# Nutritional Status of Adolescents in the Kamrup-metropolitan District of Assam, India: A Comparative Study between Rural and Urban

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*Authors' contributions*

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

Adolescents serve as the foundational resources and future citizens of the nation. India boasts the highest number of adolescents globally, with a staggering count of 253 million individuals falling between the age range of 10 to 19 years, while Assam is ranked thirteenth among the many states and Union territories in India, with a total adolescent population of 65,60,308. During the stage of adolescence, there is a notable surge in growth. With this background, the present study was carried out to study and compare the nutritional status of rural and urban adolescents of the Kamrup-metropolitan district of Assam. Based on the purposive sampling technique, a totalof 200

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adolescents were selected. A standardised pre-tested questionnaire was developed to collect information on somatic status and dietary intake. Findings revealed that the majority ofindividuals in both Urban and Rural areas have a BMI of less than 18.5, but the prevalence wasslightly higher in the rural group (56.0%) compared to the Urban group (53.0%). Urban respondents (25.4 cm, 11.28 mm) had a slightly higher mean MUAC and TSF than rural respondents (23.7 cm, 11.19mm). There is a notable difference in the amount of nutrients consumed by adolescents compared to the Recommended Dietary Allowance (RDA). Energy intake is below the recommended levels, with adequacy percentages varying from 78.6% to82.4%, indicating a critical area of concern. Conversely, Visible fat intake is above RDA, ranging from 110.8% to 118.2%, highlighting potential overconsumption in this category. Adolescents were observed to have deficiencies in vitamins A, C, and folic acid compared to the Recommended Dietary Allowance (RDA).

## 1. INTRODUCTION

According to the World Health Organization (WHO), adolescence is delineated as the phase of human maturation and advancement that transpires after childhood and precedes adulthood, encompassing the age range of 10 to 19 years [1]. Globally, adolescents constitute one-fifth of the total global population [2,3]. Approximately 87% of adolescents are in developing nations, with India hosting the biggest adolescent population, accounting for 21% of the total Indian population (MHFW., 2014).

Therefore, the concern of adolescent health is of particular significance due to the considerable population of young individuals, particularly in India.

The phase of adolescence, which encompasses the transition from childhood to adulthood, is characterised by a quick and profound development in physiological, psychological, and sexual aspects [4]. Additionally, this period is characterised by growth spurts and heightened levels of physical activity [5,6]. Consequently, teenagers require a greater quantity of essential nutrients in comparison to adults. Insufficient dietary intake can result in delayed onset of sexual maturation and decelerated linear growth [7,8]. They reach 50 per cent of their adult body weight, the final 20 per cent of their adult height, and accumulate up to 40 per cent of their adult skeletal mass during this time (Indian Academy of Pediatrics, Nutrition of Adolescents; 2021). The monitoring of nutritional indicators has played a crucial role in both the Millennium Development Goals and the Sustainable Development Goals. However, their primary concentration has been on children under the age of five [9,10]. Despite the undeniable significance of nutrition to the growth and development of adolescents (10-19 years old),

they are often overlooked in nutrition surveys [11,12,13]. The National Family Health Surveys (NFHS) in India apply adult cut-offs of nutritional status for the estimation of undernutrition/overweight in the 15–19-year-old age group. The statistics from NFHS-5 (2019-2020) indicate differences in the prevalence of underweight and overweight/obese individuals between urban and rural populations and between genders in the country and Assam. Urban areas tend to have higher rates of overweight and obesity, while rural areas have a higher percentage of individuals with a BMI below normal. Among females, both urban and rural areas have a high prevalence of individuals with a high-risk waist-to-hip ratio (≥0.85), with rural areas slightly higher than urban areas. Among males, urban areas have a higher prevalence of individuals with a high-risk waist-to-hip ratio (≥0.90) compared to rural areas, indicating that urban males are at a higher risk of this health condition [14].

