DIETARY AND NUTRIENT ASSESSMENT OF THE ADOLESCENTS STUDYING IN MADHYAMIK SHALA OF KHADIA, JUNAGADH

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ABSTRACT

It is said that the food is one of the most essential thing after Air and Water. But in current scenario, the healthy food is ignored in spite of being so essential for one's life. The unhealthy eating habits can cause many problems such as nutrient deficiency, malnutrition, delayed growth and development (physical, mental and neurological). Food plays an important role in the growth and development in Adolescents' life. The present study has attempted to study the food habits and eating patterns of the Adolescents studying in the Madhyamik Shala, Khadia of Junagadh district. Adolescent's daily diet is mostly inadequate in terms of Energy, and Protein as well as with the regards to Calcium, Iron, Zinc, β-Carotene and Vitamin C, too. In the present study, at base line the majority of the adolescents (50%) were consuming Energy between 50-74% of its RDA followed by those (26%) who was consuming Energy below 50% of its RDA. Only 8% of them met the RDA followed by 16% who met between 75 – 99 % of its RDA. Daily intake of protein among 13-15 years of girls and boys were about 73.3% and 79.5% respectively of its RDA. And in the age of 16-17 years of age in girls and boys were 76.16% and 79.77% of its RDA, respectively. The daily intake of fat was significantly higher in both the genders and both the age groups. Cereals when eaten with pulses increase the quality of protein. Consumption of green leafy vegetables, fruits, nuts were significantly low compared to its RDI. The intake of micronutrients such as vitamin C, zinc, and iron were woefully inadequate. In the age group of 13-15 years of age of girls and boys, the daily intake of vitamin C was very low. And in age group of 16-17 years of girls and boys was fairly higher than 13-15 years. Same was observed for zinc, iron, and β-carotene.

KEY WORDS: ADOLESCENTS, FOOD, NUTRITION, NUTRIENT DEFICIECY

INTRODUCTION

Eating healthy is very important for ones healthy well being and it is most important to be taught at a young age. Adolescence is the period between childhood and adulthood. Patton and others (2016) further delineate this period as early adolescence (ages 10–14 years), late adolescence (ages 15–19 years), youth (ages 15–24 years), and young adulthood (ages 20–24 years). Adolescents need more nutrients than adults because they gain at least 40 % of their adult weight and 15 % of their adult height during this period. Growth failure and micronutrient inadequacy during childhood and adolescence can delay growth and create high risk of chronic diseases in adulthood. Any nutritional deficiency experienced during this critical period of life can have an effect on the future health of the individual and their offspring. For example, failure to consume an adequate diet at this time can result in delayed sexual maturation and delayed or retarded physical growth. The rapid physical changes of adolescence have a direct influence on a person's nutritional needs. The growth spurt that occurs in adolescence, second only to that in the first year of life, creates increased demands for energy and nutrients. Nutritional status and physical growth are dependent on one another such that optimal nutrition is a requisite for achieving full growth potential. Nutrition of the adolescents is particularly important but under-nutrition (too little food or food lacking required nutrients) in adolescents frequently goes unnoticed by their families or the young people themselves.

Adolescence is a time to prepare for the nutritional demands of later part of life. Under-nutrition negatively affects adolescents by:

- Affecting their ability to learn and work at maximum productivity;
- Increasing the risk of poor obstetric outcomes for teen mothers;
- Arresting the healthy development of future children;
- Affecting sexual maturation and growth
- Preventing the attainment of normal bone strength and the development of healthy teeth if a youth doesn't get enough calcium.
- The important nutrients that need to increase during adolescence include energy, protein, calcium, and iron.

Energy:

Adolescents need significantly higher amount of energy than in childhood for growth and activity. To meet these calorie needs, adolescents should choose a variety of healthful foods, such as lean protein sources, low-fat dairy products, whole grains, fruits, and vegetables. Adolescent girls and boys require approximately 2200 to 2500 kcal energy respectively.

