Assessment of the Nutritional Status and Level of Health Awareness among the Adolescent Girls of Rural West Bengal, India

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Abstract
Adolescence is a critical transitional stage of development from childhood to adulthood. It is considered to be the second window of possibility of correcting the nutritional deficiency after infancy through which optimal health and nutrition can be achieved. This period is also crucial in the sense that adolescent girls attain about half of the adult body weight and height.
 Poor nutrition among adolescent girls endangers not only their health but also reinforces the inter-generational cycle of malnutrition. This cross-sectional study is conducted among the 100 rural adolescent girls aged between 10 to 19 years of Raina-I Block of Purba Bardhaman District, West Bengal. The present study attempts to measure the prevalence of stunting, wasting, thinness, obesity, and the level of health awareness. It is observed from the study that the major health problem among rural adolescent girls is thinness rather than obesity. The overall thinness among the subjects is 20% whereas overall obesity is 6%. The reason for higher thinness may be attributed to rural life which is characterized by poverty, illiteracy, unemployment, food scarcity, etc. Furthermore, the level of awareness regarding various health aspects is also not good which compounds the problem even more.
Keywords: Nutrition Status, Adolescent Girls, Stunting, Wasting, Body Mass Index (BMI).

I.   Introduction:

World Health Organization (WHO) has considered the segment of life between 10 and 19 as adolescence. There are around 1.2 billion adolescents in the world which is about 18% of the total of which more than 90% are in low and middle-income countries (WHO, 2011). In India, the cohort of adolescents constitutes approximately 253 million forming about 20% of its total population (Sethi et al., 2019).

Adolescence is the formative years in life when major physical, psychological, and behavioural changes take place (Singh et al., 2014; Bisai et al. 2011; Leroy et al., 2018). In terms of physical growth, adolescence is the second most influential period after early infancy (Malhotra & Passi, 2007; Saxena & Saxena, 2011) during which about half of the adult body weight, 20% of the adult length, and 20% of the adult skeleton mass are gained (WHO, 2005). Adolescent faces numerous nutritional challenges such as stunting, thinness, anemia, etc. which are responsible for poor health in adulthood (Bisai et al. 2011; Leroy et al., 2018). Interestingly, they are believed to be a low-risk group in terms of health vulnerability consequently do not receive due attention about their health and nutritional needs (Ahmad et al. 2018; Malhotra & Passi, 2007; Radhika et al., 2018). This nutritional challenge poses a serious challenge to their health status in adulthood. Malnutrition takes the form of stunting (low height for age), wasting (low weight for height), thinness, obesity, and lack of essential vitamins and minerals. Although malnutrition in adolescence is a global issue but is in the form of catastrophic in developing countries. Malnutrition starts much before birth carries on to adolescence and adulthood which transcends to generations (Hadus et al., 2021). Thus, addressing the vulnerability during adolescence is crucial to break this intergenerational chain of malnutrition.

In girls, the rapid growth spurt due to pubertal changes is observed during the early years of adolescence i.e., 10-13 years of age (Maiti et al., 2013). Hence, the need for nutrition during this phase is considerably enhanced (Parimalavalli & Sangeetha, 2011; Malhotra & Passi, 2007). Addressing the nutritional needs of adolescent girls is the foundation of the well-being of society (Bisai et al. 2011; Malhotra & Passi, 2007). However, in developing countries, only children and women get due attention while adolescent nutrition is often overlooked (Rees et al., 2012). Besides, they are the worst sufferers of the ravages of various forms due

to low social power, lesser autonomy in making choices, intra-home discrimination in food allocation, etc. which places them at nutritional risk (Saxena & Saxena, 2011; Rees et al., 2012). Improper nutrition in adolescent girls can potentially retard growth and sexual maturation (Lee et al., 2019). Moreover, malnourished adolescent girls are more likely to give birth to a child with health issues that reinforce a vicious cycle (Singh et al., 2014; Rees et al., 2012). Although these likely have roots in malnutrition during early infancy and childhood, addressing their nutritional needs during adolescence could prove to be an important step towards breaking the vicious cycle of intergenerational malnutrition, chronic diseases, and poverty (Patil et al., 2009; Malhotra & Passi, 2007; Venkaiah et al., 2002). Thus, proper food and good nutrition of adolescent girls are prerequisites to sustain a healthy body and to maintain sound mental health during this phase (Saxena & Saxena, 2011; Lee et al., 2019). This, in turn, assists in preventing nutrition-related chronic ailments (Parimalavalli & Sangeetha, 2011).

