International Journal of Applied Research 2023; 9(1): 460-464

ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 8.4
IJAR 2023; 9(1): 460-464
www.allresearchjournal.com
Received: 06-12-2022
Accepted: 04-01-2023

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Adequacy in nutrition intake of adolescent girls in Ranchi town of Jharkhand

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Abstract
Adolescent period is a critical phase that witness rapid physical growth and sexual maturity. For girls who are future mothers, this period is characterised by the onset of menstruation and hence consumption of the right nutrients is more essential than ever. Adolescent girls who suffer from malnourishment might also face complications during pregnancy and give birth to low-birth-weight babies, further continuing the cycle of malnutrition and poor health. The present study tries to finds the nutritional status and adequacy of nutrition of adolescent girls in Ranchi Town of Jharkhand with the help of primary data of 200 adolescent girls collected through stratified random sampling. In the term of natural and human resources, Jharkhand is considered the richest state but it suffers from high incidence of malnutrition among children and anaemia among adults. The t and p-value using STATA-10 has been computed to test the null hypothesis. The finding on adequacy test of consumption of different food items, that there is only adequacy in consumption in Cereals while other food items are inadequate in nature due to demand deficit which is demand side factors such as low income of the family, lack of knowledge about balanced diets, etc.

Keywords: Adolescent, malnutrition, nutritional status, Adequacy

Introduction
Adolescent population and health of adolescents is a very special issue and is focus of attention globally for various reasons. The world today is home to the largest generation of 10–19 year olds in our history and number over one billion and their population is continuously increasing. The World health organization (WHO 2000) defines adolescents as individuals between the ages of 10–19 years and they make up about 20% of the world's population. There are about 1.2 billion adolescents in the developing nations, making up one fifth to one quarter of the population. Some 1.2 billion adolescents (10-19years old) make up 18 percent of the world's population. 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. About 30% of India's population belongs to the adolescent age group of 10-19years. Nutritional status of a population according to Martorell [1] can be considered both as an 'input" as well as "output" indicator. Children's nutritional status as an "output" tends to capture the overall situations in which children are born and brought up in a population. There is no doubt about the fact that nutritional status of the children is a good yardstick for overall socioeconomic development and its importance has been recognized by international organizations like WHO, UN etc. In this study input side has been used to find the nutritional status of adolescent girls and to find health status output side has been used.
The main source of nutrition is diet constituents. The balanced diet is recommended by nutrition expert. A balanced diet is a diet that contains an adequate quantity of the nutrients that we require in a day and includes six main nutrients, i.e. Fats, Protein, Carbohydrates, Vitamins, Mineral and water. In addition, there are some micronutrients essential for health like calcium, zinc, potassium, iron, Sodium chlorides, phosphorus, magnesium etc. Balanced Diet leads to a good physical and a good mental health, it helps in proper growth of the body, also, it increases the capacity to work and increases the ability to fight or resist diseases. The balanced diet should contain all the essential nutrients. Different food items have different proportions of nutrients present in them. The requirements of the nutrients depend on the age, gender, and health of a person.

During adolescent age may rapid changes takes place in the body like in hormones, height, weight, appearance, physique and mental etc. This leads to additional energy and nutritional requirement and lake of these may lead to deficiencies, which may be about metabolic disorders during adulthood.

Adequacy of each component is important determinant for proper nutrition. Some by other studies, like Mary Story [2], AK Sharma, D. Shukla, AT Kannan [3], nutrition is based on calorie intake. But it may be possible that required calorie is fulfilled by any one or some food items. So, a good study is that which includes adequate constituent of diet. In this study this point of view has been used to find the nutritional status of adolescent girls.

The present study tries to finds the nutritional status, adequacy of nutrition of adolescent girls in Ranchi Town with the help of primary data of 200 adolescent girls collected through stratified random sampling.

Requirement of nutrition is different with respect to age, sex, nature of work etc. In Indian context the leading nutrition expert is carried by ICMR [4]. To find the adequacy of food index is a simplest method, to check whether there is adequacy in food or not which the ratio of actual intake to required intake. This index has been used in this study.

Objectives of the Study

1. To know whether there is adequacy in nutrition intake in pre-puberty adolescent girls.
2. To know whether there is adequacy in nutrition intake in post puberty adolescent girls.

Hypotheses

1. There is no inadequacy of nutrition (by 10 food intake index) in adolescent girls in pre puberty period.
2. There is no inadequacy of nutrition (by 10 food intake index) in adolescent girls in post puberty period.