Fats and oils:

During adolescence, dietary fat is essential to play important role as an energy source, a significant cell structural component, a precursor to agents of metabolic function and a potent gene regulator. Adolescents require 25% of total energy as fat.

Protein:

Protein needs of adolescents are determined by the amount of protein required for maintenance of existing lean body mass and the development of additional lean body mass during the adolescent growth spurt. In effect, protein is important for growth and maintenance of muscle. Adolescents need between 45 and 60 grams of protein each day.

Vitamin A: β- Carotene is the precursor of vitamin A which is very essential to maintain good vision, skin health and immunity. It also plays an important role in many enzymatic processes occur in cell.

Vitamin C:

Vitamin C is a water soluble vitamin which plays an important role in iron absorption. It is also a strong anti-oxidant in aqueous medium. It is the vital element required in human body to fight against and foreign cell attempt to invade.

Calcium:

It is estimated 45% of peak bone mass is attained during adolescence and so adequate calcium intake is important for the development of dense bone mass and the reduction of the lifetime risk of fractures and osteoporosis. Additionally, calcium needs during adolescence are greater than they are in either childhood or adulthood because of the increased demand for skeletal growth. Adequate calcium intake is essential also for development of strong and dense bones during the adolescent growth spurt.

Iron:

Iron is vital for transporting oxygen in the bloodstream. A deficiency of iron causes anaemia, which leads to fatigue, confusion, and weakness and lower immunity. With the onset of adolescence, the need for iron increases as direct consequence of rapid growth and the expansion of blood volume and muscle mass.

Zinc:

Zinc is an essential micro mineral and an essential component of a large number of enzymes participating in the synthesis and degradation of carbohydrates, protein, lipids and nucleic acids, as well as, in the metabolism of other micro nutrients. Zinc stabilizes the molecular structure of the cells. It is essential mineral which helps to boost immunity.

METHODLOGY:

DIETARY ASSESSMENT

The data on dietary intake of the subjects were gathered by one day 24 Hour Recall; Food Frequency Questionnaire was employed for validating the dietary data. Mean daily intake of the subjects was computed and compared with the suggested amounts of various food groups in a balanced diet for Indian girls aged 13 to 15 years.[1]

24 HOURS DIET RECALL:

The dietary history is an essential component of the nutritional assessment. The dietary history provides information not only on the amount and quality of food consumed, but also on the eating patterns and behaviors of the family. This part of the nutritional assessment also provides information on the number of meals, snacks, and beverages consumed; special foods eaten by the child and family; vitamin and mineral supplements ingested regularly; food allergies; intolerances; and unusual feeding behavior. The retrospective 24-hour diet recall provides a quicker assessment of dietary intake. For a 24-hour recall, the

Child /parent is asked to recall what and how much the child ate and drank over the past 24 hours. Recall accuracy depends on the child/parent's memory and ability to estimate portion sizes. Also, because this is only one day of intake, it may not be representative of the usual intake. When the child's intake is affected by acute illness, a 24-hour recall of a "typical day" is more useful to estimate usual intake.

NUTRIENT ASSESSMENT:

The nutrient intake was calculated using the computerized program based on food composition tables. Thereafter, mean nutrient intake was assessed and compared with the recommended dietary allowances (RDA) for the respective age groups (13-15 years, and 16-18 years).[2]

NAR = Subject's nutrient intake of a day /RDA of the respective nutrient.