To combat the nutritional deficiency and health needs of adolescent girls Government of India implemented various programmes and schemes to intervene both nutritional and non-nutritional aspects. There is provision for take-home ration or hot cooked meal for school girls. Besides, provision of health supplements like iron and folic acid , health check-ups and referral services, counseling on family welfare and health care services, etc are implemented as non-nutritional measures. However, these provisions are grossly inadequate or ill-implemented. Hence, considering the importance of nutrition to adolescent girls, the present study is an attempt to comprehend the factors and issues concerning adolescent health.

Factors Controlling Nutritional Status of Rural Adolescent girls

Nutritional status is the condition of the body influenced by dietary intake (Patil et al., 2009; Rees et al., 2012). Adolescent nutrition is paid comparatively lesser attention than the child and maternal health because they are thought to be a healthy group (Parimalavalli & Sangeetha, 2011; Saxena & Saxena, 2011). The nutritional status is controlled by both dietary and non-dietary variables (Radhika et al., 2018; Malhotra & Passi, 2007). The major dietary controls are quantity, quality, and diversity of food while the non-dietary factor comprises poverty, education, gender discrimination, etc (Sethuraman & Duvvury, 2007; Parimalavalli & Sangeetha, 2011). Rural areas of developing countries like India in particular are characterized by low income, illiteracy, malnutrition, lack of quality education, poor medical facilities, etc (Singh et al., 2014; Radhika et al., 2018; Rees et al., 2012). Poverty is the most significant controlling factor of the incidence of malnutrition. Furthermore, the poor family has a higher disease burden which causes a high out-of-pocket expenditure thus setting a self-reinforcing vicious intergenerational cycle of poverty and malnutrition (Singh et al., 2014; Rose-Clarke et al., 2019). Adolescent girls are particular more exposed to this vicious cycle because as they are thought to be a burden and pushed to marriage at an early age which renders them prone to early pregnancy and many reproductive and sexual morbidities (Lee et al., 2019; Parimalavalli & Sangeetha, 2011). Adolescent girls in rural areas often have limited or no knowledge of the importance of health and hygiene which brings in a multitude of health issues (Rose-Clarke et al., 2019). Besides, rural adolescent girls are also vulnerable to varieties of health problems due to obscure societal norms and customs (Sethuraman & Duvvury, 2007). As soon as the girls hit puberty they have to bear the onslaught of lack of freedom, low social image, and stigma, etc., and are taught to abide by the social restrictions related to their sexuality (Rees et al., 2012). They are being involved in household chores all this is done to prepare her for marriage. Girls in contrast to boys face intra-house gender discrimination which compounds their problems (Radhika et al., 2018; Saxena & Saxena, 2011). Discrimination in food allocation with preference to sons, in terms of quality and quantity of food, make them prone to under-nutrition (Sethuraman & Duvvury, 2007).

Study Area:

This study was conducted in Raina-I Block, which is mainly a rural area, situated about 100 kilometers far away from Kolkata and it is the southernmost portion of Purba Bardhaman in West Bengal. It has an area of 266.07 square kilometers and a population density of 612 persons per square kilometer (Census, 2011). The total population in this block was 173,094, of which males accounted for 51.1% and females accounted for 48.9% as per Census of India, 2011. The Sex Ratio in the region is 958, and the literacy rate is 80.21%, which is much higher than the national and state averages. Medical services in the area are provided by governmental and private institutions. The governmental facilities of the first choice include community health centers, primary health care centers, and sub-center, etc. However, the nearby town of Bardhaman has secondary and tertiary health care facilities. In order to fill the gap created by the lack of government facilities, many private hospitals have appeared in the area.
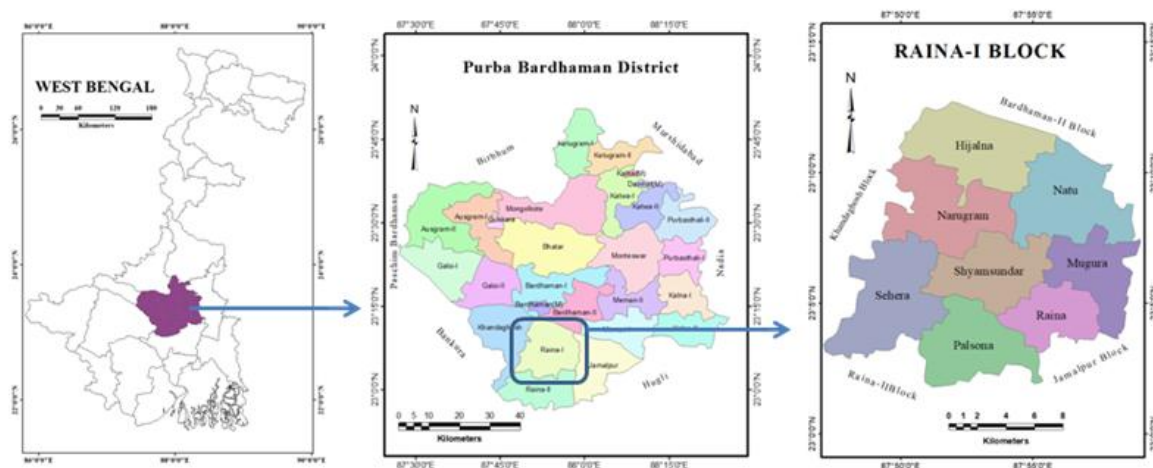
Fig 1: Location of the Study Area

