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Determinants of Nutritional Status Among Urban College-Going Girls in Kochi, Kerala

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ABSTRACT

The purpose of the study was to determine the nutritional status and investigate its causes among college-bound girls between the ages of 18 and 23. The study was conducted among152 participants pursuing undergraduate and post-graduate education. A pre-tested structured questionnaire was used to elicit information about sociodemographic details and dietary assessment. Anthropometric data with respect to height, weight, and Body Mass Index was obtained. Blood Hemoglobin was measured using the cyanmethemoglobin method. By the Kuppuswami Socio-economic strata assessment majority of participants belonged to the upper(33.6%) or lower-middle (31.6%) socioeconomic class. On studying the Body Mass Index of participants, half of the participants had a normal BMI,19.7 % were underweight and13.2% were obese.The biochemical assessment revealed a significant prevalence of anemia among the participants. Specifically, 18.4%of individuals exhibited moderate to severe anemia, and 26.3% of the participants suffered from mild anemia, while a majority, accounting for 55.3% of the participants were not anemic. The dietary assessment concerning the analysis of Healthy Eating Index scores indicated that 44.1% had poor diet quality (score below 50), 35.5% had fair diet quality (score between 50 and 64), and 20.4% had good diet quality (score between 65 and 80). Further,Dietary Diversity Scores (DDS) revealed that 3.3% of participants had poor diversity (0-3 food groups), while the majority (77%) showed moderate diversity (4-6 food groups), and a notable 19.7% demonstrated good diversity (7+ food groups), highlighting balanced consumption across various food groups. The significance of the study lies in its comprehensive examination of the nutritional status, dietary patterns, and anemia prevalence among a diverse group of participants, providing valuable insights into the complex interplay of factors influencing health and well-being. However, the study did not find a statistically significant correlation between diet quality and anemia, highlighting the need for further research to explore additional factors contributing to anemia in the studied population. The study emphasizes the need for a comprehensive approach to combat anemia and improve nutrition for urban college-going girls.

Keywords : Nutritional Status, Body Mass Index (BMI), Nutritional Assessment, Healthy Eating Index (HEI), Dietary Diversity Score (DDS).

INTRODUCTION

Health is a fundamental aspect of human life. Health, according to WHO can be interpreted as a healthy state of complete physical, mental, and social, and not merely a condition that is free from disease, disability, and weaknesses [Young adulthood, spanning approximately ages 18 to 26, is a transitional period during the life course when young people are traditionally expected to become financially independent, establish romantic relationships become parents and assume responsible roles as productive and engaged members of the community. From a developmental point of view, young adulthood is characterized by a period of normal and predictable biological and psychological maturation. According to the World Health Organization health is "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." This definition becomes particularly significant during young adulthood, as attaining optimal health during this stage lays the foundation for long term well-being and constructive social functioning.

The phases of development and sexual maturation are complete when a person reaches college age. Individual differences in the timing of growth spurts and the commencement of sexual function make people unhappy and ashamed. Due to the vast spectrum of individual differences, college-bound girls may have difficulty defining age boundaries. The health of this age group is crucial to break the inter-generational cycle of malnutrition.

In India, 15% of the population is made up of young people who are enrolled in higher education institutions. Several studies have investigated the nutritional status of college-going girls in different parts of India and confirmed that poor dietary practices and lack of nutrition knowledge are major factors responsible for malnutrition among the young population (Arlappa *et al*.,2015, Saibaba 2002 and Kotecha *et al.,*2009). Understanding the prevalence and determinants of nutritional status among college-going girls is an essential public health strategy. Addressing nutritional status can improve their overall health, academic performance, and prospects. Additionally, gender-specific healthcare initiatives can be developed to cater to the unique needs of young women.The objectives of the study were to assess the nutritional status of Urban college-going girls and gain insights into the determinants of nutritional status.

