

## A COMPARATIVE STUDY ON THE NUTRITIONAL STATUS OF ADOLESCENTS IN RESIDENTIAL SCHOOL OF SOUTH CANARA

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### **ABSTRACT**

*World Health Organization categorizes the ages from 10 to 19 as the adolescent age group. (WHO, 2017) Adolescence is the period of gradual transition from childhood to adulthood. There is a rapid rate of growth spurts occurring accompanied by major physiological, psychological and social changes. Adolescence is the time of puberty changes. Rapid skeletal growth and increase in height takes place (WHO, 2017), total bone mass increases (JM Rees et al, 1989), hormonal changes occur leading to development of sexual maturation. Psychological aspect of adolescent's development is a phase where they learn to establish their own beliefs, values and what they want to accomplish out of life. They constantly self-evaluate and begin to set long term goals, try to achieve emotional and social independence and develop a sense of self identity. Socially, they struggle for independence from parents but at the same time peer acceptance and relationships become important.*

*Being in transition, adolescents may no longer receive the attention and care given to children. However, during this period of accelerated growth, nutrient needs are the greatest (Lifshitz et al, 1993). In addition, due to psychological and social changes, an increasing independence with respect to food choices and food habits and experimentation with diets may increase vulnerability to nutritional problems if unhealthy eating behaviors are adopted (Savige et al, 2007).*

**KEYWORDS:** *Nutritional Status, Adolescents, Residential School*

### **INTRODUCTION**

For a number of years, attention towards the health of adolescents has received lower priority and research in this area has been limited as they are less susceptible to disease and suffer from fewer life-threatening conditions when compared to children and elderly population (Key et al, 1994). In India, adolescents constitute about one-fifth of the total population and are a significant human resource who will become the future's adult population. Therefore, their health and well-being are crucial (Kolhe et al, 2011). The nutrient needs vary greatly between adolescents as a result of differences in body composition, degree of physical maturation, and level of physical activity.

Groups of adolescents who are at elevated risk for inadequate energy intake include teens who frequently restrict caloric intake to reduce body weight; those living in poverty/ food insecure households; those who consume alcohol or use

illicit drugs frequently which may reduce appetite or interfere with regular food consumption and those adolescents with chronic conditions such as cystic fibrosis, Crohn's disease or muscular atrophy (Mahan *et al.*, 2012).

When protein intake does not meet the requirements, alterations in growth and development are seen. In the still-growing adolescent, inadequate protein consumption results in delayed or insufficient increase in height and weight. In the physically mature teen, protein deficient diet can result in loss of weight and lean body mass and alteration in body composition. Impaired immune response and increased susceptibility to infections may be seen (Mahan *et al.*, 2012).

Adolescents are more independent and have their own choice and decision regarding food. They are prone to eat more meals away from home due to peer influence. The choice and timing of the meal will be based on convenience and own preferences. This may lead to making unhealthy food choices and placing them at a risk for malnutrition and lifestyle related disorders in the coming years (Balan, 2016). Diet and nutrition intake have shown a common pattern emerging among the adolescents: consuming energy-dense foods, snacking on junk and fast foods, meal skipping or irregularly timed meals and low intake of vegetables and fruits. (Kotecha *et al.*, 2013).

Those adolescents who had the habit of skipping breakfast are overweight and tend to eat more of junk foods and those who did not skip had Body Mass Index in normal range. This is the reason there is higher percentage of overweight and obesity in urban areas compared to rural areas. They also reasoned that being financially sound may increase the accessibility of children to purchase calorie dense fast food and a lifestyle involving less physical activity.

Emotional intelligence is defined as a constellation of emotion related self-perceptions and dispositions at the lower levels of personality hierarchies (Petrides *et al.*, 2004). Emotional Intelligence involves the ability to monitor one's own and others feelings and emotions, to discriminate among them and to use the information to guide one's thinking and action. Measuring trait emotional intelligence is done by using various tests such as Trait emotional intelligence questionnaire (TEIQue-ASF) which is a short form variant of the test designed for adolescents between 13-17 years of age with 30 questions measuring domains of well-being, self-control, sociability and emotionality (Parker *et al.*, 2004).

Emotional Intelligence (EI) found to be significant predictor of academic success. The link between social and emotional competency and academic success (Parker *et al.*, 2004) affirmed the existence of a reliable moderate association between trait EI and various health indicators (Schulte *et al.*, 2007).

## **AIMS AND OBJECTIVE**

- To assess the nutritional status of the selected subjects.
- To examine their dietary habits, emotional intelligence and academic performance and
- To study the correlation between the variables.

