

# STATUS, IMPORTANCE AND NUTRITIONAL REQUIREMENTS OF ADOLESCENT GIRLS IN INDIA

Archana Kumari\* and Ranjana Srivastava\*\*

*Nutrition plays a very important role in the physical, mental and socio-emotional development of adolescents. Adolescence is an intense anabolic period when requirements for all nutrients increase. Nutritional deficiencies have far reaching consequences, especially in adolescent girls. If their nutritional needs are not met, they are likely to give birth to under nourished children, thus transmitting under nutrition to future generations (Brabin 1992)<sup>3</sup>. One way to break the inter-generational vicious cycle of malnutrition is to improve the nutrition of adolescent girls prior to conception. If adolescents are well nourished, today they can make optimal use of their skills, talents and energies and be healthy and responsible citizens and parents of healthy babies tomorrow.*

**Keywords:** *Dictary intakes, BMI, NFHS*

## INTRODUCTION

Adolescence is a transitional stage of physiological and psychological development and is generally the period from puberty to legal adulthood. It is a period of transition between childhood and adulthood and occupies a crucial position in the life of human beings. WHO (2000)<sup>1</sup> defines adolescence as the segment of life between the age group of 10-19 years. The nutritional status of adolescent girls, the future mothers, contributes significantly to the nutritional status of the community. Worldwide more than 1.2 billion (18% of total world population) are adolescents. This indicates that roughly one in every six persons is an adolescent. More than half of all adolescents live in Asia. In absolute numbers, India is home to more adolescents – around 243 million than any other country. Adolescent girls form an important vulnerable sector of population that constitutes about one-tenth of Indian population. About 30% of India's population belongs to the adolescent age group of 10 – 19 years. . Adolescent girls form an important vulnerable sector of population that constitutes about one-tenth of Indian population. It is rather disheartening that nearly 50% of adolescent girls aged between 15-19 years are under-weight in India (UNICEF 2012)<sup>2</sup>. India, being a country in developmental transition, faces the dual burden of pre-transition diseases like under-nutrition and infectious diseases as well as post-transition, lifestyle-related degenerative diseases such as obesity, diabetes, hypertension, cardiovascular diseases and cancers. According to recent National Family Health Survey and UNICEF Reports, 46% of preschool children and 30% of adults in India suffer from moderate and severe grades of protein-calorie malnutrition as judged by anthropometric indicators. Currently, India is in nutrition transition with 10% rural adults and 20% urban adults suffering from over-nutrition leading to an emerging double burden of malnutrition.

## Nutrition Need of Adolescence

Nutrition plays a very important role in the physical, mental and socio-emotional development of adolescents. Adolescence is an intense anabolic period when requirements for all nutrients increase. Nutritional deficiencies have far reaching consequences, especially in adolescent girls.

---

\*Research Scholar at University Department of Economics, Ranchi University, Ranchi

\*\*Associate Professor; University Department of Economics, Ranchi University, Ranchi

If their nutritional needs are not met, they are likely to give birth to under nourished children, thus transmitting under nutrition to future generations (Brabin 1992)<sup>3</sup>. One way to break the inter-generational vicious cycle of malnutrition is to improve the nutrition of adolescent girls prior to conception. If adolescents are well nourished, today they can make optimal use of their skills, talents and energies and be healthy and responsible citizens and parents of healthy babies tomorrow.

