

**ESTIMATION OF CONCENTRATION OF HEAMOGLOBIN, BODY MASS INDEX
AND THE PREVAILING ACCESSIBILITY FOR THE MAINTENANCE OF
HEALTH IN SELECTED COLLEGES IN TAMIL NADU, INDIA**

S.K.POONKUZHALI^a

N.KALA^b

K.MALATHI^c

N.MALATHI^d

P.GANESHKUMAR^e

^a Post Doctoral Fellow, Mother Teresa Women's University, Kodaikanal, Tamil Nadu, India

^b Professor, Mother Teresa Women's University, Kodaikanal, Tamil Nadu, India

^c Director of Physical Education, Vellalar College for Women, Erode, Tamil Nadu

^d Associate Professor, Quaid - e - Millath Government College for Women, Chennai, Tamil Nadu, India

^e Assistant Director of Physical Education, Veterinary College and Research Institute, Tirunelveli, Tamil Nadu, India

Abstract

The younger generation of today were subjected to erroneous life style habits, which were mostly acquired during their higher studies and results in malnutrition. Malnutrition is a serious health concern worldwide. This warrants the need for research Studies with respect to the health condition and the prevailing health environment of the students at the level of Higher Education in Tamil Nadu and to safe guard the health of the younger generation. The aim of the study is to examine the heamoglobin concentration, assessing the body mass index of the students and to study the prevailing health environment at the level of Higher Education. A cross sectional study was conducted among 366 randomly selected students doing their under graduation at Kancheepuram and Namakkal districts of Tamil Nadu. A Pre-designed, and structured questionnaire were used as a tool to elicit the information related to the study. The heamoglobin level of the students and Anthropometric measurements like height and weight were assessed. The findings of the study revealed a high prevalence of anemic condition (64.5%), underweight (21.3%), and overweight (10.4%). About 73.5% of the selected students stayed away from the parents and majority of the students were found to skip their meals and the consumption of fruits and vegetables is less. Further, poor accessibility to physical activity, unplanned menu, non availability of nutritious foods, availability of junk foods were identified as barriers of unhealthy life style. The haemoglobin concentration was found to be significantly associated with stay of the students, size of the family, BMI, frequency of consumption of canteen foods, self rating of physical activity. Environmental factors such as poor accessibility to nutritious and healthy foods and lack of physical activity friendly environment were recorded as the main contributing factors for the poor health of the students and calls for urgent attention of the Government for an action plan to increase the accessibility to healthy environment and to encounter the health burden of the

adolescent population. Positive implementation of the same, would pave way for good healthy life style practices among the adolescent group to lead a healthy and quality life in the future.

Keywords: prevalence, anemia, underweight, BMI, healthy eating, barriers.

Preamble:

The younger generation of today were subjected to erroneous life style habits, which were mostly acquired during their higher studies and the impact has resulted in the growing burden of health related complications and malnutrition among the adolescent and the young adults.¹ Malnutrition is a serious health concern worldwide that affects the health of the individual, both physically and mentally. Malnutrition is often caused due to over nutrition, under nutrition and improper physical activity practices. Several studies conducted in our country reveals the existence of anemia, underweight and overweight among the adolescent and young adults which exemplify the double burden of malnutrition related disorder. Though, micro nutrient deficiencies as common among the population, the prevalence of anemia is widespread worldwide.² Further, the complications of malnutrition, leads to deterioration of the health of the individual, the family, the community and the entire nation either directly or indirectly. Normally, good healthy habits will be acquired from the younger hood stage through parents and teachers; shaped in their adolescent and young adulthood stage and continued throughout their rest of life. Hence, the accessibility towards maintaining health practices has to be ensured to these growing young adults at the level of the community and the institution. It is obvious that the growth and health of the country greatly depends on the health of the people. This present situation, warrants the need for research Studies that will bring out the health condition of the younger generation and the prevailing health environment of the students at the level of Higher Education in Tamil Nadu. The findings of this research work will help to initiate necessary action plan to safe guard the health of the future generation of India. In this context, the present study tries to address the prevalence of malnutrition (anemia, under weight and overweight); the existing health environment of the students and the accessibility for maintaining the health at the level of community and educational institutions among female students under going Higher Education in Tamil Nadu.

