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Assessment of the nutritional status and cognitive function of the adolescent population living in rural and suburban areas with unhealthy eating habits

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Abstract

Recent years have seen a rise in the incidence of poor eating habits, particularly among adolescents. Modernization and industrialization are making it harder for even rural residents to follow a healthy dietary regimen. The stages of adolescence and infancy and childhood are equally important for different aspects of cognitive and psycho-social development. This current study evaluated the level of nutritional status and cognitive impairment among adolescence from both rural and suburban populations who had bad eating patterns. A total of 100 pupils were found to have poor eating habits during the study, which involved teenagers from both rural and suburban areas. The frequency of foods was used to gauge the unhealthy eating habit. Using food frequency, the unhealthy eating habit was evaluated. The MMSE tool and an aptitude score were used to assess cognitive function. Both the rural and suburban populations' MMSE scores were comparable and typical. The adolescent living in rural areas performed pretty well on the aptitude exam, with moderate scores, as opposed to poor results from the suburban population. The study comes to the conclusion that while the adolescent ' MMSE scores did not show any particularly concerning aberrations, the unhealthy eating habits they had may have contributed to their continued cognitive impairment as they grew older..

Keywords: Cognitive impairment; Adolescent; Unhealthy eating; MMSE

1. Introduction

The nutritional status and cognitive function of adolescents are pivotal determinants of their overall health and future potential. In India, a significant portion of the adolescent population resides in rural and suburban areas, where unhealthy eating habits are prevalent [1]. These dietary patterns, characterized by inadequate nutrient intake and poor food choices, can lead to malnutrition and various health complications [2]. Furthermore, malnutrition during adolescence can severely

impact cognitive development, affecting learning abilities, memory, and academic performance [3,4]. This assessment seeks to evaluate the nutritional status and cognitive function of adolescents living in these areas, providing a comprehensive understanding of how unhealthy eating habits influence their development.

The dietary patterns observed in these populations often include high intake of sugary beverages, fast foods, and snacks high in fats and sugars, coupled with low consumption of fruits, vegetables, whole grains, and lean proteins [5,6]. These eating habits contribute to various nutritional deficiencies, including inadequate intake of vitamins and minerals such as iron, calcium, and vitamin D, which are crucial for growth and development and cognition [7,8.9]. Malnutrition, both in the form of under nutrition and over nutrition, is a prevalent issue. Over nutrition, characterized by excessive calorie

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intake leading to obesity, is particularly concerning and has been linked to various health issues, including metabolic disorders and cardiovascular diseases [10,11].

Unhealthy eating habits prevalent in rural and suburban adolescents contribute significantly to their overall nutritional status and cognitive function [12,13]. Skipping meals, particularly breakfast, is a common practice that can lead to decreased cognitive performance throughout the day [14,15]. Breakfast consumption is linked to better memory, attention, and academic achievement, making it a critical meal for adolescents [16].

Additionally, the habitual consumption of junk food and sugary snacks not only leads to poor physical health outcomes like obesity but also affects mental health, contributing to issues such as depression and anxiety, which in turn can impair cognitive functions [17,18]. The correlation between diet, mental health, and cognitive abilities underscores the intricate relationship between nutrition and overall adolescent well-being [19,20]. By shedding light on these critical issues, the study aims to support the formulation of effective nutritional interventions and policies to enhance the health and cognitive outcomes for adolescents in rural and suburban India.

2. Methodology

With the rise of evolving technologies and modern lifestyles, there has been a noticeable shift in daily habits, leading to increased stress levels and significant changes in eating patterns. As noted by Ming Ling Fu et al.[8], unhealthy eating habits can adversely affect cognitive function and performance. This study aimed to improve cognitive function through better dietary habits, promote informed and healthier dietary choices, and enhance the overall nutritional status of adolescents.

The research objectives were as follows:

- To assess the prevalence of impaired cognitive function among adolescents with unhealthy eating patterns.
- To compare cognitive health between rural and suburban adolescent populations.
- To provide nutrition education to the sample population and evaluate their knowledge before and after the intervention.