The Body Mass Index (BMI) is a commonly employed diagnostic measure for assessing the nutritional health of a population. The body mass index (BMI) is a widely used method forassessing an individual's weight status based on their age and gender (18). The assessment of nutritional status furnishes the requisite information for investigating the impact of nutrition on health and disease, identifying essential nutrients in a particular population, and determining the subgroups within this population that are susceptible to deficiencies. Furthermore, it aids in the formulation of efficacious public health strategies aimed at preventing and treating nutrition-related ailments (19). In this context the present study was undertaken to assess and compare the nutritional status of adolescents in the Kamrup-Metropolitan district of Assam from rural and urban areas.

## 2. MATERIALS AND METHODS

**Study design and selection of locale:** A cross-sectional comparative study was carried out in schools purposively selected in rural and urban areas of the Kamrup metropolitan district of Assam. The two rural schools selected for the study were 1) Swahid Kushal Konwar High School, Panikhaiti and 2) Chandrapur High School, Chandrapur. The two Urban schools selected for the study were 1) Pub Guwahati High School, Bamunimaidan and 2) St.Vivekananda English Academy, Maligaon. A total of 200 adolescents (100 from rural and 100 from urban) in the age group of 13- 18 years studying in 7th - 12th standard were randomly selected. Out of 200 adolescents, 87 were males, and 113 were females.

**Data collection tool:** The quantitative data were collected using a pre-tested semi- structured questionnaire. The questionnaire was developed to collect the information on socio economic status, somatic status, dietary intake and food behaviors. The anthropometric measurements, including Height (Ht), Weight (wt), Mid-Upper Arm Circumference (MUAC) and Triceps skin fold thickness (TSF) were measured as per standard procedures. Subsequently, indices such as body mass index (BMI), height for age, and weight for age were computed and compared against the established standards. Data on dietary intake was collected by 24-hour recall method on 3 alternative days.

**Analysis:** Data was analyzed using suitable statistical tests.

## 3. RESULTS AND DISCUSSIONS

**Somatic status of urban and rural respondents:** In Table 1 the data indicated that individuals in the "160+" cm height category were more prevalent in the urban group (45.0%) compared to the rural group (23.0%). In contrast, the "132-150" cm height category was more common in the rural group (38.0%) than in the urban group (21.0%).The data subjected for statistical tests revealed the difference in height of the respondents found to be significant ($\chi2$ = 12.35*). The results showed that the majority of respondents were 160+ cm in height in urban areas when compared to rural areas. Similar to the findings of the present study was reported by Sen and Lakhawat [15] in the Assessment of the nutritional status of rural and urban adolescent girls in the Udaipur district where the mean height of rural respondents was less when compared to urban respondents. Urban girls were significantly taller than rural girls. Similar results were also observed by Zanvar et al. [16]. The underlying cause for this result remains unclear; nonetheless, it is plausible that urban girls placed greater focus on consuming pulses and protein-rich diets.

Respondents in the "28-40" kg weight category were more common in the rural group (44.0%) compared to the urban group (28.0%). The weight category of "50+" kg exhibited a higher prevalence in the urban group (45.0%) compared to the rural group (18.0%). The data subjected for statistical tests revealed the difference in weight of the respondents found to be statistically significant ($\chi2$ = 16.98 *). More of the respondents from rural weighed between 28-40 kg whereas more number of respondents weighed 50+kg. Observation recorded in the present study is similar to the findings reported by Sen and Lakhawat [15] in the Assessment of the nutritional status of rural and urban adolescent girls in the Udaipur district where the mean weight of urban respondents was higher than the mean weight of rural respondents. Similarly, a

**Table 1. Classification of respondents by Somatic Status and BMI (Residence wise)**

| Characteristics | Group | Urban (n=100) | | Rural (n=100) | | Total (n=200) | | χ2 Test |
|---|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % | |
| Height (cm) | 132-150 | 21 | 21.0 | 38 | 38.0 | 59 | 29.5 | 12.35 |
| | 151-159 | 34 | 34.0 | 39 | 39.0 | 73 | 36.5 | * |
| | 160+ | 45 | 45.0 | 23 | 23.0 | 68 | 34.0 | |
| Weight (kg) | 28-40 | 28 | 28.0 | 44 | 44.0 | 72 | 36.0 | 16.98 |
| | 41-49 | 27 | 27.0 | 38 | 38.0 | 65 | 32.5 | * |
| | 50+ | 45 | 45.0 | 18 | 18.0 | 63 | 31.5 | |
| BMI (kg/m²) | Underweight (<18.5) | 53 | 53.0 | 56 | 56.0 | 109 | 54.5 | 10.21 |
| | Normal (18.5-24.9) | 35 | 35.0 | 43 | 43.0 | 78 | 39.0 | * |
| | Overweight (25-29) | 12 | 12.0 | 1 | 1.0 | 13 | 6.5 | |