Objectives:

Objectives of the study is to examine the hemoglobin concentration; to assess the body mass index; to elicit the existing health environment and to study accessibility towards healthy life style practices at the level of Higher Education in Tamil Nadu.

Methods:

This is a cross sectional study conducted among female students studying in Tamil Nadu. Female students were purposively selected for the study, as they play a vital role in the preparation of the next generation. Pre- designed and self administered questionnaire was used as a tool to gather the necessary information that are required for the study. Anthropometric measurements such as height, weight and biochemical parameters such as concentration of haemoglobin level were used as a tool for assessing the nutritional status of the students.

To complete the research task, two colleges were randomly selected by the investigator, one from Kancheepuram District and the other from Namakkal District in Tamil Nadu. Prior permission was obtained from the Head of the institution of the respective Colleges for conducting the research work. Data collection dates were planned according to the availability of the students in the college campus during their free hours as directed by the institutional head and the investigator was asked to conduct the research survey without disturbing the student's routine activities. Prior to data collection, the students were contacted in person and the need for the study was explained to them and they were requested to participate in the study. Those students accepted, were provided with the questionnaire. The questionnaire consisted both open and closed ended questions and was designed in such a manner to elicit the general information, life style factors and the accessibility towards maintaining the health of the student at the community and institutional level. The anthropometric measurements such as height and weight of the students were measured using standard procedures with the help of the respective class Coordinators and the BMI of the students were calculated using the formula weight in Kilogram divided by height in meter squared. The concentration of hemoglobin level was recorded as per the student's Health Record that is maintained by the institution. The collected, filled in questionnaires were scrutinized by the investigator and incomplete questionnaires were rejected from the study. Finally, a total of 366 filled-in questionnaires were coded and computed for further analysis. The statistical analysis was done using IBM SPSS software with appropriate statistical tools.

Results :

A total of 366 female students between the age group of 17-21 years participated in the study. As per the health record of the students, the concentration of the haemoglobin level of the students were noted and were categorized as anemic and non-anemic. The results obtained, revealed that 64.5% of the students were anemic and the rest were non-anemic. The obtained results were found to be in consistent with the findings of S.Kaur et al., Rajaratnam J. et al., and Chakraborty N, where more than 50% of the study population were in anemic condition.³⁻⁵ It was studied through this research that about 73.5% of the students were staying away from their parents and only 26.5% of the students were found to stay along with their parents and the stay of the students was significantly associated with low levels of haemoglobin (p value 0.001). About 57% of the students is leading a nuclear family system and the remaining students still remain to live in joint family system and family system were found to be significantly associated (p value 0.048) with the anemic status of the students (Table 1).

The anthropometric measurements revealed that the average height, weight and BMI of the students were 154.4 +/- 5.56 cm, 46.71 +/-7.34 Kg, and 19.55 +/-2.6 Kg/m² respectively. The BMI of the students was calculated using the formula weight in kilogram divided by height in meter square. The obtained BMI was categorized as per WHO-Asian pacific guide lines. The findings of BMI categorization (Table No.2) revealed that a majority of 68.3% of the students had normal BMI as per WHO-Asian Pacific guidelines, 21.3% of the students were underweight and 9.6 % of the students were in overweight and 0.8% were in the obese category and students belonging to underweight were prone to be more anemic and found to be associated (p value 0.027).

The food consumption pattern of the students were studied (Table 3) and the outcome of the study indicated that the majority (79%) of the students consumed non vegetarian foods, 18 % of the students reported that they belong to ova vegetarians or lacto ova vegetarian category and only 2.5% of the students were vegetarians and it was identified that students belonging to pure vegetarian group were more anemic compared to that of other groups (Table 3). The results obtained were similar with the findings of Verma et al⁶ reported that almost 66 % of the study population were anemic, hence vegetarian pattern may be one of the contributing factor for the occurrence of anemia among adolescent girls.

The findings, further revealed that most (74.6%) of the students had 3 meals in a day and the rest consume less than 3 meals in a day. Poor eating habits were often noticed among the

graduate students and it is identified as one of the major health concern. Today skipping of meals is a common practice among college going students. Hence, the habit of skipping of meals and the reasons for skipping of meals was elicited from the students. The findings of the research revealed that a majority of 77.6% of the students had the practice of skipping of meals regularly. During the visit for the research survey, it was observed that canteen was present in both the selected colleges and almost all varieties of vegetarian foods were made available in the canteen, irrespective of healthy or unhealthy food or junk food. The students consumption of canteen foods was ruled out through the questionnaire and the findings of the study showed that 63% of the students used to take meals and other snacks from canteen and the rest doesn't show interest in taking the canteen foods.