The study was conducted in the Virudhunagar district of Tamil Nadu, with rural adolescents sampled from Vilampatti and suburban adolescents from Vishwanatham, Sivakasi, both within the district. The research focused on comparing cognitive function between rural and suburban adolescents with unhealthy eating patterns. A quantitative research methodology was employed, and results were derived through mathematical and statistical analysis.

Sample Size: Based on the 2011 census, the population of Virudhunagar district was 1,942,288, comprising 967,709 males and 974,579 females. The sample size was calculated using a standard formula. From an initial sample size of 384, only 150 participants fell within the 12-18 age group. Of these, 30 participants were unwilling to participate, and another 20 did not exhibit unhealthy eating patterns. The inclusion criteria encompassed adolescents aged 13 to 18 years from both rural and suburban populations, including both boys and girls. Adolescents below 13 years and adults above 18 years were excluded from the study. The research was conducted over a period of 30 days.

The samples were collected using a structured, face-to-face interview method. Pre-prepared questions were asked in a standardized format to gather data on various topics, including demographic information, anthropometric measurements, and dietary habits through a food frequency questionnaire.

Anthropometric measurements such as height, weight, waist circumference, hip circumference, and waist-hip ratio were recorded to assess the nutritional status of adolescents. The nutritional status was further evaluated using the Waterlow classification, which determines the degree of wasting (percentage of expected weight for height) and stunting (percentage of expected height for age). Additionally, the Gomez classification was employed to assess nutritional status based on the percentage of expected weight for age. Dietary patterns were also assessed.

To evaluate cognitive function, the Mini-Mental State Examination (MMSE) was administered. The screening tool assesses various cognitive domains, including orientation, registration, attention and calculation, recall, and language, with each function assigned a specific score. The total score was based on a maximum of 30 points.

In the present study, nutrition education focusing on brain-healthy foods and habits was provided to adolescents aged 13 to 18 years by the researcher. Emphasis was also placed on the dos and don’ts for maintaining optimal cognitive

function, which were conveyed through an informative pamphlet. The pamphlet offered a clear and detailed overview of brain health, along with practical instructions on how to enhance cognitive function.

To evaluate the effectiveness of the nutrition education, pre-test and post-test questions were administered. The questions included:

- What foods improve brain function?
- Are all fats harmful to our health, and should they be avoided entirely?
- How often should one engage in physical activity?
- Is eating breakfast important for better concentration and memory throughout the day?
- What is the best approach to obtaining affordable organic foods?

These questions were designed to assess the participants' knowledge before and after the nutrition education intervention.

3. Results and Discussion

Table 1 Height and weight

PARTICULARS	ZONE	N	MEAN	SD
HEIGHT(cm)	1(suburban)	50	159.88	8.52
	2(rural)	50	155.98	6.90
WEIGHT(kg)	1(suburban)	50	47.54	10.13
	2(rural)	50	44.05	7.36

Table 1 presents the anthropometric distributions of height and weight for the two zones. In Zone 1 (suburban), the mean height was 159.88 cm, while in Zone 2 (rural), the mean height was slightly lower at 155.98 cm. The mean weight in Zone 1 was 47.54 kg, compared to 44.05 kg in Zone 2. These differences in height and weight suggest variations in anthropometric measurements between the rural and suburban adolescent populations.

Table 2 Waist circumference, HIP circumference & WHR

PARTICULARS	ZONE	N	Mean	SD
Hip circumference(cm)	1(suburban)	50	83.35	8.05
	2(rural)	50	84.13	6.44
Waist circumference(cm)	1(suburban)	50	69.37	6.49
	2(rural)	50	68.02	5.87
WHR	1(suburban)	50	0.84	0.09
	2(rural)	50	0.80	0.03

The table 2 describes the waist, hip circumference and waist to hip ratio of the adolescent's .The mean hip circumference of sub-urban population was 83.35 cm and that of the rural population was 84.13cm which are considered as normal. The mean waist circumference of sub-urban population was 69.37 cm and that of the rural population was 68.02 cm which are considered as normal. The mean waist hip ratio of sub-urban population was 0.84 and that of the rural population was 0.80 which do not indicate any potential risk.

The table 3 illustrates the Waterlow and Gomez classification .The normal Water low classification score ranges from 90-95% of the expected weight for height and expected height for age. In this study, the mean Waterlow score for the suburban population was 98.86, and for the rural population, it was 97.43. These scores indicate that there were no signs of wasting or stunting among the participants, and all samples were within the normal range for their age.