MATERIALS AND METHODS

The selected locale, Ernakulam district in Kerala, has diverse food culture and significant nutrition transition, making it an ideal setting to explore the determinants of nutritional status among college-going girls. The research aimed to ensure adequate statistical power by using purposive sampling to select a sample of 152 undergraduate and postgraduate female students aged 18-23 years. This sample size was determined based on the prevalence of anemia in Kerala according to NFHS-5 data, with a confidence level of 80 percent. This age group is particularly vulnerable to anemia due to

various factors such as menstruation, dietary habits, and lifestyle choices. By excluding married, pregnant, and lactating students, the study focused on a homogeneous group in the pre-marriage and pre-pregnancy phases, enabling insights into anemia prevalence before these critical life stages.The study obtained ethical clearance from the Institutional Research Ethics Committee (STCAU/115/25).

Data collection comprised Socio-demo graphic information, including age, family type, education, occupation, and socioeconomic class based on the Kuppuswamy Socio-Economic Scale 2022, anthropometric measurements, such as height, weight, and BMI (Body Mass Index), were recorded following standardized procedures to assess the physical development and nutritional status of the participants. The World Health Organization's (WHO) cut-off scores for BMI were used to categorize participants into different BMI categories. BMI <18.5: underweight. BMI 18.5-24.9: normal weight. BMI ≥ 25.0: overweight. BMI ≥ 30.0: obesity. (WHO, 2010). Hemoglobin levels, an essential indicator of anemia, were measured using the reliable cyanmethemoglobin method, a commonly accepted laboratory technique. This method involves converting hemoglobin to cyanmethemoglobin, which can be quantified using colorimetry. The cyanmethemoglobin method provides accurate and reliable measurements of hemoglobin levels in blood samples. The World Health Organization (WHO) classifies anemia severity for non-pregnant women aged 15 years and above based on hemoglobin levels. The classification includes four categories: "Non-anemic" (hemoglobin 12 g/dl or higher), "Mild Anemia" (hemoglobin 11-11.9 g/dl), "Moderate Anemia" (hemoglobin 8-10.9 g/dl), and "Severe Anemia" (hemoglobin lower than 8 g/dl).(WHO, 2011). The entire study population is categorized into anemic and non-anemic groups to facilitate the correlation analysis.

The dietary assessment comprised both 24-hour dietary recalls and FFQs (Food Frequency Questionnaires), providing comprehensive information about food intake patterns and frequency, especially focusing on iron-rich and vitamin C-rich foods and their impact on iron absorption. The 24-hour dietary recalls allowed participants to recall their food and beverage consumption over the previous 24 hours, while the FFQs provided insights into long-term dietary habits. A 24-hour dietary diversity score (DDS) was calculated to assess the variety of food groups consumed by each participant within a single day. DDS scoring involves assigning a score based on the number of different food groups consumed. A higher score indicates greater dietary diversity, reflecting a broader range of nutrients consumed. The tool used to check dietary diversity is the Individual Dietary Diversity Score (IDDS). The IDDS is calculated based on different numbers of food groups because the scores are used for different purposes. The IDDS reflects the probability of micronutrient adequacy of the diet and therefore food groups included in the score are tailored towards this purpose. Here the IDDS is calculated based on the reference period of one day, for each food group consumed a score of one is given and for not consumed a score of zero is given. Nine food groups are proposed for the IDDS (FAO, 2010).

Additionally, the Healthy Eating Index (HEI) was calculated to evaluate the nutritional quality of participants' diets. HEI is a composite score that assesses how well dietary patterns align with recommended guidelines. HEI scoring takes into account various aspects of diet quality. Higher HEI scores indicate better adherence to healthy dietary patterns.The U.S. Department of Agriculture (USDA) developed the Healthy Eating Index (HEI) to assess how well Americans adhere to recommended healthy eating patterns. The index ranges from 0 to 100, with each of the 10 dietary components having a scoring range of 0 to 10. Maximum scores are awarded when individuals meet recommended intake levels, while zero is given when no foods from a particular group are consumed. Intermediate scores are calculated proportionately. The HEI analyzes dietary intake based on the five major food groups in the Food Guide Pyramid. Maximum scores of 10 are given for each food group when recommended servings are met, and zero is assigned when no servings are consumed. Intermediate scores reflect partial adherence. A total score above 80 indicates 'good' dietary quality, 51 to 80 suggests 'needed improvement,' and 50 or less signifies 'poor quality' in the diet (Guenther, P.M. 2007).