### **Adolescence is considered as a nutritionally critical period of life for several reasons :**

- The dramatic increase in physical growth and development puts greater pressure on the needs for nutrients. During this period, adolescent will experience a weight gain equivalent to 65% of their weight at beginning of the period or 40% of their final weight, and a height gain equivalent to 15% of their adult height (Brasel, 1982)<sup>4</sup>.
- There may be socio-cultural factors or change of life-style and food habits of adolescents that can affect both nutrient intake and needs (Spear, 2002)<sup>5</sup>. Many of the changes appears to be universal, their timing and the speed of change vary among and even within individual. External factor like inadequate nutrition, an obsessive environment and the characteristics of individuals influences these changes.
- Growing adolescents have increased nutrients requirements during pregnancy and illness (Scholl et al, 1994; Storg et al, 1999)<sup>6</sup>
- Adolescence can be the second opportunity to catch up growth if environmental conditions, especially in terms of nutrient intake are favorable (Gopalan, 1989)<sup>7</sup>.
- Finally, The hormones mediating the pubertal growth spurt are sex steroids and growth hormone, which are modulated to a great extent by nutritional factors. These changes create special nutrition needs. The requirement of some of the nutrients is as high as, or higher in adolescents than in any other age groups (WHO, 2000)<sup>8</sup>, and therefore, many micronutrients including Vitamin A, Thiamine, Riboflavin, Niacin, Folic acid, Vitamin B12, Vitamin C and iodine, reach levels required by adults.

### **Nutritional Requirements of Adolescent Girls**

**Energy and Protein Requirements:** The requirement of energy as well as proteins increases considerably during this period of energy intake in limited, dietary protein may be used to meet energy needs and be used to meet energy needs and be unavailable for synthesis of new tissues or for tissue repair. This may result in reduction of growth rate and muscle mass despite an apparent adequate protein intake (Spear, 2002)<sup>9</sup>.

**Mineral and Micronutrient Requirements:** Micronutrients deficiencies results from inadequate dietary intake, poor absorption of nutrients, excessive losses, increased requirement or a combination of these factors. Mineral plays a crucial role in adolescent nutrition. The increment in skeletal mass, body size and body density, associated with pubescence, highlights the role of minerals in the growth process (Daniel, 1997)<sup>10</sup>. The following minerals are required :-

**Iron requirements :** There is a convincing evidence that iron deficiency and anemia causes impaired growth developmental delay, decrease physical activity, behavioral abnormalities, impairs cognitive function and school performance in adolescent. Iron requirements peak during adolescence

due to rapid growth with sharp increase in lean body mass, blood volume and red cell mass which increases iron needs for myoglobin in muscles and hemoglobin in blood (Beard, 2000)<sup>11</sup>. The mean requirement for iron reaches a maximum of approximately 15mg/day at peak growth but settles to approximately 13 to 15 mg/day because of the need to replace menstrual iron losses.

**Calcium requirements:** Because of the accelerated muscular] skeletal and endocrine development, Calcium needs are greater during puberty and adolescence than in any other population age group except pregnant women (Spear, 2002)<sup>12</sup>. Consumption of calcium rich products with every meal goes a long way towards ensuring that requirements are met for calcium and many other nutrients e.g. phosphorus, magnesium and vitamin D needs for bone health.

**Zinc Requirements:** Zinc is known to be essential for growth and sexual maturation during puberty. Limited intake of Zinc containing foods may affect physical growth as well as development of secondary sex characteristics (Thompson, 1986)<sup>13</sup>.

**Iodine Requirements:** Iodine is important during adolescence for two reasons . These are the high growth velocity of adolescent and the increased ironine requirements during pregnancy. Severe iodine deficiency in children results in learning disability and lowered achievement (Tiwari et al, 1996). Iodine associated with increased incidence of miscarriages, still births, birth defects and mental retardation, and if severe, may result in cretinism in the offspring (Levander and Whanger, 1996)<sup>14</sup>. Among adolescent girls Iodine deficiency may cause mental impairments, impede, physical development and harm school performance,

**Other Minerals :** Although the role of other minerals in the nutrition of adolescents have not been studied extensively, the importance of magnesium, phosphorus, copper, chromium, cobalt and fluoride is well recognized. The possibility of interactions among these nutrients cannot be overlooked (Spear, 2002)<sup>15</sup>.

