International Journal of Home Science 2020; 6(2): 359-364

International Journal of Home Science

ISSN: 2395-7476
IJHS 2020; 6(2): 359-364

www.homesciencejournal.com
Received: 04-03-2020
Accepted: 06-04-2020

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Dietary intake of iron and nutritional status of the (10-12) year old female school going children

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Abstract
The term 'nutritional anemia' encompasses all pathological conditions in which the blood hemoglobin concentration drops to an abnormally low level, due to a deficiency in one or several nutrients. An abnormally low hemoglobin level due to pathological condition(s) is defined as anemia. Iron deficiency is one of the most common among school going female children, but not the only cause of anemia. Other causes of anemia include chronic infections, particularly malaria, hereditary hemoglobinopathies, and folic acid deficiency. It is worth noting that multiple causes of anemia can coexist in an individual or in a population and contribute to the severity of the anemia. Anemia is a serious condition that impacts cognitive development. The effects of iron deficiency that are observed in the first six months of life can lead to permanent brain damage. An afflicted child is likely to remain vulnerable to infection and continue to have lower immunity toward infection throughout childhood. Also, the overall appetite is reduced and this vicious cycle perpetuates a series of events that must be stopped, to ensure the child's health Although it is well established that iron-deficiency anemia among children is responsible for higher morbidity and subsequent mortality, systemic studies to quantify them are practically difficult for a number of epidemiological reasons, and therefore, are not available. Iron-deficiency anemia rarely exists in isolation, and to disentangle the proportion of the role played by anemia from the total level of malnutrition and other precipitating factors, although desirable, is difficult to get at the community level.

Keywords: nutritional anemia, chronic infections, malnutrition, community level.

Introduction
The term 'nutritional anemia' encompasses all pathological conditions in which the blood hemoglobin concentration drops to an abnormally low level, due to a deficiency in one or several nutrients. The main nutrients involved in the synthesis of hemoglobin are iron, folic acid, and vitamin B_{12}. In public health terms, iron deficiency is by far the first cause of nutritional anemia worldwide. Folic acid deficiency is less widespread and is often observed with iron deficiency. Vitamin B_{12} deficiency is far rarer. Therefore, the focus in this article is on Iron-deficiency anemia in children.

Worldwide, at any given moment, more individuals have iron-deficiency anemia than any other health problem. Anemia is the most common morbidity among micronutrients and affects health, education, economy, and productivity of the entire nation. Anemia, like fever, is a manifestation and not a disease *per se*. The most common group among the causes for anemia is malnutrition and among that group, iron deficiency makes up the bulk of it. A large portion of iron deficiency is preventable with appropriate and timely intervention. Iron deficiency is the most common nutritional disorder in the world. The numbers are staggering: two billion people – over 30% of the world's population – are anaemic, mainly due to iron deficiency; and in developing countries this figure is frequently exacerbated by malaria and worm infections. Iron deficiency affects more people than any other condition, constituting a public health epidemic. It exerts the heaviest overall toll in terms of ill-health, premature death, and lost earnings. The effects of anemia on children are the most dire because their bodies are still developing, including the brain, which is the fastest developing organ in infancy and early childhood.

Iron deficiency, and the anemia that results from it, is a major health problem affecting more than 3.5 billion people in developing countries, reducing vitality for the young and old alike, and impairing the cognitive development of children.

Anemia is most often a hidden deficiency, with a few overt symptoms. Policy makers often fail to recognize the massive economic costs, service providers often fail to recognize the significant health consequences, and societies are too often ignorant of anaemia's capability to cause permanent cognitive defects, denying children their right to full mental and emotional development, before they ever reach a classroom.

Often programs and projects to prevent and control anemia have been constrained by the erroneous perception that effective and practical interventions are not available. These perceptions have their origin in poor implementation, rather than the availability of the interventions. It adds to the burden on the health systems, affects learning and school performance, and reduces adult productivity.