Nutritional Adequacy Ratio (NAR), a measure of the proportion of dietary intake that meets the recommended dietary allowance (RDA) for specific nutrients, was calculated to assess the participants' overall nutritional adequacy. The NAR values were categorized into different levels of adequacy. NAR values of (≤ 50.00) were classified as poor, those ranging from (50.01 to 75.00)as fair, NAR values from (75.01 to 100.00) as adequate, and NAR values(≥ 100.01) as excessive nutrient intake.

Data analysis was conducted using SPSS version 25, a powerful statistical tool for data interpretation. Various statistical tests, such as the Independent Sample T-test, Mann-Whitney U test, and chi-square test, were employed to compare differences between anemic and non-anemic groups and assess correlations between variables. A significance level of $p<0.05$ was used to determine statistically significant associations.This comprehensive approach to data collection and analysis ensured a well-rounded understanding of anemia prevalence and its determinants among college-going girls in Ernakulam district, Kerala.

RESULTS AND DISCUSSION

The study participants represented diverse socio-demographic profiles, with 89.5% belonging to nuclear families, 9.9% to joint families, and 0.7% to extended families. These findings are in line with recent trends, where India is experiencing a profound metamorphosis in its family structures. Traditional joint family systems, once the cornerstone of Indian society, have gradually given way to the prevalence of nuclear families within urban centers mainly due to the factors like increased education, career opportunities, and exposure to globalized values .These reasons are reshaping family ideals and aspirations, steering them towards smaller, more independent family units (Gupta, 2012) (Chakrabarti, 2015; Deshpande, 2010). Socioeconomic classes ranged from 2.6% in the lower class to 10.5% in the upper class. Non-vegetarian diets were

prevalent at 90.8%, while 5.9% were vegetarian, and smaller percentages practiced ovo-vegetarian (2.6%) or lacto-vegetarian (0.7%) diets. These profiles offer insights into the participants' backgrounds that could influence nutritional status and dietary patterns.

The anthropometric assessment of the 152 participants based on BMI classification by IOTF classification revealed that half of the

Table 1 : Socio-demographic profile of participants (n=152)

Socio - demographic Characteristics	Frequency (n)	Percentage (%)
TYPE OF FAMILY		
Nuclear family	136	89.5
Joint family	15	9.9
Extended family	1	0.7
SOCIO-ECONOMIC CLASS		
Lower	4	2.6
Upper lower	33	21.7
Lower middle	48	31.6
Upper middle	51	33.6
Upper	16	10.5
FOOD PATTERN		
Vegetarian	9	5.9
Non-vegetarian	138	90.8
Lacto-vegetarian	1	0.7
Ovo-vegetarian	4	2.6

participants had a normal BMI (50%), falling within the range of 18.5 to 22.9kg/m^2. However, a considerable number of participants were found to be underweight, accounting for 19.7%. Additionally, 17.1% were classified as overweight, with a BMI ranging from 23 to 24.9kg/m^2, and 13.2% fell into the category of obese grade 1, with a BMI ranging from 25 to 29.9 kg/m^2. In the anthropometric assessment of 152 participants using the WHO criteria for BMI classification, it was observed that 19.7 % of the subjects were underweight (<18.5 kg/m^2). A majority of the participants (67.1%) were classified as having a healthy weight (18.5-24.99 kg/m^2), while 13.15% were categorized as overweight (including obesity) with a BMI of 25 or higher as depicted in Table 2.

On studying the hemoglobin among participants as depicted in Table 3, it was

Table 2 : BMI classification of participants

BMI classification (kg/m²)	Frequency n (%) *	Frequency n (%) **
Underweight	30 (19.7)	30 (19.7)
Normal BMI	76 (50)	102 (67.1)
Overweight	26 (17.1)	20 (13.15)
Obese grade 1	20 (13.2)	

*IOTF Classification ** WHO classification

observed that. 18.4% were categorized to have moderate to severe anemia (Hemoglobin ≤ 10.9 g/dL), 26.3% were classified with mild anemia (Hemoglobin between 11.0 and 11.9 g/dL), and the largest group, comprising 55.3% of the population, were considered non-anemic (Hemoglobin≥ 12.0 g/dL). These results underscore the significance of monitoring and addressing anemia, particularly in those with moderate to severe cases, as it can impact overall health and quality of life.