**Vitamins :** The requirements for vitamins are also increased during adolescence. Because of higher energy demands, more thiamine, riboflavin and niacin are necessary for the release of energy from carbohydrates. The increased rate of growth and sexual maturation increases the demand for folic acid and vitamin B-12 (Spear 2002, Hoddad and Johnston, 1999)<sup>16</sup>. The rapid rate of skeletal growth demands more Vitamin D. Vitamins A,C, and E are needed in increased amount for new cell growths. Adolescents vitamin needs are also associated with the degree of maturity rather than chronological age because of demands of growth. Severe Vitamin A deficiency (VAD) causes blindness, less severe VAD impairs the immune system, making people more susceptible to infection and putting them at increase risk of death. Concurrent infection with parasites and illness such as diarrhea as well as having several pregnancy to close together the exacerbate VAD. Pregnant women are especially vulnerable to VAD. So, all these nutrients are very important for adolescent girls. Lack of these places them at high risk of iron deficiency and anemia, mental health problems, early pregnancy and child birth, human immunodeficiency virus/sexually transmitted infection (HIV/STI) and other infectious diseases, violence, unintentional injuries, malnutrition and substance abuse.

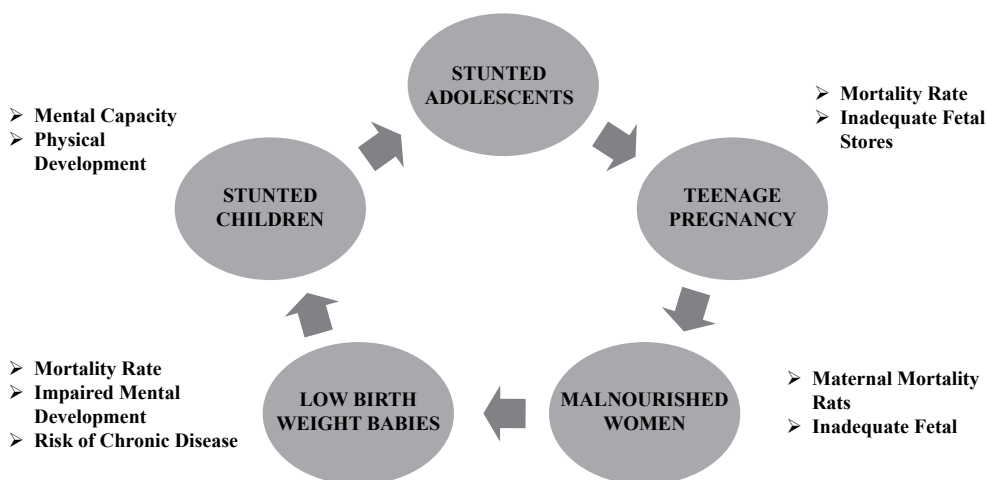
**Inappropriate dietary intakes during adolescence can have several consequences. For example, it can:**

- Potentially retarded physical growth, reduce intellectual capacity and delay sexual maturation, as rapid physical growth creates an increased demand for energy and nutrients.
- Affect young people's risk for a number of immediate health problems such as iron deficiency,

under-nutrition, stunting, bone health, eating disorders and obesity. It may also affect concentration, learning and school performance in school going adolescents.

- Also have long term implications. For example – low calcium intake during adolescence is associated with low bone density and an increased risk for osteoporosis later in life; being overweight as an adolescent is associated with higher risk for diabetes as an adult; and high fat intake during adolescence and into adulthood is associated with an increased risk of heart diseases.

### Vicious Circle of Malnutrition



## LITERATURE REVIEW

There is no dearth of theoretical literature and empirical work on health and nutrition in general and context of adolescents in particular. The proposed study will include a review of important available literature on the fields related to this study like period of adolescence, importance of health and nutrition in adolescents, especially adolescent girls, measures of health and nutrition, measures to improve health and nutrition, status of health and nutrition in adolescent girls in world, India, Jharkhand and Ranchi etc.