Data and Methodology

The study is based on based on primary data which have been collected from 200 sampled adolescent girls selected by proportionate stratified random sampling technique in Ranchi town, the capital of Jharkhand. 6 wards (3 tribal dominated wards- 3, 4 and 5 & 3 from nontribal dominated wards-19, 24 and 25) were randomly selected after stratifying the 53 wards of Ranchi town. As the period of adolescence covering 10 to 19years is marked by two distinct stages, the sample has been accordingly selected to cover Pre-puberty period (10 to 12years) and Post puberty period (13 to 19years). Pre-puberty period is a period in which girls have not reached their puberty. Generally in India it is assumed that at the age of 12, girls reach their puberty. So the age group of 10-12years has been taken as the phase of pre puberty and the age of 13 to 19 is taken as post puberty period. A pilot study was done to mark the households having adolescent girls of pre-puberty age, post-puberty age and both ages. 1/3rd of the sampled adolescent girls comprises of girls between 10 to 12years. The rest 2/3rd include the girls of age 13 to 19 i.e., those who are in the post puberty phase. Thereafter from each selected ward, 12 adolescent girls of pre-puberty stage and 23 of post puberty stage were selected by method of systematic random selection of households. The final sample of 200 adolescent girls comprised of 68 adolescent girls of pre-puberty period and 132 of post-puberty period.

The sampling frame is as follows

Sample Plan/Design

Stage 1: 6 Wards out of total 53 Wards of Ranchi Town

A total of 200 adolescent girls were selected by proportionate stratified random sampling method as per design given below			
a) 3 Tribal Dominated Wards (100 Adolescent girls)		**b) 3 Non-tribal Dominated Wards (100 Adolescent girls)**	
Pre Puberty*	**Post Puberty****	**Pre-puberty***	**Post puberty****
Ward 1:12	23	Ward 1: 12	23
Ward 2:12	23	Ward 2: 12	23
Ward 3:12	23	Ward 3: 12	23
Total Selected 36	69	36	69

Comprised in sample, ***Only 34 were finally taken, ****Only 66 were finally taken

1st Round: Selection of households having

Pre-Puberty Adolescent Girls	Category I
Post-Puberty Adolescent Girls	Category II
Both	Category III

2nd Round: A systematic Sampling has been done and get data from household having both Pre & Post Puberty Adolescent girls.

Data for study has been collected through pre-framed schedule which collects information on nutritional status and adequacy in consumption of nutrition intake in sampled adolescent girls. Nutritional index has been computed for each respondent as the ratio of reported average daily food intake of past week by recall method and the required intake as suggested by Nutrition expert group I.C.M.R. Of the various categories of dietary recommendations, the balanced diet (gm) at moderate cost for school going urban children was found to be most suitable in the study, hence selected for Recommended Dietary Allowance (RDA). Of the various food plans, the 10 food plan comprising cereals, pulses, green leafy vegetables, other vegetables, milk, fat and oils, meat/fish/egg, sugar/Jaggery and peanuts was used it is as most suited diet in urban areas of social groups. The study covers adolescent girls of ages 10 to 19. Hence the chart of required food intake covering these ages has been taken. The table is given below:

Table 1: Balanced Diet (gm) at moderate cost for school children and adolescents

Foodstuffs	School Children				Adolescent Girls	
	10-12years		13-15years		16-18years	
	V*	NV**	V*	NV**	V*	NV**
Cereals	290	290	400	400	320	320
Pulses	70	60	70	50	70	50
Green Leafy Vegetables	100	100	100	100	150	150
Other Vegetables (roots & Tubers)	75	75	150	150	150	150
Fruits	100	100	100	100	100	100
Milk	600	400	600	400	600	400
Fat & Oils	30	30	30	30	30	30
Mean, Fish and eggs	---	60	---	80	---	80
Sugar & Jiggery	30	30	30	30	30	30
Peanut	40	30	40	30	50	30

Source: ICMR (Handbook of Food and Nutrition, Swaminathan, M. S., 2010)
*Vegetarian, **Non-vegetarian

In this study the Nutritional index has been computed for each food item for each adolescent girl separately. For example actual intake by a 12 year sampled adolescent girl per day for cereal is 400gm, pulses is 30gm, green leafy vegetables is150gm, other vegetables like roots and tuber is 100g, fruits is 0gm, milk is 0ml, fats and oils is 20ml, flesh food is 5gm, sugar and jiggery is 20gm and peanut is 10gm, while the required intake per day should be 290gm, 60gm, 100gm, 75gm,11gm, 400gm, 30gm, 60gm, 30gm and 30gm respectively. Nutritional index for the particular girl has been calculated by dividing actual intake by required quantity i.e. for cereals, nutritional index=Actual intake/ required intake=400gm/290gm=1.37. Similarly for other 9 items for the particular adolescent girl has been calculated. As an example, the Nutritional Index of 24th sampled tribal adolescent girl who was 12years old and belongs to ward no-4 and was of Sarna religion may be explained by the table below-