II. Methodology:

A cross-sectional study was conducted among 100 adolescent girls aged 10-19 years in the two villages of Raina-I CD Block of Purba Bardhaman district, West Bengal. Samples from the villages are reached through a simple random sampling technique. The primary survey was conducted through a predesigned, semi-structured questionnaire to get anthropometric measurements, socio-demographic information, questions related to nutritional knowledge and health awareness. Height in centimeters was measured through a measuring tape. Similarly, the weights of the subjects were measured through a bathroom scale in kilogram. The scale was handled with due diligence and calibrated periodically. The BMI was thus, computed using the following formula: BMI = Weight (kg) / Height (m^2). Further, to supplement the analysis various statistical formulations such as mean, SD, etc. were performed by using SPSS20 software. The results from the studied sample data were compared with the reference value of ICMR and NCHS-CDC. To derive thinness and obesity, the standard cut-off values of NCHS-CDC have been followed as less than 5 percentile and more than 85 percentile respectively. Secondary data have been collected from the reports of WHO, ICMR, and census of India, 2011.

Socio-Demographic Profile

The study is based on 100 adolescent girls of age 10-19 years. The proportion of girls in the early adolescent age (10-14 years) was 41% while in the late adolescence was 59%. The respondents had an average age of 14.8 years. All the girls had attained menarche and 2% of them were married. All the respondents were school-going. The majority of respondents were Hindu (89%) and the rest were Muslim. Caste wise the Scheduled Castes were 38%, Other Backward Classes were 43%, Scheduled Tribes were 3% and the rest were General Castes. 61% of the respondents reported that their family income was less than Rs. 15000 per month. Besides, cultivation (46%) and agricultural labour (32%) are the two dominant occupations that respondents' family depends upon.

III. Results and Discussions

A. Nutritional Status

Adolescence is a transition period of development from childhood to adulthood characterized by accelerated growth. Growth monitoring may detect a nutritional deficiency or other health problems which would otherwise go unnoticed. Weight and Height are two important and widely used tools using which a state of nutrition i.e. stunting, wasting, thinness, obesity, etc. are measured. A number of factors that contribute to the abnormal weights or heights prominent among them are genetics, family history, metabolism, etc. Here, the anthropometric measurements of the studied adolescent girls are obtained and the results are compared using NCHS and ICMR standards to assess the level of nutrition prevalent among them.

Height for age: The figure 2 shows the mean height of the adolescent girls compared with ICMR and NCHS standards. The mean height ranges from 135.33 ± 4.08 cm for 10 years age to 154.33 ± 4.97 cm for 18 years age. A rapid growth in height is observed in the age of 11, 12, and 13 when height registers a rapid growth from 135.33±4.08 cm for 10 years to 146.5±5.08 cm for 13 years age. Thereafter, height increases but at a slower pace. It, therefore, denotes the maximum growth in girls that happens during the early adolescence period i.e. 10-14 age growth. Furthermore, a *t*-test was performed to compare the studied mean height with NCHS and