Commenting on the period of adolescence Gregory (2000) observed that the nutritional requirements of young people are influenced primarily by the spurt of growth that occurs at puberty. The peak of growth is generally between 11 and 15 years for girls and 13 and 16 years for boys. The nutrient needs of individual teenagers differ greatly, and food intake can vary enormously from day to day, so that those with deficient or excessive intakes on one day may well compensate on the next. In this period of life, several nutrients are at greater deficiency risk including iron and calcium. However, WHO considers the period of 10 to 19 years as adolescence, which may be further classified into pre puberty and post puberty period, as these make significant changes in mind & body.

On the extent of under-nutrition and poor health Kuzur (1996)<sup>18</sup> holds that Stunting in adolescence is 32% in India, 36% in Bangladesh, and 47 in Nepal, and low body mass index (BMI) is 53% in India, 50 % in Bangladesh and 36% in Nepal.

The National Family Health, Survey 3 (2005-06) data reveal that the nutritional status of girls and women in India remains unacceptably low with only negligible improvement in the past decade. Anaemia continues to pose a serious problem for women in India, with the number of women suffering from anaemia having actually increased from 52 percent (NFHS-2) to 56 per cent (NFHS-3). More than a third (36%) of women have a low body mass index (BMI), indicating a high prevalence of nutritional deficiency and protein calorie deficit. Among women who are underweight, 44% are moderately or severely underweight.

According to UNICEF, (2012) nearly 50% of adolescent girls aged 15-19 in India are underweight, with a body mass index of less than 18.5. Such under-nutrition renders adolescents vulnerable to disease and early death and has lifelong health consequences. In adolescent mothers, under-nutrition is related to slow fetal growth and low birth weight.

In view of importance of health and nutrition, Golden (1994) goes to the extent of saying that Adolescence offers the less opportuned to intervene and recover the growth faltered in childhood and also support growth spurt and skeletal development to break the vicious cycle of inter-generational under-nutrition. But to gain from this opportunity, they must be provided ample nutrition.

Sahgal & Robinson (2017) a leading organisation on diet & nutrition observed that adolescent is a growth spurt time. Kids gain about 20% of adult height and 50% of adult weight during adolescence. Because growth and change is so rapid during this period, the requirements for all nutrients increase. This is especially true of calcium and iron. Adolescents and teens are at a high risk of developing anorexia, bulimia, or binge eating disorder.

WHO, (1995) measures that there are three distinct status of adolescent girls with regard to this health and nutritional status – Stunting, under nutrition and Overweight. The diagnostic criterion for defining stunting in adolescents is a height-for-age less than the third percentile of the NCHS/WHO reference data or less than -2 Z-score. Under nutrition or thinness in adolescence is indicated by a body mass index less than the fifth percentile of the NCHS/WHO reference data. A BMI greater than the 85th percentile, in adolescence is indicative of a risk of overweight.

Realising the importance of good health and nutrition of adolescent girls many government and non-government. Organisations at national and international levels are taking positive steps. UNICEF is assisting the government to further expand and enhance the quality of Integrated Child Development Scheme(ICDS) in various ways: by improving the training of Anganwadi workers; by developing innovative communication approaches with mothers; helping to improve monitoring and reporting systems; providing essential supplies; by developing community based early childcare interventions etc. UNICEF supports iron supplementation for adolescent girls and Vitamin A supplementation for children. It encourages the universal use of adequately iodised salt by educating the general population and collaborating with the salt industry.

## OBJECTIVES OF STUDY

In view of the immense literature and data on health and nutrition, with special focus on adolescent girls and at the same time lack of analytical study on the status of the country, the present study is important. With the help of UNICEF supported study by the Union Ministry of Women and Child Development (MWCD) on Rapid Survey on Children 2013-14 on a sample of 45561

adolescent girls across various social groups (SC, ST, OBC and others), marital status, residence (urban and rural) and wealth status measured by wealth index derived from income and expenditure of households (table 1) the present study aims to following analysis :

- To study the impact of marital status on health and nutritional status of adolescent girls in India.
- To study the impact of residence on health and nutritional status of adolescent girls in India.
- To study the inter-social group variation in the status of health and nutrition of adolescent girls in India.
- To study the impact of wealth index status on health and nutritional status of adolescent girls in India.