study by Pavithran and Bant [17] revealed that approximately 14.9 per cent of adolescent females residing in rural areas exhibited a body weight that was below the recommended range for their respective age groups.

The majority of individuals in both Urban and Rural areas have a BMI less than 18.5, but the prevalence was slightly higher in the rural group (56.0%) compared to the Urban group (53.0%). The "18.5-24.9" BMI category is more common in the Rural group (43.0%) compared to the urban group (35.0%). The "25-29" BMI category was very low in both rural (1.0%) and in the urban group (12.0%). Underweight was more prevalent in rural adolescents. This is in line with the findings reported by Joshi et al. [18] in a study of the nutritional status of adolescent girls in rural areas of the Bhopal district, where a significant proportion of adolescent girls residing in rural areas were undernourished.

This study revealed that overweight was more in urban. However, the percentage of overweight was less compared to underweight and normal. This is because children are usually more active at this age group, play in school and work at home. Obesity is not so common among adolescents in Assam. Also, after examining the causes of a higher incidence of obesity and overweight adolescents in urban populations, it was observed that higher household wealth, frequent use of restaurant and school cafeteria food, and less frequent participation in physical activity were the main contributing factors. A higher prevalence of overweight in the upper class may be because adolescents from upper SE classes have a better dietary intake than those from lower SE classes. Adolescents from urban background might have better dietary intake and have easier access to junk food than those from rural areas, making them more prone to overweight and obesity. Relatively, Pathak et al. [19] reported that only 2.2 per cent of rural children were obese and that 8.9 per cent of them were either obese or overweight, while 31.3 per cent of urban adolescents were obese and 63.6 per cent were either obese or overweight. Similarly, Chaturvedi and Katare [20] studied the overall prevalence of overweight was found to be 5.4 per cent and 3.9 per cent among urban and rural school-going adolescents, respectively. Thomas et al. [21] also reported that the incidence of obesity and overweight among school-age children is rather elevated. According to the authors, the primary determinants of obesity status among school children were found to be higher household income, dietary patterns, parental history of obesity and diabetes, and urban residency.

**Comparison of height and weight of Male respondents:** The mean height of all the male respondents found to be higher among all age groups in comparison with IAP (2015) standards (Table 2), which was statistically significant. ($p<0.05$). The average weight of male participants was shown to be significantly greater across all age categories when compared to the standards set by IAP (2015). Similar studies were reported by Mondal and Terangpi [22], in a study of undernutrition among tribal adolescents of Karbi Anglong district of Assam, where overall mean height and weight were higher among boys. The findings are contradictory to that reported by Nagi et al. [23], in a study on physical growth and nutritional status of Mising adolescent boys: a cross-sectional study from northeast India, where the prevalence of stunting was found to be considerably higher ($p<0.05$) among older adolescents compared to their younger counterparts.

**Comparison of height and weight of Female respondents:** The mean height of all the female respondents was found to be significantly ($p<0.05$) higher among all age groups in comparison with IAP (2015) standards in Table 3.

