e-ISSN: 0975-5160, p-ISSN: 2820-2651

Available online on www.ijtpr.com

International Journal of Toxicological and Pharmacological Research 2022; 12 (6); 185-195

Original Research Article

Is Nutritional Anaemia Dilemma of Only Lower Socioeconomic Strata: A Comparative Study of Iron Deficiency Among Adolescents of Government and Private Schools

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Received: 15-04-2022 / Revised: 18-05-2022 / Accepted: 01-06-2022

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Conflict of interest: Nil

Abstract

Objective: A comparative study of iron deficiency among adolescents of government and private schools ,research was done to understand the burden of iron deficiency among the middle and upper socio-economic strata and compare it with the underprivileged ones.

Methods: A cross-sectional study was done in Indore where 500 adolescent students, of age group 10-18 years, from government (250 students) and private (250 students) schools were individually studied and compared clinically for signs and symptoms of iron deficiency. Their weight, height and BMI were also recorded to assess nutritional status and relate it clinically with micronutrient deficiency.

Results: 45.8% students belonged to lower socio-economic strata out of which 74.2% students attended government school, whereas 54.2% students belonged to middle and upper socio-economic strata, out of which 92.1% attended private schools. 34% students from government school and 32% students from private school students had signs and symptoms of anaemia. The prevalence of iron deficiency anaemia was higher in female population, i.e. 61.3% as compared to males, 11.8%.

Conclusion: Anaemia being an iceberg disease, often has no obvious clinical signs and symptoms but every other child, especially adolescent female irrespective of her socio-economic status is having iron deficiency anaemia. The almost equal prevalence of anaemia in private schools and upper socio-economic strata can be attributed to the high consumption of JUNCS among adolescents which is often ignored.

Keywords: School health study, Adolescents, Anaemia

Introduction

The world's adolescent population faces a series of serious nutritional challenges affecting their growth and development as adults. It is the second growth spurt of life, as both boys and girls undergo different experiences in this phase. Yet, adolescents

remain a largely neglected, in which the needs of adolescent girls in particular, are still ignored. Malnutrition in school children implies to both undernutrition and overnutrtion and micronutrients share a major share on its etiology. With one sixth of the global population residing in India, one third of about two billion people suffering from vitamin and micronutrient deficit are in India. Under article 24, paragraph 2c of the Convention on the Rights of the Child, to which India a party is, India has committed to yielding "adequate nutritious foods" for children and owing to it India started started midday meal scheme on 15 August 1995 which serves millions of children with fresh cooked meals in almost all the government run and government aided schools, yet In 2006, more than 36 million died of diseases due to deficiencies in micronutrients and of all unnourished children India has more share African and Sub-African countries [1-7].

Iron deficiency anaemia in adolescents : IDA, VAD and IDD accounted for 2.4% of overall disease burden in the developing countries. Nutritional anaemia is the most prevalent form of anaemia in adolescents with a prevalence rate of more than 80% in major states, especially in M.P. and Chattisgarh where it ranges to 90%. But in severely anaemic adolescents who were admitted in a tertiary care hospital, megaloblastic anaemia was most common type of anaemia (42.5%). Anaemia in community was found to be significantly associated with history of worm infestation, attainment of menarche, vegetarian diet (low intake of iron, vitamin B12 and folate) were also significantly associated with severe anaemia. The National Family Health Survey-3 (NFHS-3) data suggests that the prevalence of anaemia in adolescent girls (15-19 years) is 56%. According to National Nutrition Monitoring Bureau Survey (NNMBS) 2006, the prevalence of anaemia in adolescent girls (12-14 years) is 68.6% whereas in (15-17 years) it is 69.7%. There is a significant increase in the requirement of iron from preadolescent level, 0.7-0.9 mg iron per day to as much as 1.37-1.88 mg per day in adolescent boys and 1.40-3.27 in adolescent girls. Where prevalence of anaemia in pubertal girls is severe, preventive iron supplementation of 60 mg/day iron with 400 ug folic acid along with vitamin C supplementation for 3 months should be considered. Adolescent boys should also receive preventive iron supplementation where prevalence of anaemia among them is severe.

