ORIGINAL RESEARCH ARTICLE

Dietary Diversity and Nutritional Status: An Association Among the Elderly

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ABSTRACT

Background: Old age and nutrition have become a Global challenge. Inadequate dietary intake arises mostly as a result of physiological changes which contribute to malnutrition. Studies conducted in India focused mainly on the Nutritional Status of Infants and Pregnant women, leaving out this important age group which is also vulnerable to malnutrition. The focus of this study was to find out the dietary diversity and its association with nutritional status among the rural elderly.

Materials and Methods: This study was a community-based cross-sectional study conducted among 200 elderly participants from twelve selected villages in Chengalpattu district by multistage random sampling. A semi-structured questionnaire obtained from the Food and Agricultural Organization was used to find out Dietary Diversity. Nutritional status was assessed by the Mini Nutrition Assessment tool and Anthropometric indices. The collected data was analysed using SPSS version 21.

Results: The mean dietary diversity score was 7.2±1.8. 37% of respondents with dietary diversity scores below the mean value were considered to have Inadequate dietary diversity while 63 % consume diverse diets. Nutritional assessment based on WHO BMI standards revealed undernutrition among 21.5% of respondents while 60% were of normal weight. Chi-square revealed a statistically significant association between Dietary Diversity and Nutritional status (p value=0.000)

Conclusion: The present study found that most study participants were consuming a diverse diet and those subjects with better dietary diversity scores had their Body Mass Index in the normal range. This indicates that adequate dietary diversity can contribute to the attainment of optimum nutritional status.

Keywords: Anthropometry, Dietary diversity, Elderly, Health status, Nutritional status

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INTRODUCTION

Globally, the prevalence of the elderly population aged more than 60 years has increased gradually over the past few decades. In India, it accounts for 6.8 percent of the total population as per the population pyramid.[1] India and other countries are experiencing an increasing elderly population as a result of the decline in fertility and mortality rates. Old age and nutrition have become a Global challenge. Malnutrition among the elderly often goes unrecognized. Inadequate dietary intake arises due to physiological changes, lack of financial support, stressful life events, and improper access to food, which contribute to malnutrition.[2] Dietary Diversity is the number of food groups consumed by the individual over a reference period.[3] It reflects the concept that increasing the variety of food groups in the diet helps to ensure the intake of adequate nutrients which is essential to maintain proper health status.[4] It is a key component of health, fitness, and overall wellness and helps to reduce the risk of major diseases like Diabetes, Hypertension, Metabolic syndrome, Stroke, and Cancer. Dietary diversity is usually affected by various factors like age, sex, physical and mental health, and social and macro-environment. Studies conducted in India have shown a strong association between Dietary diversity and nutrient adequacy.[5,6]

Although there are previous studies evaluating the factors of dietary diversity and nutritional status, most of them have focussed on children, and pregnant and lactating women unrecognizing the elderly age group which is most vulnerable to malnutrition because of inadequate food intake, poor nutrient absorption, illnesses that cause increased nutrient requirement, lack of proper care. Malnutrition and unintentional weight loss among the elderly contribute to reduced physical and cognitive functional status, increased hospitalizations, progressive decline in health, and increased mortality.[7] Nutritional assessment should be a routine point of care for all elderly persons so that malnutrition can be recognized at an early stage and appropriate preventive measures can be taken. The focus of this study was to assess the dietary diversity among the elderly and its association with nutritional status and awareness in the study population about nutritional deficiencies. The objectives were to find out the dietary diversity and prevalence of malnutrition among the elderly and to find out the association between dietary diversity and nutritional status among them in the rural areas of the Chengalpattu district.

METHODOLOGY

Study setting: This study was carried out in a rural field practicing area of a tertiary care teaching hospital in Chengalpattu district, Tamil Nadu. The field practice area includes 12 villages from 2 blocks among the 8 blocks of Chengalpattu district, namely Thiruporur and Thirukazhukundram block. The total population of 12 villages was 42425 among which elderly people aged 60 years and above were listed and the samples were selected for the study.

Study design and Target population: This study was a community-based cross-sectional study carried out among Elderly people residing in a study setting. The inclusion criteria were elderly people above 60 years of age who are permanent residents of the study setting. People with acute illness and discharged from the hospital, previously diagnosed chronic illnesses, and patients with neuropsychiatric disorders were excluded from the study.