Iron-deficiency anemia can usually be prevented at a low cost, and the benefit/cost ratio of implementing preventive programs is recognized as one of the highest in the realm of public health. This information has equipped everyone in public health to take action against this longstanding problem and to do whatever is needed to be done. Because anemia is the most common indicator used for screening iron deficiency, the terms 'anemia,' 'iron deficiency,' and 'iron-deficiency anemia' are often used interchangeably. However, prior to the development of iron-deficiency anemia, there have been mild-to-moderate forms of iron deficiency, where various cellular functions are impaired. We need to differentiate between, iron deficiency, anemia, and iron-deficiency anemia, to put each of them in their proper perspective.

Prevalence of Anaemia

Anaemia is a worldwide problem that is highly prevalent in developing countries of the world with the highest incidence reported in Asia and Africa. Anaemia prevalence is high in children and its cause is frequently multifactorial. It has been estimated that about 40% of the world's population (more than 2 billion individuals) suffer from anaemia with a prevalence of 48% in school-aged children. Anaemia occurs as a result of abnormally low haemoglobin due to pathological conditions. Iron deficiency is one of the most common causes of anaemia, other causes include chronic infections such as malaria, worm infestation, hereditary haemoglobin pathies and other micronutrient deficiency particularly folic acid. The prevalence of iron deficiency is usually detected by low serum ferritin concentrations while iron deficiency anaemia is typically diagnosed by haemoglobin concentrations, accompanied by biochemical evidence of iron deficiency such as low serum ferritin concentration. Highest prevalence of anaemia is seen in developing countries. Anaemia is widely prevalent in India and affects both sexes and all age groups.1 Global anaemia prevalence when examined for each physiological group using the WHO global data on anaemia reports that most affected groups are pregnant women (69%) and school age children (33%). In Asia the prevalence of nutritional anaemia is particularly high in countries such as Bangladesh (74-80%), Indonesia (37-73%), and India (34-69%).3 Since several decades, it has been known to be important problem in most tropical countries. WHO global data show, that anaemia due to iron deficiency affects approximately 30% of World's population and about 37% of school children. In Indian children, high prevalence of anaemia varying from 27% to 90% has been reported in different studies. The population differences in the prevalence of anaemia are explained by environmental factors affecting nutrition, chief among these are economic status, ethnic customs and geographic considerations Because of the high prevalence and severe consequences of anaemia are long lasting and possibly irreversible in children has led international organizations like WHO, UNICEF, NFHS, Govt. of India and other NGO's agencies to reduce the prevalence of anaemia as major goal. Several strategies were implemented to achieve this goal including iron fortification, use of iron supplements, deworming for school children, Mid-day meal programme and education regarding nutrition, but the goal still needs to be achieved. Study aimed to know the prevalence of anaemia and various factors associated with it in school going children with the objectives to know the prevalence of anaemia in school going children, to study the association between Socio-Economic Status (SES) and anaemia and to detail the association between dietary habits and anaemia.According to WHO study prevalence of anaemia in school children was 33%. The prevalence of anemia in our study is more than the prevalence of anaemia by WHO worldwide study in school children. The reason may be that we have included both Government and private school children of urban area in Hyderabad but WHO prevalence of anemia which has included children worldwide developed as well as developing countries, cities as well as rural areas, slums as well as affluent society. Overall prevalence of anemia in school children of 6-12 years in urban Hyderabad was found to be 53.6%, which is of severe public health magnitude according to WHO.