Consumption of JUNCS among adolescents :There has been a dramatic modifications in lifestyle patterns including consumption of unhealthy food choices, eating outside the home (mainly at fast food restaurants), sedentary behaviours, especially among girls, all of which put adolescents at nutritional risk. Fast food contains more saturated fat, added sugars, salt, and energy and less dietary fiber; therefore, eating fast food seems to have an adverse effect on health. A strong positive association has been reported between fast food consumption and both weight gain and insulin resistance, suggesting that fast food increases the risks of obesity and type 2 diabetes.

Till date there is no data published on comparison of health status of government and private school in my study area and compared to the vast amount of work done in pregnant mothers and young children, there are relatively few published studies, evaluating deficiencies of micronutrients in adolescents.

Materials and Methods

Place of study: The study will be conducted in government and private schools in Indore.

Duration of study: The duration of study was from November 2017 to March 2019 (18 months). It was a cross sectional observational study in which students from government and private schools were examined as per the proforma .

Inclusion criteria:

- School children of age group 10-19 years from government school of Indore.
- School children of age group 10-19 years from private school of Indore.
- Students, age group 10-19 years studying from 4th standard to 12th standard were selected randomly at a single point for the study.

Exclusion criteria:

- School children below 10 years of age and above 19 years of age.
- Adolescents suffering from any chronic illness and is already on iron and folate supplements

Consent: A verbal and written explained consent was obtained from school authority, mainly Principle of the schools after explaining the nature and purpose of the study (Annexure 2 and 3).

Ethical clearance: Ethical clearance was obtained from the Ethical Clearance Committee, Sri Aurobindo Institute of Medical Sciences, Indore, prior to start of the study.

Methodology: All children from age group 10-19 years studying in government and private schools in Indore were randomly selected for the study. These children were examined clinically with personal and family details noted. Students meeting the inclusion criteria were selected. Anthropometric examination was done to assess the nutritional status. It is a cross-sectional observational type of study carried over a period of one year in inpatient children in department of Paediatrics, SAMC & PGI.

We divided the students included into two major groups, Government school A group and Private school B group. Both male and female students were selected without any discrimination, randomly. For government school study, Bal Vinay Mandir Senior Secondary School of Excellence and Government Middle School, Alwasa located in Indore was selected. A written and verbal consent was taken from the school authority and method of the study was explained. Students were from class 4th to class 12th, mainly class 6th-8th. 250 students were examined; their personal details including name, age, gender, date of birth, current address, guardian name, their contact number were recorded. Their socio-economic status was assessed using Kuppuswamy classification and was further grouped into lower, middle and upper classes. Students were asked for any active health issues, recent chief complaints present at the time of examination. Their significant past history and family history was also recorded.

Anthropometric examination was done. Their weight, height and BMI were recorded to assess undernutrition and obesity. Head to toe examination was done to see for hair changes, vision, oral hygiene including oral ulcers and dental caries. General examination was done to look for pallor, icterus, cyanosis, clubbing, oedema and lymphadenopathy and any other significant general examination. Systemic examination including respiratory, abdominal, cardiovascular and central venous system to look for any chronic and active illness. Specific general and systemic examination was done for micronutrient deficiencies. For iron deficiency pallor, koilonychias and irritability was taken as signs and symptoms.

Similar procedure was done for private schools. Study was conducted in three private schools of Indore and 250 students all together from; Mother India Children Care Academy, Takshshila Academy Sr. Secondary School and G.S. Academy Higher Secondary School Indore were examined.