To find out whether the students take enough iron rich food sources, the frequency of consumption of fruits and vegetables for the past 7 days was elicited from the students (Table 3) and it was surprising to note that only 8.2 % of the students consumed vegetables for at least 5 days in a week and the consumption of vegetable is very poor among 56% of the students as they consumed vegetables only once in a week. The frequency of consumption of fruits among the subjects showed that about 57.7% have not consumed fruits for the past 7 days and it was noted that only 7% consumed fruits for at least 5 days in a week. Fruits and vegetables are rich sources of vitamins and minerals. Consumption of fruits were significantly (P value 0.027) associated with the anemic condition of the students. Since, the consumption of fruits and vegetables remain very poor among the students, they have more chances for having micro nutrient deficiencies. It was also noted that about 97.3 % of the students consumed milk and milk products almost on all days. Though majority of the students belonged to non vegetarian diet, about 65% of the students reported that they have consumed chicken and mutton once in week, about 53.3% of the students consumed sea foods once in a week, and about 51% of the students reported that they consume eggs for more than 3 times in a week. The students were asked to self rate their present food habits and the report revealed that 27.7% of the students reported their food habit as good, 59% of the students reported that their food habit as average and 13% reported that their food habit as poor. Most of the students (92.9%) were reported to be aware of healthy eating and maximum number of students have reported to have acquired knowledge through their educational institutions. Further, about 81% of the students preferred to have health education classes to enrich their health related knowledge and the preference it was found to be significantly associated (p value 0.004).

Finding the problems will help to arrive with solutions and hence in order to find out the barriers in achievement of balanced diet, the students were asked propose their suggestions and possible ways to improve the food environment in the college campus (Table 5). About 66.1% of the students suggested to provide healthy foods (Fruits, pulses and more vegetable based dishes with less oil and spice in the hostel food and in the canteen), 18.3% of the students suggested to avoid selling of junk foods in the college premises, 7.7% of the students suggested for having health education classes to enrich their knowledge with regard to healthy foods and about 7.9 % students suggested that the canteen and the hostel mess should be monitored under the supervision of a Nutritionist or a Dietician. Further, the students were also asked to suggest the possible ways for bringing out healthy food environment for the public and to elicit the common barriers of the common man to get nutritious and healthy foods. About 44.8% of the students suggested the government to supply fruits and vegetables at lower cost to improve the intake of fruits and vegetables among common people, 33.9% suggested for conduction health education programme through mass media to make bring awareness about healthy eating among the public, 21.3% suggested for developing health centres exclusively to give health counseling and to assess the health status of the public on a regular basis.

The physical activity performance and conducive environment to do physical activity was studied (Table 4), It was reported that nearly about 52% of the students rated their physical activity as poor, 44% as average and only 3.2% of the students rated their physical activity level as good. It was also reported that only 35.6% of the students were aware about the benefits of physical activity. As the majority were less active, the barriers were elicited from the students and it was identified that about 80% of the students reported that they were not allowed to play inside the college campus because of no PT class or leisure time during the college hours and they were kept engaged with the academic routines, 10% reported that they was not interested for being physically active and another 10% doesn't responded to the question. The students were asked to give their suggestions to improve their physical activity and about 90 % of the students suggested to provide PT class during the working hours, 4% suggested for health education and another 4% suggested for yoga classes during the working hours. About 31.1% of the students suggested the government to conduct awareness programmes for the welfare of the public to make them aware of health benefits of physical activity through mass media communication, 63% suggested to plan for providing play ground and special walking/cycling track for the public to encourage them to be physically

active and about 5.5 % suggested for free yoga campaigns. The students were ready to change their life style, as the findings revealed that 81% of them were ready to move towards healthy life style practices and it was found to be significantly (p value 0.000) associated with the anemic condition.