ICMR standards. The *t*-test values for height show that there is a significant difference in the studied mean and NCHS standard
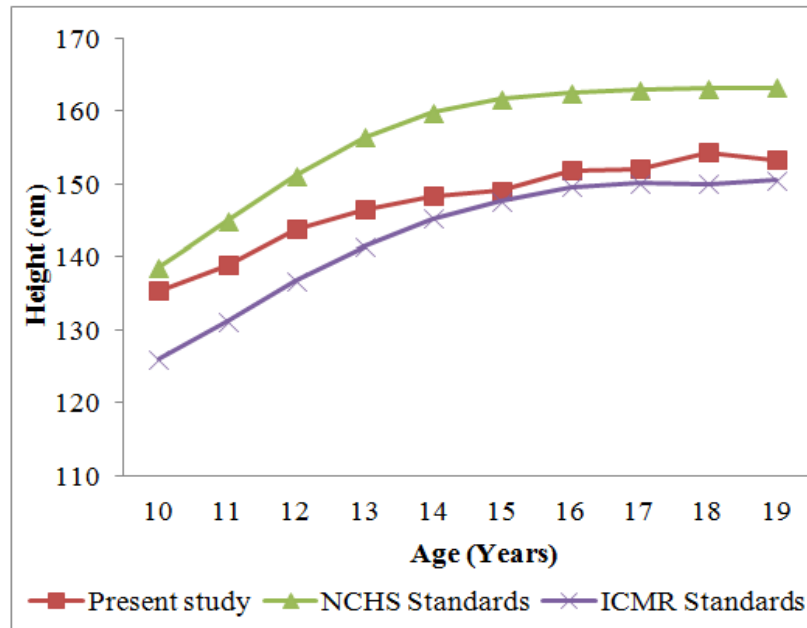

Fig 2: Height for Age
(Source: Primary Survey, 2020-2021)

Table 1: Height for Age compared with NCHS and ICMR standards

Height					
Age(Years)	**Present study**	**NCHS Standards**	*P* value	**ICMR Standards**	*P* value
10	135.33±4.08	138.6	0.107	126±7.01	0.003
11	138.88±3.64	145	0.002	131.2±7.25	0.001
12	143.86±4.6	151.2	0.006	136.7±8.16	0.006
13	146.5±5.08	156.4	0.000	141.5±7.26	0.013
14	148.36±4.41	159.8	0.000	145.3±7.22	0.044
15	149.13±4.03	161.7	0.000	147.7±6.87	0.178
16	151.92±4.87	162.5	0.000	149.6±5.99	0.128
17	152.07±6.11	162.9	0.000	150.1±5.96	0.249
18	154.33±4.97	163.1	0.001	150.0±5.92	0.031
19	153.29±6.21	163.2	0.006	150.5±5.97	0.280

(Source: Primary Survey, 2020-2021)

for the 12, 13, 14, 15, 16, 17, 18, and 19 years age whereas for the 10 year age the observed mean 135.33 ± 4.08 cm is not significant (*p*= 0.107,) against NCHS standard. Contrarily, it is evident from the table 1 that for the early adolescent age (10-14 years) the observed values surpass the ICMR standard (*p*<0.05). However, for older adolescent girls the i.e. age 15 (*p*= 0.178), 16 (*p*= 0.128), 17 (*p*= 0.249) and 19 (*p*= 0.280) there is no significant difference between observed and the ICMR standards. It may thus be said that the studied mean heights for the corresponding age are more than the ICMR standard but less than the NCHS standard. The general propensity of

the studied value is towards the ICMR standard except for ages 10, 11, and 12 where values show an inclination to NCHS standard.

Weight for Age:

Requirement of the age and sex-specific healthy weight is crucial for sound health. It helps in preventing or controlling many health problems. Both being underweight or overweight have a bearing on mortality and morbidity. A comparison of the studied age-wise mean weight with NCHS and ICMR has been performed. The age-wise mean weight of the studied subjects varies from 26.83 ± 3.71 for 10 years to 49.29 ± 5.27 for 19 years. The weights of the adolescent girls across the age groups are higher ICMR standards. The mean weights for all ages compared to NCHS standards are significantly lower. There is a gradual increase in the mean age of the studied subjects except for 17 years age for which the mean slightly declines to 45.89 ± 5.63. Similar to height, weight also registers a rapid increase in the early adolescent phase (10-14) during which it increases from 26.83 ± 3.71 for 10 years age to 43.69 ± 5.1 for 15 years age.
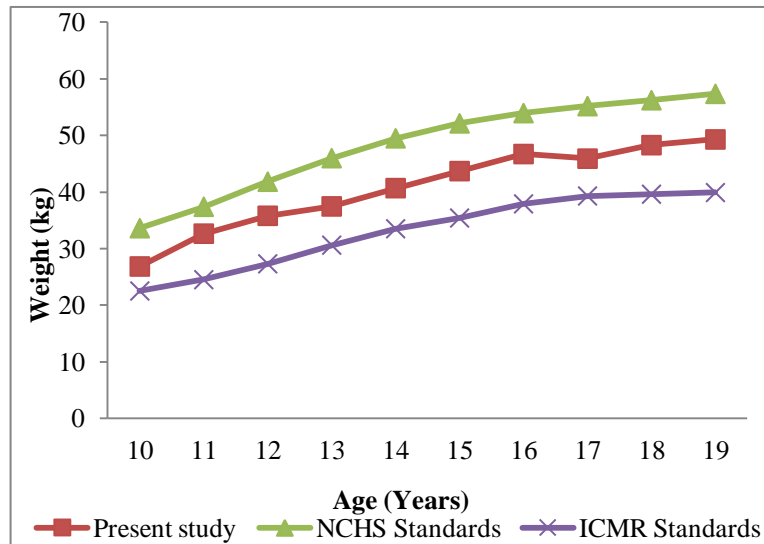

Fig 3: Weight for Age
(Source: Primary Survey, 2020-2021)

Table 2: Weight for Age compared with NCHS and ICMR standards

	Weight				
Age (Years)	Present Study	NCHS Standards	*p* value	ICMR Standards	*p* value
10	26.83±3.71	33.6	0.003	22.5±4.28	0.076
11	32.63±3.69	37.39	0.008	24.5±4.62	0.000
12	35.79±4.74	41.82	0.015	27.3±5.70	0.003
13	37.45±5.15	45.98	0.001	30.6±6.58	0.002
14	40.68±4.94	49.49	0.000	33.5±5.69	0.001
15	43.69±5.1	52.13	0.000	35.4±6.78	0.000
16	46.71±6.02	53.94	0.002	37.9±5.81	0.000
17	45.89±5.63	55.18	0.000	39.3±5.65	0.001
18	48.28±5.45	56.22	0.002	39.6±7.57	0.001
19	49.29±5.27	57.35	0.007	39.9±6.38	0.003

(Source: Primary Survey, 2020-2021)

The figure shows that the mean weight values are quite higher than the ICMR standard but lower than the NCHS standards. The age-wise comparison of studied mean weight with NCHS standards shows that the studied mean weight is significantly lower than ($p < 0.05$) than standard across the ages. When compared with the ICMR standard the mean weights are found to be significantly higher ($p < 0.05$) except for 10 years ($p =$

0.076). The results thus obtained are concomitant with the studies such as Sachan et al. 2012. The weight thus seems to increase with age which reflects the adolescent girls having a better nutritional condition. The better nutritional status is probably due to the reach of education, socio-economic condition, etc. Furthermore, governmental interventions such as Mid-Day Meal targeted through school also have significantly improved the availability of food.

BMI and Prevalence of Thinness and Obesity:

Body Mass Index or BMI is a convenient and effective tool to measure the nutritional status of a person. It is the most widely used measure computed by dividing the body mass through the square of the body height and is usually expressed as kg/m^2. Despite the fact that it takes into account only height and weight and ignores skinfold measures, ethnic differences, etc. it helps in screening the prevalence of thinness and obesity quite easily (Bhurosy & Jeewon, 2013). Thinness denotes a state of low BMI for age which is linked to growth faltering and enhanced risk of mortality and morbidity. Thinness in girls may result in weaker immunity, anaemia, irregular periods, slow or impaired growth, etc. Obesity is the condition of having an excess of body fat than the required level which may result in impaired health. This is commonly observed in a person leading a sedentary life and has access to plenty of food and (Maiti et al., 2013). It is found to be associated with health risks such as cardiovascular disease, hypertension, and diabetes mellitus, cancers, etc.

