CONCLUSION AND POLICY IMPLICATIONS
Development of any country depends on dynamic and healthy younger generation. Adolescence is a crucial period when major physical, psychological, and behavioral changes take place (Mala V, 2007). The adolescence period is an important stage in everybody’s life as it prepares a child for its adulthood life. However, the age from 13 to 19 is considered more crucial as far as the growth, mental maturity and development of reproductive system including health and nutritional status of individuals is concerned (Rajaretnam T, 2012). Inadequate diet and unfavorable environmental condition in developing nations like India may adversely affect the growth of adolescents. Due to malnutrition, both undernutrition and anaemia refer to an impairment of health, resulting from a deficiency or from an excess or imbalance of nutrients. It is a public health concern. Caballero (2001) opines that interventions in nutrition introduced in early life have the potential to improve nutritional status and bring about major reductions in the incidence of several diseases. WHO (1997) has documented that one of the determinants of malnutrition is lack knowledge of nutrition which has been addressed in the present study. According to Ali (1992) an individual’s nutrition is determined by food availability, purchasing power of the people, distribution of income, food consumption pattern, and intra-family food distribution, level of nutritional knowledge, levels of employment, illiteracy and parent’s ignorance. According to Bull (1998) adolescent’s food preference and food selection are influenced by social and external pressures. The fundamental determinants of health, apart from the genetic constitution are nutrition, environment and lifestyle. The health of any rural Indian society is directly linked with value system, cultural traditions, socio-economic set up and political organization (Chakravarti, 1987).

Adolescents are considered to be a nutritionally vulnerable segment of the population. A rapid growth rate combined with a marginal nutrient intake increases the risk of nutritional deficiencies in this population. Healthy diets and regular, adequate physical activity are major factors in the promotion and maintenance of good health during adolescence and throughout the entire life course. As per WHO, approximately 2.7 million deaths are
attributable to low fruit and vegetable intake and about 1.9 million deaths are attributable to physical inactivity (WHO, 2007). The phenomenal growth that occurs in adolescence, second only to that in the first year of life, creates increased demands for energy and nutrients. Total nutrient needs are higher during adolescence than any other time in the lifecycle. During adolescence, a child gains about 20 percent of adult height and 50 percent of their adult weight and 50 percent of their adult skeletal mass during their rapid growth period.

Malnutrition is very common in adolescents. The most prevalent consequences of malnutrition in adolescents are underweight, overweight or obesity; iron deficiency anaemia and eating disorders such as anorexia nervosa and bulimia. Undernutrition leads to stunted growth and underweight, whereas over-nutrition leads to over-weight and obesity. Consumption of healthy foods such as milk, fruits and green leafy vegetables is low, while that of junk foods and fried or sweet foods are high. This poor dietary pattern is the cause of several nutritional deficiencies in adolescents. Therefore, present study was undertaken to assess the prevalence of Malnutrition among adolescents of Raichur District of Karnataka State with following objectives;

**OBJECTIVES OF THE STUDY**

1. To study the awareness of Nutrition among Parents and Adolescents
2. To study the Determinants of Malnutrition among Adolescents
3. To study the Menstrual Hygiene and Practices among Adolescent girls
4. To study the Morbidity Pattern among Adolescents
5. To suggest Policy Implications

**HYPOTHESIS**

In pursuance of the objectives stated above, few hypotheses have been framed

1. Majority of the parents and Adolescents are not aware of Nutrition
2. Most of the adolescents are malnourished or anaemic.
3. Most of the adolescent girls are underweight and anaemic than boys
4. Socially backward communities are more likely to be vulnerable to malnutrition
Literature Review

The literature search carried out from printed and electronic sources. Printed materials included books, reports, dissertations, periodicals (journals, magazines and newspaper), statistical report, manuscripts, dictionaries, conference proceedings and Census reports. Electronic sources that are online database used to search electronically available information such as periodicals (journal, articles, magazines and newspaper articles).

Specifications for the Selection of Samples

The samples were selected from 57 villages of Raichur District of Karnataka State. A multi stage stratified sampling procedure was employed for the selection of the respondents.

Tools of Study

The well-structured interview schedule was prepared in light of the study and used as a tool for collection of data. The instrument used in the study was the interview schedule, which was considered to be the most appropriate to get the correct response and information from the adolescents.