## METHODOLOGY

To fulfill the above objectives of present study secondary data from Rapid Survey on Children (RSOC) 2013-14 National Report, UNICEF (Chapter 6). For estimating nutritional status measurement of height and weight of adolescent girls age 10 to 18 were collected across all states. BMI was calculated to show the nutritional status using descriptive statistics. The sampled adolescent girls were grouped into Underweight (BMI < 18.5), Normal (BMI 18.5 to 24.9) and Overweight (BMI > 25). The nutritional status has been shown as per demographic characteristics of marital status, social groups, residence and wealth index. Test whether the difference between percentage of normal adolescents in any two groups z-test has been used. The percent values are converted to proportion values giving  $p_1$  &  $p_2$ . The null hypothesis in each case  $H_0 : p_1 = p_2 = p$  vs  $H_1 : p_1 \neq p_2$  where  $p$  can be found in the given formula

$$P = \frac{n_1 p_1 + n_2 p_2}{n_1 + n_2}, \text{ where } p \text{ is the mean of the two proportions.}$$

Then for z-test we have to find S.E.( $p_1 + p_2$ ) using formula

$$SE(p_1 - p_2) = \sqrt{pq(1/n_1 + 1/n_2)}$$

$$\text{Then } z = \frac{p_1 - p_2}{SE(p_1 - p_2)}$$

Two tail test (.025 on the left and .025 on the right) will be used.

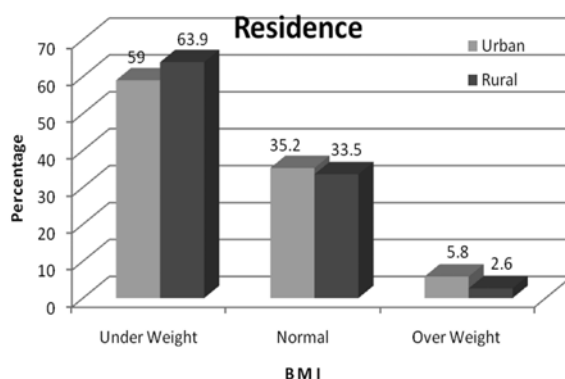
If  $|Z|$  remains between the range  $\pm 1.96$  the null hypothesis is accepted at 5% level of hypothesis.

## ESTIMATION OF NUTRITIONAL STATUS

### Impact of Residence on Health and Nutritional Status

It is generally believed that in spite of government initiatives and programs, the health and nutritional status is comparatively poor in rural areas. Figure – 1 shows that while 35.2% of adolescent girls have normal BMI in urban areas, the corresponding figure is 33.5 for rural areas. Percentage of underweight adolescent girls is also very high in rural areas (63.9%). It may be tested whether the difference in health and nutritional status of adolescent girls as per residence status is

significant or not. From the percent of girls with normal BMI in urban and rural areas the sample size (Table – 1), the proportion may be computed as  $p_1 = 0.352$  &  $p_2 = 0.335$  .... The combined proportion is  $p = 0.339814$



$$H_0: p_1 = p_2 = p$$

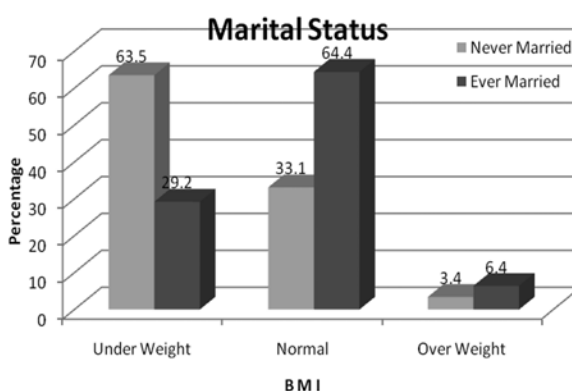
$$\text{The SE } (p_1 - p_2) = 0.004$$

$$\text{The corresponding value of test statistics } Z = (p_1 - p_2) / \text{SE } (p_1 - p_2) = 3.45 > 1.96$$

Hence,  $H_0$  is rejected at 0.5% of level of significant and we safely conclude there is significant difference between the percent of adolescent girls with normal BMI in urban and rural areas of India.