**Table 2. Classification by height and weight in comparison with standards among Male respondents**

| Age (years) | Sample | Height (cm) | | | 't' Test | Weight (kg) | | | t- Test |
|---|---|---|---|---|---|---|---|---|---|
| | | Std | Mean ± SD | % | | Std | Mean ± SD | % | |
| 13 | 14 | 137.0 | 153.0±5.2 | 112 | 11.51* | 26.8 | 38.8 ± 9.7 | 145 | 4.63* |
| 14 | 22 | 142.2 | 158.3±8.2 | 111 | 9.21* | 29.9 | 42.5±10.2 | 142 | 5.79* |
| 15 | 21 | 146.9 | 165.6±10.2 | 113 | 8.40* | 33.6 | 52.9 ± 11.9 | 157 | 7.43* |
| 16 | 12 | 150.9 | 159.6±13.2 | 106 | 2.28* | 36.8 | 46.6 ± 8.7 | 127 | 3.90* |
| 17 | 10 | 154.2 | 162.4±8.6 | 105 | 3.02* | 39.3 | 51.9 ± 8.5 | 132 | 4.69* |
| 18 | 8 | 157.4 | 168.2±5.0 | 107 | 6.11* | 41.3 | 66.9 ± 14.4 | 162 | 5.03* |

**Table 3. Classification by height and weight in comparison with standards among Female respondents**

| Age (years) | Sample | Height (cm) | | | 't' Test | Weight (kg) | | | t- Test |
|---|---|---|---|---|---|---|---|---|---|
| | | Std | Mean ± SD | % | | Std | Mean ± SD | % | |
| 13 | 26 | 137.3 | 150.2 ± 6.0 | 109 | 10.96* | 28.3 | 39.0 ± 8.7 | 138 | 6.27* |
| 14 | 26 | 140.6 | 153.8 ± 8.1 | 109 | 8.31* | 30.8 | 44.8 ± 6.9 | 145 | 10.35* |
| 15 | 30 | 142.9 | 154.4 ± 8.9 | 108 | 7.08* | 32.7 | 45.9 ± 8.5 | 140 | 8.51* |
| 16 | 24 | 144.4 | 152.5 ± 5.6 | 106 | 7.09* | 34.4 | 46.3 ± 6.1 | 135 | 9.56* |
| 17 | 3 | 145.5 | 160.2 ± 2.5 | 110 | 16.97* | 35.9 | 40.0 ± 2.9 | 114 | 12.85* |
| 18 | 4 | 146.4 | 158.3 ± 3.5 | 108 | 7.60* | 37.3 | 52.3 ± 10.6 | 140 | 3.16* |

The average weight of female participants was also shown to be significantly greater across all age categories when compared to the standards set by IAP (2015). The height and weight of adolescents girls increased gradually as they age. The findings of a national survey on children, jointly undertaken by the Government of India and UNICEF during the year of 2013-2014, indicated a substantial decrease in the prevalence of stunting among children in many states on India. The findings is contradictory to the study reported by Adams et al. [24], Goyal and Talwar [25], and Santra et al. [26] where majority were stunted in late adolescents group. Prevalence of thinness, stunting, protein-energy malnutrition, and inadequate consumption of essential dietary groups was observed among teenage girls in the tea community, Assam [27].

**Mean MUAC among respondents:** The results in the Table 4, indicated that a slightly higher MUAC was noticed in urban (25.4 cm) as compared to rural (23.7 cm). The mean MUAC of the age group 16-18 years was slightly higher (25.7 cm) as compared to 13-15 years of age (24.0 cm). Regarding gender, the results indicated that males (25.0 cm) had a higher MUAC than females (24.1 cm). The difference between residence, age and gender found to be significant at 5% level. In the present study the mean MUAC of all the respondents fell under the normal category, as recommended by Nutrition Assessment, Counselling, and Support (NACS) guidelines. Similar, study was reported by Jaswant and Nitish [28], where the authors assessed age-sex-specific upper-arm composition and nutritional status among adolescents in Assam. The results stated that MUAC was gradually increased with age. Age-specific mean differences between ages in upper-arm composition variables were found statistically significant in both gender. From the present study, it was also observed that the mean MUAC of males were slightly higher than females maybe because that gender differences in growth and development during adolescence can also play a role. Males generally have a higher percentage of lean muscle mass compared to females [29]. The present study contradicts to the study reported by De [30], a cross-sectional study on 10-19 years of adolescent girls of rural areas to assess the Nutritional status of Adolescent Girls by Mid-Upper.

Arm Circumferences where, as per MUAC, 40 per cent and 24 per cent based on BMI were undernourished. MUAC and BMI showed a significant regression relation. Similarly, Dasgupta et al. [31] found out the magnitude of malnutrition among the adolescents of an urban slum of Kolkata study population, where 60.30% as per MUAC were malnourished.

