transitioning from predominantly cereal-based diets to a more varied spectrum of food choices.

Notably, there has been an increase in the consumption of pulses, fish, eggs and meat, vegetables, sugar, and non-alcoholic beverages, accompanied by a corresponding decline in the proportion of cereal intake (National Sample Survey Organization, 2012).). This shift raises questions about the nutritional implications, especially among lower-income groups. Studies suggest that declining per capita cereal consumption may lead to a decline in nutritional status, particularly among the poor (Shah, 1983; Behrman and Deolikar, 1989; Kumar and Dey, 2007).The escalating prevalence of non-communicable diseases (NCDs) in Kerala has generated significant apprehensions regarding the sustainability of notable accomplishments in its health sector, including elevated life expectancy, low infant mortality rates, and reduced birth and death rates (Economic Review, 2021). NCDs are estimated to contribute to 42 per cent of deaths in India, with Kerala experiencing over 52 per cent of total deaths within the productive age group of 30-59 years attributed to such diseases (NITI Aayog, 2019). Kerala is notably characterized by a heightened incidence of diabetes Mellitus, affecting 27 per centof adult males, in contrast to the national average of 15 per cent (NITI Aayog, 2019). This emergent trend is largely ascribed to shifts in dietary patterns and sedentary lifestyles.

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1.1. Review of literature: Dietary diversity is a crucial aspect of individuals' food consumption patterns, measuring the range of different food items or food groups they incorporate into their diets within a specified timeframe (Pattersone et al., 1994; Ruel, 2003). Within the field of nutritional science, there is a strong emphasis on recognizing the importance of diverse dietary choices as a protective measure against chronic diseases (Randallet al., 1985; Drewnowski and Popkin, 1997). A growing body of epidemiological research has yielded compelling evidence regarding the positive impacts of dietary diversity on both the enhancement of nutritional quality and the promotion of child growth, particularly in developing nations (Ogle et al., 2001; Ruel, 2003; Arimond&Ruel, 2004).

Hunt (2002) highlights the crucial role of ensuring appropriate iron nutrition during the first three years of life in brain development. The adoption of a diverse diet has been associated with increased lifespan and a reduced risk of chronic degenerative diseases (Jacques and Tucker, 2001). Additionally, dietary diversity not only promotes balanced diets and improved health outcomes but also enhances nutrient intake, incorporating other beneficial elements such as fiber and antioxidants (Jacques and Tucker, 2001). This aspect is particularly relevant in preventing diseases such as HIV/AIDS, diabetes, cancer, and vision impairment (Johns and Sthapit, 2004). Conversely, adhering to monotonous diets or consuming the same food items daily can have serious implications for nutritional well-being (Cornia, 1994).

A substantial body of empirical research has been dedicated to analysing the determinants of dietary diversity in various countries (Moon et al., 2002; Karamba et al., 2011).Theil and Finke (1983) utilized the Herfindahl and entropy index, along with income elasticity, to examine this association in 30 countries and finds that higher income levels were linked to a greater variety of food choices. Jackson (1984) confirmed this positive relationship by conducting a hierarchical demand system analysis. Falkinger and Zweimuller (1996) expanded on Jackson's research, analysing 57 countries and also observing a positive connection between income and food diversity.Herrman and Roeder (1998) specifically focused on Germany and revealed that higher income levels were associated with increased food diversity and enhanced dietary quality, with education and dietary knowledge playing crucial roles. Theil and Weiss (2003) carried out a study in Germany that reaffirmed the positive correlation between income and food diversity while also identifying demographic factors that influenced demand. Jekanowski and Binkley (2000) found that markets with a high proportion of low-income households exhibited less variety in grocery categories and breakfast cereals. Other studies explored the impact of household characteristics, such as

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household composition, age, education levels, and race/ethnicity, on food diversity (Moon et al., 2002; Rashid et al., 2006)