The distribution of participants based on their Healthy Eating Index, indicatedthe quality of diet. The results show that a significant proportion of participants (44.1%) had poor diet quality, scoring below 50 on the index. A considerable number of respondents (35.5%) had a fair diet quality, with scores ranging from 50 to 64. A smaller but still notable percentage (20.4%) had a good diet quality, scoring between 65 and 80. These findings suggest that a significant portion of the surveyed population has room for improvement in terms of their dietary habits and overall diet quality (Figure 1).

Table 3 : Prevalence of anemia among study participants (n=152)

Classification (g/dl)	Frequency (n)	Percentage (%)
Moderate to severe	28	18.4
Mild	40	26.3
Non-anemic	84	55.3

Moderate to severe Hb. ⩽ 10.9g/dl, Mild Hb. 11-11.9g/dl, non-anemic Hb. ⩽ 12g/dl

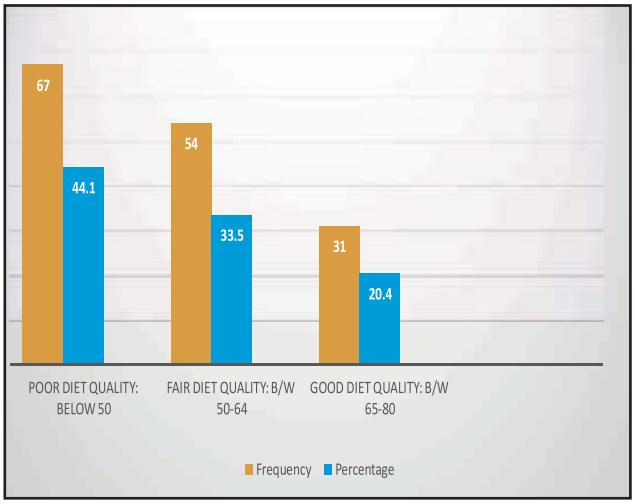


Figure1 : Diet quality based on Health Eating Index (HEI) score

Table 4 illustrates the distribution of participants based on their Dietary Diversity

Table 4 : Dietary Diversity Score (DDS) of study participants (n=152)

Dietary Diversity Score	Frequency (n)	Percentage (%)
Poor	5	3.3
Moderate	117	77
Good	30	19.7

*Poor (0-3), *Moderate (4-6), *Good (>7)

Score (DDS). The results indicate that a small proportion of participants (3.3%) had poor dietary diversity, consuming only 0-3 different food groups. The majority of respondents (77%) had moderate dietary diversity, consuming 4-6 different food groups. A notable percentage (19.7%) had good dietary diversity, consuming seven or more food groups.

The Nutrient Adequacy Ratio (NAR) of nutrients among the study participants was assessed based on the percentage of recommended dietary intake for each nutrient. The data reveals that a substantial number of participants had inadequate intake of certain nutrients, with 68.4% having insufficient calcium and 61.8% lacking adequate iron. In contrast, 55.9% consumed excess protein, and 27.0% exceeded the recommended intake of carbohydrates. These findings highlight potential areas of concern regarding nutritional imbalances in the studied population. Addressing these dietary patterns could be crucial for improving overall nutritional health and promoting a balanced diet among the participants (Table 5).

The study examined the correlates of anemia

Table 5 : NAR of diets consumed by participants

Criteria (%)	Frequency (n)	Percentage (%)
CARBOHYDRATES		
≤50.00	12	7.9
50.01-75.00	68	44.7
75.01-100.00	31	20.4
≥100.01	41	27.0
PROTEINS		
≤50.00	2	1.31
50.01-75.00	20	13.2
75.01-100.00	45	29.6
≥100.01	85	55.9

Criteria (%)	Frequency (n)	Percentage (%)
CALCIUM		
≤50.00	104	68.4
50.01-75.00	23	15.1
75.01-100.00	91	5.9
≥100.01	16	10.5
IRON		
≤50.00	94	61.8
50.01-75.00	29	19.1
75.01-100.00	14	9.2
≥100.01	15	9.9

among the participants, focusing on various factors such as type of diet, type of family, and socio-economic status. The data revealed that the majority of respondents followed a non-vegetarian diet (90.8%), with only a small percentage being vegetarians (5.9%). Although a slightly higher proportion of anemic individuals were vegetarians (10.3%) compared to non-anemic individuals (2.4%), this difference was not statistically significant. Regarding family structure, most participants belonged to nuclear families