Government and private school students were compared on the following grounds:

a. Socioeconomic status

b. Active health issues/ chief complaints

c. General examination

d. Head to toe examination
e. Systemic examination
f. Iron deficiency

Observation Chart

Table 1: showing comparison of gender distribution along with their anthropometric examination

	Government School	Private School	**p-value**
Number	250(50%)	250(50%)	-
Age in years	13.41±1.7	12.31±1.4	0.0001
Gender, (M: F)	150(30%):102(20.4%)	138(27.6%):110(22.0%)	0.231
Height(cm)	150.68±12.7	141.60±10.0	0.0001
Weight(kg)	38.53±9.1	32.41±7.1	0.0001
BMI($kg/m^{2)}$	16.78±2.5	16.78±2.4	0.001
M: male; f: female; BMI: body mass index Data are present in number (percentage) and mean± standard deviation			

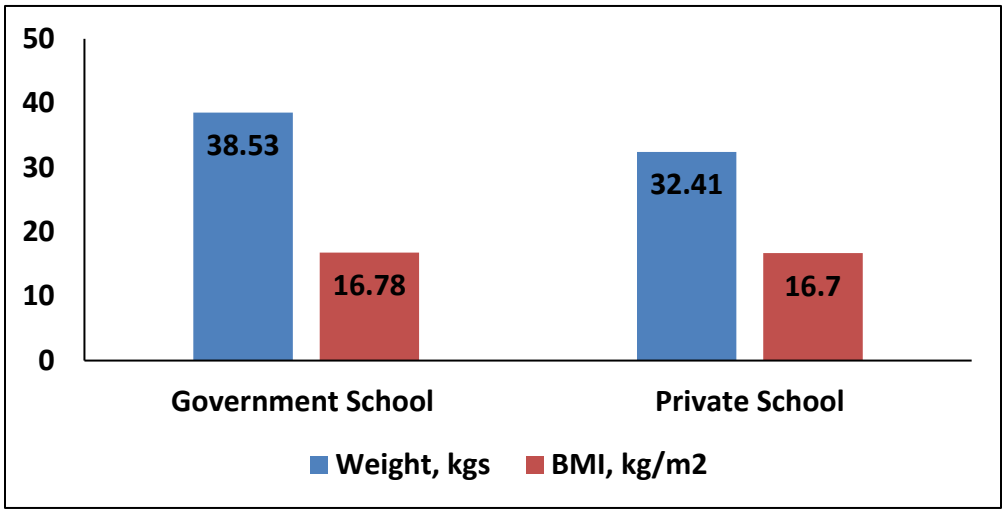

Figure 1: Showing bar graph representation of gender wise BMI

Table 2: Represents a comparison between socioeconomic status of student government and private school

Socioeconomic Status	Government School	Private School	Total	p-value
Lower	170	59	229(45.8%)	0.0001
Middle	79	115	194(38.8%)	
Upper	3	74	77(15.4%)	

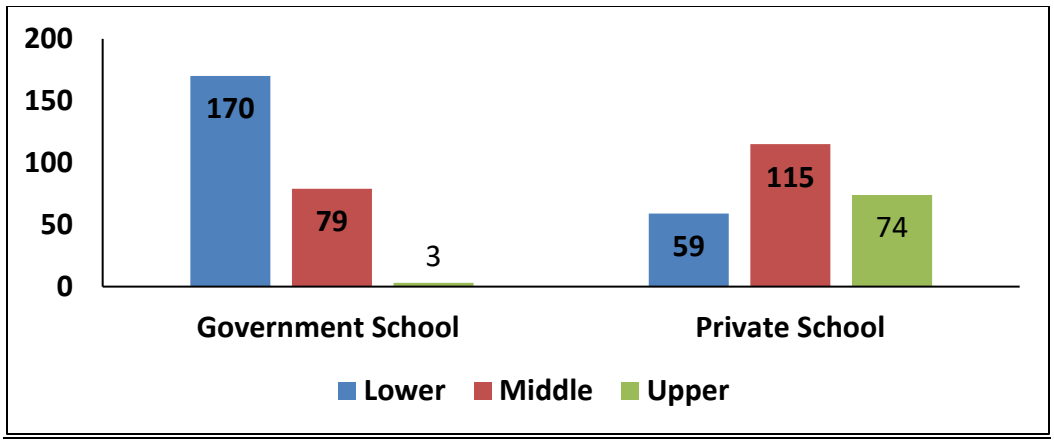

Figure 2: Showing bar graphical representation of distribution of government and private school students according to their socio-economic strata