Physiology of Haemoglobin Production

Erythropoietin is the primary hormone regulator of red blood cell (RBC) production. In the fetus, erythropoietin comes from the monocyte/macrophage system of the liver. Postnatally, erythropoietin is produced in the peritubular cells of the kidneys. Key steps in red blood cell differentiation include condensation of red cell nuclear material, production of hemoglobin until it amounts to 90 percent of the total red blood cell mass and the extrusion of the nucleus that causes loss of RBC synthetic ability. Normal RBCs survive an average of 120 days, while abnormal RBCs can survive as little as 15 days. The hemoglobin molecule is a hemeprotein complex of two pairs of similar polypeptide chains. There are six types of hemoglobin in developing humans: the embryonic, Gower-I, Gower-II, Portland, fetal hemoglobin (HbF) and normal adult hemoglobin (HbA and HbA_2). HbF is the primary hemoglobin found in the fetus. It has a higher affinity for oxygen than adult hemoglobin, thus increasing the efficiency of oxygen transfer to the fetus. The relative quantities of HbF rapidly decrease to trace levels by the age of six to 12 months and are ultimately replaced by the adult forms, HbA and HbA_2.

Justification

An abnormally low hemoglobin level due to pathological condition(s) is defined as anemia. Iron deficiency is one of the most common, but not the only cause of anemia. Other causes of anemia include chronic infections, particularly malaria, hereditary hemoglobinopathies, and folic acid deficiency. It is worth noting that multiple causes of anemia can coexist in an individual or in a population and contribute to the severity of the anemia. Anemia is a serious condition that impacts cognitive development. The effects of iron deficiency that are observed in the first six months of life can lead to permanent brain damage. An afflicted child is likely to remain vulnerable to infection and continue to have lower immunity toward

infection throughout childhood. Also, the overall appetite is reduced and this vicious cycle perpetuates a series of events that must be stopped, to ensure the child's health Although it is well established that iron-deficiency anemia among children is responsible for higher morbidity and subsequent mortality, systemic studies to quantify them are practically difficult for a number of epidemiological reasons, and therefore, are not available. Iron-deficiency anemia rarely exists in isolation, and to disentangle the proportion of the role played by anemia from the total level of malnutrition and other precipitating factors, although desirable, is difficult to get at the community level.

Objectives

1. To assess the iron nutritional profile of the (10-12) year old female School going children.
2. To find out the consumption pattern of selected Iron intake of the (10-12) year old female School going children.
3. To educate the (10-12) year old female school going children regarding iron deficiency in order to prevent or reduce incidences of anemia.

Material and Methods

The project entitled "Dietary Intake of Iron and Nutritional Status of (10-12) Year of School going Children"

The study will be conducted using the following methodology.

Design of the study- Cross sectional and descriptive design will be opted.

Area of the study-The study will be conducted in the school of rural area of Prayagraj.

Technique of sampling-Random sampling will be the Technique of sampling followed.

Population of the study- 10-12 year old school going children of group with special needs.

Sample Size of the study-30 (10-12) year old school going children of group with special needs will be taken for the study from rural area school of the Prayagraj district.
The Prayagraj city will be selected purposively for the study.

Tools and Techniques

Educational aid:-Educative Leaflets will be used to educate them.

Collection of data:-open-ended questionnaire will be used for the data collection from the respondents.

Methods of Enquiry and Data Collection

The survey method will be used as the method of enquiry. The selected respondents will personally interviewed and necessary information collected using a pre structured and pretested questionnaire. The questionnaire included aspects which led to the fulfilment of the objectives of this study. 24 hours dietary recall (Swami Nathan) will be done and average nutrient intake per day calculated of each respondents using the nutritive value for Indian foods by C. Gopalan *et al.*
The questionnaire included the following information:

- General Profile Survey
- Dietary intake (24 hours dietary recall method)
- Anthropometric measurement
- Clinical sign and symptoms

General Profile Survey

Data regarding general profile of the 10-12 year old school gong children will be collected using the first part of the questionnaire. The section covered aspects including respondent's name, age, type of family, Monthly income, monthly expenditure on food items.

Dietary Survey

Diet surveys constitute an essential part of any complete study of nutritional status of individuals or groups, providing essential information on nutrient intake levels, sources of nutrients, food habits ; attitudes. It will help to following information. A diet survey will be conducted.