The students were asked whether they have to do life style modification to ensure a healthy living and about 88.8% of the students have come forth that they have to modify their life style to lead a healthy living and pointed out that they have to undergo more physical activity and take healthy foods to improve their health condition.

Discussion: The study was carried out to examine the hemoglobin concentration ; to assess the body mass index and to study the prevailing health environment at the level of Higher Education of the selected female students in Tamil Nadu and the outcome of the study is discussed here under.

It is important to note that this present study bring out the health status of female students, who were ready for the preparation of the next generation. Moreover, adolescent group were targeted as the demand for nutrients is higher during this period.⁷ Though our government have come forth to enhance the health of the women of child bearing age through supplying folic acid tablets and iron tablets, the results and findings of the study, shows that the plans were not reached the said vulnerable group and it has been proved through this study with its results, as the findings showed a higher prevalence of anemia among the selected students that accounted to almost 65%. Whereas, in a similar study conducted in 16 districts of India, the prevalence of anemia is reported to be even higher (90%).⁸ As anemia affects the reproductive physiology and physical work capacity of the adolescent women, it becomes essential to implement possible strategies to overcome iron deficiency iron among the adolescent population.⁹

As far as the BMI of the students is considered, about 21% of the students fall in the underweight category and 9.6% in the overweight and obese category, which indicates the need to draw attention for the improvement of the health of the selected students. This study is one of the clear evidence and has highlighted the existence of underweight, overweight and the prevalence of anemia among adolescent population. In spite of Government initiatives to protect the health of the women at child bearing stage, the present research work have found out that the Government have not succeeded in its implementation. However, few studies conducted in India also exhibited the escalation in the prevalence of obesity among the adolescent group.¹⁰⁻¹⁶

The findings of the study revealed that the dietary consumption of the students was poor, as they have not consumed nutritious and healthy foods regularly. This indicates that the selected group either doesn't have access to healthy foods or doesn't aware of healthy practices. Rama Dupe et al., have commented that intake of unbalanced diet as the main cause of nutrient deficiencies.^{17,18}

Being physically active helps to protect the health of the individuals and it is an well established fact that engaging in physical activity is positively associated with a longer and better quality of life.¹⁹⁻²¹ But, the physical activity rating of the students have showed a poor outcome and the students have failed to keep themselves active. Similar, low levels of physical activity were also reported among students by Cale, Saxena, et al., in United States and in United Kingdom respectively.^{22,23} Further, the study has also exposed the existence of poor accessibility towards nutritious foods and poor accessibility to do physical activities. The students, further, have pointed out that higher cost of the healthy foods, such as protein rich foods, fruits, and vegetables; easy availability and fondness for junk foods and high calorie foods in their educational institutions run canteens and local eateries; lack of balanced diet and less awareness and knowledge of healthy life style practices as some of the barriers for faulty dietary habits among the students. The reported barriers of physical activity includes, non availability of parks, walking tracks in their residential environment and absence of physical activity (PT Class) in their educational curriculum and lack of leisure time during the college hours. A study conducted in Andhra Pradesh have also observed that proper accessibility towards the maintenance of health were not available for the adolescent group in their educational institutions and in their residential area.²⁴

It is also observed that most of the students resided in the hostel and they were totally depend on the hostel foods or at times on the canteen foods. The results of the research showed that the college canteen and hostel food has to be improved, in terms of quality and taste of the food. This will help the students to take the food regularly and ensure good nutritional status. In order to identify the barriers of healthy nutrition, the students were asked to suggest their opinion to improve the food environment inside the campus and at the community level. The students participated in the study suggested to supply healthy foods inside the campus that includes both the canteen and hostel foods; to improve the taste of the food; to reduce the spice in the food; to make sure enough accessibility for consuming more fruits and vegetables; to include more protein foods in both hostel and in canteen foods; and also suggested that the canteen has to be supervised by a professional Dietician or a Nutritionist to