Sample size determination and Sampling procedure: Geoffrey Maila et al in their study among the elderly in rural South Africa found low dietary diversity among 64.4% of participants [(5)]. Considering its prevalence, with a 95% confidence interval, allowable error of 7%, and non-response rate of 10%, the sample size was estimated to be around 200. The study was conducted in Chengalpattu district of Tamil Nadu and the sampling method followed was multistage random sampling. Among 8 blocks, 2 blocks were selected by lottery method. The blocks selected were the Thiruporur and Thirukazhukundram blocks. These two blocks contain several villages among which 12 villages that come under the field practice area of tertiary care hospital were selected. The 12 villages include Mahabalipuram, Kokilamedu, Poonjeri, Kadumpadi, Manamai, Kunnathur, Nallur, Perumaleri, Karanai, Kunnapattu, Kuzhipanthandalam, Payyanur covering a population of 42425. Among these, 5642 elderly above 60 years were listed. These 12 villages were considered as 12 clusters and 17 participants from each cluster were selected by simple random sampling to obtain a sample size of 200.

Study period: The study duration was from Sep 2022 – Nov 2022

Study tool: A semi-structured questionnaire obtained from the Food and Agricultural Organisation[7] for measuring the Individual Dietary Diversity Score (IDDS) was used in the study. The questionnaire consists of the following sections. Section 1 had questions related to the socio-demographic profile of the participant.

Section 2 was the dietary diversity questionnaire based on 14 food groups consumed by each participant 7 days before the day of the interview. In addition to the 24 hours, a 7-day reference period was used as a valid timeframe for dietary recall. Respondents who consumed a specific food group were given a score of 1 and who never consumed the notified food group were given a score of 0. To calculate Dietary Diversity Score (DDS), the number of food groups consumed by individual respondents was summed over the 7-day recall period.[8] Currently, as there are no established cut-off values for the number of food groups to indicate Inadequate and Adequate dietary diversity for the Elderly, the mean dietary diversity score was used as the cut-off. Based on this, participants with DDS less than 7 were considered to have Inadequate dietary diversity and those who had DDS 7 and above as Adequate dietary diversity.

Section 3 consisted of questions modified from the Mini Nutritional Assessment tool[9] to assess the Nutritional status of the participants and it also included other age-related perceived health statuses like Ocular morbidities, Hard of hearing, Tooth loss, Insomnia, and Falls. Section 4 included Anthropometric measurements like weight, height, BMI, Waist circumference, Hip circumference, Waist-hip ratio, Mid-Upper arm circumference, Body Adiposity Index, and Calf circumference that were classified based on WHO standards for assessing nutritional status.[11,12]

Data collection: After obtaining Institutional Ethical Committee approval (IHEC-I/1228/22) participants were selected based on inclusion and exclusion criteria. Informed consent was obtained from the participants, the questionnaire was explained and the responses were filled out using the interview method. The dietary diversity was calculated as per the guidelines of the Food and Agricultural Organization based on the Individual Dietary Diversity Score. Anthropometric measurements such as Weight, Height, Waist Circumference, Hip Circumference, Mid Upper Arm Circumference, and Calf Circumference were measured using a digital weighing scale, Stadiometer, and a measuring tape. Waist-hip ratio, Body Adiposity Index, and BMI were computed using standardized formulas.

Statistical analysis: The collected data were entered into Microsoft Office Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 21. Relevant frequency distribution was calculated and tabulated. The continuous variables were expressed in mean and standard deviation. Categorical variables were presented as percentages and compared using the Chi-square test and Fisher's exact test. A p-value of <0.05 was considered significant and the independent variables were dichotomized and subjected to the bivariate logistic regression model. The outcome is reported as an adjusted odds ratio with 95% CI.

RESULTS

Demographic and socio-economic characteristics: Out of 200 participants, the majority were females (52.5%) and 47.5% were males. The mean age of the participants was 70±5.7 years. A total of 66.5% of respondents were married while almost 33.5% were single due to divorce or the spouse's death. More than half of the respondents (56.5%) had no formal education while 56.5% of participants were unskilled workers. Most participants, 33%, belonged to the Upper lower class of socio-economic status as per the modified BG Prasad scale (Feb 2022)[10] 57 % of respondents have comorbidities. Table 1 shows the distribution of baseline characteristics of participants.

Dietary Diversity: Food groups like Cereals, Vitamin A-rich vegetables, Green leafy vegetables, and eggs were found to be highly consumed by 100%, 90%, 82%, and 80% of the respondents respectively. Also, Seafood (mostly fish), Flesh meat, Roots and Tubers, and Milk products were found to be commonly consumed by 74.5%, 59%, 58%, and 46% of respondents respectively while few of the respondents do consume fruits (24%), Organ meat (11.5%), Nuts and legumes (5%), Oil and Fat (4%). Further analysis revealed that the mean dietary diversity score was 7.2±1.8. The minimum DDS was 4 while the maximum was 12. Currently, as there are no established cut-off values to classify dietary diversity as low or high, the mean score was used as a cut-off for Adequate and Inadequate dietary intake. Based on this, 37% of respondents have Inadequate dietary diversity, while 63% consume diverse diets.

