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Assessment of the nutritional status of adolescent girls aged between 15 to 18 years studying in government high school in Raipur, Chhattisgarh, India

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Introduction: The prevalence of malnutrition among adolescent girls is high in India. Malnutrition has long term effects on the physical and mental health of adolescents. **Objectives:** To find out the prevalence of underweight, overweight and stunting and correlate with a dietary pattern, socio-demographic profile and prevalence of clinical anemia and signs of vitamin and mineral deficiency. **Method:** This is a community-based cross-sectional observational study conducted for 1 year (Jan 2019 – Dec 2019), including a total of 480 adolescent girls who were attending government high school. Observations and **Result:** 480 girls were interviewed. As per WHO nutritional measurement criteria, adolescent girls were classified as per their anthropometric criteria, 50.63% of girls were moderately stunted and 7.29% had severe stunting. 7.29% of girls were in the category of severe thinness, 36.04% had thinness and 9.37% were overweight. 28.12% had conjunctival pallor (anaemia), 4.80% had dental caries, 1.46% had vitamin B complex deficiency and 1.04% had signs of vitamin A deficiency. **Conclusion:** More than half of the (57.92%) late adolescent school girls were stunted, 43.33% were having some form of thinness and 28.12% had clinical anaemia. Effective implementation of government programs such as the RKSK and Sabla Yojana program will be a paradigm shift from the existing clinic-based services to promotion and prevention and reaching adolescents in their environment, such as in schools, families and communities. Skills-based nutrition education for the family and effective infection control and routine health assessment of school-going girls should be done.

Keywords: Adolescent girls, Government high schools, Nutritional status

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Introduction

Adolescents are people aged between 10 to 19 years. More than 1.2 billion are adolescents worldwide [1]. About 21% of the Indian population is comprised of adolescents [2]. They require balanced nutrition comprising of macronutrients and micronutrients which helps in a rapid growth spurt and increased physical activity. The National Family Health Survey revealed that in the age group of 15–19 years, about 41.9% of girls were thin while 4.2% of girls were overweight [3]. Thinness (low BMI-for-age) is a common problem among adolescents in India. Many girls are also overweight and obese [4]. This ensues as a double burden of malnutrition which is due to nutritional transition [5]. Undernutrition leads to decreased immunity whereas overweight adolescents are predisposed to non-communicable diseases [6]. Assessment of nutritional status is valuable to predict efficient physical activity and healthy reproductive outcome. Nutritional status is the physiological state of an individual, which results from the relationship between multiple factors such as nutrient intake, requirement and body‘s ability to digest, absorb and use these nutrients and factors that affect the abovementioned factors. It is a total of an individual’s anthropometric indices and factors that influence the dietary pattern of that individual. These include external factors such as food safety, cultural, social, economical factors and internal factors which include age, sex, nutrition, behaviour, physical activity and diseases of the person.

Chronic undernutrition leads to short stature in adolescents. It also causes reduced lean body mass and decreased muscular strength and physical capacity. Low literacy levels, poor socioeconomic status, poor environmental hygiene, poor dietary habits aggravate malnutrition. Undernutrition continues indefinitely across generations, particularly in girls. Puberty and menarche increase energy and nutrients demand leading to thinness, stunting and various micronutrient deficiencies [7]. Growth spurt, poor nutrition, menarche and poor dietary habits predispose an adolescent girl to anemia. Anemia limits growth and may further delays the onset of menarche, which in turn may later lead to cephalopelvic disproportion. Iron deficiency is the most common manifestation of malnutrition among adolescent girls. India has the highest prevalence of iron deficiency anemia among women, including adolescents [8].

Micronutrient deficiencies such as vitamin A, B complex, C, iron, zinc and calcium deficiencies are common. Vitamin A deficiency causes dry conjunctiva and an impaired immune system. Vitamin B complex compounds anemia and leads to oral ulcers and angular stomatitis. Vitamin C deficiency causes bleeding tendencies. Iron deficiency leads to anemia and poor motor and cognitive development [9].

Zinc deficiency impairs the immune system which causes infections, which further has deleterious effects on health. Calcium deficiency leads to poor growth and weak bones. Poor dietary patterns like snacking, skipping meals especially breakfast, irregular meal timings, fast food etc. are common among adolescents in the school-going age group. Poor eating habits and lifestyle leads to severe morbidities in later stages of life.