Table 3: Showing comparison of general examination between government and private schools students

General Examination	Government School	Private School	p-value
Pallor	85	80	0.412
lcterus	0	0	-
Clubbing	0	0	-
Cyanosis	0	0	-
Oedema	4	4	0.627
Lymphadenopathy	3	8	0.104
Other	3	4	0.489

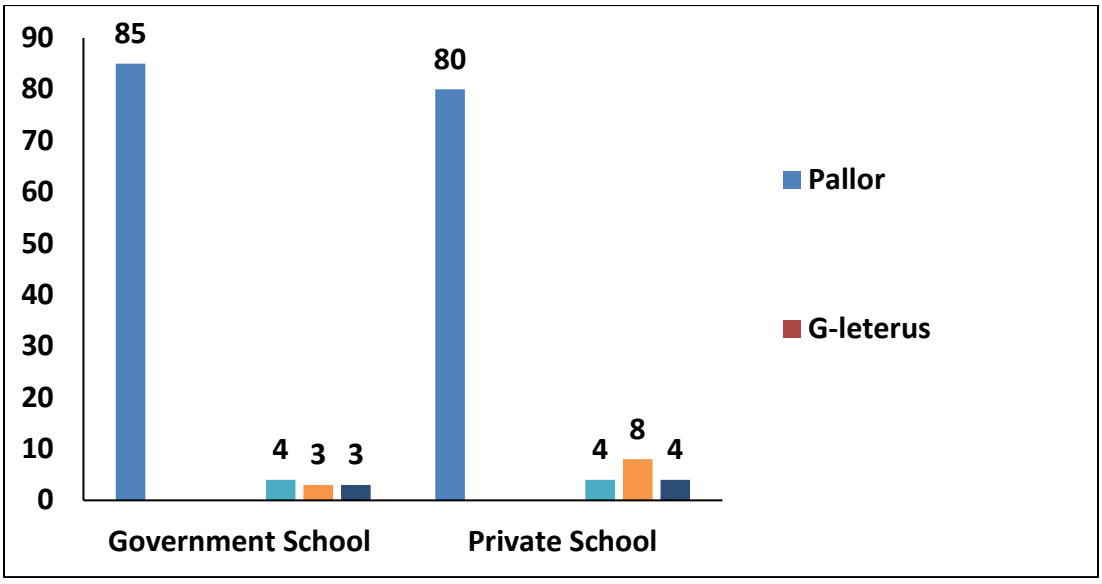

Figure 3: Showing bar graphical representation of general examination in students of government and private schools

Table 4: Representation of data of iron deficiency anaemia of adolescents of government and private school

Iron deficiency	Government school	Private school	P-value
Pallor	85	80	0.373
Koilonychia	7	16	0.039
Irritability	18	44	0.056