**Table 4. Characteristic-wise mean MUAC among respondents**

| Characteristics | Group | Sample | MUAC (cm) | | Students 't' Test |
|---|---|---|---|---|---|
| | | | Mean | SD | |
| Residence | Urban | 100 | 25.4 | 3.3 | 4.23 * |
| | Rural | 100 | 23.7 | 2.3 | |
| Age (years) | 13-15 | 139 | 24.0 | 2.7 | 3.62 * |
| | 16-18 | 61 | 25.7 | 3.2 | |
| Gender | Male | 87 | 25.0 | 3.6 | 2.03 * |
| | Female | 113 | 24.1 | 2.3 | |

**Table 5. Characteristic-wise mean TSF among respondents**

| Characteristics | Category | Sample | TSF (mm) | | Student 't' test |
|---|---|---|---|---|---|
| | | | **Mean** | **SD** | |
| Residence | Urban | 100 | 11.28 | 2.4 | 0.29 [NS] |
| | Rural | 100 | 11.19 | 1.9 | |
| Gender | Male | 87 | 11.25 | 2.6 | 0.09 [NS] |
| | Female | 113 | 11.28 | 1.8 | |
| Age (years) | 13-15 | 139 | 10.73 | 1.8 | 4.65 * |
| | 16-18 | 61 | 12.38 | 2.5 | |
| Combined | | 200 | 11.24 | 2.1 | |

**Table 6. Major Nutrients intake in comparison with RDA and adequacy (%)**

| | | Response by Age and Gender | | | |
|---|---|---|---|---|---|
| | | **13-15 (years)** | | **16-18 (years)** | |
| **Nutrients** | **Contents** | **Male** | **Female** | **Male** | **Female** |
| Energy (kcal/day) | RDA | 2860 | 2400 | 3320 | 2500 |
| | Mean | 2302 | 1886 | 2736 | 2023 |
| | Adequacy (%) | 80.5 | 78.6 | 82.4 | 80.9 |
| | t- Test | **36.55 *** | **38.18 *** | **25.26 *** | **21.81 *** |
| Protein (g/day) | RDA | 45 | 43 | 55 | 46 |
| | Mean | 66.9 | 65.1 | 84.0 | 70.7 |
| | Adequacy (%) | 148.6 | 151.4 | 152.7 | 153.8 |
| | t- Test | **19.19 *** | **21.75 *** | **16.03 *** | **13.50 *** |
| Visible Fat (g/day) | RDA | 45 | 40 | 50 | 35 |
| | Mean | 49.86 | 45.56 | 58.4 | 41.37 |
| | Adequacy (%) | 110.8 | 113.9 | 116.8 | 118.2 |
| | t- Test | **3.08 *** | **5.78 *** | **5.41 *** | **3.69 *** |
| CHO (g/day) | RDA | 115 | 115 | 115 | 115 |
| | Mean | 178.9 | 174.6 | 185.5 | 184.5 |
| | Adequacy (%) | 155.6 | 151.8 | 161.3 | 160.4 |
| | t - Test | **20.79 *** | **18.17 *** | **12.70 *** | **13.53 *** |

**Mean TSF among respondents:** The results indicated that a slightly higher TSF was noticed in urban (11.28 mm) as compared to rural (11.19 mm). The mean TSF of the age group 16-18 years is slightly higher (12.38 mm) as compared to 13-15 years of age (10.73 mm). Regarding gender the results indicated that females (11.28 mm) had higher response of TSF than males (11.25 mm). However, the data subjected for statistical test (t-test) to measure the difference between residence, and gender found to be non-significant (p>0.05) while age is found to be statistically significant. (p<0.05). Triceps skinfold thickness (TSF) measures are a non-invasive method that can be used as independent predictors of hypertension in children and adolescents [32]. The optimal cut-off percentile yielding maximal sensitivity and specificity for predicting high BP was the 70th TSF percentile in boys and girls (IAP, 2015). In the present study, the mean TSF of the female respondents was up to 25th percentile (9.9mm -12.4 mm for 11-17.5 years., IAP) and the male respondents was above 50th percentile (10.8mm-13.7 mm for 11-17.5 years., IAP). This depicts that the respondents of Assam had TSF below the Cut-off Value of 70th percentile of TSF for hypertension risk. Female mean TSF was slightly higher than male and this finding is in line with a study by Tang et al. [33] on Triceps and subscapular skinfold thickness percentiles of a school-based sample of adolescents in Ho Chi Minh City, Vietnam, where Triceps, subscapular skinfolds, and TSF + SSSF were significantly higher in girls than in boys. The present study however, contradicted a study by Khadilkar et al. [34], where the findings revealed that Indian children exhibited TSF values up to the 50th centile in males and up to the 75th centile in girls.