Socio-demographic factors and economic factors including adolescent’s age, mother’s age, parents’ occupation and income, literacy level, dietary habits and cultural factors are associated with the nutritional status of adolescents [10]. This is mainly due to nutrition, epidemiologic, and socio-demographic transition across the world. Socio-economic status affects the nutritional status of adolescents. The level of maternal education was found to be associated with the nutritional status of children. This implies that the ability of mothers to care for their children is high among literate mothers.

Aim

To assess the nutritional status of adolescent girls aged between 15 to 18 years studying at different government high schools in Raipur by using anthropometric measurements and clinical examination.

Objectives

Primary objective: To find out the prevalence of underweight, overweight and stunting.

Secondary objectives:

01. To correlate dietary patterns to the nutritional status of adolescent girls.
02. To correlate socio-demographic profile to the nutritional status of adolescent girls.
03. To find out the prevalence of clinical anemia and signs of vitamin and micronutrient deficiency.

Material and Method

Type of study- It is a community-based cross-sectional observational study.

Study setting- Different government high schools and higher secondary schools in the urban area of Raipur, Chhattisgarh, India.

Study period- Jan 2019-Dec 2019

Study population- A total of 480 adolescent girls who were aged between 15 to 18 years and attending government high and higher secondary schools in Raipur.

Inclusion criteria-

01. Girls attending government high schools and higher secondary school
02. Age group 15-18 years
03. Girls studying in class IX-XII

Exclusion criteria-

01. Girls not consenting to participate
02. Age group <15 years and >18 years
03. Girls studying in classes other than IX-XII
04. Girls with a known history of any hemoglobinopathies or dysmorphic features
05. Girls having any chronic disease affecting nutrition.

Methodology/ data collection-

All the selected adolescent girls were personally interviewed with the help of a questionnaire regarding age, type of family, dietary pattern and socioeconomic status. The anthropometric measurements of the selected adolescent girls were measured by following standard procedures. Anthropometric measurements like height (cm), weight (kg), body mass index (kg/m2) were recorded and general and systemic examination was done.

Following schedules were filled during the study period-

Schedule A Data collection format of Anthropometric measurement

Schedule B Interview questionnaire of study subjects

Schedule C Clinical Examination form for study samples

Major variables-

01. Weight
02. Height
03. Body mass index

Outcome variables-

01. Proportion of adolescent girls classified as underweight or overweight/obese
02. Proportion of girls with moderate or severe stunting
03. Proportion of clinically anemic girls.
04. Proportion of adolescent girls with different vitamin or mineral deficiency.

Confounding factors-

01. Socio-economic status
02. Parental education
03. Parental occupation
04. Menstrual history
05. Food habit.

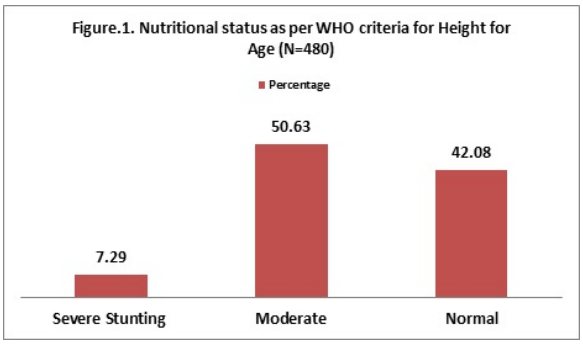
Data entry and analysis- Data entry was done in Excel and analysis was done using SPSS 20.0 and WHO Anthroplus software. Wherever possible, percentage, Chi-square test and logistic regression were applied. P-value < 0.05 was considered as statistically significant.

Ethical issues- Informed consent was taken from mothers of all the study participants and ethical issues were considered.

Results

- 120 study samples were taken from each age group.
- The mean weight of adolescent girls was 42.08±7.17 kg and height was 146.87±3.84 cm in 15 year age group. Mean weight was 41.66±7.50 kg and height was 146.75±3.75 cm in 16 years age group. Mean weight was 41.07±6.33kg and height was 147.54±3.74cm in 17 years age group. Mean weight was 41.77±7.80 and height was 147.66±3.64 in the 18 years age group. The mean weight (kg) of adolescent girls was 41.64±7.26, mean height (cm) was 147.20±3.75 and mean BMI (Kg/M2) was 19.25±3.44.
- As per WHO criteria for Height for Age (H/A) which measure stunting in girls, 42.08% were normal, 50.62% were moderately stunted and

7.30% of girls were severely stunted.



- As per WHO criteria for Body Mass Index (BMI, 47.30% were normal, 9.40% were overweight, 36.04% were thin and 7.30% girls were severely thin.