## **MATERIALS AND METHODS**

It is a cross-sectional study and was performed in Alva's Residential School, Moundbird, and Dashing Kannada district of Karnataka. A total of 100 students were included in the study of 13-16 years of age. Approval was sought from the Principal of the school before data collection began. After explaining the purpose of the study, a verbal consent was obtained from every student. Data collection included questionnaire administration, dietary intake assessment (2 days of 24 hours of dietary recall) and anthropometric measurement as detailed below.

### **Questionnaire Administration**

Data was collected by face to face interviews using a semi-structured questionnaire. The semi-structured questionnaire included sections on demographic information, dietary practices and emotional quotient.

### **Demographic Information**

This section was designed to collect information regarding the participant's age, gender and class currently studying in.

### **Dietary Habits**

Habit of skipping of meals was inquired and if present, whether breakfast, lunch or dinner was skipped was also recorded. Frequency of consumption of food outside hostel premises at various eateries or hotels was inquired and documented as daily, weekly or monthly practice.

### **Diet Assessment**

Diet assessment was done by recording 2 day diet intake through 24 hour diet recall method. The data was recorded as breakfast, lunch, evening snacks, dinner and others. The nutritive value of the diet consumed was calculated using Nutritive value of Indian foods (National Institute of Nutrition). Total calorie, protein and fat intake was calculated and was compared with the Recommended Dietary Allowances

### **Anthropometry**

The anthropometric measurements such as height, weight and waist circumference until age 13 or 14 varies very little between boys and girls and thereafter boys shows a faster growth rate than girls.

#### **Height**

Was measured in centimeters with the help of a non-elastic measuring tape Using the measuring tape, the height from the floor to the marked area was recorded. Height was recorded to the nearest 1centimeter. Height recorded was compared with the WHO reference values of Height for Age and was classified as Normal ( $> \text{Median} - 2\text{SD}$ ), Stunted (between  $\text{Median} - 3\text{SD}$  to  $\text{Median} - 2\text{SD}$ ) and Severely stunted ( $< \text{Median} - 2\text{SD}$ ).

#### **Weight**

Was measured in kilograms using a bathroom weighing scale Weight was recorded to the nearest 1kilogram. Weight recorded was compared with the WHO/NCHS reference Weight-for-Height for adolescents and was classified as Normal ( $> \text{Median} - 2\text{SD}$ ), Underweight (between  $\text{Median} - 3\text{SD}$  to  $\text{median} - 2\text{SD}$ ) and severely underweight ( $< \text{Median} - 3\text{SD}$ ).

#### **Body Mass Index (BMI)**

Was calculated as weight in kilograms divided by square of height in centimeters Body mass index was classified into subgroups as Normal ( $\text{Median} \pm 1\text{SD}$ ), Undernourished ( $< \text{Median} - 1\text{SD}$ ), Severely undernourished ( $< \text{Median} - 2\text{SD}$ ), Overweight ( $> \text{Median} + 1\text{SD}$ ) and Obese ( $> \text{Median} + 2\text{SD}$ ) as per WHO guidelines.

#### **Mid Upper Arm Circumference (MUAC)**

was measured in centimeters with a non-elastic measuring tape at the midpoint of the left upper arm between the tip of the shoulder and tip of the elbow Mid upper arm circumference was recorded to the nearest 0.1 centimeter. Mid upper arm

circumference was classified into five subgroups as Severely thin (0 to 5<sup>th</sup> percentile), Thin (5.1 to 15<sup>th</sup> percentile), Normal (15.1 to 85<sup>th</sup> percentile), Overweight (85<sup>th</sup> to 95<sup>th</sup> percentile) and Obese (95.1 to 100<sup>th</sup> percentile).

### Triceps Skinfold Thickness (TSF)

Was measured in centimeters using skinfold caliper Triceps skinfold thickness was recorded to the nearest 0.1 centimeter Triceps skinfold thickness was classified into five subgroups as Severely thin (0 to 5<sup>th</sup> percentile), Thin (5.1 to 10<sup>th</sup> percentile), Normal (10.1 to 85<sup>th</sup> percentile), Overweight (85.1 to 95<sup>th</sup> percentile) and Obese (95.1 to 100<sup>th</sup> percentile).

### Academic performance

Percentage of marks scored by the students in two examinations conducted during the ongoing academic year was recorded and their average percentage was calculated. The performance was classified as Very good (>85%), Good (85 to 60%) and Average (<60%).