**Dietary intake:** Energy was slightly less than the RDA as per ICMR guidelines in all age groups. A similar study was reported by Sinha and Singh et al. [35]. In all three age groups, the daily average intake of energy was less than the RDA as per

ICMR guidelines in all age groups in both urban and rural school girls. In the age group 10-13 years, the calorie deficit was 9.5 per cent and 18.3 per cent in both urban and rural school girls, respectively. However, about 18.3 per cent and 30.2 per cent calorie deficit were noticed in the age group 14-16 years of both urban and rural school girls, respectively.

Protein, fat, and carbohydrate intakes are generally above the RDAs, indicating that adolescents were consuming more than the recommended levels of these nutrients. Protein and fat intake were higher among respondents as Assam exhibits a diverse culinary heritage that encompasses a wide array of non-vegetarian delicacies, encompassing an assortment of fish, poultry, and meat-based preparations. Animal protein sources, such as fish curry (*Masor Tenga*), chicken curry (*Murgir Mangxo*), and pork dishes (Pork Curry), are commonly found in traditional Assamese cuisine. These cultural practices have a significant impact on daily dietary habits. Rice is a staple in Assamese cuisine and is commonly served with various non-vegetarian dishes. The combination of rice and meat or fish results with higher carbohydrate, protein and fat content. However, a contradicting study was reported by Sinha and Singh et al. [35] regarding the daily average intake of protein, was less than RDA as per ICMR guidelines in allage groups.

A study conducted by Kenmogne-Domguia et al. [36] examined the protein-energy intakes of a sample of 770 teenagers residing in Baham, Cameroon. The study's findings indicated that there was no statistically significant difference in the daily consumption of protein and energy ($p \leq 0.05$) among teenagers aged 10-13, regardless of gender.

The adequacy on Vitamin A consumption in both the age group and genders was found to range between (86.7 – 88.9 %). The adequacy of Vitamin C was found to be higher in females in both age group ranging between (50.6 - 51.2%). The study revealed that the level of folic acid adequacy was found to be higher in females which ranged between (51.2-51.3%) in both the age group. The adequacy of zinc ranged between (38.6- 40.7 %) in both age groups. The percentage of males meeting the recommended calcium intake was found to be greater than that