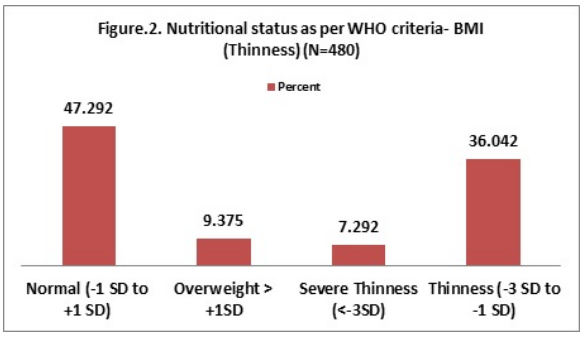


Table 1: Distribution of Major morbidity conditions in study subjects

Disease	Frequency	Percentage
Anemia (Conjunctivital Pallor)	135	28.12
Dental Carries	23	4.80
Vitamin B Complex deficiency	7	1.46
Vitamin A deficiency (Bitot's spot)	5	1.04

- Table 1 shows the prevalence of clinical anemia and signs of vitamin and mineral deficiency among study participants. 28.12% had clinical pallor (anemia), 4.80% had dental carries, 1.46% had signs of vitamin B complex deficiency and 1.04% had signs of vitamin A deficiency.
- A multivariate logistic regression statistical tool was used to understand the determinants of malnutrition in study subjects. Severely stunted and moderate stunted were considered 'stunted' as one category and rest were considered 'normal' as another category. Then other variables i.e. age of children, educational class, Religion, Parents education, Parents occupation, socio-economic class, type of family, immunization status and menstrual history were taken as the independent variable.

Table 2: Multivariate analysis for determinants of stunting in adolescent girls from 15 to 18 years old:

Variables	Stunting (%)	Odds Ratio	P-value	[95% Conf.Interval]	
Age in years					
15 year	55	Ref.			
16 year	58.3	0.876	0.649	0.495	1.551
17 year	60	1.053	0.858	0.595	1.864
18 year	58.3	1.062	0.842	0.588	1.919
Religion					
Hindu	59.4	Ref.			
Muslim	57.7	0.840	0.547	0.475	1.483
Christian	36	0.202	0.004	0.069	0.595
Mother's education					
Illiterate	57.1	Ref.			
Primary	63.5	1.863	0.194	0.728	4.767
High school	43.8	1.319	0.754	0.233	7.461
Higher Secondary	57.1	1.194	0.714	0.463	3.080
Father's education					
Illiterate	58.5	Ref.			
Primary	57..4	0.913	0.868	0.312	2.672
Middle	75	1.565	0.617	0.270	9.074
High school	33.3	0.309	0.342	0.027	3.482
Higher Secondary	56.6	0.977	0.965	0.337	2.832
Graduate	61.5	1.400	0.582	0.423	4.631
Father's occupation					
Daily wages	64.2	Ref.			
Job	55.5	0.337	0.025	0.130	0.872
Self business	55.5	0.519	0.142	0.216	1.245
Mother's occupation					
Daily wages	59	Ref.			
House wives	57.8	1.105	0.835	0.432	2.828
Socio-economic status					
Lower	100	Ref.			
Lower middle	56.5	0.937	0.921	0.256	3.425
Upper lower	57.1	0.821	0.795	0.187	3.616
Upper middle	60.9	1.000			

Table 3: multivariate analysis for determinants of stunting in adolescent girls from 15 to 18 years old(continued):

Type of family					
Joint	58	Ref.			
Nuclear	57.9	0.999	0.997	0.647	1.544
Environmental hygiene					
Good	59.2	Ref.			
Fair	56.9	1.093	0.846	0.447	2.669
Poor	60.8	0.706	0.622	0.177	2.816

Immunization status					
Complete	58.5	Ref.			
Incomplete	51.2	0.738	0.425	0.350	1.556
Menstrual history					
Regular	59	Ref.			
Irregular	52.1	0.675	0.157	0.392	1.163
Teeth					
Carries	60.9	Ref.			
Normal	57.8	1.065	0.894	0.423	2.680
Diet					
Vegetarian	52.3	Ref.			
Non Vegetarian	63.5	1.677	0.010	1.133	2.483
Pattern of diet					
Regular	54.6	Ref.			
Irregular	62.5	1.486	0.053	0.995	2.220

Table.2 and 3. shows that 17 and 18 years old girls have more chance of being stunted whereas 16 years old has less chance (OR 0.876, P= 0.876) of being stunted as compare to 15 years old; though this difference is not statistically significant. As compared to Hindu girl, Muslim and Christian girl has less chance of stunting. Parents' education does not have a significant impact on the height of adolescent girls. Girls who had educated mothers had more chance of being stunted.