### Emotional intelligence

Emotional intelligence was measured with the help of Trait Emotional Intelligence Questionnaire- Adolescent Short Form (Toque-ASF). The questionnaire comprising of 30 statements required the subjects to rate the extent they agree or disagree with each statement on a seven point scale (1=strongly disagree, 7=strongly agree). The maximum possible score to achieve on this questionnaire is 210. Based on their scoring, the students were classified as having Very well (>180), Good (180 to 120) and Average (<120) emotional intelligence.

### Statistical Analysis

The study population was divided into groups on the basis of gender and their dietary habits, nutritional status (BMI), academic performance, emotional intelligence was compared. Chi-squared test was used for test of significance and p-value of <0.05 was taken as significant.

## RESULTS AND DISCUSSIONS

### Skipping of Meals

Regular intake of foods has a positive effect on children's cognitive performance particularly in the domains of memory and attention, increased ability to attend to and remember information during lessons. Adolescents have a tendency to skip meals due to lack of time between schooling and tuitions, overload of assignments, project works, weekly class tests and cultural activities. Adolescents miss their meals due to ill health, lack of appetite or disliking the food served (Kotecha *et al*, 2013

Table 1

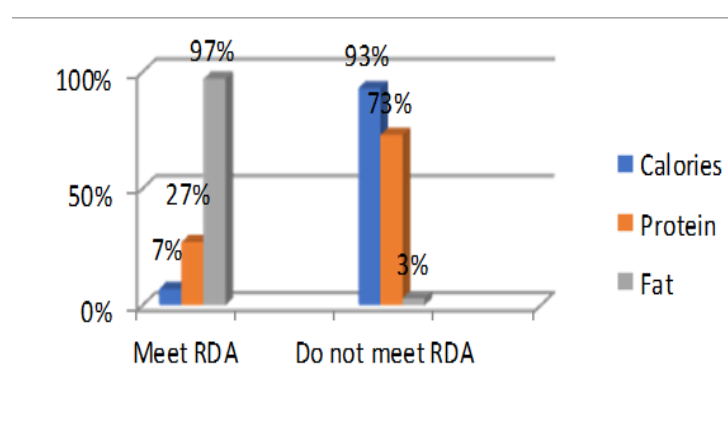
Gender	Boys				Girls				p=0.023		
	Yes		No		Yes		No				
	2 (4%)		43 (96%)		12 (22%)		43 (78%)				
Body Mass Index	Severely Undernourished		Undernourished		Normal		Overweight		Obese	p=0.035	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes		No
	3 (14%)	19 (86%)	2 (7%)	28 (93%)	8 (17%)	38 (83%)	1 (50%)	1 (50%)	0 (0.0%)		0 (0.0%)

Table 1 presents the correlation of meal skipping with gender and BMI. Meal skipping was compared between boys and girls. Girls had significantly higher incidence for skipping of meals (22%) compared to boys (4%). The difference was statistically significant ( $p < 0.02$ ) and is presented in the table 2. Skipping breakfast is common among girls and they believed that it would help in reducing their body weight. (SV Balan, 2016) Several studies have shown that skipping breakfast influences the physical and mental functioning in school going children. It impairs attention and short-term memory (Garg *et al*, 2014).

Adolescence is an intense anabolic period, therefore, macronutrients such as carbohydrates, protein and fats are required in large amounts as they are energy giving foods (Balan, 2016). During this period of adolescence, the macronutrient intake should be sufficient enough to support the energy employed for physiological functions, growth and development, repair of tissues and various physical activities (Kotecha *et al*, 2013).

The graphical presentation Figure1 indicates the mean dietary intake of energy, protein and fat of the boys and girls and their comparison with the Recommended Dietary Allowances. Diet intake was compared between the boys and girls. Energy requirements are different among genders. Growth rates and physiological developmental properties of girls differ from boys after 11-12 years old (Ozdemir, 2016). Intake requirements of carbohydrates, protein and fats differ according to the energy needs. Generally, the energy needs are higher for girls during their early puberty period (11-14 years) whereas the energy needs of boys are higher in their middle puberty period (15-18 years) (Aykut, 2011). During adolescence, protein requirement significantly increases due to increases in muscle mass, need for erythrocyte and myoglobin, and hormonal changes.

On calculation, it was found that protein and calorie intake were considerably less than the Recommended Dietary Allowance (RDA) standards among both the genders (73% and 93% respectively) and very few i.e. 27% (protein) and 7% (calorie) managed to fulfill their standard requirements. In contrast, a greater percentage of the study population (97%) met their fat intake requirements. Optimum intake of dietary lipids and cholesterol during adolescence helps in prevention of chronic degenerative disorders of the cardiovascular system, beginning in childhood. (American Academy of Pediatrics, 1998) Dietary fat intake was not statistically significant difference.