The BMI value calculated for the present study shows a gradual increase with age except for 19 years of age. The mean BMI values range between 14.69±2.25 for 10 years to 21.10±3.09 for 19 years. Thinness which is computed as BMI <5th percentile of NCHS-CDC reference shows a varying picture across the ages. The highest and lowest thinness for age is 33.33% (10 years age) and 10% (13 years age) respectively. The ages showing higher thinness are 11 (25%), 16 (25%), 17 (21.43%) and 18 (22.22%). The overall thinness among the subjects is 20% which is somewhat better compared to the findings of Bisai et al. 2011 (24.2%), Bose &

Table 3: Measuring BMI and Prevalence of Thinness and Obesity

BMI Values			Thinness			Obesity		
			5th Percentile			85th Percentile		
Age	N	Studied BMI (Mean ± SD)	NCHS standard	N	%	NCHS Standard	N	%
10	6	14.69±2.25	14.23	2	33.33	20.19	0	0.00
11	8	16.97±2.27	14.6	2	25.00	21.18	0	0.00
12	7	17.26±1.74	14.98	1	14.29	22.17	0	0.00
13	10	17.51±2.77	15.36	1	10.00	23.08	1	10.00
14	11	18.52±2.42	15.67	2	18.18	23.88	0	0.00
15	16	19.72±2.78	16.01	3	18.75	24.29	1	6.25
16	12	20.31±3.00	16.37	3	25.00	24.74	1	8.33
17	14	19.92±2.83	16.59	3	21.43	25.23	1	7.14
18	9	20.35±2.92	16.71	2	22.22	25.56	1	11.11
19	7	21.10±3.09	16.87	1	14.29	25.85	1	14.29

(Source: Primary Survey, 2020-2021)

Bisai (25.2%) and Venkaiah et al., 2002 (39.5%), Ahmad et al. 2018 (47%). However, Sachan et al. 2012 in their study of adolescent girls of Lucknow district had reported an overall thinness level of 11.4% for rural girls. The prevalence of obesity among the studied subjects is far lesser compared to thinness. There is an absence of obesity in the age group of 10, 11, 12, and 14. The maximum obesity is observed in 19 years of age (14.29). Obesity among the older adolescents age (15-19 years) is relatively higher than the younger adolescents (10-14 years)The overall obesity registered in the study is 6% which is almost comparable with the findings of Sachan et al. 2012 which reported an obesity level of 3.9%. However, the prevalence of overweight in the present study

is comparatively lesser than the findings from different studies across India. Danasekaran & Ranganathan, 2019 in their study in Tamil Nadu found out 9.24% were overweight among adolescent girls. Similar findings were observed in other studies such as Goyal, 2018 (4.7%), Maiti et al. 2013 (10.62%), Ahmad et al. 2018 (5.9%). The low obesity in rural adolescent girls is due to the fact that rural life is comparatively more mobile than urban ones.
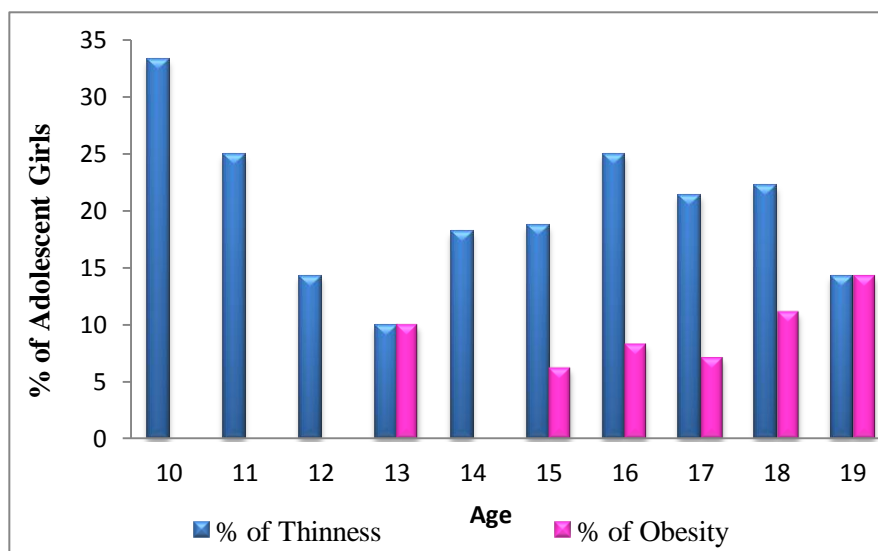