Moon et al. (2002) investigated the demographic and socio-economic determinants of food diversity in Bulgaria, finding that older consumers with lower income and less education had limited demand for food diversity. Factors such as children's taste preferences, household size, age of household heads, working parents, race/ethnicity, and education levels also affected food diversity. Lee and Brown (1989) found that the presence of older females in a household had a significant impact on the variety of food choices. Factors such as cooking preferences, dietary habits, and their influence in decision-making contributed to this influence. Rashid et al. (2006) used a household expenditure survey in Bangladesh and identified total expenditure per capita, female and male education, female household heads, the number of adults in the household, and food prices as important determinants of food diversity. Herrmann and Roeder (1997) analysed the impact of socio-economic determinants, health concerns, and nutrition knowledge on food demand in Germany, highlighting the influence of education on food variety and dietary quality.

In India Gaihaet al (2012) studied diet diversification by using data from the National Sample Survey and constructed a food diversity index based on five food commodities and explored the role of income, household characteristics, and the general environment in dietary changes. Gaiha et.al (2012) emphasized the importance of food prices, expenditure, demographic characteristics, and lifestyle changes in diet diversification and nutritional outcomes. Das (2014) analysed food diversity in India using the Entropy Index and found that income, education, and infrastructural facilities significantly influenced food diversity. Das (2014) also highlighted the negative association between quality-adjusted unit values and dietary diversity. Parapurathu et al. (2015) investigated food consumption patterns and dietary diversity in selected villages in eastern India and their findings showed that larger households with better-educated male heads and higher purchasing power had higher dietary diversity scores. The accessibility to the public distribution system (PDS) also indirectly enhanced dietary diversity. Venkatesh et al. (2016) examined food consumption trends and nutrient intake in India. They found that per capita consumption of cereals decreased while that of edible oils, vegetables, eggs, fish, and meat increased. Increased income, education, and production diversity were identified as significant determinants of food diversity. Steffen and Yu (2018) assessed the latent demand structure for food diversity in India. They found two distinct demand patterns, with consumers near their subsistence threshold prioritizing calorie

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sufficiency and transitioning to a more varied diet once that threshold is surpassed.

Existing studies have identified different determinants of dietary quality, but there is limited research specifically focusing on the state of Kerala in India. Furthermore, previous studies have primarily examined individual-level factors such as income, education, and household characteristics, neglecting the influence of factors such as age, gender, marital status, household size, household type, religion, social group, income classes, and land ownership at the state level. This research gap calls for a comprehensive analysis that considers these factors within the context of Kerala to gain a deeper understanding of their impact on the dietary quality of Keralites.

1.2. Objectives: This study aims to investigate the dietary practices through food diversity analysis of Keralites through an interdisciplinary lens, combining the fields of economics and nutrition science. Along with this, it is crucial to empirically examine the socio-economic factors influencing the healthy food diversity of households in Kerala.

2. Materials and methods: The study utilizes unit-level of 13857 sample households from three rounds of the NSSO household consumer expenditure surveys that is 4310 samples form the 50th (1993-94), 5146 from 61st (2004-05), and 4400 from 68th (2011-12). The data extraction process involves capturing information on the quantity of food items consumed by sampled households, which are classified into ten major food groups: (I) Cereal, (II) Pulses and pulse products, (III) Roots and tubers, (IV) Milk and milk products, (V) Egg, fish, and meat, (VI) Leafy vegetable, (VII) Other vegetables, (VIII) Edible oil, (IX) Sugar, and (X) Fruits. The classification of food items follows slight modifications to the NSSO classification based on the recommendations outlined in the National Institute of Nutrition's report on 'Dietary Guidelines for Indians: A Manual' (National Institute of Nutrition 2011). The study does not consider the remaining four food groups of the NSSO methodology, namely salt and spices, beverages, served processed food, and packaged processed food. The exclusion is necessary as these food groups are not considered to contribute to the nutritional value of a healthy diet, according to the 'Dietary Guidelines for Indians' (National Institute of Nutrition 2011).