Table 3 Waterlow's classification& Gomez's classification

PARTICULARS	ZONE	N	MEAN	SD
WATERLOW'SCLASSIFICATION	1(suburban)	50	98.86	5.07
	2(rural)	50	97.43	4.03
GOMEZ'SCLASSIFICATION	1(suburban)	50	97.15	20.05
	2(rural)	50	90.27	15.91

In terms of the Gomez classification, a score above 90% of the expected weight for age is considered normal. The mean Gomez classification score for the suburban population was 97.15%, while the rural population had a mean score of 90.27%, indicating 1st degree malnutrition in the rural group.

Table 4 Consumption of different varieties of snack

SNACKTYPE	Zone1(suburban)		Zone2(rural)	
	N	%	N	%
Fruits/salads	4	8.0	3	6.0
Home-mades nacks	9	16.0	15	30.0
Packed food items	18	36.0	21	42.0
Fruits & home-made snacks	1	2.0	0	0
Home–made snacks &Packed foods	6	12.0	4	8.0
Fruits & Packed Foods	4	8.0	3	6.0
All types	8	16.0	4	8.0

Table 4 outlines the types of snacks most commonly consumed by the selected samples in both zones. In Zone 1, 8% of the participants consumed fruits and salads as snacks, 16% opted for homemade snacks, 36% chose packaged food items, 2% consumed a combination of fruits and homemade snacks, 12% consumed both homemade snacks and packaged food items, and 8% consumed a mix of packaged foods and fruits. Additionally, 16% of the subjects in Zone 1 consumed all three types of snacks.

In Zone 2, 6% of participants consumed fruits and salads, 30% chose homemade snacks, 42% consumed packaged food items, 8% consumed a combination of homemade snacks and packaged food items, and 6% consumed both packaged foods and fruits. A smaller proportion, 8%, consumed all three types of snacks. These results indicate a higher preference for packaged food items in both zones, with some variation in the combination of snack types consumed.

Table 5 Description of the effectiveness of nutrition education among sub urban samples

S.No.	Questions	Before		After		Chi–square Test
		F	%	F	%	
1.	What foods improve brain function?					
a)	Caffeine	2	4.0	0	0	P0.0001 S***
b)	Fruits & Vegetables	20	40.0	0	0	
c)	Fish	5	10.0	0	0	
d)	Nuts	19	38.0	0	0	
e)	All the above	0	0	50	100.0	
f)	Others	4	8.0	0	0	

2.	Are all fats harmful to our health, and should they be avoided entirely?					
a)	True	28	56.0	6	12.0	P=0.0001 S***
S***		22	44.0	44	88.0	
b)	False					
3.	How often should one engage in physical activity?	45	90.0	50	100.0	P=0.02 S*
a)	Daily	5	10.0	0	0	
S*		-	-	-	-	
b)	Weekly					
c)	Monthly	50	100.0	50	100.0	-
4.	Is eating breakfast important for better concentration and memory throughout the day?"	-	-	-	-	
a)	Yes					
b)	No	22	44.0	0	0	P=0.0001 S***
5.	What is the best approach to obtaining affordable organic foods?	13	26.0	50	100.0	
a)	Directly from farmers	6	12.0	0	0	
S***		9	18.0	0	0	

Table 5 illustrates the impact of nutrition education on suburban adolescents, revealing a significant improvement in their knowledge. Prior to the education intervention, the percentages of correct responses regarding brain-healthy foods were as follows: 4% for caffeine, 40% for fruits and vegetables, 10% for fish, 38% for nuts, and 8% for other foods. Post-education, knowledge increased to 100% for all categories, demonstrating a significant improvement with a p-value of0.0001. Regarding the awareness of fats, 56% of participants initially believed fats were essential, while 44% did not. After counseling, only 12% thought fats were not essential, and 88% recognized the importance of good fats, with a significant p-value of 0.0001.

In terms of physical activity, 90% of participants initially considered daily exercise essential, whereas 10% deemed weekly exercise sufficient. Post counselling 100% acknowledged the importance of daily exercises, this shows a significant difference with a p-value of 0.02. For breakfast, before the education, participants had good awareness of its importance for concentration and memory. After the intervention, this understanding was reinforced across all samples.