Table 1: Baseline Characteristics of study participants (n=200)

Variables	Participants (%)
Age	
60-70	106 (53)
71-80	81 (40.5)
81-90	12 (6)
>90	1 (0.5)
Gender	
Male	95 (47.5)
Female	105 (52.5)
Marital status	
Single	1 (0.5)
Married	133 (66.5)
Widowed	66 (33)
Educational status	
Illiterate	113 (56.5)
Primary	58 (29)
Secondary	28 (14)
Graduate and above	1 (0.5)
Type of family	
Nuclear family	125 (62.5)
Joint family	2 (1)
Three generation family	73 (36.5)
Type of house	
Pucca	95 (47.5)
Kutcha	29 (14.5)
Semi-pucca	76 (38)
Occupation	
Professional	2 (1)
Clerk/Shopkeeper	4 (2)
Skilled/Semiskilled/	113 (56.5)
Unskilled	0 (0)
Unemployed	81 (40.5)
Socioeconomic Status (modified BG Prasad scale)	
Upper	21 (10.5)
Upper-middle	33 (16.5)
Lower-middle	45 (22.5)
Upper-lower	66 (33)
Lower	35 (17.5)
Comorbidities	
Diabetes	37 (18.5)
Hypertension	43 (21.5)
COPD/CVA	9 (4.5)
Others comorbidities	25 (12.5)
No Comorbidities	86 (43)

BG Prasad scale- Feb 2022

A significant association was observed between dietary diversity scores and socio-demographic characteristics like marital status (p = 0.045), educational status (p = 0.002), Type of house (p = 0.001), and Socioeconomic status (p = 0.000) indicating that adequate diversity is observed among participants who are married, residing in the pucca house with better educational level and belonging to upper socio-economic status. Table 2 shows the association between the socio-demographic characteristics and dietary diversity of respondents.

Nutritional status: The nutrition assessment component of the study revealed that 21.5% of respondents were undernourished as characterized by the WHO BMI [11] cut-off value of less than 18.5, 60% of participants were in normal weight while 18.5% were overweight. Being Underweight was more prevalent in men (57%, n=25) than in women (43%, n=18). The study assessed Waist circumference (WC) and Waist-to-hip ratio (WHR) as per WHO cut-off points[12] for both men and women and found that the majority of women (71%) were at risk of developing Central Obesity compared to men (29%).

Table 2: Sociodemographic characteristics and Dietary diversity of respondents (n=200)

Variables	Dietary Diversity		P-Value
	Inadequate	Adequate	
n	**74**	**126**	
Sex			
Male	38 (49)	57 (45)	0.403
Female	36 (51)	69 (55)	
Age			
61-70	34 (46)	72 (57)	0.092
71-80	32 (43)	49 (39)	
81-90	8 (11)	4 (3)	
Above 90	0 (0)	1 (1)	
Religion			
Hindu	64 (86)	117 (93)	0.084
Muslim	2 (3)	5 (4)	
Christian	8 (11)	4 (3)	
Marital status			
Single	1 (1)	0 (0)	0.045
Married	42 (57)	91 (72)	
Widowed	31 (42)	35 (28)	
Educational status			
Illiterate	53 (72)	60 (47.6)	0.002
Primary	18 (24)	40 (31.7)	
Secondary	3 (4)	25 (19.8)	
Graduate and above	0 (0)	1 (0.9)	
Occupation			
Professional	0 (0)	2 (1.5)	0.071
Skilled	0 (0)	4 (3.2)	
Semiskilled/Unskilled	37 (50)	76 (60.3)	
Unemployed	37 (50)	44 (35)	
Type of family			
Nuclear family	48 (65)	77 (61)	0.784
Joint family	1 (1.3)	1 (0.7)	
Three generation family	25 (33.7)	48 (38.3)	
Type of house			
Pucca	25 (34)	70 (55.5)	0.001
Kutcha	19 (26)	10 (8)	
Semi-pucca	30 (40)	46 (36.5)	
Socioeconomic status			
Upper	0 (0)	21 (16)	0.000
Upper middle	2 (3)	31 (25)	
Lower middle	14 (19)	31 (25)	
Upper lower	30 (40)	36 (28.5)	
Lower	28 (38)	7 (5.5)	
Comorbidities			
Diabetes	14 (19)	23 (18)	0.014
Hypertension	8 (11)	35 (28)	
COPD/CVA	6 (8)	3 (2)	
Other comorbidities	10 (13)	15 (12)	
No comorbidities	36 (49)	50 (40)	