Fig 4: Prevalence of Thinness and Obesity
(Source: Primary Survey, 2020-2021)

It is thus, observed from the study that the major health problem among rural adolescent girls is thinness rather than obesity. The reason for higher thinness may be attributed to rural life which is characterized by poverty, illiteracy, unemployment, food scarcity, etc. If underweight (thinness) is not addressed during this phase it may cause a serious blow to the health of adolescent girls in the form of higher susceptibility to diseases, anemia, menstrual problems, etc. It is thus imperative that nutritional improvements of underweight girls through proper food supply be ensured. Contrary to thinness, the increasing incidence of overweight in the older adolescent age (15-19 years) is beckoning the emerging health burden in the form of non-communicable diseases. The gradual adoption of the urbanized life in the rural areas of developing countries is leading to an upcoming threat of morbidity and mortality due to hypertension, diabetes, cancer, etc.

B. Level of Health Awareness

Health Awareness refers to the knowledge of individuals regarding different aspects of health. It plays an important role in ensuring greater access to health care services. Rural adolescent girls face barriers in the form of limited education, lack of social and health knowledge, and restricted autonomy in decision-related to their health (Sharma et al., 2009). These factors affected a lot in the form of poor nutrition status , early childbearing cases, which reinforce various complications related to reproductive health (Rees et al., 2012). Most girls as well as their parents are often not aware of the enhanced nutritional needs during this critical juncture of life which results in various health complications such as malnutrition, stunting, wasting, etc. (Sharma et al., 2009). It is evident from the table 4 that the health awareness of the adolescents in this study is not satisfactory. Although, majority of them are aware of the common health problems such as cold and cough (73%), fever (68%), etc. but they lack a sound understanding of the causative factors behind those ailments. Their understanding of water-borne diseases is also not satisfactory i.e., diarrhea (33%), dysentery (28%), etc. Furthermore, adolescents' knowledge about the source of nutrients is somewhat better for carbohydrates (53%) and fats (62%) but for vitamins (39%) majority of them lack proper knowledge. Besides, their knowledge of diseases due to nutritional deficiency such as anemia (37%), Rickets (28%), scurvy (22%), etc. is also poor. Menstrual health hygiene is very crucial for combating various reproductive complications. It was astonishing that only 36% of them knew the appropriate cause of menstruation. Similarly, their knowledge of common menstrual problems (48%), UTI, and RTI (25%) is also not satisfactory. However, the majority of the girls are aware of the use of sanitary napkins (71%).

Table 4: Health Awareness of the adolescent girls

Health Awareness			
General Health Problems	**%**	**Diseases due to Nutrition Deficiency**	**%**
Reason of Cold and Cough	73	Anaemia	37
Reason of Fever	68	Rickets	28
Water-Borne Diseases	**%**	Scurvy	22
Diarrhoea	48	Night Blindness	31
Typhoid	33	**Menstrual Health and Hygiene**	**%**
Loss of Appetite	75	Cause of menstruation	36
Cholera	46	Use of sanitary napkin	71
Dysentery	28	Common menstrual problems	48
Nutrients Knowledge	**%**	Urinary Tract Infection and Reproductive Tract Infection	25
Sources of Carbohydrate	53	Sexually Transmitted Diseases	42
Sources of Protein	62	**Other Health Problems**	**%**
Sources of Vitamins	39	Hypertension	40
Sources Fat	50	Diabetes	59

(Source: Primary Survey, 2020-2021)

IV. Conclusion:

Nutrition of the adolescent girls is crucial for breaking the chain of the vicious cycle of intergenerational malnutrition. Although India has made rapid strides in ensuring the food security of its masses as evident from this study a lot needs to be done on multiple fronts in a more oriented and holistic way. It is obvious from the study that the major health problem among rural adolescent girls is thinness rather than obesity. The reason for higher thinness may be attributed to rural life which is characterized by poverty, illiteracy, unemployment, food scarcity, etc. However, an increasing incidence of obesity is observed in the late adolescent phase (15-19 years) which may be an indication of the gradual encroachment of the urban lifestyle into the rural areas. Further, the level of health awareness among them is not satisfactory. Although the majority of them are aware of the health problems and but they lack a sound understanding of the necessity of proper nutrition. It is evident that along with ensuring the nutritional needs, there is a dire necessity of health awareness through various means.

Conflict of Interest: The authors declare that there is no conflict of interests of any sort.

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