Pilot Study

The pilot study was carried out in Kudalagi village of Kalghatgi taluka Dharwad district with 50 samples were covered.

Sample Size

The sample size i.e. number of adolescents were determined by using the formula below. This method requires a target precision for the estimates and a given design effect (with the adjustment for expected non-response) (Lwanga and Lemeshow, 1991).

\[
    n = \frac{Z^2_{\alpha} \times p \times q \times (1 + R) \times (\text{deff})}{d^2}
\]

The number of respondents after solving the above equation is 618.
The present study follows cross sectional design. A multi stage stratified sampling procedure was employed for the selection of the respondents. From 57 villages 728 adolescents and 283 parents were interviewed.

**Anthropometry Measurement**

Anthropometry data was also collected for the purpose of the study, height and weight of the adolescents was taken.

**Haemoglobin Test**

Measurements were taken in the field using the *HemoCue Hb 201+* analyzer.

**Classification of Anthropometry**

1. Stunting (Height-for-age -2SD)
2. Severely Stunted (Height-for-age -3SD)
3. Underweight (BMI-for-Age -2SD)
4. Severely Underweight (BMI-for-Age -3SD)

**Classification of Anaemia**

1. Mild/Moderate Anaemia
2. Severe Anaemia
3. Any Anaemia
4. No Anaemia

**Data Collection, Analysis, Measurement and Interpretation**

The following statistical tools were used for interpreting the data.

**Statistical Analysis**

Frequency and percentage, arithmetic mean, Standard deviation (S.D.), Pearson’s coefficient of correlation and binary logistic regression were applied.
**Qualitative Method**

The data entry were done using CSPro 6.1 software package. The analysis was systematically done by using the STATA version 12, Microsoft office package were used for data analysis and preparing graphs. Quantum GIS software used to plot the GIS maps when it needed.

**WHO Anthroplus**

For all indices of physical growth, minus 2 standard deviation (-2SD) and minus 3 standard deviation (-3SD) below Z score was computed and used in the study.

**RESULTS AND DISCUSSION**

The results of the various aspects are presented under the following sections.

- Background characteristics of the respondents and household
- Parents and adolescents awareness towards nutrition
- Nutritional anaemia status
- Nutritional anthropometry outcome
- Menstrual hygiene and practice among adolescent girls
- Morbidity pattern among adolescents

**Background Characteristics of the Respondents and Household**

In present study, 728 respondents were interviewed; among them 41.2 percent were boys and 58.8 were girls, which show equal participation of both the gender in the study. When we looked at the taluka wise distribution of the respondents, Deodurga taluka represents 31.7 percent of the respondents than Raichur Taluka (18.1%), Lingasugur taluka (16.9%), Sindhanur taluka (16.8%) and Manvi taluka (16.5%) respectively. In the present study, majority of the respondents were girls (58.8%). It was found from the study that, around 23.2 percent of the respondents were 13-14 years of age group, while 38.9 percent of respondents were in the age group of 15-16 years and remaining 37.9 percent were in 17-19 years age groups, which indicates inclusion of all group representation in study.
32.7 percent respondents belong to scheduled caste (SCs), 24.8 percent were scheduled tribes (STs), 23.6 percent respondents were other backward caste (OBCs) and remaining 18.9 percent were other general caste/category respondents. 55 percent respondents belong to nuclear family and 45 percent were joint family. In present study three types of houses were classified, kachcha house, semi-pucca house and pucca houses. 7.7 percent respondents were residing in kachcha houses while 64 percent respondents were residing in semi-pucca house and 28.3 percent were staying in pucca houses.

76.7 percent households’ main sources of income was agriculture, 13.5 percent depended on small scale business. It shows that most of the households engaged agricultural related works.

As far as living condition is concerned, 84.5 percent households were using public tap for source of drinking water, 7.1 percent households depended on uncovered well or river canal and so on, 3.2 percent were using packed water cans and remaining 5.2 percent households were using purified water facility established by Gram Panchayats. Standard of living index is computed taking into consideration the household assets and living condition of the household. 47.3 percent households belong to low SLI families, 33.7 percent were from medium SLI families and 19.1 percent were from high SLI families. In present study, 80.6 percent households did not have toilet facilities and they go for open defecation, whereas, 17.9 percent households have toilet facility and 1.5 percent household were using public toilet.