DD- Dietary diversity. Chi-square test/Fischer's exact test applied. P value <0.05 is significant

Table 3: Anthropometric indices and Dietary diversity of respondents (n=200)

Variables	Dietary Diversity		P Value
	Inadequate	Adequate	
n	**74**	**126**	
BMI			
<18.5	30 (40.5)	13 (10.3)	0.001
18.5 to 24.99	40 (54)	80 (63.5)	
>25	4 (5.5)	33 (26.2)	
MUAC			
<21 cm	32 (43)	6 (5)	0.000
21 to 22 cm	24 (32)	34 (27)	
>22 cm	18 (25)	86 (68)	
Waist Circumference			
Normal	67 (90.5)	77 (61)	0.000
Central Obesity	7 (9.5)	49 (39)	
Waist-Hip Ratio			
Normal	40 (54)	40 (32)	0.002
Central Obesity	34 (46)	86 (68)	
Calf circumference			
<31 cm	70 (95)	68 (54)	0.000
>31 cm	4 (5)	58 (46)	

DD- Dietary diversity. Chi-square test/ Fischer's exact test applied, P value <0.05 is significant

Calf Circumference was measured to analyze the skeletal muscle mass and the results stated that 69% (n=138) of participants had low muscle mass. There was a significant association between Dietary diversity and Anthropometric indices like BMI (P = 0.001), Waist circumference (p = 0.000), Waist-Hip ratio (p = 0.002), MUAC (P = 0.000), and Calf circumference (p = 0.000) indicating that dietary diversity is better among participants having higher MUAC, CC, WC, WHR, and Normal BMI (Table 3). Findings from perceived health conditions revealed that 85% of participants had Ocular morbidity, 38.5 % had Hard of hearing, 53.5% had Insomnia, 22.5% had Falls, and 48.5% of participants experienced stress during the past 1 year.

Table 4: Perceived Health status and Dietary diversity of respondents (n=200)

Variables	Dietary Diversity		P-value
	Inadequate	Adequate	
n	**74**	**126**	
Loss of Appetite			
Mild	25 (34)	83 (66)	0.000
Moderate	36 (49)	40 (32)	
Severe	13 (17)	3 (2)	
Weight loss			
Mild	24 (32)	105 (83)	0.000
Moderate	37 (50)	18 (14)	
severe	13 (18)	3 (3)	
Mobility			
No restriction	34 (46)	87 (69)	0.005
Mild	35 (47)	33 (26)	
Moderate	5 (7)	6 (5)	
Severe	0 (0)	0 (0)	
Ocular morbidity			
Refractive error	28 (38)	51 (40)	0.105
Cataract	32 (43)	48 (38)	
Pterygium	7 (9.5)	4 (3)	
None	7 (9.5)	23 (19)	
Hard of Hearing			
No	31 (42)	92 (73)	0.000
Sometimes	23 (31)	22 (17)	
Yes	20 (27)	12 (10)	
Dentures			
No	37 (50)	92 (73)	0.003
Partial	29 (39)	29 (23)	
Complete	8 (11)	5 (4)	
Insomnia			
No	21 (28)	72 (57)	0.000
Yes	53 (72)	54 (43)	
Falls			
No	46 (62)	109 (86.5)	0.003
Yes	28 (38)	17 (13.5)	
Neuropsychological problems			
No	14 (19)	44 (35)	0.034
Mild dementia	31 (42)	49 (39)	
Severe dementia	29 (39)	33 (26)	

DD- Dietary diversity. Chi-square test/Fischer's exact test applied, P value <0.05 is significant

Table 5: Binary logistic regression analysis of factors with Adequate Dietary diversity (n=200)

Variables	Significance	AOR	CI
Educational status-Graduate and above	**0.013**	**5.50**	1.42 - 21.24
Upper Socioeconomic status	0.100	0.16	0.80 - 0.32
Residing in Pucca house	0.179	1.58	0.80 - 3.11
No reduced food intake	0.955	1.02	0.44 - 2.34
No Weight loss	**0.000**	**7.91**	3.40 - 18.39
No Psychological problems	0.646	1.21	0.52 - 2.83
No Dentures	**0.045**	**2.20**	1.01 - 4.76
No Hard-of-hearing	0.146	1.75	0.82 - 3.76
No Insomnia	0.177	4.06	0.53 - 31.14
MAUC >21cm	**0.001**	**9.10**	2.56 - 32.26
BMI >18.5	0.401	0.58	0.16 - 2.05
Waist circumference - Central obesity	0.570	1.35	0.47 - 3.84
Waist-Hip ratio - Central obesity	0.263	1.52	0.72 - 3.19
Calf circumference >31 cm	**0.001**	**7.27**	2.29 - 23.01
Waist-height ratio >0.5	0.287	1.62	0.66 - 3.96