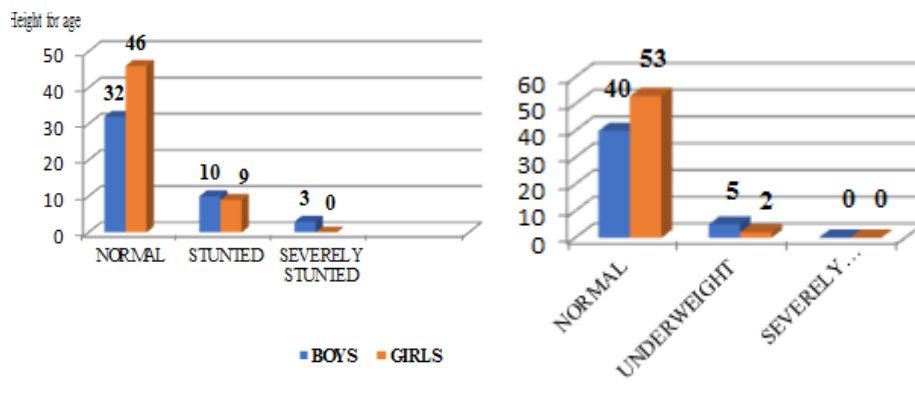


**Figure 1: Percentage of Students that Meet and Do Not Meet RDA in their Calorie, Protein and Fat Intake Respectively.**

### Body Mass Index (BMI)

As per the nutritional status classified, BMI reported that majority of the adolescents were classified as normal after measuring their height and weight i.e., 46%. Comparison of Height for age and weight for height between boys and girls are presented in the Figure 2. Body mass index was compared against height for age and the findings were not significant.

On comparing weight for height against BMI, it was found that the students who came under underweight category according to the weight for height classification were having severe undernourishment ( $p < 0.001$ ). The reason for the normal Body Mass Index (BMI) status of the adolescents was due to the fact that the students did not consume junk foods since breakfast, lunch and snacks was being provided at the Hostel (Mavroveli *et al*, 2007).



**Figure 2: Comparison of Height for Age and Weight for Height Between Boys and Girls.**

Table 2a presents the comparison of students according to Mid Upper Arm Circumference (MUAC) as per the categories. On analysis of the recorded MUAC data, it was found that students were thin, severely thin and average in the percentage of 10, 20 and 70 respectively. ( $p < 0.001$ ).

Table 2b presents the comparison of students according to TRICEPS SKINFOLD THICKNESS (TSF) categories. It was observed that 82% were having average TSF followed by 15% and 16% of them being severely thin and overweight TSF respectively. Girls had significantly higher in both MUAC and TSF when compared with boys ( $p < 0.01$ )

**Table 2: Comparison of Students According to (MUAC)**

Severely thin			Thin			Average			Overweight			Obese			P-value
B	G	Total	B	G	Total	B	G	Total	B	G	Total	B	G	Total	
9 (20%)	1 (2%)	10 (10%)	14 (31%)	6 (11%)	20 (20%)	22 (49%)	48 (87%)	70 (70%)	0	0	0	0	0	0	P<0.001

**Table 3: Distribution of Students According Triceps Skinfold Thickness (TSF)**

Severely Thin			Thin			Average			Overweight			Obese			P-Value
B	G	Total	B	G	Total	B	G	Total	B	G	Total	B	G	Total	
0 (0%)	1 (%)	1 (1)	0	0	0	29 (64%)	53 (96%)	82 (82%)	15 (33%)	1 (18%)	16 (16%)	1 (2%)	0	1 (1%)	P<0.001

## Academic Performance & Emotional Intelligence

Adolescents found that trait emotional intelligence (EI) was positively associated with adequate coping styles and negatively associated with depressive thoughts and frequency of somatic complaints. It was also negatively correlated with maladaptive coping styles in boys. Adolescents with high trait EI scores received more nominations from their classmates for being cooperative and girls gave significantly more nominations to classmates with high trait EI scores for having leadership qualities (Mavrovelli et al, 2007).

A perusal of table 3a and 3b indicates the comparison of the subjects as per gender wise according to their level of academic performance and emotional intelligence. The average marks scored by the students in the two examinations conducted were recorded and analyzed for their academic performance. 42-49% ranged from good to very good. Girls scored higher marks in comparison to boys ( $p < 0.01$ ). 85% of them had good emotional intelligence level with only 7% of them with an average emotional intelligence. Academic performance and emotional intelligence compared with each other and also with the dietary intake (energy, protein and fat), nutritional status (Height for age, BMI, MUAC and TSF). It was found that there was no statistically significant difference between the groups.