### Role of marital status on health and nutritional status

Marital status has an important role on health and nutrition and usually it is seen that within households there is a differential treatment by gender in allocation of food and consequently adolescent girls have poor nutritional status. It is interesting to make a comparison of nutritional status of never married and ever married adolescent girls in Jharkhand. There is a 31.3% of difference in percentage of adolescent girls with normal BMI and a -24.5% difference in percent of adolescent girls who are underweight. It can be tested whether this difference is significant. From the percent of girls with normal BMI in never married and ever married adolescent girls in the sample size (Table – 1), the proportion may be computed as  $p_1 = 0.333$  &  $p_2 = 0.64$ . The combined proportion is  $p = 0.35$



$$H_0: p_1 = p_2 = p$$

$$\text{The SE } (p_1 - p_2) = 1.22$$

$$\text{The corresponding value of test statistics } Z = (p_1 - p_2) / \text{SE } (p_1 - p_2) = -0.27 > -1.96$$

Hence,  $H_0$  is rejected at 0.5% of level of significant and we safely conclude there is significant

difference between the percent of adolescent girls with normal BMI in ever married and never married adolescent girls i.e. there is great difference between the normal BMI of never married and ever married adolescent girls.

**Table No. 1 : Nutritional Status of Adolescent Girls By Marital Status, Residence Social Groups And Wealth Index**

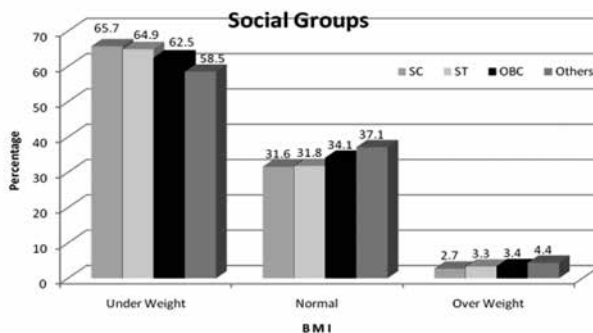
Percent distribution of adolescent girls aged 10-18 by BMI level according to background characteristics				
Characteristics	Underweight	Normal	Overweight/obese	Number of Adolescent Girls
<b>Marital Status</b>				
Never married	63.6	33.1	3.4	44,030
Ever Married	29.1	64.4	6.6	1,521
<b>Residence</b>				
Urban	59.0	35.2	5.8	12,903
Rural	63.9	33.5	2.6	32,658
<b>Social Group</b>				
Scheduled Caste	65.7	31.6	3.3	9,360
Scheduled Tribe	64.9	31.8	3.4	4,942
OBC	62.6	34.1	4.4	19,241
Others	58.5	37.1	3.1	11,728
<b>Wealth Index</b>				
Lowest	66.4	31.3	2.3	9,349
Second	64.3	33.1	2.7	10,237
Middle	63.9	33.2	2.9	9,372
Fourth	59.8	34.7	5.5	8,920
Highest	56.9	38.7	4.4	7,682

Source : Rapid Survey on Children 2013-14,MWCD,GOI

#### Inter-social group discrepancy in nutrition intake

Inter social group comparison of nutritional status according to BMI of different social groups clearly shows that the highest percent of adolescent girls with normal BMI belongs to 'others' category (37.1%) followed by OBC (34.1%), ST (31.8%) and SC (31.6%). It may be tested whether the nutritional status of each group is significantly different from 'other' group.