Girls whose fathers were educated till middle school has 1.56 times more chance (OR-1.565, p=0.617) and those who were graduate has 1.4 times more chance (OR-1.4, p=0.582) of stunting as compared to girls having illiterate fathers. Girls having fathers who had a job had less chance of stunting (OR-0.337, P=0.025) as compared to girls having fathers who were daily wagers.

Girls having mothers who were housewives had 1.105 times more chance (OR-1.105, p=0.142) of stunting as compared to girls having mothers who were on daily wages. Type of family does not have a significant impact on the height of a girl child. Girls with lower socio-economic status have more chance of stunting as compared to the lower-middle and upper lower class.

Similarly environmental hygiene, menstrual history, immunization status and dental carries do not have a significant impact on the stunting status of adolescent girls. Adolescent girls who were non-vegetarian had more chance of being stunted (OR-1.677, P=0.01) as compared to vegetarian girls. Adolescent girls who had irregular diet had more chance of being stunted (OR-1.486, P=0.05) as compared to girls having regular diet.

Table 4: Multivariate analysis for determinants of thinness in adolescent girls from 15 to 18 years old girls

Variables	Thinness (%)	Odds Ratio	P value	[95% Conf.Interval]	
Age in years					
15 year	35	Ref.			
16 year	41.7	1.488	0.200	0.810	2.733
17 year	50.8	2.470	0.003	1.359	4.490
18 year	45.8	1.950	0.035	1.047	3.630
Religion					
Hindu	36.2	Ref.			
Muslim	70.4	3.810	0.000	2.089	6.946
Christian	76	5.216	0.002	1.858	14.642
Mother's education					
Illiterate	53.2	Ref.			
Primary	34.6	0.927	0.880	0.349	2.467
Middle	100	1.000			
High school	62.5	3.260	0.202	0.530	20.055
Higher Secondary	42.6	1.558	0.381	0.578	4.199
Father's education					
Illiterate	56.9	Ref.			
Primary	61.7	1.209	0.737	0.399	3.661
Middle	50	0.778	0.763	0.151	3.999
High school	66.7	1.481	0.752	0.130	16.852
Higher Secondary	39.5	0.596	0.359	0.197	1.804
Graduate	31.9	0.576	0.388	0.165	2.014
Father's occupation					
Daily wages	56	Ref.			
Job	34.9	0.623	0.316	0.247	1.571
Self business	43.8	0.653	0.319	0.282	1.510
Mother's occupation					
Daily wages	69.2	Ref.			
House wives	41	0.554	0.230	0.211	1.452
Socio-economic status					
Lower	88.9	Ref.			
Lower middle	37.3	0.304	0.327	0.028	3.289
Upper lower	46.3	0.292	0.295	0.029	2.921
Upper middle	30.4	0.287	0.385	0.017	4.787

Table 5: Multivariate analysis for determinants of thinness in adolescent girls from 15 to 18 years old (continued):

Type of family					
Joint	38.5	Ref.			
Nuclear	45.4	1.137	0.577	0.724	1.787
Environmental hygiene					
Good	32.7	Ref.			
Fair	40.4	1.203	0.713	0.449	3.228

Poor	58.8	1.299	0.683	0.370	4.564
Immunization status					
Complete	44.2	Ref.			
Incomplete	34.1	0.428	0.036	0.194	0.947
Menstrual history					
Regular	42	Ref.			
Irregular	50.7	1.349	0.301	0.765	2.377
Teeth					
Carries	43.5	Ref.			
Normal	43.3	0.937	0.895	0.357	2.464
Diet					
Vegetarian	44.4	Ref.			
Non Vegetarian	42.3	0.919	0.682	0.613	1.376
Pattern of diet					
Regular	43.2	Ref.			
Irregular	43.5	0.923	0.702	0.612	1.391

Table.4 and 5. shows that 17 years old girls (OR-2.47, P=0.003), 18 years (OR-1.95, P=0.035) and 16 years (P=0.20) have more chance of being thin as compared to 15 years old girls. As compared to Hindu girl, Muslim and Christian girls have a significantly more chance of being thin. Parents' education does not have a significant impact on the BMI of adolescent girls.