Thereafter, the subjects were categorized as those having an adequate (≥1.00), fairly adequate (0.66−<1.00) or inadequate (<0.66) NAR for various nutrients. Since NAR is not a good indicator for assessing the adequacy or inadequacy of energy intake therefore, energy intake data were expressed as % of RDA for the particular age group. In the present study, 25% below the RDA has been employed as the cut-off for estimating energy inadequacy while 25% above the RDA has been used to identify subjects with excess energy intake.[3]

RESULTS AND DISCUSSIONS:

1 .DIETARY ASSESSMENT (DIETARY INTAKE)

1.1 Cereals:

Cereals are the main source of energy, the dominant cereal in the diets of adolescents were wheat and millets. Mean daily intake at baseline in the diet of girls (13-15) was 282.1g which was 85.4 % of its RDIs. (Table 1) Mean daily intake at baseline in the diet of boys (13-15) was 325.1 which were77.3% of its RDIs. Mean daily intake at baseline in the diet of girls (16-17) was 260.1 which were 78.7 % of its RDIs. (Table 1) Mean daily intake at baseline in the diet of boys (16-17) was 344.08 which were 76.4% of its RDIs. (Table 2)

Table 1 Daily mean food intake of adolescent girls and boys (13-15 Years)

Foodstuff	RDI for girls (13-15) (grams/ml)	Mean intake of Girls(n=33)	RDI for Boys (13-15) Grams/ml)	Mean intake of Boys(n=29)
Cereals	330	282.1±43.2(85.4)	420	325.1±109.1(77.3)
Pulses	60.0	35.7±16.3(58.3)	75	50.5±5.9(67.33)
Milk and Milk products	500.0	305±59.7(61.1)	500	344.0±62.9(68.8)
Roots and tubers	150.0	129.9±35.9(86.0)	200	169.5±40.7(84.5)
Green & leafy vegetables	100.0	29.9±8.6(29.0)	100	30.1±6.3(30.1)
Other vegetables	200.0	144.1±28.0(72.0)	200	151.7±35.1(75.5)
Fruits	100.0	50.9±8.2(50.0)	100	51±8.6(51)
Fats & oils	40.0	50.7±5.9(125.0)	45	48.3±7.1(107.4)
Sugar & jaggery	25.0	37.5±9.8(148.0)	20	35.1±9.7(175)

Values are mean± SD, "significant at 1% level"
"Significant at 5% Level"
Values in parentheses indicate % RDI

1.2 Pulses:

The data presented in table 1 indicate that daily mean intake of pulses among school going girls (13-15) was 35.7g (58.3% of RDI) Among boys of the same age group, daily mean intake of pulses was 50.5 g (67.3% of RDI). The daily mean intake of pulses of girls and boys of age 16-17 years of age was 48.55g and 58.23 g, respectively, which was 64.0% and 64.7% of RDI, (Table 2).

1.2 Milk and Milk products:

Mean daily intake of milk and milk products in the diets of girls and boys (13-15y) were 305.1 and 344 ml, respectively which was 61.1% and 79.1 % of their respective RDIs (Table 1) Mean daily intake of milk and milk products in the diets of girls and boys (16-17) were 330.67 and 349.97 ml, respectively which was 66 % and 69 % of their respective RDI's (Table 2).

1.3 Roots and Tubers:

The daily mean intake of roots and tubers in the diets of school going girls (13-15y) was significantly lower than the RDI; which was 86.0 % of the RDI. Similarly, boys were also consuming significantly lower amounts of roots and tubers than the RDI; which was 84.5% of the RDI (Table 1). The similar trend was followed for daily mean intake of root and tubers of both the boys and girls of 16-17 years of age. Mean intake of roots and tubers among girls was 164.73 g; which was 82.0 %of RDI and intake among boys was 171.97 g; which was 85.5 %of RDI (Table 2).

Table 2 Daily mean food intake of adolescent girls and boys (16-17 Years)

Foodstuff	RDI for girls (16-17) (grams/ml)	Mean intake of Girls(n=17)	RDI for Boys (16-17) Grams/ml)	Mean intake of Boys(n=21)
Cereals	330	260.14±96.85(78.7)	450	344.08±63.63(76.4)
Pulses	75	48.55±50.09(64.0)	90	58.23±9.23(64.7)
Milk and Milk products	500.0	330.67±46.91(66.0)	500	349.97±353.26(69.9)
Roots and tubers	200.0	164.73±38.1(38.11)	200	171.97±40.91(85.5)
Green leafy vegetables	100.0	21.72±5.68(21.7)	100	30.24±8.26(30.2)
Other vegetables	200.0	148.32±21.64(74.0)	200	161.36±24.44(80.6)
Fruits	100.0	59.88±9.16(59.8)	100	63.54±12.29(63.5)
Fats & oils	35.0	56.61±7.03(161.7)	50	59.84±10.66(119.6)
Sugar &jiggery	25.0	38.11±10.34(152.0)	30	40.45±8.40(134.8)