Firstly between SC and others social groups From the percent of girls with normal BMI in SC and other social groups in the sample size (Table – 1), the proportion may be computed as  $p_1 = 0.31$  &  $p_2 = 0.37$ . The combined proportion is  $p = 0.11$





$$H_0: p_1 = p_2 = p$$

$$\text{The SE } (p_1 - p_2) = 1.43$$

$$\text{The corresponding value of test statistics } Z = (p_1 - p_2) / \text{SE } (p_1 - p_2) = -0.041 > -1.96$$

Hence,  $H_0$  is rejected at 0.5% of level of significant and we safely conclude there is significant difference between the percent of adolescent girls with normal BMI in Sc and other social groups in India.

Secondly, between ST and others social groups From the percent of girls with normal BMI in ST and other social groups in the sample size (Table – 1), the proportion may be computed as  $p_1 = 0.31$  &  $p_2 = 0.37$ . The combined proportion is  $p = 0.22$

$$H_0: p_1 = p_2 = p$$

$$\text{The SE } (p_1 - p_2) = 0.2.71$$

$$\text{The corresponding value of test statistics } Z = (p_1 - p_2) / \text{SE } (p_1 - p_2) = -0.206 > -1.96$$

Hence,  $H_0$  is rejected at 0.5% of level of significant and we safely conclude there is significant difference between the percent of adolescent girls with normal BMI in ST and other social groups in India.

Thirdly, between OBC and others social groups From the percent of girls with normal BMI in OBC and other social groups in the sample size (Table – 1), the proportion may be computed as  $p_1 = 0.37$  &  $p_2 = 0.37$ . The combined proportion is  $p = 0.2002$

$$H_0: p_1 = p_2 = p$$

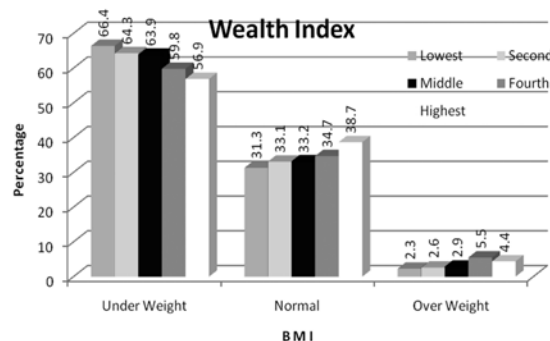
$$\text{The SE } (p_1 - p_2) = 1.21$$

$$\text{The corresponding value of test statistics } Z = (p_1 - p_2) / \text{SE } (p_1 - p_2) = 0.0 > -1.96$$

Hence,  $H_0$  is accepted at 0.5% of level of significant and we safely conclude there is not significant difference between the percent of adolescent girls with normal BMI in OBC and other social groups in India.

### Role of Wealth Index on Health and Nutritional Status

Nutritional status of adolescent girls differs according to income and expenditure patterns as reflected in the wealth index. In RSOC following the DHS (Demographic Health Survey) patterns like in NFHS 2005-06, questions at household levels were asked about household ownership of certain assets, infrastructure and housing characteristics (Rutstein, 1999). To test the impact of wealth the difference between BMI of families with lowest and highest wealth index may be tested.



From the percent of girls with normal BMI in Lowest and highest Income group of adolescent girls in the sample size (Table – 1), the proportion may be computed as  $p_1 = 0.313$  &  $p_2 = 0.387$ . The combined proportion is  $p = 0.121$

$$H_0: p_1 = p_2 = p$$

$$\text{The SE } (p_1 - p_2) = 0.2242$$

$$\text{The corresponding value of test statistics } Z = (p_1 - p_2) / \text{SE } (p_1 - p_2) = -0.33 > -1.96$$

Hence,  $H_0$  is rejected at 0.5% of level of significant and we safely conclude there is significant difference between the percent of adolescent girls with normal BMI in lowest and highest wealth index of adolescent girls i.e. there is great difference between the normal BMI of lowest and highest wealth index of adolescent girls.