Furthermore, this study examines food diversity based on the quantity consumed by households, rather than relying on the expenditure approach. This approach allows for a more accurate measurement and analysis of diet quality by considering the quantities of different food groups consumed, rather than focusing on expenditure. The present study relies on the uniform reference period (URP) definition provided by the NSSO, which involves a 30-day

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reference period for all items. This URP definition enables the study to conduct a comparative and pooled analysis of the 50th, 61st, and 68th rounds of consumer expenditure. Regarding the quantities of food items collected by the NSSO, they are predominantly measured in kilograms. However, there are a few exceptions where certain items such as milk are measured in litters, and items like eggs, lemon, banana, pineapple, and orange are measured in units. Additionally, ice cream and other milk products are measured in rupees. Wherever possible, appropriate conversions of food items to kilograms were performed, following the methodology employed by Majumdar et al. (2012).

The established distribution measures, such as the Herfindahl-Index (Jacquemin and Berry, 1979), Berry Index or Simpson Index (Berry, 1971), and Entropie-Index (Gollop and Monahan, 1991), are employed to assess food diversity to capture the picture of diet quality. These measures offer a more comprehensive approach to measuring food diversity compared to count measures, as they consider both the frequency and distribution of food items consumed.The extended diversity measures such as the Gollop-Monohan Index (Gollop and Monahan, 1991) have been developed to increase the sensitivity of the Herfindahl-Index to product heterogeneity (Dresher et al., 2007). However, these measures still fall short in accounting for the healthiness of food items. To address this deficiency, Dresher et al (2007) introduced the Healthy food diversity index as a single measure to concurrently evaluate the variety, quality, and proportionality of dietary intake. This index provides a more comprehensive evaluation of food diversity by considering the number, distribution, and healthiness of food items.

2.1. Simpson Healthy Food Diversity Index: The Healthy Food Diversity Index[i] (HFDI) is ameasure of food diversity that was used in this study to assess the diet quality of households' food baskets.The healthy food diversity index can be generated by multiplying the health value with the Simpson index.

$$SI = 1 - \sum_{i=1}^{n} Si^2\, hv \qquad (1)$$

Where $SI$the quantity share of ith food is consumed, $'i'$ is about the total consumption bundle, and $'n'$ represents the number of items considered. Where 'hv' represents the health value (HV) can be calculated by multiplying the quantitative share of each food group by its corresponding health factor (HFi). This study depends on 'Dietary Guidelines for Indians: A Manual' provided by the National Institute of Nutrition for the derivation of health factors of

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each food item (see Appendix 1). The value of the Healthy food diversity index lies between zero and one, indicating that the higher the value, the higher will be the diversity in the consumption of healthy food items.

2.2. Regression model: This study examines the socio-economic determinants of Healthy food diversity by employing the pooled cross-section regression model, and it is specified as:

$$FD_{it} = \alpha + \beta_1 X_{it} + \beta_2 P_{it} + T + \varepsilon_{it} \qquad (2)$$

Where FD_{it} represent food diversity (Simpson/HFDI) for the i^{th} household at time period 't'. X_{it} is the vector of socio-economic characteristics of the i^{th} household at the time 't'. P_{it} is the vector of the unit value of the food groups such as Rice, Pulse and Milk for the i^{th} household at time period $'t'$. T stands for years and it represents three rounds[1].ε represent omitted determinants of Food Diversity. As the dependent variable in this model is an index and range bound value (the value of Simpson and Healthy food diversity indices (HFDI) lies between 0 to 1, the study performed a logit transformation of the variables using the following formula.

$$TFD_{it} = \log\left(\frac{FD_{it}}{1 - FD_{it}}\right) \qquad (3)$$

Where,TFD_{it} is the transformed Food Diversity score for the ith household at time period't'. The present study uses the TFD_{it} as the dependent variable and estimate the equation (1) in a pooled cross-section regression framework using the OLS method.