Girls having mothers who are educated till high school (OR-3.260, p=0.202) and who were graduate (OR-1.55, p=0.381) have more chance of thinness as compared to girls with illiterate mothers. Girls having fathers who do job and self business has less chance of thinness as compared to girls having fathers who are daily wagers. Girls having mothers who are housewives have less chance (OR-0.554, p=0.230) of thinness as compared to girls having mothers who are daily wagers.

Type of family does not have a significant impact on the BMI of girls. Girls with lower socio-economic status have more chance of thinness as compared to the lower-middle and upper lower class. Environmental hygiene, menstrual history, immunization status, dental caries and diet do not have a significant impact on the BMI of adolescent girls.

Discussion

This study was conducted in government high schools of the state capital city, Raipur. 480 schoolgirls from 15 to 18 years of age group were assessed for their nutritional status. Socio-economic determinants were also assessed among study subjects.

In the present study, religion-wise analysis of nutritional status showed that 59.37% of Hindu girls were stunted as compared to 57.75% of Muslim girls and the association between underweight and religion was statistically significant. 36.20% of Hindu girls were thin as compared to 70.42% in Muslim girls which was statistically significant. As compared to Hindu girls, Muslim girls have more chance (OR- 3.81, P=0.000) of being thin. Rani D et al (2018) in a similar study assessed the nutritional status of adolescent girls in an urban slum of Varanasi.

They reported that 60.4% of Hindu girls were thin as compared to 57.1% of Muslim girls. Though unlike our study, the association was statistically not significant [11]. Among girls having educated mothers, 58.06% of girl children were stunted as compared to 57.14% of girls having illiterate mothers. Among girls having educated mothers, 41% of girls were thin as compared to 53.24% of illiterate mothers. Among girls having educated fathers, 41.20% were thin as compared to 56.92% girls having illiterate fathers.

Girls having mothers who are educated till high school (OR-3.260, p=0.202) and who were graduate (OR-1.55, p=0.381) have more chance of being thin as compared to girls having illiterate mothers. The Association between parental education and the nutritional status of their children was statistically significant. A similar study by Singh K S et al (2014) in Makhinagarkhalapar block which is the field practice area of Muzaffarnagar Medical College, Muzaffarnagar (UP) reported that illiterate mothers had 50% girls whose BMI was <18.5 and who were educated had 19% girls whose BMI was <18.5 whereas illiterate fathers had girls whose BMI was <18.5 and who were educated had 28.72% girls whose BMI was <18.5 [12].

In the present study, girls having fathers on daily wages had a high prevalence of thinness (55.97%) as compared to girls having fathers who had jobs (34.93%) and self business (43.80%). Similarly girls having mothers who were on daily wages had more prevalence of thinness (69.23%) as compared to girls having mothers who were housewives (41.04%). The Association between parental occupation and the nutritional status of their children was statistically significant. Girls having fathers who had a job had less chance of thinness (OR-0.623, P=0.316) as compared to girls having fathers who were on daily wages.

Girls having mothers who are housewives has significantly less chance (OR-0.554, p=0.230) of thinness as compared to girls having mothers who were on daily wages. Raikwar R and Sharma K.K.N. (2018) in Sagar, Madhya Pradesh reported that it is apparent that a high prevalence of severe malnutrition is found in girls whose fathers were unemployed (16.7%) as compared to other professions as daily wages and farmers. They revealed that a high prevalence of malnutrition is found in those adolescent girls whose mothers are labourer (5.0%), housewives (3%) and bidi worker (25%).

There is a positive significant correlation found between father's occupation, mother's occupation, and Body Mass Index ($p<0.05$) [13]. In the present study, the upper lower class has more prevalence (46.34%) of thinness in girls as compared to the lower middle class (37.27%) and upper-middle class (30.43%) whereas the Upper middle class (60.87%) has more prevalence of stunting as compared to the upper-lower class (57.14%) and lower middle class (56.54%). The Association between SES status and nutritional status of their children was statistically significant.

Nair A et al (2017) conducted a study to assess the nutritional status of adolescent girls during January 2015 to June 2015 in 10 villages included under the Primary Health Centre area of a district in Maharashtra reported that as per modified BG Prasad socioeconomic scale, SEC-I had 33.33% stunting, SEC-II had 40.91%, SEC-III had 42.22%, SEC-IV had 47.17% and SEC-V had 51.84% adolescent girls who were stunted. Also SEC-I had 33.33%, SEC-II had 22.73%, SEC-III had 26.67%, SEC-IV had 13.58% and SEC-V had 22.45% adolescent girls who were thin [14].