Values are mean= SD, "significant at 1% level",
"Significant at 5% level",
Values in parentheses indicate % RDI

1.4 Green leafy Vegetables:

A very low consumption of green leafy vegetables among the adolescent of both the age groups was observed. Data revealed that mean daily intake of green leafy vegetables of the girls and boys of 13-15 years was 49.9 % and 30.1 % of their respective RDIs, respectively (Table 1). Similar trend was observed for the mean daily intake of green leafy vegetables among girls 21.7% and boys 30.2 % of 16-17 years of age (Table 2).

1.5 Other Vegetables:

This group is consisted of vegetables those are not covered under green leafy vegetables, roots and tubers. Data showed comparatively an optimum consumption of other vegetables among the adolescent of both the age groups and gender. Among girls of 13-15 years of age the intake of other vegetables was 144.1 g/day which was 72.0 % of RDI. In the boys belong to the same age group; the mean daily intake of other vegetable s was 151.7 g. In both the case the intake was slightly lower than their respective RDI (Table 1). The girls and boys of 16-17 years of age consuming 148.3 g of and 161.36g of other vegetables per day; which was 74.0 % and 80.6 % of their respective RDIs, (Table 2)

1.6 Fruits:

The mean daily intake of fruits among girls and boys (13-15 y) was 50 g and 51g respectively. In both the girls and boys the intake of fruits was far below than their respective RDIs (Table 1). A similar trend was observed for the fruits intake in the diets of both the boys and girls of 16-17 years of age. Mean daily fruit intake of the girls s was 59.8g, whereas the mean daily fruit intake of the boys was 63.5g. (Table 2)

1.7 Fats and Oils:

In contrast to the trend of lower intake of cereals and millets, pulses, milk and milk products roots and tubers, GLV, other vegetables and fruits than their respective RDIs, the daily mean intake of fats and oils was observed higher than the RDIs. The daily mean intake of fats and oils among girls and boys (13-15y) was 50.7g and 48.3g, which was 125 % and 107.4 % respectively of their RDIs. The daily mean intake of fats of oils among girls and boys (16-17y) was 56.61g and 59.8g, which was 161.7 and 119.6 % respectively of their RDIs.

1.8 Sugar and jaggery:

The adolescents of both the gender and age group had significantly higher consumption of sugars than their respective RDIs which was not good as lot of consumption of sugars may cause over weight, obesity and degenerative diseases. The consumption of sugar and jaggery among girls (13-15y) was37.5g/day and among boys (13-15y) was 35.1g/day. (Table 1).Table 2 highlighted the mean intake of sugar and jaggery of the girls and boys of 16-17 years of age. Among girls the daily mean intake of sugars and jaggery was 38.1g which was 152 % of the RDI. Among boys the intake was 40.45g which was 134.8 % of RDI.

2 NUTRIENT ASSESSMENT (NUTRIENT INTAKE)

Table 3. Daily mean nutrient intake of adolescent girls and boys (13-15 Years)