Regarding the availability of cheap organic foods, 44% initially preferred buying directly from farmers, 26% favored home gardening, 12% had no opinion, and 18% had other suggestions. Post- counseling, 100% of participants chose home gardening as the most affordable method for obtaining organic foods, indicating a significant change with a p-value of 0.0001.

Table 6 Description of the effectiveness of nutrition education among rural samples

S.No.	**Questions**	**Before**		**After**		**Chi-square Test**
		F	**%**	**F**	**%**	
1.	What foods improve brain function?					
a)	Caffeine	8	16.0	0	0	P=0.0001 S***
b)	Fruits Vegetables	31	62.0	0	0	
c)	Fish	-	-	-	-	
d)	Nuts	5	10.0	0	0	

e)	All the above	0	0	50	100.0	
f)	Others	6	12.0	0	0	
2.	Are all fats harmful to our health, and should they be avoided entirely?					
a)	True	True	17	34.0	0	P=0.0001
S***		False	33	66.0	50	S***
b)	False					
3.	How often should one engage in physical activity?	35	70.0	50	100.0	P=0.0001
a)	Daily	14	28.0	0	0	S***
S***		1	2.0	0	0	
b)	Weekly					
c)	Monthly	47	94.0	50	100.0	P=0.079N.S
4.	Is eating breakfast important for better concentration and memory throughout the day?"	3	6.0	0	-	
a)	Yes					
b)	No	22	44.0	0	0	P=0.0001
5.	What is the best approach to obtaining affordable organic foods?	22	44.0	50	100.0	S***
a)	Directly from farmers	-	-	-	-	
S***		6	12.0	0	0	

Table 6 illustrates the impact of nutrition education on rural adolescents, demonstrating a significant improvement in their knowledge. Initially, the percentages of correct responses regarding brain-healthy foods were 16% for caffeine, 62% for fruits and vegetables, 10% for nuts, and 12% for other foods. Post-education, knowledge improved to 100% across all categories, indicating a significant change with a p-value of 0.0001.

Regarding the awareness of fats, 34% of participants initially believed that fats were essential, while 66% did not. After counseling, all participants (100%) recognized the importance of good fats, reflecting a significant improvement with a p-value of 0.0001.

In terms of physical activity, 70% of participants initially considered daily exercise essential, 28% deemed weekly exercise sufficient, and 2% thought monthly exercise was adequate. Following the education, 100% of participants understood the necessity of daily physical activity, showing a significant difference with a p-value of 0.0001.

For breakfast, 94% of participants believed it was important for better concentration and memory, while 6% did not consider breakfast essential.

Regarding the availability of cheap organic foods, 44% preferred buying directly from farmers, 44% favored home gardening, and 12% had other suggestions before counseling. After the intervention, 100% chose home gardening as the most cost-effective method for obtaining organic foods, with a significant change indicated by a p-value of 0.0001.

Overall, there were significant differences in adolescents' knowledge before and after nutritional counseling, consistent with the findings of Neha Rathi et al. (2017) [17], which showed that a nutrition curriculum increased awareness about healthy eating among secondary school students, despite some identified weaknesses. This study highlights the need for a skill-focused food and nutrition curriculum to further promote healthy eating behaviors.

4. Conclusion

The present study aimed to compare cognitive function between rural and suburban populations with unhealthy eating patterns. The findings revealed that many participants had regular consumption of deep-fried foods from street

vendors, where oil was often reused multiple times. Additionally, high intake of processed and packaged foods such as chips, biscuits, and chocolates was prevalent among the subjects. Coupled with stress and inadequate physical activity, these lifestyle factors could contribute to cognitive decline and other cognition-related issues.

These results underscore the critical need for adopting a healthy dietary pattern during adolescence to ensure better cognitive health and overall well-being in the future. A balanced diet, reduced consumption of processed foods, and improved lifestyle habits are essential for mitigating the risk of cognitive decline and promoting long-term health. Implementing targeted nutrition education and lifestyle interventions during this formative period can play a vital role in fostering healthier eating habits and enhancing cognitive function.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study."

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