**Table 7. Minerals and Vitamins intake in comparison with RDA and adequacy (%)**

| Nutrients | Contents | Response by Age and Gender | | | |
| --- | --- | --- | --- | --- | --- |
| | | 13-15 (years) | | 16-18 (years) | |
| | | Male | Female | Male | Female |
| Vit A (µg/day) | RDA | 930 | 890 | 1000 | 860 |
| | Mean | 806.31 | 784.09 | 875 | 764.54 |
| | Adequacy (%) | 86.7 | 88.1 | 87.5 | 88.9 |
| | t- Test | 8.10 * | 8.75 * | 6.28 * | 5.10 * |
| Vit C (mg/day) | RDA | 70 | 65 | 85 | 70 |
| | Mean | 34.79 | 32.89 | 40.63 | 35.84 |
| | Adequacy (%) | 49.7 | 50.6 | 47.8 | 51.2 |
| | t- Test | 14.60 * | 16.24 * | 11.41 * | 9.75 * |
| Folic acid (µg/day) | RDA | 285 | 245 | 340 | 270 |
| | Mean | 144.21 | 125.44 | 169.32 | 138.51 |
| | Adequacy (%) | 50.6 | 51.2 | 49.8 | 51.3 |
| | t- Test | 10.65 * | 11.15 * | 9.35 * | 7.51 * |
| Calcium (mg/day) | RDA | 1000 | 1000 | 1050 | 1050 |
| | Mean | 446 | 417 | 474.6 | 442.05 |
| | Adequacy (%) | 44.6 | 41.7 | 45.2 | 42.1 |
| | t- Test | 45.61 * | 58.72 * | 28.21 * | 35.07 * |
| Iron (mg/day) | RDA | 22 | 30 | 26 | 32 |
| | Mean | 10.71 | 14.79 | 12.974 | 16.064 |
| | Adequacy (%) | 48.7 | 49.3 | 49.9 | 50.2 |
| | t- Test | 17.38 * | 15.83 * | 8.39 * | 6.52 * |
| Zinc (mg/day) | RDA | 14.3 | 12.8 | 17.6 | 14.2 |
| | Mean | 5.734 | 4.940 | 7.163 | 5.552 |
| | Adequacy (%) | 40.1 | 38.6 | 40.7 | 39.1 |
| | t- Test | 13.19 * | 17.35 * | 11.43 * | 10.24 * |

of female respondents in both age groups (41.7-45.2%). The study revealed that the levels of iron adequacy varied within the ranged of 48.7% to 50.2% across different age groups and genders.

Adolescents in both age groups and both genders are generally not meeting the recommended daily allowances (RDAs) for calcium, and iron intake. Adequacy percentages are below 100.0 per cent for calcium, and iron, indicating inadequacies in these nutrients intake. This may be because consumption of milk and milk products was found to be very low among the respondents. Traditional Assamese cuisine, for example, may focus more on rice, fish, and leafy vegetables. Adolescents and their families may have limited awareness of the nutritional importance of calcium and iron, and their dietary choices may not be guided by specific nutrient recommendations. However, the percentage adequacy of iron was higher among female respondents, which may be due to the distribution of iron and folic acid tablets in schools. to provide iron and folic acid tablets to school-going adolescent girls in the state, under the "Weekly Iron and Folic Acid Supplementation (WIFS) Program", centrally sponsored by the National Health Mission, Government of India, where iron and folic acid tablets are distributed to adolescent girls in government and government-aided schools. These tablets are typically provided on a weekly basis to address iron deficiency anaemia and improve the overall health and nutritional status of adolescent girls.

Adolescents belonging to both age groups and encompassing both genders failed to meet the recommended daily intakes (RDAs) for vitamins and minerals. This could be attributed to the predominant dietary pattern in Assam, which primarily consists of rice, poultry/fish, and eggs. Reliance on a limited range of foods may have resulted in deficiencies in micronutrients.

The study is in line with the findings of Awasthi et al. [37] where the authors found that micronutrient deficiencies are found in almost one-half of school children in urban areas across India. In a study conducted by Rathi and Rani [38], the researchers found the mean intake of nutrients in the age group of 13-15 years, encompassing both genders, in both government and private schools, were significantly lower than the RDAs. Moreover, it was observed that the nutrient intake of male participants and private schools was substantially better compared to

their female and government schools. The authors reported the discrepancy might be due to higher consumption among boys [40,41]. According to Doustmohammadian [39] the intake of energy and some micronutrients when compared with DRI among adolescent girls was significantly lower than the normal range (p<0.0001) [42,43].

## 4. CONCLUSION

The findings of the study depicted that the overall somatic status where underweight was more prevalent in rural compared to urban, whereas obesity was more prevalent among urban respondents. The dietary intake of macronutrients was good in both urban and rural whereas the micronutrients were found to be deficient in both rural and urban. This unequivocally demonstrated the necessity of implementing a nutritional status survey and dietary counselling intervention for adolescents. It is recommended to provide encouragement for individuals to enhance their consumption of macro and micronutrients, namely by incorporating a greater variety of foods, viz., fruits and vegetables, into their diet. Conducting a nutritional status survey in both urban and rural areas of Assam for adolescents is a vital step in improving the health and well-being of this age group. It provides essential data for informed decision- making, targeted interventions, and the overall improvement of public health outcomes.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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