**Parents Awareness towards Nutrition**

With this background it will be interesting to know the impact of these variables on different aspects of nutritional awareness as a subject of understanding. Parents awareness and perceptions about nutrition and food related issues were very important in improving children’s health and development. 41.7 percent parents were having knowledge about good health. Similarly, 43.1 percent parents were aware of nutrition food. It was found
from the study that, more than 55 percent of the parents were not having any awareness about nutrition food. It could be because of Illiteracy among parents particularly mother (74.8%). Nutritional awareness level was less among SCs parents (6%) as compared to STs (7.8%), OBCs (15.5%) and other general categories (13.8%). It is clearly indicating that scheduled caste respondents were more vulnerable than other caste categories; it could be because these people were socially and economically more vulnerable communities in India.

All parents were admitted that, about 59.4 percent children skip breakfast regularly, 7.1 percent children skip lunch frequently. Study found that, skipping lunch was very less it could be because most of the adolescents were studying in school (77%) and most of them were getting their food in school i.e., mid-day meal. Majority of the parents pointed out that, 40.6 percent children skip their dinner. Reasons for skipping meals by adolescents are, about 59.7 percent children skip their meals because of getting late for school/college/work.

**Awareness of Nutrition among Adolescents**

61 percent adolescents in Raichur district were aware of nutrition food. It was found from the study, majority of the Hindu respondents (49.3%) were aware of nutrition food as compared to Muslims (10.4%) and Christians (1.4%). Along with religious factor, caste factors also play the substantial role in Indian society. It was found from the study that other respondents were less aware of nutrition food (11.8%), as compared to STs (12.1%), SCs (14.1%) and awareness level was high among OBC respondents (23.1%). Awareness about nutrition was highest among 15-16 age-groups (26.6%) and 17-19 age-groups (23.5%) and less among 13-14 age-groups with 11 percent. Those adolescents belong to medium SLI families were more aware of nutrition (27.2%) than low SLI (25.1%) families and high SLI families (8.8%). Adolescent children of the illiterate parents were found to have highest awareness (37.5%) about nutrition compared to adolescent children of
literate and educated parents group. 35.2 percent respondents were aware of nutritional deficiency and 64.8 percent were not aware.

**Prevalence of Anaemia among Adolescents**

Anaemia is currently one of the most common and intractable nutritional problems globally. More than half of the adolescents (55.4%) in Raichur district were found to be anaemic. Recent DLHS-IV (2012-13) report reveals that, prevalence of anaemia in Karnataka State was 56 percent among adolescents (15-19 years of age). Prevalence of severe anaemia in Raichur district were 5 percent and moderate/mild anaemia were 50.4 percent respectively. 22.7 percent of males and 31.7 percent of females whose haemoglobin level tested were found to be anaemic. This result was consistent with studies were conducted by state and national agencies such as DLHS, NFHS and UNICEF.

Taluka wise prevalence of anaemia among adolescents, around 55.4 percent of respondents in Raichur district were found to be anaemic and remaining 44.6 percent were normal anaemia level. The taluka wise trend shows that, 19.5 percent of Deodurga respondents were found to be anaemic followed by Raichur taluka (10.6%), Lingasugur taluka (9.4%), Manvi taluka (8.2%) and Sindhanur was 7.8 percent. Anaemia was much more widespread among respondents belong to Hindu religion with 46.2 percent, 7.3 percent among Muslims and 1.9 percent among Christian respondents.

Prevalence of anaemia was more prevalent among SC respondents with 19.4 percent were found to be anaemic followed by OBCs (17.3%), ST (10.6%) and least among others respondents with 8.2 percent were found to be anaemic. Majority of respondents belong to Madiga caste were found to be anaemic (17.3%) followed by Valmiki Nayak (12%), Kuruba (6.3 %), Lingayat (6%), Muslims (5.7%). Study proved that, gender wise prevalence of anaemia for girls and boys. 24.2 percent boys and 31.2 percent girls those haemoglobin levels tested were found to be anaemic. Adolescents who go for open defecation were more likely to be anaemic (46%). Study revealed that mean and standard
deviation of Haemoglobin (Hb) by gender and age of adolescents. The average mean Hb and standard deviation (SD) for boys were 12.5 and 2.3 (SD); similarly girls were around 11.4 and 2.0 (SD). The mean Hb was relatively lowest in age group 13, 14 and 15 years for boys (11 g/dl each) and then started increase from 12.6 to 14.6 g d/l from 16 to 19 years age. The mean Hb for girls was relatively similar across age. It was found in the study that, boys are relatively more Hb concentration than girls. Conversely, girls found more anaemic across all age group.