Table 6 : Correlates of anemia among participants (n=152)

Classification	Anemic (n=68)		Non-anemic (n=84)		Total		χ2 value	P value
	N	%	N	%	N	%	N	%
TYPE OF DIET AND ANAEMIA								
Vegetarian	7	10.3	2	2.4	9	5.9	6.059	0.109
Non-vegetarian	59	86.8	79	94	138	90.8		
Lacto-vegetarian	1	1.5	0	0	1	0.7		
Ovo-vegetarian	1	1.5	3	3.6	4	2.6		
TYPE OF FAMILY AND ANAEMIA								
Nuclear	55	80.9	81	96.4	136	89.5	9.795	0.007*
Joint	12	17.6	3	3.6	15	9.9		
Extended	1	1.5	0	0.0	1	0.7		
SOCIO - ECONOMIC STATUS AND ANAEMIA								
Lower	2	2.9	2	2.4	4	2.6	3.086	0.544
Upper lower	16	23.5	17	20.2	33	21.7		
Lower middle	25	36.8	23	27.4	48	31.6		
Upper middle	20	29.4	31	36.9	51	33.6		
Upper	5	7.4	11	13.1	16	10.5		

*Significant

The study aimed to investigate the correlation between the Healthy Eating Index (HEI) and anemia among the study participants. The participants were categorized into three groups based on their diet quality scores: poor diet quality (below 50), fair diet quality (between 50-64), and good diet quality (between 65-80). The data

analysis revealed that 44.1% of the participants had a poor diet quality, 35.5% had a fair diet quality, and 20.4% had a good diet quality. Among those with poor diet quality, 42.6% were anemic, while 45.2% of non-anemic individuals also fell into this category. The chi-square test showed no significant correlation between diet quality and anemia ($\chi2 = 0.113$, $p = 0.945$) (Table 7). All the same, there was a decreasing trend in

Table 7 : Correlation between Healthy Eating Index (HEI) and anemia (n=152)

Classification	Anemic (n=68)		Non-anemic (n=84)		Total		χ2 value	Pvalue
	N	%	N	%	N	%		
Poor diet Quality : below 50	29	42.6	38	45.2	67	44.1	0.113	0.945
Fair diet Qualit y: b/w 50-64	25	36.8	29	34.5	54	35.5		
Good diet quality : b/w 65-80	14	20.6	17	20.2	31	20.4		

CONCLUSION

In conclusion, this study provided insights into the diverse socio-demographic backgrounds of the participants, reflecting a wide range of family structures, socio-economic classes, and dietary patterns. Notably, non-vegetarian diets prevailed, while BMI classification revealed variations in nutritional status. Anemia severity classification exhibited a distribution across different categories, with a substantial proportion in each group. The examination of dietary quality through the Healthy Eating Index (HEI) and dietary diversity via the Dietary Diversity Score (DDS) highlighted suboptimal dietary habits, emphasizing the need for diet improvement. The correlation analysis indicated that while certain factors did not show direct associations with anemia, diet remains a pivotal influencer of nutritional status. As dietary quality is linked to health outcomes, enhancing the quality of the diet becomes a crucial parameter for alleviating the nutritional status of this segment of the society.

- Ethical clearance-Study obtained ethical clearance from the Institutional Research Ethics Committee (STCAU/115/25) and Informed consent was also obtained from study participants.
- Conflict of Interest-Nil
- Source of Funding-Self

REFERENCES

A. Mahtab S. Bamji, N. Pralhad Rao, Vinodini Reddy. (1998). Textbook of Human Nutrition. Oxford and IBH Publication Cooperative Privet Limited, Calcutta, New Delhi.

A. Mahtab S. Bamji. A Report of the Expert Group of the Indian Medical Research (2010). Nutrition Requirements and Recommended Dietary Allowances for Indians. Indian Council of Medical Research (ICMR). New Delhi.