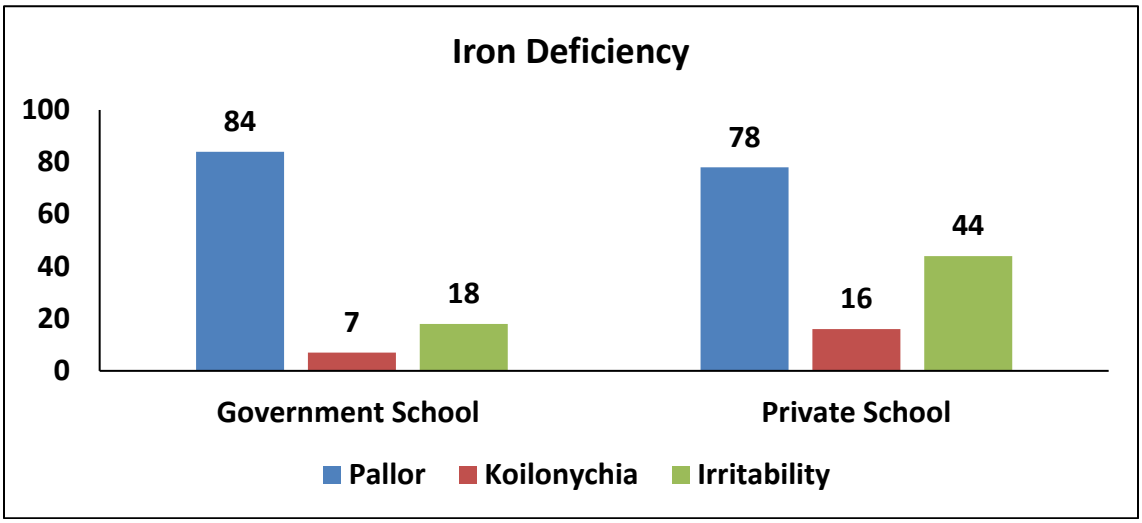

Figure 4: Showing graphical representation of data of iron deficiency anaemia

Table 5: Comparison of iron deficiency anaemia among male and female student population in both government and private schools

	Male	Female	Total	P-value
Normal	254	82	336	<0.05
Iron deficiency anemia	34	130	164	
Total	288	212	500	

Results

45.8% students belonged to lower socio-economic strata out of which 74.2% students attended government school, whereas 54.2% students belonged to middle and upper socio-economic strata, out of which 92.1% attended private schools. 34% students from government school and 32% students from private school students had signs and symptoms of anaemia. The prevalence of iron deficiency anaemia was higher in female population, i.e. 61.3% as compared to males, 11.8%.

Statistical Analysis

Statistical analysis was done using Statistical Package of Social Science (SPSS Version 22; Chicago Inc, USA). Data comparison was done by applying specific statistical tests to find out the statistical significance of the comparisons. Quantitative variables using mean values and qualitative variables using proportions. Significance level was fixed at $P \leq 0.05$. Statistical test employed for the obtained data in our study was Chi-Square (X^2) Test.

Discussion

Anemia prevalence in young children continues to remain over 70% in most parts of India and Asia despite a policy being in place and a program that has been initiated for a long time. The irreparable damage that anemia in childhood can cause particularly to the development of a young child on one hand and the knowledge and mechanism available for its control on the other, makes this silent morbidity completely unacceptable in modern times where we strive for millennium development Goal 4. An understanding of the risk factors for nutritional deficiency and infections resulting from them is critical for improved diagnosis and preventive management. When children present with nutritional deficiencies, their socio-economic status, family background, living standards and academic status of these children should also be assessed.

In the present study, around 50.4% students were randomly taken from government school and 49.6% were taken from private schools from 4^{th} standard to 12^{th} standard, which is similar to Laxmaiah A *et al*, G.Srihari *et al*, Babita *et al*, Mrigen Kr *et al* where a community based cross sectional study was done among school and pre-school children and observed for iron deficiency. In the present study, there was no significant difference between male and female gender population in government and private schools. This is similar to study done by Mrigen Kr. Deka *et al* [12-15].

In the present study, there was no significant difference between height, weight and BMI of adolescents of government and private schools which is similar to the study done by Prakash PS *et al*. Although there are studies done in which higher BMI was recorded in private schools as compared to government schools as in Patnaik *et al*, Jagadesan *et al* and Marwah *et al* [16-19].

In present study, there was a significant difference in the economic strata of students studying in government and private schools, which is similar to the study done by NC Ashok *et al*, in which the difference in the nutritional status can be attributed to difference in the socioeconomic strata. Data on demographic details, dietary habits, and physical activity of child and education status, occupation, monthly income of their parents were collected. This study attempt to highlight the dual nutritional problem, under-nutrition among the lower socioeconomic class on one hand and growing epidemic of obesity among the affluent on the other.