**Nutritional Anthropometry Status among Adolescents**

When we applied WHO (2007) Growth Standard of adolescents to the present study, we found that, 30.1 percent of the respondents’ age 13-19 years in Raichur district was found to be underweight and 30 percent were stunted growth. Overall the prevalence of stunting and underweight in Raichur district was 38.3 percent and 43 percent respectively. 34 percent boys and 28.6 percent girls found to be stunted; 11.2 percent and 7.6 percent boys and girls were found to be severely stunted respectively.

Prevalence of stunting and severe stunting was relatively higher among Christian respondents (43% and 10%) followed by Hindu respondents (31% and 9%), than Muslim respondents (22% and 7%). The prevalence of underweight and sever underweight were likely to be higher among Hindu respondents (31% and 13%) followed by Muslim adolescents (28% and 13%) than Christian adolescents (19% and 10%).

Anthropometric analysis shows that, those respondents belong to schedule castes were relatively worse (Stunting 32% and Sever Stunting 11%) followed by other backward classes (Stunting 30% and Severely Stunting 7%). Within sub caste, prevalence of stunting was more prone among Chalawadi caste respondents (43%) followed by Kuruba (38.4%), Lingayat (33.3%), Madiga (31.5%), Valmiki Nayak (25.5%) and less likely among Muslims (23%) respondents.
34 percent boys and 28.6 percent girls were found to be stunted 11.2 percent and 7.6 percent boys and girls were found to be severely stunted. Study found that, 43.8 percent boys and one-fourth (25.6%) of the girls were relatively underweight. Similarly, 22.5 percent of boys and 9.8 percent of girls were found to be severely underweight. It was found in the present study that substantially boys were more likely to be malnourished than girls.

It was found from the study that, stunting was 35 percent in the age of 13 years and started increasing gradually up to age of 14 and 15 years (47% and 50%); and started decreasing in 16 to 17 years (37% and 27%). In ages of 18 and 19 years, rate of stunting was increased from 44 percent and slight decrease in 19 years (43%). Likewise, the prevalence of underweight was relatively highest (54%) in the age of 13 years and started decreasing in the age of 14 and 15 years (47% each) followed by 39 percent in age of 16 years. It was found in the study that, stunting was relatively highest in the age of 15 years and least in 17 years of age, similarly underweight was constant across all age group except 18 years of age.

The prevalence of stunting was more likely to be highest among above four birth order of respondents (35%) and least among first birth order (25%). The severe stunting was relatively high among third birth order adolescents (11%).

Study found the association between stunting and type of toilet facility at households. Respondents those who go for open defecation relatively more stunted (31.2%) and severe stunted (9.5%) than respondents who have toilet facilities at household. Respondents those use to go for open defecation relatively were more underweight (32.2%) and severe underweight (13.8%) than those have toilet at inside the home (21.3% and 9.2%) respectively.

The average mean weight and standard deviation (SD) for boys were 41 kg and 9.4kg; similarly girls were around 40 kg and 6.5 kg (SD). The average mean height and standard
deviation for boys were 156.1 cm and 10.8 cm; similarly girls were around 150.8 cm and 6.6 cms (SD).