ensure the supply of well balanced nutritious diet to the students. Further, the study reflected the need for nutritional awareness campaigns among the students and it was reported that the communication will be best reached to the students by conducting nutritional awareness campaigns in colleges, and through broad casting health awareness programme through Television channels. In-order to make them healthier, the students suggested to monitor their weight on regular basis to keep track their weight through implementing health centres at institutional and at community level. Today, all the public eateries are of business motive, and making all possible ways and tricks to drag the younger generation to faulty food habits and many fall as prey for the food business industry through its attractive presentation and advertisement and hence strict rules has to be followed at the level of the Government and at the level of the institution and avoid the sale of junk foods and unhealthy foods to protect the health of the people. The study also draws the attention of the educational institutions to ensure proper accessibility towards increasing the level of physical activity through providing a particular time interval (PT Class), at least for an hour on all working days, to do any kind of physical activity or sport activities that the students wishes and to inculcate the habit of being physically active. The students also suggested to lay down local parks, walking tracks and gym facilities to encourage the public to increase their physical activity and help the public to be fit and healthy. In this juncture, it is becomes necessary to point out that WHO has also insisted all the countries to promote the physical activity and to do possible better means to improve the physical activity of the people. Further, WHO has also identified educational institutions as the powerful force in eliminating the sedentary life style practices among the adolescent group.^{20, 25- 29}

Conclusion

The research study concludes that nutrient related illness such as anemia, under weight and overweight were prevalent in the study population. Environmental factors such as poor accessibility to nutritious and healthy foods and lack of physical activity friendly environment were recorded as the main contributing factors for the poor health of the students. Hence, this research work warrants the Government to consider the present health issue of the students seriously and to take appropriate measures in order to overcome the health burden. The Government as a preliminary step, shall pass orders to the educational institutions and the local body to provide enough accessibility towards nutritious foods and to develop the infrastructure facility to enhance physical activity among the students at the level

of educational institutions and at the level of community. Further, the study has also identified the sale of junk foods and unhealthy foods in the eateries and hence, the canteens run by the institutions and other common eateries has to be monitored by the Health Department or should be kept under the supervision of a Nutritionist or a Health Inspector. Higher education curriculum should come forth with inclusion of Physical activity classes for at least one hour per day to keep the students physically active and to protect the health of the adolescent students. Positive implementation of these suggestions, would pave way to inculcate good healthy life style practices among the adolescent group and to lead a healthy, quality life.

Table 1: Comparison of Anemic status of the students and other variables

Variables	Non Anemic	Anemic	Chi value	Sig.
Stay of the students				
With Parents	19 (14.6)	78 (33.1)	14.626	0.000 *
Away from parents	111 (85.4)	158 (66.9)		
Number of family members				
Nuclear (1-4)	75 (52.7)	115 (48.8)	7.914	0.048*
Joint (5 and above)	55 (42.3)	125 (51.3)		

Table 2: Categorization of Body Mass Index and anemic status of the students

Variables	Non Anemic	Anemic	Chi value	Sig.
BMI classification – WHO Asian Indians				
Under weight	33 (25.4)	45 (19.1)		
Normal weight	77 (59.2)	173 (73.3)	9.139	0.027*
Over weight	18 (13.8)	17 (7.2)		
obese	2 (1.5)	1 (0.4)		

Table 3: Dietary habits and anemic status of the selected students

Variables	Non Anemic	Anemic	Chi value	Sig.
Dietary habit				
Pure vegetarian	2 (1.5)	7(3)		
Ova vegetarian	15 (11.5)	18(7.6)	2.857	0.414
Lacto ova vegetarian	10 (7.7)	25 (10.6)		
Non vegetarian	103 (79.2)	186 (78.8)		
Habit of skipping of meals				
Yes	105 (80.8)	179 (75.8)	1.168	0.280
No	25 (19.2)	57 (24.2)		
Frequency of consumption of canteen foods				
Will not take foods from canteen	60 (16.4)	75 (20.5)		
On all working days	15 (4.1)	34 (9.3)	12.327	0.015*
1-2 times per week	47 (12.8)	113 (30.9)		
3-4 times per week	2 (0.5)	10 (2.7)		
>5 times per week	6 (1.6)	4 (1.1)		
Self rating of consumption of Fruits and fresh juices				
Very Poor (nil)	57 (15.6)	77 (21)		
Poor (1-2 times / week)	44 (12)	81 (22.1)		
Average (3-4 times / week)	7 (1.9)	25 (6.8)		
Good (5-6 times / week)	6 (1.6)	18 (4.9)	7.031	0.134