General examination was done in all the students selected from both type of schools. In my study, micronutrient deficiency was started with examination for iron deficiency anaemia. The clinical signs and symptoms taken were pallor, irritability and nail changes, including koilonychia. Iron deficiency was found prevalent in both government and private school students. There were no obvious symptoms but every other child especially adolescent female had pallor, which is similar to study done by Jhansi Rani P *et al* and Verma *et al*. Students from private school were also found to have pallor inspite coming from middle and upper socio-economic strata and affluent society which can be attributed to high consumption of JUNCS which has nil nutritive value and adds only to obesity among adolescents [20-21].

Nutritional status of MHSES children in India needs attention especially with respect to the high prevalence of anemia, overweight and obesity. There are indications that micronutrient deficiencies exist, but sufficient data are lacking, in particular biochemical data. A current estimate, using well designed methodologies, of prevalence of micronutrient deficiencies and information on the etiology of anemia among children of MHSES groups would be valuable to help understand the nutritional status and extent of micronutrient malnutrition.

The goals of the Government of India's tenth

five-year plan for anemia control for children includes:Screening of children for anemia wherever required and appropriate treatment for those found to be anemic ,Reducing the prevalence of anemia by 25% and moderate and severe anemia in children by 50% .Unlike other countries where the policy refers to anemia control, but there is no specific intervention program, in India, the Nutritional Anemia Prophylaxis program is in existence since 1970. As anemia has continued to be highly prevalent among children, the program has been re-designated as the National Nutritional Anemia Control Program in 1991. This program aims at decreasing the incidence of anemia among the vulnerable sections of the population, namely pregnant and lactating women, intrauterine device (IUD) users, and children in the one-to-five year age group. For children between 12 and 59 months the program prescribes one tablet of 20 mg elemental iron and to treat children found clinically anemic 100 ?g of folate for 100 days in a year.

The program is envisaged to be implemented as part of the RCH II package now and is being implemented through the existing health system and Integrated Childhood Development Scheme (ICDS) run by the Department of Women and Child Development. Studies suggest that iron and folic acid (IFA) tablets given to young children under the age of three years is not well-accepted and efforts have been made to recommend that liquid IFA be replaced by IFA tablets for young children. This recommendation has been endorsed in the Government of India's policy in the year 2007 and it further endorses the requirement of iron supplementation to children below one year of age as well .

Micronutrient malnutrition is a major public health nutritional problem in India, and iron deficiency anaemia (IDA) continues to be a major nutritional problem of public health significance, affecting all physiological groups, of which rural pre-school children are the most vulnerable.Arlappa N *et al* studied prevalence of anaemia among rural pre-school children of West Bengal, India. The main aim of the community-based cross-sectional study was to assess the prevalence of anaemia among rural pre-school children.The prevalence of anaemia is a severe nutritional problem of public health significance. Therefore, iron supplementation and health and nutrition education programmes should be strengthened. The community needs to be encouraged to diversify their diets by consuming iron-fortified and iron-rich foods [22].

Srihari G,Seshadri S *et al* studied nutritional status of affluent Indian school children.This paper reviews available literature on nutritional status of Indian school children 6-18 years from middle and high socio economic status .Studies showed that anemia prevalence (hemoglobin concentration <120 g/L) ranged from 19-88% across five different cities in India. Other micronutrient deficiencies including, folate, riboflavin, niacin, vitamin C, vitamin A, and vitamin B12 were also present based on biochemical parameters in one study and clinical signs of deficiency in three other studies. Overweight and obesity were prevalent among 8.5-29.0% and 1.5-7.4% respectively among school children, as indicated by 11 studies. Predominant components in children's diet were cereals and pulses, followed by milk and milk products; the fruits and vegetables component was comparatively lower [23,24].