Table 2: Food wise & composite nutritional index of a single sampled adolescent girl

Food items (in grams)	Cereal	Pulses	Green veg.	Other veg.	Fruits	Milk	Fats and oils	Flesh food	Sugar & Jaggery	Peanut
Required intake	290	60	100	75	100	400	30	60	30	30
Actual intake	400	30	150	100	0	0	20	5	20	10
Nutritional Index	1.37	.5	1.5	1.33	0	0	.66	.08	.66	.33
Composite Nutritional Index	.627									

Source: Own computation from primary Data

Nutritional Index has been computed across both the puberty phases (pre and post), across both social groups (Tribal and Non-Tribal) and across all religions. The study is based on cross sectional study carried out in Ranchi town, from the month of September to December, the capital town of State of Jharkhand.

Adequacy of nutrition of adolescent girls in study area

An adequate diet should contain the required amounts of all foods and should supply all the dietary essentials in the required amounts. One of the main objectives of the present study to find the adequacy in consumption in all the food items ie whether the adolescent girls (Aged 10-19) get sufficient food quantity of each of the 10 types of food or not. To test the adequacy in consumption, STATA-10 one sample t-test has been done. In this software the mean has been computed and tested. To test adequacy in consumption in different food items, null hypotheses have been formulated as follows:

H_O: There is no inadequacy of nutrition of ith food (where I=1……..10) in sampled adolescent girls in the study area ($\mu=\mu_0$)

And Alternative Hypothesis is,

H_1: There is inadequacy of nutrition of ith food (where I=1……..10) in all sampled adolescent girls in the study area ($\mu<\mu_0$)

The mean nutritional status by food intake in adolescent girls (Pre and Post) has been reflected by the following table. The std. dev. has also been shown. The t and p-value using STATA-10 has been computed to test the null hypothesis. The result along with interpretation for each of the 10 food items has also been shown below:

Table 3: Adequacy test of different food items using one sample t-test (STATA-10)

Food items	Mean N.I	Std. Dev.	T-Value	P-Value	Null Hypothesis
Cereals and Millets(x_1)	1.96	10.38	2.67	0.008	Accepted
Pulses	.499	.271	26.03	0.0000	Rejected
Green leafy vegetables	.781	.372	29.64	0.0000	Rejected
Other vegetables	.625	.243	36.34	0.0000	Rejected
Fruits	.392	.320	36.34	0.0000	Rejected
Milk	.390	.315	17.31	0.0000	Rejected
Fats and Oils	.624	.347	25.43	0.0000	Rejected
Flesh Food	.537	.306	23.74	0.0000	Rejected
Sugar & Jaggery	1.08	.603	25.353	0.0000	Rejected
Peanut	.30	.288	14.74	0.0000	Rejected
Composite N.I	.718				

Source: Own Computation from primary data

When it has been tested whether there is adequacy in consumption in each food items or not, it has been found that in Cereals, Sugar & Jaggery, the average consumption to required consumption is adequate, as mean of Cereals is 1.96, the standard deviation is less (10.38) and the p-value is 0.008. The average consumption to require consumption is also high in Sugar & Jaggery as mean has been calculated 1.082, the standard deviation is very less (.603) and pvalue is 0. Hence null hypothesis is rejected.

The present study is based on two distinct period of adolescent, so these two periods has been discussed separately.

Adequacy of nutrition of adolescent girls in Pre-puberty period in study area

To test adequacy in consumption in different food items, null hypotheses have been formulated

As,

H_O: There is no inadequacy of nutrition of i^{th} food (where I=1……..10) in Pre-Puberty adolescent girls in the study area. ($\mu=\mu_0$)

And Alternative Hypothesis is,

H_1: There is inadequacy of nutrition of i^{th} food (where I=1……..10) in Pre-Puberty adolescent girls in the study area. ($\mu<\mu_0$)

The result along with interpretation for each of the 10 food items has also been shown below:

Table 4: Adequacy test of different food items using one sample t-test (STATA-10)