[1]The variable "Year" has been added to the study to capture the trend in healthy food diversity over three rounds of the NSSO consumption expenditure survey, specifically the 50th, 61st, and 68th rounds.

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3. Results and discussion:

3.1. Socio economic features of the sample household: The descriptive analysis (Table1) provides valuable insights into the demographic and socio-economic characteristics of the population, aiding in a comprehensive understanding of the dataset. In terms of age, the majority of individuals belongs to ">25 to </=50" age category followed closely by the ">50 to </=75" category. The gender distribution is nearly equal in all rounds, with the domination of male. Marital status indicates that a substantial portion of the population is currently married. When examining education, the "middle and secondary" category has the highest share, while the "illiterate and literate without formal education" category has the lowest. Household size reveals that the majority of households consist of 4 to 6 members and in case of religion, Hindus constitute the largest religious group, followed by Islam and Christianity respectively. The "OBC" social group has the largest share while the "Others" category representation is low. The majority of the population resides in rural areas, and the middle-income class has the highest share among income classes.

Table 1: Socio economic determinants of sample households

Variable	Category	Code	50th		61st		68th		Total	
			Frequency	Share (%)	Frequency	Share(%)	Frequency	Share(%)	Frequency	Share(%)
Age	</=25	0	76	1.8	62	1.2	52	1.2	190	1.37
	>25 to </=50	1	2341	54.3	2406	46.8	1860	42.3	6607	47.68
	>50 to </=75	2	1773	41.1	2423	47.1	2235	50.8	6431	46.41
	>=75	3	121	2.8	254	4.9	253	5.8	628	4.53
Gender	Female	0	1008	23.4	1319	25.6	1175	26.7	3502	25.27
	Male	1	3303	76.6	3826	74.4	3225	73.3	10354	74.73
Marital status	Never married	0	119	2.8	101	2.0	103	2.3	323	2.33
	Currently married	1	3408	79.1	4084	79.4	3469	78.8	10961	79.11
	Widowed	2	746	17.3	897	17.4	786	17.9	2429	17.53
	Divorced/separated	3	38	0.9	63	1.2	42	1.0	143	1.03
Education	Illiterate+ literate without formal education	0	628	14.6	713	13.9	406	9.2	1747	12.61
	Below primary and primary	1	1779	41.3	1766	34.3	136	29.7	4851	35.01
	Middle & secondary	2	1456	33.8	1972	38.3	1878	42.7	5306	38.29
	Higher secondary	3	159	3.7	338	6.6	358	8.1	1097	60.17
	+Diploma Degree and above	4	289	6.7	356	6.9	452	10.3	855	7.92
Household size	1 to 3	0	1141	26.5	1615	31.4	1773	40.3	4529	32.69
	4 TO 6	1	2571	59.6	2905	56.5	2332	50.7	7708	55.63
	7 TO 9	2	487	11.3	465	9.0	301	6.8	1253	9.04
	10 and above	3	112	2.6	160	3.1	94	2.1	366	2.64
Employment	Regular wage/salary	0	883	20.5	1236	24.0	966	22.0	3085	22.26
	Self- employed in agri.	1	355	8.2	605	11.8	385	8.8	1345	9.7
	Self- employed in non agri.	2	1170	27.1	1130	22.0	1115	25.3	3415	24.65
	Casual labour	3	1105	25.6	1310	25.5	1199	27.3	3614	26.08
	Otherr	4	798	18.5	864	16.8	735	16.7	2397	17.30