CI- Confidence Interval. AOR – Adjusted Odds ratio

Chi-square analysis further revealed a significant association between Dietary diversity and perceived health status such as loss of appetite (p = 0.000), Weight loss (p = 0.000), Hard of hearing (p = 0.000), Insomnia (p = 0.000), Mobility (p = 0.005), Psychological stress (p = 0.034), Dentures (p = 0.003), Falls (p = 0.003) and Neuropsychological problems (p = 0.034) which are depicted in Table 4. Inadequate dietary diversity is higher among participants having severe loss of appetite, weight loss, Hard of hearing, Insomnia, restricted mobility, psychological stress, dentures, experienced falls and neuropsychological problems.

The Association of Dietary diversity and Nutritional status with selected factors by Binary logistic regression is depicted in Table 5. Significantly higher odds of having adequate dietary diversity were observed among respondents with Higher educational status(AOR=5.50, CI=1.42-21.24, P=0.013), No significant weight loss(AOR=7.915, CI=3.406 - 18.396, P=0.000), Not wearing dentures(AOR=2.20, CI=1.01-4.76, P=0.045), MUAC >21cm (AOR=9.10, CI=2.56 - 32.26, P=0.001) and Calf circumference >31cm (AOR=7.27, CI=2.29 - 23.01, P=0.001) than the respondents with lower educational status, with significant weight loss and wearing dentures and who are with decreased MAUC and Calf circumference respectively.

Discussion

The study explored the association between dietary diversity scores and nutritional status among older persons. The findings on food consumption revealed that many participants consumed mostly carbohydrate food sources and vegetables whereas Vitamin A-rich foods, and protein-rich food were consumed in lesser quantities. Their diet typically consisted of Rice and green leafy vegetables. This agrees with the study conducted in rural Zambia on dietary diversity among the Elderly by Geofrey Maila et al.[5] It was also observed that most of the vegetables that were consumed at the time of the study were seasonal and rain-fed.

Most participants consuming vegetable foods may be attributed to the availability and affordability of vegetables during the study. Low consumption of organ meat, legumes and nuts, milk, and milk products, and moderate consumption of eggs and fish may be a result of the low socioeconomic status of participants, as they could not afford to purchase foods that they did not produce. This finding concurs with that of other researchers[13,14] that poor households subsist on monotonous staple-based diets and lack access to nutritious food such as vegetables, fruits, and animal source foods. It can further be stated that the high rice and maize consumption observed was a result of these being stapled foods for the local community. The nutritional status of respondents was measured using the Anthropometry method. Based on Body Mass Index, more than half of the respondents (60%) had an acceptable Nutritional status while some (18.5%) were Overweight and Obese. However, being Underweight (21.5%) was more prevalent among men compared to women which is contrary to studies conducted on nutritional status among the elderly by Thouhidur Rahman et al and Patra S et al which state that females are vulnerable to malnutrition.[15,16] This can be attributed to the fact that most of the male participants in the study setting were living independently and experienced depressive symptoms which tend to lose their appetite, refuse to eat, and experience weight loss.[17]

Waist circumference and Waist-Hip Ratio among study participants indicated that most of the women were at risk of developing Central obesity compared to men which are in accordance with the study conducted in India among Older adults by Banerjee, S. et al[18]. This indicates that the elderly in the study area must be duly taken care of to reduce the prevalence of malnutrition among them by targeting the dietary intervention program thereby improving the quality of life of the rural elderly. However, recall bias could not be eliminated because the participant's replies to questions about dietary diversity relied on their memory and capacity to recall the specific food groups correctly. The study could not assess the seasonal variation of dietary diversity among the study participants.

Conclusion

The present study found out that most study participants were consuming a diverse diet and those subjects with better dietary diversity scores had their Body Mass Index in the normal range. Thus, the study revealed a statistically significant association between dietary diversity and nutritional status among older persons suggesting that adequate dietary diversity can contribute to the attainment of optimum nutritional status. Nutritional intervention should focus on older people with lower wealth and educational

levels and who live in rural areas which might help to increase dietary diversity in the elderly. It also recommends the existing public health guidelines that encourage people to consume all major food groups including fruits, vegetables, and dairy products as a part of their regular Balanced diet.

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