**Menstrual Hygiene and Practice among Adolescent Girls**

It was found in the study that, out of 84 percent of Hindus, 39.2 percent of Hindu respondents were using both sanitary pads and cloths. 34.3 percent were using only cloths and 10.5 percent were using only sanitary pads during menses. Whereas, out of 12.7 percent of Muslim respondents, 4.9 percent were using only sanitary pads. Majority of the Scheduled caste respondents were using only cloths (14.2%) and two percent were using only sanitary pads. Among Scheduled tribes, 9.8 percent were using both sanitary pads and cloths, 9.3 percent were using only cloths and 3.3 percent of the respondents were using only sanitary pads. Out of 32.2 percent OBC respondents, majority of them (17%) were using both sanitary pads and cloths, 32.8 percent of the respondents were suffering from irregular menstrual cycles. 31 percent experienced prolonged bleeding, 29.7 percent were suffering from painful periods, 26.4 percent frequent period and 13.4 percent were experiencing scanty bleeding.

Study revealed the relationship between awareness about Shuchi napkin program and education of the mother, religion, caste and SLI of the respondents. It was found in the study that, 38.8 percent respondents of the illiterate mothers were aware about Shuchi napkin program. When researcher observe the religion of the respondents and awareness of Shuchi Napkins, awareness level was highest among Hindu respondents (52.1%). When we see the caste composition, 14.7 percent SCs, 13.6 percent STs, 21.3 percent OBCs and 12.9 percent of other category respondents were aware about Shuchi napkin program. Similarly, 25.7 percent of Low SLI families, 29.2 percent medium SLI families and 7.5 percent of high SLI family respondents were aware about Shuchi napkin program.
Morbidity Patterns among Adolescents

Morbidity pattern among adolescents both boys and girls are as follows. Three months preceding the survey, it was found in the study that, of 728 respondents, 44.9 percent had experienced headache, 40.4 percent of the respondents said they have problem with Concentration, 39.4 percent had experienced Fever with Cold, dizziness (37.2%), Pain in the abdomen (33.4%), Unable to Taste the Food (32.7%).
UNIQUE FINDINGS OF THE STUDY

In the present study, there are few unique findings that are not found in any of the previous research studies.

To assess malnutrition there are various parameters. But among them the two major methods are through testing Haemoglobin and measuring anthropometry. In the present study both measures were used to check the prevalence of malnutrition have not been used in earlier studies in context of malnutrition.

Though many studies have been undertaken on malnutrition in Raichur district no studies concentrated on age group of 13-19 years adolescents at community level. The present study has filled this gap in research.

Present study found strong association between skipping meals and malnutrition. The study shows that majority of the adolescents missing their breakfast are malnourished than the adolescents who did not skip meals. Thus, skipping meal has been identified as one of the major causes for malnutrition.

Though, government of India has introduced free meal for school going children in order to reduce classroom hunger and school dropout rate. The present study has given a negative picture of association between Mid-Day-Meal and malnutrition. In present study it was found that the adolescent consuming Mid-Day-Meal is more malnourished than those children who are not consuming Mid-Day-Meal. Thus, the study shows that Mid-Day-Meal has a negative association with malnutrition and the study also identified that Mid-Day-Meal have become a major cause for malnutrition.
RECOMMENDATIONS AND POLICY IMPLICATIONS

The major problem of malnutrition and its causes among the adolescents can be reduced using various interventions. Since, it is known that malnutrition among adolescents undermines the growth and development of the society, the intervention is inevitable.

Thus, from the findings of the study researcher has recommended some key intervention. They are

1. Biological assessments
2. Community based nutritional awareness and practice and food preparation programs for parents
3. Home based nutritional awareness program for parents
4. School based growth monitoring program
5. Effective Iron supplements program
6. Centralized Mid-Day Meal program
7. Other suggestions

**Biological Assessments**

a. Identify population more affected or at greater risk. This information enables national authorities to select priority area for action, especially if resources are limited
b. Determine the magnitude, severity and distribution of iron malnutrition/anaemia and preferably its main causes. This information can serve as a basis for planning policies and intervention.

c. Monitor trends in prevalence and regulate the impact of interventions. Other program indicators are also needed for monitoring program implementation
d. Measure progress towards achieving the goals adopted by the international community
e. Provide the basis for advocacy program for malnutrition/anaemia prevention in affected vulnerable population.
Community Based Nutritional Awareness and Practice Programs: There is no program on nutritional awareness and practice exclusively for parents, so some programs must focus on parents.

Home Based nutritious food preparation program for parents

Knowledge must be given to the parents about the home based nutritional food preparation mainly focusing on locally available foods such as grains, jiggery, peanuts, and green vegetables instead of other sources that available in the market. Motivate and support parents to adopt practices that support healthy eating i.e. family meal times, involving children in food preparation, eating more fruit and vegetables, drinking water and milk.