Very good (All days in a week)	16 (4.4)	35 (9.6)		
Self rating of consumption of green leafy vegetables				
Very Poor (nil)	15 (41)	26 (7.1)	1.527	0.822
Poor (1-2 times / week)	92 (25.1)	160 (43.7)		
Average (3-4 times / week)	12 (3.3)	32 (8.7)		
Good (5-6 times / week)	07 (1.9)	11 (3)		
Very good (All days in a week)	4 (1.1)	7 (1.9)		
Self rating of food habits				
Poor	16 (4.4)	33 (9)		
Average	69 (18.9)	147 (40.2)	8.632	0.071
Good	45 (12.3)	53 (14.5)		
Very good	0	3 (0.8)		
Awareness about healthy eating habits				
Aware	121 (33.1)	219 (59.8)		
unaware	9 (2.5)	17 (4.6)	0.010	0.920
Source of information of healthy eating				
Unaware	11 (3)	17 (4.6)		
Newspaper	11 (3)	14 (3.8)		
Other magazines	2 (0.5)	0		
Text books	42 (11.5)	84 (23)		
Teachers	10 (2.7)	19 (5.2)	24.664	0.002*
TV shows	3 (0.8)	7 (1.9)		
Educational Programmes	27 (7.4)	17 (4.6)		
Friends	2 (0.5)	11 (3)		
From many sources	22 (6)	67 (18.3)		

Table 4 : Physical activity and anemic status of the selected students

Variables	Non Anemic	Anemic	Chi value	Sig.
Self rating of physical activity				
Very Low	16 (4.4)	41 (11.2)		
Low	59 (16.1)	74 (20.2)		
Adequate	55 (15)	109 (29.8)	12.812	0.012*
Good	0	6 (1.6)		
Very Good	0	6 (1.6)		
Factors responsible for low physical activity				
Not applicable	13 (3.6)	28 (7.7)		
No PT class	63 (17.2)	83 (22.7)		
No Play ground	3 (0.8)	22 (6.1)	23.148	0.006*
Not allowed to play	8 (2.2)	13 (3.6)		
Non availability of time	7 (1.9)	27 (7.4)		
No interest to play	12 (3.3)	26 (7.1)		
Using vehicles to reach nearby places	6 (1.7)	1 (0.3)		
Fully engaged in academic work	18 (4.9)	36 (9.8)		
Student's preference towards healthy life style changes				
Preferred to change	104 (28.4)	221 (60.4)	15.688	0.000*
Not preferred to change	26 (7.1)	15 (4.1)		
Students choice of preference to remain fit and healthy				
Not interested to change	24 (18.5)	21(8.9)		
To do physical activity	50 (38.5)	68 (28.8)	16.661	0.001*
To have healthy foods	22 (16.9)	77 (32.6)		
Both healthy food and physical activity	34 (26.2)	70 (29.7)		

Table 5: Suggestions to improve the health environment of the educational institutions and in the residential places

Variables	Non Anemic	Anemic	Chi value	Sig.
Suggestions to improve food environment in the educational institutions				
Providing healthy foods in the canteen	92 (70.8)	150 (63.6)		
Conducting health education programmes	5 (3.8)	23 (9.7)	4.528	0.210
Avoiding sale of junk foods	23 (17.7)	44 (18.6)		
Monitoring the canteen under the supervision of a Nutritionist	10 (7.7)	19 (8.1)		
Suggestions to improve food environment of the Public through the Government				
Conducting awareness programme	49 (13.4)	75 (20.5)		
Supplying healthy foods at lower cost	51 (13.4)	113 (30.9)	2.808	0.423
Opening Health education centres in all villages	21 (5.7)	36 (9.8)		
Monitoring weight assessment for the public	9 (2.5)	12 (3.3)		
Student's suggestions to improve the Physical activity through institutions				
PT class during college hours	118 (90.8)	212 (89.8)		
Conducting health education classes	6 (4.6)	11 (4.7)	1.689	0.639
Conducting yoga classes	6 (4.6)	10 (4.2)		
Monitoring weight of the students periodically	0	3 (1.3)		
Student's suggestions to improve the Physical activity of the public through Government				
Conducting awareness programme	42 (32.3)	72 (30.5)		
Providing play ground/ walking/ cycling track	75 (57.7)	157 (66.5)	8.708	0.013*
Conducting Yoga classes	13 (10)	7 (3.0)		

*- Significantly associated

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