A. Saibaba1, M. Mohan Ram, G. V. Raman Rao, Uma Devi, T.S. Syamala. (2002). Nutritional Status. Journal of Community Medicine, vol. xxvii, 4, 151-155.

Brahmam, GNV1, Laxmaiah, A., Mallikharjuna, K., and Reddy, G. (2005). Methodology of assessment of diet and nutritional status of community. In Manual of National Institute of Nutrition, Hyderabad, pp. 7-9, 13, 16.

Canêo, L. F.1, and Neirotti, R. (2017). The Importance of the Proper Definition of Adulthood: What is and What is Not Included in a Scientific Publication. Brazilian Journal of Cardiovascular Surgery, 32(1), 60.

De Benoist, B.1, McLean, E., Egli, I., & Cogswell, M. (2008). Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia.

Elizabeth, K. E. (2000). Measurement techniques. In Fundamentals of Pediatrics, First Edn, Aras Publ., Hyderabad, Pp. 50-69.

Hearty, Á. P.1, McCarthy, S. N., Kearney, J. M., & Gibney, M. J.. (2007). Relationship between attitudes towards healthy eating and dietary behaviour, lifestyle and demographic factors in a representative sample of Irish adults. Appetite, 48(1), 1-11.

Hurley, K. M., Oberlander, S. E., Merry, B. C., Wrobleski, M. M., Klassen, A. C., & Black, M. M. (2009). The Healthy Eating Index and Youth Healthy Eating Index Are Unique, Nonredundant Measures of Diet Quality among Low-Income, African-American Adolescents. The Journal of Nutrition, 139(2), 359-364.

James F. Sallis, Thomas L. McKenzie, John E. Alcaraz, Bohdon Kolody, Nell Faucette, Melbourne F. Hovell. (1997). The effects of a 2-year physical education program (SPARK) on physical activity and fitness in elementary school students. American Journal of Public Health, Vol. 87, pp. 1328-1330.

Joglekar, Abhaya and Bhoi, S. (2016). Impact of Nutrition Education on Nutritional Status and Daily Dietary Pattern of College Going Girls. International Journal of Science and Research (IJSR), 5, 6-391.

Leonie Nzefa Dapi, Christophe Nouedoui, Urban Janlert, Lena Haglin. (2005). Adolescents food habits and nutritional status in urban and rural areas in Cameroon, Africa. Scandinavian Journal of Nutrition, Vol. 49(4), pp. 151-158.

Ministry of Health and Family Welfare, Government of India. (2013). Comprehensive National Nutrition Survey (CNNS) Report, 2016-18. Retrieved from

https://www.mohfw.gov.in/newshighlights/comprehensive-national-nutrition-survey-cnns-report-2016-18

Mirmiran P, Azadbakht L, Esmaillzadeh A, Azizi F. (2004). Dietary diversity score in adolescents - a good indicator of the nutritional adequacy of diets: Tehran lipid and glucose study. Asia Pac J Clin Nutr, 13(1), 56-60. PMID: 15003915.

N. Arlappa, N. Balakrishna, A. Laxmaiah, GNV Brahman. (2012). Prevalence of anemia among rural pre-school children of Maharashtra, India.

Ramalingaswami, V.. (1993). New global perspective in overcoming malnutrition. XV International Congress of Nutrition, Adelaide, Australia.

Recep Kurkcu and Sanliurfa-Turkey. (2010). The effects of short-term exercise on the parameters of oxidant and antioxidant system in handball players. African Journal of Pharmacy and Pharmacology, Vol. 4, pp. 448-452.

Stevens, G. A.1, Finucane, M. M., De-Regil, L. M., Paciorek, C. J., Flaxman, S. R., Branca, F., (2013). Global, regional, and national trends in hemoglobin concentration and prevalence of total and severe anemia in children and pregnant and non-pregnant women for 1995–2011: a systematic analysis of population-representative data. Lancet Global Health, 1, e16-25.

Tiwari, P., and Sanchala, A. (2007). Prevalence of obesity, weight perception and dietary behaviour of urban college going girls. Journal of Human Ecology, 21(3), 181-183.

Ujwala, U. (2012). Nutritional transition, body mass index, and their implications in