Effective Growth Monitoring System

Growth monitoring has been defined as the regular measurement, recording and interpretation of child’s growth change. The advantages of growth monitoring and promotion are:

- It allows for the early identification of children at high risk of malnutrition.
- It enhances the transfer of nutritional information by providing the educator with data concerning children’s growth patterns that can be used in tailoring advice
- It assists in focusing scarce resources such as supplementary food commodities and recipients who most need them
- When combined with nutrition surveillance, it assists in evaluating the impact of other health and development activities and in identifying groups in need of special health attention.

In present study the prevalence of stunting and underweight in Raichur district were 38.3 percent and 43 percent respectively. In this regards researcher suggests that;
Children Growth Monitoring System (CGMS)

Currently there is no regular school based growth monitoring program run by government or other NGOs, researcher suggests that, it would be better to introduce centralized and computerized growth monitoring system (Children Growth Monitoring System-CGMS) because every child is special and unique. Information pertaining to height, weight, morbidity, personal hygiene and socioeconomic and demographic characteristics of adolescents must be entered. This application could save time, money and energy to collect information on adolescents and it will reduce the dependency on others agencies. Every school going children should be measured his/her height and weight once in every three month and once in a year his/her socioeconomic conditions by school authority, this work must be done by physical education (PE) teacher and monitored by principal.

Data entry must be entered/computerized in school/college only. We can use model of Mother and child tracking system (MCTS-2011), where every mother and child has been monitored through online from beginning of ANC, PNC to Delivery and Immunization and so on. Before submitting growth monitoring data it must be properly checked and entered. This data will be monitored by UNICEF, WHO and MoHFW etc. for planning and timely implementation purpose. This information must be available in public domain.

Centralized Kitchen for Mid-Day meal program and proper monitoring mechanism.

The Mid Day Meal (MDM) is a welfare scheme funded by the government of India, which offers free cooked meals to students in primary and upper primary schools, aiming at improving nutritional status and school enrolment. It was found in the present study that, those adolescents eating under school MDMP 78.9 percent were anaemic, 80.2 percent were stunting and 79.8 were underweight. Most of these schools were in rural areas and run by government authority, those enrolling in these schools were poor family background. Mid-Day meal program is very good initiative of government but meal provided by schools were not nutritious it would be because there is no quality assurance team monitoring food quality and quantity.

a) Taking model of ‘Akshya Patre’ by ISCKON temple. ISCKON is providing mid-day meal to school children in four districts of Karnataka state (Bellary, Bengaluru, Dharwad and Mysore districts). They are preparing meal in centralised kitchen

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which is running in four districts. Through this method ISCKON is providing nutritious food and maintaining both quality and quantity with proper hygiene and taste.

b) Instead of cooking at school it is better to decentralise food preparation facility using public private partnership model (PPPM).

c) It is necessary to constitute quality assurance team OR monitoring team to assure food quality and quantity.

d) It was found in the present study that, most of the school going adolescents were skip their morning breakfast twice/thrice in a week and found to triple burden of malnutrition. If it is possible, government could introduce morning breakfast program on conditional base.

**Haemoglobin Test:** Every adolescent must be testing his/her Hb level once in every six month and same will be uploaded in web portal as like growth monitoring system.

**School Based Nutritional Awareness Programs (SBNAP):** such as essay competitions, debates, discussions and seminar must be organised by school authorities. Key speakers in seminars must be local doctors (local PHC/CHC medical officers) or nutrition specialists or NGO representatives. Also awareness should be given to the parents as well as adolescents about importance of morning breakfast. Study found that 11 percent adolescents were suffering from night blindness and defective vision. It could be because of Vitamin A deficiency. Supplement of Vitamin A may be distributed effectively at schools.

**Growth Charts:** In every school/college/gram panchayats growth charts must be hanged. So that, adolescents can notices it at least once and could evaluate their height and weight.

**Season wise Vegetables and Fruits:** Awareness of consuming seasonal fruits and vegetables are not known to common people. By organizing awareness camps these issues may be addressed for better health of the adolescents.