**Table 4: Comparison of the Subjects According to their Academic Performance (Gender Wise)**

Gender	Very Good		Total	Good		Total	Average		Total	P-Value
	B	G		B	s		B	G		
	15 (33%)	34 (62%)	49 (49%)	25 (56%)	17 (31%)	42 (42%)	5 (11%)	4 (7%)	9 (9%)	p=0.018

**Table 5: Comparison of the Subjects According to their Academic Performance ( Gender Wise)**

Gender	Very Good			Good			Average		Total	P-Value
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls		
	4 (9%)	4 (7%)	8 (8%)	39 (87%)	46 (84%)	85 (85%)	2 (4%)	5 (9%)	7 (7%)	p=0.647

Table 4 expresses the correlation of Nutritional Status (BMI) with Gender, Meal skipping, Energy, Protein and fat Intake, Academic Performance and EI. Overall EI was found to be significant predictor of academic success. The findings had link between social & emotional competency and academic success (Ashok *et al*, 2014). And, statistically affirmed the existence of a reliable moderate association between trait EI and various health indicators (Schutte *et al*, 2007) Body Mass Index was compared with the Emotional Intelligence and it was not statistically significant. Energy, protein and fat intake of the students did not correlate with the Body Mass Index. Adolescents who had the habit of skipping breakfast were overweight and those who did not skip breakfast had Body Mass Index in normal range. They opined that as breakfast skippers tend to eat more of outside junk food during break hours, this may be the reason for increase in overweight and obesity (Garg *et al*, 2014). Increase in the number of adipose tissue cells, early puberty and growth spurt which occur at an earlier age for girls may account for the increase in Body Mass Index, in comparison to the boys of the same age (Hirsch, 1995).



**Table 6: Nutritional Status (BMI) Correlated with Gender, Meal Skipping, Energy, Protein and Fat Intake, Academic Performance and Emotional Intelligence**

		Severely Under Nourished	Under Nourished	Normal	Overweigh	Obese	P-Value
Gender	Boys	13 (28.9%)	14 (31.1%)	17 (37.8%)	1 (2.2%)	0	p=0.388
	Girls	9 (16.4%)	16 (29.1%)	29 (52.7%)	1 (1.8%)	0	
Meal Skipping	Yes	3 (13.6%)	2 (6.7%)	8 (17.4%)	1 (50%)	0	p=0.035
	No	19 (86.4%)	28 (93.3%)	38 (82.6%)	1 (50%)	0	
Average Energy	Above RDA	0	2 (6.7%)	4 (8.7%)	1 (50%)	0	p=0.056
	Below RDA	22 (100%)	28 (93.3%)	42 (91.3%)	1 (50%)	0	
Average Protein	Above RDA	4 (18.2%)	5 (16.7%)	17 (37%)	1 (50%)	0	p=0.148
	Below RDA	18 (81.8%)	25 (83.3%)	29 (63%)	1 (50%)	0	
Average Fat	Above RDA	20 (90.9%)	29 (96.7%)	46 (100%)	2 (100%)	0	p=0.231
	Below RDA	2 (9.1%)	1 (3.3%)	0	0	0	
Academic Performance	Very good	10 (45.5%)	14 (46.7%)	23 (50.0%)	2 (100%)	0	p=0.89
	Good	10 (45.5%)	13 (43.3%)	19 (41.3%)	0	0	
	Average	2 (9.1%)	3 (10.0%)	4 (8.7%)	0	0	
Emotional Intelligence	Very good	0	4 (13.3%)	3 (6.5%)	1 (50.0%)	0	p=0.088
	Good	22 (100%)	24 (80.0%)	38 (82.6%)	1 (50.0%)	0	
	Average	0	2 (6.7%)	5 (10.9%)	0	0	

## CONCLUSIONS

The study was conducted at Alva's Residential School, Moodbidri, Karnataka and 100 students were recruited with boys: girl's ratio of 9:11. Meal skipping was observed in 14% of students. Breakfast (9%) was the most commonly skipped meal. Girls that showed higher incidence of skipping meals and skipping of meals was correlated with poor nutritional status. Boys consumed significantly higher amount of protein when compared to girls. It was also observed that majority of the students did not meet the Recommended Dietary Allowance (RDA) requirements for energy and protein intake. 22% of the students were severely undernourished and 46% had normal BMI. Academic performance was better in girls when compared to boys. No correlation was observed with dietary habits, dietary intake and nutritional status. Correlation between BMI and emotional intelligence, academic performance and dietary intake was not observed.



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