In the present study, adolescent girls from the nuclear family (45.4%) have more prevalence of thinness as compared to joint families (38.46%). Among girls who lived in houses with poor environmental hygiene, 58.7% of girls were thin. Among girls who lived in houses with fair environmental hygiene, 40.41% of girls were thin. Among girls who lived in houses with good environmental hygiene, 32.6% were thin. There was a statistically significant association between environmental hygiene and the nutritional status of adolescent girls.

A similar study by Chandrashekarappa SM et al (2016) in n the city of Mysore under JSS Mahavidyapeetha reported that 64% of adolescent girls belonging to a nuclear family were thin as compared to 36.5% of girls belonging to joint families and it was statistically not significant [15]. Rani D et al (2018) did Assessment of Nutritional Status of Teenage Adolescent Girls in Urban Slum of Varanasi and reported that 53.9% of adolescent girls were undernourished in a joint family as compared to 62% in the nuclear family [11].

In the present study, the mean weight (kg) of adolescent girls was 41.64±7.26, mean height (cm) was 147.20±3.75 and mean BMI (Kg/m2) was 19.25±3.44. The maximum prevalence of thinness (50.8%) was in 17 year age group followed by 47.5% in 15 years, 45% in 16 year age group and 43.3% in 18 years age group. A similar study by Chandrashekarappa SM et al (2016) in Mysuru reported that a maximum of 44.2% thinness was seen in 16 years age group and followed by 32.3% in 17 years and 32.7% in 18 years age group [15].

As per WHO criteria for Height for Age (H/A), which measure the level of stunting in girls, 50.63% were moderately stunted and 7.29 % of girls were severely stunted. As per WHO criteria for Body Mass Index (BMI), 7.29% of girls were severely thin, 36.04% were thin and 9.37% were overweight. Dambhare DG et al (2010) did a similar study by Wardha among school-going adolescents. They reported that 27.5% were stunted [16]. Sachan B et al (2012) in Lucknow did a similar study on school-going adolescent girls. The overall prevalence of thinness was found to be 17.0% and 11.4% among urban and rural girls respectively [17].

The present study showed that 28.12% had conjunctival pallor (anemia), 4.80% had dental carries, 1.46% had Vitamin B complex deficiency and 1.04% had Vitamin A deficiency (Bitot's spot). In a similar study DG Dambhare et al (2010) in Wardha among School going Adolescent girls reported that 38.89% had anaemia, 35.34% had dental caries, 6.9% adolescents had skin problems, and 2.59% had wax in the ear [18]. KM Susmitha et al (2012) in Nellore, A.P. study on Morbidity pattern among the adolescent girls residing in six social welfare hostels for scheduled caste students in Nellore. They reported the major prevalent morbid conditions among girls were pediculosis 83.21%, dysmenorrhea 43.6% dental caries 28.04% and skin disorders 26.4% [18].

Conclusion

The present study was conducted among high school girls from government schools in Raipur city of Chhattisgarh state to evaluate their nutritional status and morbidity pattern. More than half of them (57.92%) late adolescent school girls were stunted, 43.33% were having some form of thinness and 28.12% had clinical anemia. As a preventive strategy, there is a need to apply health and nutritional education program for inculcating healthy lifestyles. To ensure holistic development of adolescent GoI launched Rashtriya Kishor Swasthya Karyakram (RKSK) in 2014.

The programme expands the scope of adolescent health programming in India – from being limited to sexual and reproductive health, to nutrition, injuries and violence (including gender-based violence), non-communicable diseases, mental health and substance misuse. The Chhattisgarh government with the Women and Child development department started the Sabla Yojana programme targets adolescent girls between 11-18 years. Services provided include Nutritional supplement, iron and folic acid (IFA) supplementation, biannual deworming, medical examination and education on topics including nutrition, hygiene, the legal age of marriage, and the benefits of delaying childbearing. Nutrition education can have a significant effect in promoting healthy eating habits, and schools can contribute to reducing nutrition-related problems by integrating nutrition interventions into a comprehensive school health program.

What does this study add to existing knowledge?

Effective implementation of these programs will be a paradigm shift from the existing clinic-based services to promotion and prevention and reaching adolescents in their environment, such as in schools, families and communities. Skills-based nutrition education for the family and effective infection control and routine health assessment of school-going girls should be done.

Author's contribution

Dr. Sharja Phuljhele: concept and study design, **Dr. Shashikant Dewangan:** manuscript writing, **Dr. Anu:** manuscript writing and statistical analysis

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