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Religion	Hindu	0	2622	60.8	3062	59.5	257	58.1	8241	59.48
	Islam	1	796	18.5	1123	21.8	1079	24.5	2998	21.64
	Christian	2	869	20.2	957	18.6	763	17.3	2589	18369
	Others	3	24	0.6	3	0.1	1	0.0	28	0.20
Social group	Others	0	870	20.2	1561	30.3	121	27.8	3652	26.36
	ST	1	54	1.3	61	1.2	45	1.0	160	1.15
	SC	2	321	7.5	473	9.2	316	7.2	1110	8.01
	OBC	3	3066	71.1	3050	59.3	2818	64.1	8934	64.48
Sector	Urban	0	1771	41.1	1877	36.5	1809	41.158.9	5457	39.38
	Rural	1	2540	58.9	3268	63.5	2591		8399	60.62
Income class	Low	0	1312	30.4	1544	30.0	1334	30.3	4190	30.24
	Middle	1	1736	40.3	2066	40.2	1761	40.0	5563	40.15
	High	2	1263	29.3	1535	29.8	1305	29.7	4103	29.61
Land Owned (Hector)	Landless	0	184	4.3	135	2.6	102	2.3	421	3.04
	> 0.004 -0.04	1	1490	34.6	1974	38.4	1826	41.5	5290	38.18
	> 0.04-0.08	2	602	14.0	793	15.4	836	19.0	2231	16.10
	> 0.08-0.12	3	337	7.8	402	7.8	406	9.2	1145	8.26
	> 0.12-0.16	4	198	4.6	267	5.2	230	5.2	695	5.02
	> 0.16-0.2	5	210	4.8	212	4.1	139	3.2	561	4.05
	>0.2	6	1290	29.9	1362	26.5	861	19.6	3513	25.35

Source: Author's own calculations using NSS unite level data, various round

3.2. Determinants of healthy food diversity of the households in Kerala: The pooled cross-section regression model is employed to identify the socio-economic determinants of healthy food diversity of the households in Kerala. The findings (Table 2) robustly support the suitability of the current model for the dataset. This assertion is substantiated by the notably significant F-statistics value (F=101.38; P=0.00). The adjusted R-Square value, standing at 0.39, signifies that 39 per cent of the model's variability can be accounted for by the included independent variables. The examination of multi collinearity, gauged through the Variance Inflation Factor (VIF), indicates an absence of substantial correlation among the independent variables. Consequently, the model stands as a reliable and effective tool for forecasting the healthy food diversity index within households in Kerala.

The results shows that the coefficients of the age categories up to 75 are found to be positively significant. This implies that households headed by this age group in Kerala consume a greater variety of healthy food items. These findings are consistent with the results of Dresher et al. (2007), who observed a positive relationship between food diversity and age. Similarly, male-headed households showed a greater inclination towards consuming various food items. The positive and significant coefficient for male household heads indicates that there is a significant difference in the consumption of food items between male and female-headed households in Kerala. The result is confirmed with the findings of Parapurathu, et al. (2015) in Eastern India. Additionally, the study finds that currently married, widowed, and divorced/separated households consume a greater variety of food items compared to never-married households in Kerala.

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Households led by individuals with higher educational levels exhibit a broader array of food consumption, likely attributable to the positive association between income and education. he degree of dietary diversification is significantly linked to educational attainment, as evidenced by studies conducted by Moon, et al. (2002) and Dresher, et al. (2007). Household size, a critical factor, positively influences diversified food consumption due to economies of scale, as larger households tend to consume a more varied diet, as indicated by Lee (1989). However, the impact of household size on food diversity is nuanced. Contrary to expectations, households with 4 to 6 members consume slightly more diverse food items compared to smaller households. Nevertheless, a negative impact on food diversity is observed when household size exceeds 10. The empirical investigation into household food diversity in Kerala reveals an unexpected correlation between self-employment in agriculture or engagement in casual labour and increased food diversity, contrary to conventional expectations. This counterintuitive finding necessitates thorough scrutiny and interpretation through novel analytical frameworks. Notably, this outcome aligns with the observations of Das (2014), who identified that individuals employed in agricultural labour, despite exhibiting the lowest monthly per capita expenditure (MPCE), demonstrate the highest levels of food diversity.