Nutrients	RDA for girls (13-15)	Mean intake of Girls (n=33)	RDA for Boys (13-15)	Mean intake of Boys (n=29)
Energy (kcal)	2330	1930.74±447.68(82.8)	2750	2039.26±308.51(74.1)
Protein(g)	51.9	38.08±6.6(73.3)	54.3	43.21±11.32(79.5)
Fat(g)	40	51.33±8.86(127.5)	45	54.39±7.62(120.8)
β-carotene(µg)	4800	1904.22±567.50(39.6)	4800	1947.78±620.35(40.5)
Vitamin C (mg)	40	27.2±12.4(68.0)	40	24.4±10.43(60.7)
Iron (mg)	27	13.42±2.4(49.7)	32	16.13±2.61(50.4)
Zinc (mg)	11	6.93±1.33(63.0)	11	7.87±69(71.5)
Calcium (mg)	800	475.34±67.22(59.4)	800	492.05±71.20(61.5)

Values are mean± SD, "significant at 1% level"
"Significant at 5% level"
Values in parentheses indicate % RDA

2.1 Energy:

Mean energy intake at baseline in the diet of girls (13-15y) was 1930.74 kcal which was 82.8 % of its RDA (Table 4.12).However, the even at the end line the energy intake was lower than the RDI's. Mean daily energy intake in the diet of girls (16-17y) at baseline was 2135.28 Kcal which was 87.51 % of its RDA (Table 4.13). The similar trend was observed for the energy intake in the diets of the both the age groups of boys 913-15y, 16-17y). The mean daily energy intake in the diets of boys of 13-15y and 16-17y of age at base line was 2039.2 Kcal and 2501.67 Kcal, respectively, which was 74.1 % and 82.8 % respectively of RDA's.

2.2 Protein:

Protein is the major nutrient responsible for muscle tone in adolescents and keep body healthy while maintain immunity. The data presented in table 4.12 indicated that daily mean intake of protein among school going girls (13-15y) was 38.08g (73.3 % of RDA).Among boys of same group, daily mean intake of protein was 43.21g (79.5% of RDA). The daily mean intake of protein of girls and boys of 16-17 years of age was 42.27g and 49.06g, respectively, which was 76.16 and 79.77 % of RDA, respectively (Table 1& 2)

2.3 Fat:

Fat is the major nutrient as it provides energy to the body, protects body from shock and is the part of every cell as every cell is made up of lipid and proteins. The data presented in table 4.12 indicated that daily mean intake if fat among school going girls (13-15y) was 51.33g (127.5% of RDA). Among boys of the same group, daily mean intake of the fat was 54.39g (120.8% of RDA). The daily mean intake of fat of girls and boys of 16-17 years of age was 43.95g and 59.98g respectively, which was 122.7 % and 118.9 % of RDA, respectively (Table1 &2)

Table 4. Daily mean nutrient intake of adolescent girls and boys (16-17)

Nutrients	RDA for girls (16-17)	Mean intake of Girls (n=17)	RDA for Boys (16-17)	Mean intake of Boys (n=21)
Energy (kcal)	2440	2135.28±390.15(87.51)	3020	2501.67±368.73(82.8)
Protein(g)	55.5	42.27±8.55(76.6)	61.5	49.06±7.33(79.77)
Fat(g)	35	43.95±6.55(122.7)	50	59.98±8.02 (118.9)
β-carotene(µg)	4800	1946.41±632.15(40.5)	4800	2118.98±653.13(44.1)
Vitamin C (mg)	40	23.4±3.84(58.6)	40	24.4±7.49(60.7)
Iron (mg)	26	16.01±4.02(61.5)	28	19.03±5.74(67.9)
Zinc (mg)	12	7.78±0.63(58.3)	12	8.34±0.49(69.5)
Calcium (mg)	800	472.86±62.67(59.1)	800	593.00±61.48(74.1)

Values are mean± SD, "significant at 1% level"
"Significant at 5% level"
Values in parentheses indicate % RDA

2.4 β-carotene:

A very low intake of β-carotene among the adolescents of both the age group was observed. Data revealed that mean daily intake of β-carotene among girls and boys of 13-15 years was 39.6 % and 40.5 % of their respective RDA, respectively. Similar trend was observed for the mean daily intake of β-carotene among girls (40.5% of RDA) and boys (44.1 % of RDA) of 16-17 years of age.