Food items	Mean N.I	Std. Dev.	T-Value	P-Value	Null Hypothesis
Cereals and Millets	3.33	17.806	1.543	0.127	Accepted
Pulses	.519	.225	19.02	0.00	Rejected
Green leafy vegetables	.968	.496	16.085	0.00	Rejected
Other vegetables	.527	.184	23.50	0.00	Rejected
Fruits	.359	.287	10.316	0.00	Rejected
Milk	.380	.229	13.68	0.0000	Rejected
Fats and Oils	.659	.481	11.307	0.00	Rejected
Flesh Food	.571	.362	12.21	0.00	Rejected
Sugar & Jaggery	1.304	.771	13.951	0.00	Rejected
Peanut	.257	.262	8.106	0.00	Rejected
Composite N. Index	.8874				

Source: Own Computation from primary data (Appendix)

Above table explains that there is adequacy in consumption only in the food item cereals and millets. In all other food items, the consumption level are inadequate. In case of other 9 food items null hypothesis is rejected which means there is inadequacy in consumption of pulses, green vegetables, other vegetables like root and tubers, fruits, milk, fats and oils, flesh food, sugar and jiggery and peanuts. For this result one of the most important reasons is that the Government, by its PDS only provides cereals. It may also possible that due to demand deficit they don't consume enough due to low income, lack of more knowledge about proper diet and their quantity, may be religion don't give more emphasis to eat such foods. These factors lead to demand side factors. Due to these factors, the consumption of milk, fruits, peanut etc. are not sufficient. Supply side factors includes lack of availability, this does not hold in the study area as it comes under urban area, so there is no supply side factors in the study area.

Adequacy of nutrition of adolescent girls in post-puberty period in study area

To test adequacy in consumption in different food items, a null hypothesis is formulated as,

H_O: There is no inadequacy of nutrition of i^{th} food (where I=1……..10) in Post-Puberty adolescent girls in the study area. ($\mu=\mu_0$)

And Alternative Hypothesis is,

H_1: There is inadequacy of nutrition of i^{th} food (where I=1……..10) in Post-Puberty adolescent girls in the study area. ($\mu<\mu_0$)

The result along with interpretation for each of the 10 food items has also been shown below:

Table 5: Result of adequacy test of different food items using one sample t-test (STATA10)

Food items	Mean	Std. Dev.	t-value	p-value	Null Hypothesis
Cereals and Millets	1.26	.258	56.14	0.00	Accepted
Pulses	.489	.292	19.210	0.00	Rejected
Green leafy vegetables	.685	.240	32.78	0.00	Rejected
Other vegetables	.675	.254	30.48	0.00	Rejected
Fruits	.408	.335	13.99	0.00	Rejected
Milk	.396	.352	12.91	0.00	Rejected
Fats and Oils	.606	.252	27.59	0.00	Rejected
Flesh Food	.520	.274	21.01	0.00	Rejected
Sugar & Jaggery	.968	.459	24.213	0.00	Rejected
Peanut	.323	.299	12.37	0.00	Rejected
Composite N.I	.633				

Source: Own Computation from primary data

Here also the null hypothesis is accepted only in case of cereal and millets which implies that there is adequacy in consumption of cereal and millets in sampled adolescent girls in the study area. In case of other 9 food items null hypothesis is rejected which means there is inadequacy in consumption of pulses, green vegetables, other vegetables like root and tubers, fruits, milk, fats and oils, flesh food, sugar and jiggery and peanuts.

Conclusions

Adequate nutrition is important for girls not only because it helps them be productive member of society but also because of the direct effect maternal nutrition has on the health and development of the next generation. There is an acute scarcity of programs targeted at adolescents in the region. The major resource being lack of studies and disaggregated data on health and nutrition based on age, education level, caste, religion, occupation of family head etc. Govt. has taken some initiatives to address the problem of adolescent nutrition but they are few and on small and experimental basis, mostly aimed to control anaemia.

The finding on adequacy test of consumption of different food items, that there is only adequacy in consumption in Cereals while other food items are inadequate in nature due to demand deficit (demand side factors) such as low income, lack of knowledge about balanced diets, etc**.** The present study concludes that the health and nutrition of adolescent girls is most important in any demographic trait. In the study area it was found that the nutritional status of adolescent girls was poor than the world status.

Suggestions

Adolescence comprises $1/5^{th}$ to $1/6^{th}$ of population of any area and this important demographic dividend has to be considered in framing policies. This health and nutrition are of prime concern especially in underdeveloped regions, Jharkhand being one. Data on girls nutritional status can be a powerful tool for informing communities and governments about the nature, extent and consequences of female malnutrition but data need to be collected regularly, analysed and disseminated. Policy makers can also make the

government and programme managers accountable for improving the outcomes.

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