Table 2: Determinants of Healthy Food Diversity in Kerala

Variable	*Category*	*Code*	*Coefficient*	*Std. Error*
Age	Reference group: </=25	0		
	>25 to </=50	1	0.105*	0.061
	>50 to </=75	2	0.122**	0.062
	>75	3	0.111	0.068
Gender	Reference. group: Female	0		
	Male	1	0.106***	0.019
Sector	Referecne group : Urban	0		
	Rural	1	0.007	0.006
Marital status	Reference group: Unmarried	0		
	Currently married	1	0.745***	0.049
	Widowed	2	0.667***	0.053
	Divorced/separated	3	0.756***	0.074
Education	Reference group: Illiterate+literate without formal education	0		
	Below Primary and primary	1	0.068***	0.019
	Middle and secondary	2	0.174***	0.021
	Higher secondary+diploma	3	0.320***	0.032
	Degree and above	4	0.315***	0.033
Household size	Reference group: 1 to 3	0		

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	4 to 6	1	0.025*	0.013
	7 to 9	2	-0.034	0.023
	10 and above	3	-0.105***	0.041
Household Type	Reference group: regular wage/salary earning	0		
	Self-employed in: agriculture	1	0.054***	0.019
	Self-employed(non-agriculture)	2	-0.010	0.018
	Casual labour	3	-0.077***	0.018
	Others	4	0.080***	0.019
Religion	Reference. group: Hindu	0		
	Islam	1	0.056***	0.016
	Christian	2	0.019	0.016
	Others	3	-0.211*	0.117
Social Group	Reference. group: others	0		
	ST	1	-0.177***	0.049
	SC	2	-0.149***	0.025
	OBC	3	-0.038**	0.017
Income classes	Reference. group: low	0		
	Middle	1	0.337***	0.014
	High	2	0.508***	0.017
Land owned	Landless	0		
	> 0.004 -0.04	1	0.414***	0.049
	> 0.04-0.08	2	0.467***	0.050
	> 0.08-0.12	3	0.500***	0.052
	> 0.12-0.16	4	0.491***	0.053
	> 0.16-0.2	5	0.500***	0.054
	>0.2	6	0.513***	0.049
Year			-0.431***	0.022
Unit value of rice (Rs./Kg)			0.002	0.002
Unit value of pulses (Rs./Kg)			-0.006***	0.001
Unit value of milk (Rs./Liter)			-0.005***	0.001
Constant			-0.826***	0.083
F(38, 13817)			101.38 (0.000)	
Adj R-squared			0.39	
VIF			2.29	

Source: Author's own calculations using NSS unite level data

By examining the influence of religious affiliation, the study discerns slightly elevated food diversity among households led by individuals adhering to Islam in the Kerala context. The statistical significance and negative coefficients across all social groups: Scheduled Castes (SC), Scheduled Tribes (ST), and Other Backward Classes (OBC); underscore a substantial

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reduction in the diversity of nutritious food when compared to the general category in Kerala. This implies that membership in SC, ST, or OBC significantly diminishes access to a varied and healthy food repertoire within the state. The unanticipated patterns in the relationship between employment types, religious affiliations, and social groups necessitate nuanced exploration and the formulation of refined analytical models to deepen our understanding of the dynamics governing food diversity in Kerala households

Per capita monthly household consumption expenditure serves as a proxy for income in this analysis. The results affirm a positive correlation between higher income and the consumption of a diversified diet, consistent with findings by Behrman and Deolikar (1989), Lee and Brown (1989), Dresher et al. (2007), and Das (2014). The notable and positive coefficients observed for the middle and high-income categories underscore the pivotal role of income in fostering a broader spectrum of food consumption in Kerala. In comparison to the low-income group, household heads within the middle and high-income strata exhibit a more extensive array of food consumption. The extent of landholdings emerges as a significant factor influencing diversified food consumption in India, as indicated by Das (2014). Along with this, the variable representing the size of land owned by households exhibit high significance and positive coefficients, indicating a robust association between larger land size and heightened dietary diversity in Kerala households

The variable "year" in the study aims to capture the trajectory of healthy food diversity across three rounds of the NSSO consumption expenditure survey, specifically the 50^{th}, 61^{st}, and 68^{th}. The variable demonstrates statistical significance and a negative correlation with healthy food diversity, suggesting a lack of improvement in the nutritional variety of households in Kerala over the specified time span. Furthermore, within the category of price-related (unit value) variables, the coefficients associated with pulse and milk exhibit statistical significance and a negative correlation with the demand for healthy food diversity in Kerala. This signifies that an increase in the unit value of pulses and milk corresponds to a decrease in the demand for a diverse range of nutritious foods.