2.5 Vitamin C:

Data show that mean daily intake of vitamin C among girls and boys of 13-15 years was 68.0 % and 60.7 % of their respective RDA, respectively. Similar trend was observed for the mean daily intake of vitamin C among girls (58.6% of RDA) and boys (60.4% of RDA) of 16-17 years of age.

2.6 Calcium:

Data revealed that mean daily intake of calcium among girls and boys of 13-15 years was 59.4 % and 61.5 % of their respective RDA, respectively. Similar trend was observed for the mean daily intake of calcium among girls (59.1% of RDA) and boys (74.1% of RDA) of 16-17 years of age.

2.7 Iron:

An extremely low intake of iron among the adolescent of both the age groups and gender was observed. Data revealed that mean daily intake of iron among girls and boys of 13-15 years was only 49.7 % and 50.4 % of respective RDA, respectively. Similar trend was observed for the mean daily intake of iron among16-17 years old girls (61.5 % of RD) and boys (67.9 % of RDA) respectively.

2.8 Zinc:

Data revealed a low intake of zinc among the adolescents of the both the age groups and gender was observed. Data revealed that mean daily intake of zinc among girls and boys of 13-15 years was only 63.0 % and 71.5 % of their respective RDA, respectively. Similar trend was observed for the mean daily intake of zinc among girls (58.3% of RDA) and boys (69.5% of RDA) of 16-17 years of age.

3. Nutrient adequacy ratio of adolescents (Diet quality)

It was observed from the results presented in table 5 that at base line the majority 84% of the adolescents' NAR was less than 0.66, inadequate diet quality. Whereas, 16% of adolescents were having fairly adequate NAR. None of them were having adequate NAR. Regarding adequacy of protein, fat, calcium, iron, zinc, β-carotene and vitamin C it was observed that 93%, 0%, 65%, 100%, 100%, 100% 100% were having inadequate NAR,

respectively. 35% were having fairly adequate NAR for calcium among the other nutrients; none of them were having adequate NAR pertaining to protein, calcium, iron, zinc, β-carotene and vitamin C, respectively.

Table 5 Nutrient Adequacy Ratio of adolescent (n=100) (%)

Nutrients	Nutrient Adequacy Ratio (NAR)*		
	Inadequate (<0.66)	Fairly adequate (0.66 − <1.00)	Adequate (≥1.00)
Energy(Kcal)	84%	16%	NIL
Protein(g)	93%	7%	NIL
Fat(g)	NIL	NIL	100%
Calcium(mg)	65%	35%	NIL
Iron(mg)	100%	NIL	BIL
Zinc(mg)	100%	NIL	NIL
β-carotene(µg)	100%	NIL	NIL
Vitamin C(mg)	100%	NIL	NIL
*NAR- Nutrient Adequacy Ratio. Figures in parenthesis indicate %ages			

CONCLUSION:

The 24- hour recall data on nutrient intake and clinical signs of nutritional deficiencies was also collected on 100 adolescents. Mean intake of energy, protein, iron, fiber, riboflavin were below the RDA. Most of energy and nutrients came from cereals grains. Habitual pattern of food intake revealed poor intake of milk, green leafy vegetables and pulses and fruits. According to the clinical findings nearly 68% of adolescents were underweight whereas, only 32% of adolescents were normal weighted. There were no obese or over weight adolescents seen in the study. Out of those 68 %of Underweight adolescents, 40% were from the age group of 13-15 years. The extent of Vitamin C and Iron, zinc and β-carotene deficiencies were more prevalent among adolescents. The finding of the dietary pattern reveals that adolescents in the age group of 16 - 17 years could be at greater risk of nutritional stress because of inadequate dietary intake. Deficiency of protein and iron can lead them to diseases such as anaemia, PEMand lower immunity. Simultaneous substantial deficits in energy, proteins and several other nutrients in their diet stress the need for an appropriate intervention to improve their overall nutritional and physical status of the young generation of the era.

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