## CONCLUSIONS

The percent of adolescent girls with normal BMI in urban area is significantly higher than that of rural areas. The difference between the percentage of adolescent girls with normal BMI of ever married and never married adolescent girls is significant. There is not significant difference between the percent of adolescent girls with normal BMI in OBC and other social groups in India. There is significant difference between the normal BMI of lowest and highest wealth index of adolescent girls.

Hence, it may safely be concluded that marital status, place of residence and wealth of family has a significant influence on the nutritional status of adolescent girls in India. Social groups however do not exert significant influence on the nutritional status.

## Notes / References

### Notes

1. WHO. (2000). *The Management of Nutrition in Major Emergencies* 2nd edn, p 236, Geneva: World Health Organization.
2. [www.unicef.org/india/nutrition](http://www.unicef.org/india/nutrition) . Accessed on 10.12.2014
3. Brabin L, Brabin BJ (1992). The cost of successful adolescent growth and development in girls in relation to iron and vitamin A status. *Am J Clin Nutr.* May; 55(5):955-8.
4. Brasel J. (1982) Changes in body composition during adolescence. In: Myron Wied, ed. *Adolescent nutrition*. New York; John Wiley & Sons,
5. Spear BA (2002). Adolescent growth and development. *J Am Diet Assoc.* Mar; 102(3 Suppl): S23-9
6. Scholl TO, Hediger ML, Schall JI, Khoo CS, Fischer RL. (1994) Maternal growth during pregnancy and the competition for nutrients. *Am J Clin Nutr.* Aug; 60(2): 183-8
7. Gopalan C (1989). Growth of affluent Indian girls during adolescence. NFI Scientific paper no. 10. New Delhi: Nutrition Foundation of India, p. 22-23.
8. Op. cit. WHO (2000)
9. Op.cit. Spear (2002)
10. Daniels SR, Khourey PR, Morrison JA (1997). The utility of body mass index as a measure of body fatness in children and adolescents: differences by race and gender. *Pediatrics.* Jun; 99 (6):804- 7
11. Beard JL (2000). Iron requirements in adolescent females. *J Nutr.* Feb; 130 (2S Suppl):440S-442S.
12. Op.cit. Spear (2002)

13. Thompson P, Roseborough R, Russek E, Jacobson M, Moser PB. (1986) Zinc status and sexual development in adolescent girls. J Am Diet Assoc. Jul; 86(7): 892-7
14. Levander OA, Whanger PD (1996). Deliberations and evaluations of the approaches, endpoints and paradigms for selenium and iodine dietary recommendations. J Nutr. Sep;126(9 Suppl): 2427S-2434S
15. Op.cit. Spear (2002)
16. Op.cit. Spear (2002)

## References

- Gregory, J.; Lowe, S.; Bates, C. J., Prentice, A., Jackson, L.V., Smithers, G., Wenlock, R., Farron, M., (2000). National Diet and Nutrition Survey: young people aged 4-18 years, vol. 1. Report of the Diet and Nutrition Survey, TSO, London.
- Golden MH (1994) : Is complete catch up possible for stunted malnourished children ? Eur J Clin Nutr. 48:558-71 (suppl 1).
- International Institute for Population Sciences (IIPS) and Macro International, (2007) Family Health Survey (NFHS-3), 2005-06: India: Volume I. Mumbai: IIPS. National Family Health Survey (NFHS-3), 2005-06. National Family Health Survey (NFHS-3),
- Kuzur K M (1996) Adolescent nutritional status in developing countries. Proc. Nutr. Soc. 1996; 55:32-31.
- Sehgal, J. & Robinson Lawrence (2017) : Nutrition for children and teens, HELP GUIDE.ORG ([www.helpguide.org/articles/healthy.../nutrition-for-children-and-teens](http://www.helpguide.org/articles/healthy.../nutrition-for-children-and-teens)). Accessed on 29.04.2017.
- WHO. (1995). *Physical status: the use and interpretation of anthropometry*. WHO Technical Report Series no. 854. Geneva:WHO.
- [www.unicef.org/india/nutrition](http://www.unicef.org/india/nutrition) . Accessed on 10.12.2014