In conclusion, the investigation into the socio-economic determinants of healthy food diversity in Kerala households reveals nuanced dynamics. While factors such as income, education, and landholdings positively correlate with diverse dietary habits, unexpected trends in employment, religious affiliation, and household size add layers of complexity. The temporal analysis indicates a concerning trend of stagnation in healthy food diversity over the survey periods. Overall, this interdisciplinary study, combining insights from economics and

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nutrition science, provides valuable insights for policymakers and researchers seeking to address nutritional challenges and enhance food diversity in Kerala. Further research is warranted to delve into the intricacies of these relationships and devise targeted interventions for sustainable improvements in dietary practices

4. Conclusion and Policy Implications: This study has several policy implications: Firstly, despite Kerala's unique position in the health landscape of India, the study reveals an increasing prevalence of diet-related diseases, indicating the need for a comprehensive assessment of the diet quality of Keralites. Utilizing the Healthy Food Diversity Index, the study examined whether the dietary behaviour of Keralites aligns with the dietary recommendations set by the National Institute of Nutrition (2011). The diet quality of Keralites falls below the recommended levelhighlights the urgency of implementing policies aimed at improving the dietary habits of the population. Moreover, the study identifies significant disparities in healthy food diversity between male and female-headed households in Kerala. These disparities call for targeted interventions that address the unique challenges faced by each group in accessing and consuming nutritious foods. Strategies should be developed to promote equal access to diverse and nutritious food options, taking into account the specific needs and circumstances of different household types. Furthermore, it is clear that the influence of socio-economic factors on the healthy food diversity of households in Kerala which demands the policymakers should focus on addressing socio-economic inequalities through measures that improve income levels, educational opportunities, and employment prospects. Targeted interventions, such as skill development programs and social welfare initiatives, should be implemented to uplift vulnerable populations and enhance their access to nutritious food. In addressing the triple burden of malnutrition in India, it is crucial to develop food security policies that not only ensure an adequate quantity of food but also prioritize its quality. Policies should aim to promote access to affordable and nutritious food, encourage diverse agricultural practices, and support food fortification programs. Furthermore, a multi-sectoral approach is necessary, involving collaboration among the health, agriculture, education, and social welfare sectors. This collaboration will enable the development of comprehensive strategies and interventions that can effectively improve the diet quality and overall health of Keralites. By implementing these policy implications, policymakers can take meaningful steps towards combating diet-related diseases and improving the health and well-being of the population in Kerala.

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Appendix 1: Derivation of Health Factors for Different Food Groups (weight)

Food group	Portion Size (in gms)	Male			Female		
		No. of portions	Total (in gms)	Weight	No. of portions	Total in gms	Weight
Cereal	30	12.5	375	0.269	9	270	0.213
Pulses & Pulse products	30	1.5	45	0.032	1	30	0.024
Roots and Tubers	100	2	200	0.143	2	200	0.157
Milk & Milk products	100	3	300	0.215	3	300	0.236
Egg, Fish and Meat	30	1	30	0.022	1	30	0.024
Leafy Vegetable	100	1	100	0.072	1	100	0.079
Other Vegetable	100	2	200	0.143	2	200	0.157
Edible Oil	5	5	25	0.018	4	20	0.016
Sugar	5	4	20	0.014	4	20	0.016
Fruits (Fresh and Dry)	100	1	100	0.072	1	100	0.079

Source: Dietary Guidelines for Indians: A Manual, NIN, 2011