Kashyap *et al* saw prevalence and pattern of anaemia and correlation with booking status in a new Medical College in Haryana, India. Similar study by Gomber S *et al* on prevalence & etiology of nutritional anaemia among school children of urban slums. Kotecha PV *et al* studied nutritional anemia in young children with focus on Asia and India. Their article reviews in detail the magnitude of child anemia and the mechanism for its occurrence, and deals, in detail, about what needs to be done, what difficulties we face,

and how to overcome them, with the primary focus on iron-deficiency anemia (IDA) [25-27].

Olivares M *et al* studied anaemia and iron deficiency disease in children. In the developing world the prevalence of iron deficiency is high, and is due mainly to a low intake of bioavailable iron. However iron deficiency often co-exists with other conditions such as, malnutrition, vitamin A deficiency, folate deficiency, and infection. In tropical regions, parasitic infestation and haemoglobinopathies are also a common cause of anaemia. In the developed world iron deficiency is mainly a single nutritional problem. The conditions previously mentioned might contribute to the development of iron deficiency or they present difficulties in the laboratory diagnosis of iron deficiency [28].

Arnold F, Parasuraman S,Kumar A *et al* presented their strategies of the National Nutritional Anemia Control Program (NNACP) in India. The program, implemented through the Primary Health Centers and its subcenters, aims at decreasing the prevalence and incidence of anemia in women of reproductive age. It focuses on three vital strategies: promotion of regular consumption of foods rich in iron, provisions of iron and folate supplements in the form of tablets to the high risk groups, and identification and treatment of severely anemic cases. The program solicits the support of various departments in implementing the dietary modification and supplementation measures.There are proposed initiatives to improve coverage, quality, and efficiency of the NNACP, the Ministry of Health and Family Welfare in India organized a National Consultation on Control of Nutritional Anemia to review the epidemiology of nutritional anemia and the existing policy on nutritional anemia control [29].

Shamah T *et al* enumerated the role of enriched foods in infant and child nutrition. Fortified and enriched foods are products whose original composition has been modified–through addition of essential nutrients–to satisfy specific population needs. For the fortification of foods to have a positive impact on nutritional status, the micronutrients added must be well absorbed and utilized by the organism (bioavailability). Diverse factors affect bioavailability, such as the nutritional status of individuals, the presence in the diet of substances which facilitate or inhibit its absorption, interactions among micronutrients, illnesses, and chemical characteristics of the compound used for fortification. In summary, food fortification is a low-cost, relatively simple strategy that may reach a wide range of people, and contribute to reducing the high prevalence of micronutrient deficiencies affecting children, especially in poor countries. The costs due to losses of human capital and their repercussions on health and future development are very high. Building links among academic researchers, politicians, food manufacturers and consumers is essential in order for food fortification to be efficacious and effective, and therefore should be considered as part of an integral strategy to combat micronutrient deficiencies [30].

Conclusion

The conclusion drawn was though the overall prevalence of iron deficiency anaemia is still prevalent among adolescents belonging to lower socioeconomic strata but the private schools with huge infrastructure and a high fee structure, and with maximum population from upper and middle socio-economic strata also shares burden of malnutrition in form of obesity and nutritional anaemia.

One important conclusion drawn from the study is whether the micronutrient deficiency is only the dilemma of lower socio-economic strata? With the enormous branding, advertising and availability of non-nutritive junk food items in the market the affording

socioeconomic strata is at higher risk of developing non communicable diseases like obesity, metabolic syndrome and multiple micronutrient deficiencies.

Limitations of the Study

- It was only observational study so quantification of iron deficiency could not be accurately assessed.
- As it was a cross sectional study, students who were not present at that time could not be included in the study, which also caused a limitation in the sample size.
- As the study includes children from 10-19 years, and the whole research was based on the information given by the children without any documented evidence of the latter, so accurate clinical and dietary history could be missed and manipulated. There was no follow up to the clinical status of these students.

What this Study Add to Existing Knowledge The government of India has implemented so many programmes for the nutrition of children including immunizations, deworming, iron folic acid supplementation, salt fortification with iodine and iron but still the deficiency and its scholastic consequences are quite evident which forces us to question about various government schemes like mid day meal programme.

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