24 hour dietary recall

24- Hour dietary recall method is widely used in dietary surveillance. The interviewer asks the respondents questions to obtain information on the types and the amount actually consumed by an individual one or more specific days.

Anthropometric Measurement:

Nutritional anthropometry is concern with the measurement of variations of physical dimensions, the gross composition and degree of nutrition. Hence, anthropometric measurements are useful criteria for assessing the nutritional status. The anthropometric measurement including height and weight are recorded using the process prescribed by **Gibson (1990).**

Height Measurement

Height (cm) of the subject will be taken with the help of measuring tape in centimetres by sticking it to the wall. The subject will be made to stand erect, look straight with buttocks, shoulders and head touching the wall, heels together, toes apart and hands hanging loosely by the sides.

Weight Measurement

The weighing scale with maximum capacity of 120 kg and the minimum division of 0.5kg will be used to weigh all the subjects. The respondents will be made to stand erect on the weighing scale with minimum of clothes, without footwear, not learning against and holding anything and the weight was recorded in kg.

Body mass index (BMI) – BMI was calculated as the standard of nutritional status anthropometrically, by using the following formula derived from the weight and height.

$$BMI = \frac{\text{Weight (kg}}{\text{Height (m}^2\text{)}}$$

Statistical Analysis- The collected data will be analysed with the help of t-test, anova and other appropriate statistical technique.

Result and Discussions

The data collected and tabulated under the study are presented.
General information

Table 1: Distribution of the respondents of the (10-12 year old female) school going children according to the general information.

Particulars	Distribution	Frequency	Percentage
Family type	Joint	11	36.66
	Nuclear	19	63.33
Occupation	Business	8	26.66
	Service	10	33.33
	Any other	12	40
Total family income	Below 5000	8	26.66
	5000-10000	9	30
	10000-20000	10	33.33
	21000-25000	3	10
Education of the children's parents	Uneducated	7	23.33
	Primary	5	16.66
	High school	12	40
	Intermediate	6	20

Family type: The majority of respondents, 63.33 percent belonged to Nuclear family and 36.66 percent respondent belonged to Joint family.

Occupation of the family: According to the table most of the (10-12 year old female) school going children's family head were in business 26.66 percent and in the government and private service belongs to 33.33 percent and about 40 percent belong to any other occupation respectively (agriculture etc.)

Total family income: showed that 26.66 percent monthly income belonged to below 5000 and 30 percent monthly income belonged to 50, 00-10,000, 33.33 percent monthly income belonged to 10000-20000 rupees and 10 percent monthly income belong to 21000-25000 per month.

Education of the children's parents - the majority of the (10-12 year old female) school going children's parents were belonged to the Uneducated that is 23.33 percent and 16.66 percent are primary pass and high school pass belonged to 40 percent followed by intermediate belonged to 20 percent.

Anthropometric Measurements

Table 2: Distribution of the (10-12 year old female) school going children according to BMI

BMI Range	Frequency	Percentage
18.5 (underweight)	11	36.66
18.5-24.9 (normal)	5	16.66
25-29.9 (obese grade I)	6	20
30-40 (obese grade II)	5	16.66
40 (obese grade III)	3	10
Total	30	100

Table no 2- shows that 16.66 percent of (10-12 year old female) school going children were normal BMI, 36.66 percent children were underweight and obese grade I children strength were 20 percent, and grade II were 16.66 percent and obese grade III were 10 percent respectively.

Diet and Nutrient intake

Table 3: Distribution of the (10-12 year old female) school going children according to the food habits.

Food habits	Frequency	Percentage
Vegetarian	14	46.66
Non-Vegetarian	7	23.33
Eggetarian	9	30
Total	30	100

Table 3- study shows that majority number of the (10-12 year old female) school going children in which 46.66 were percent vegetarian, 23.33 percent were non vegetarian and 30 percent were eggetarian.

Table 4: Average daily nutrients intake of the (10-12 year old female) school going children

RDA	Reference value of the 10-12 year old female school going children	Average intake of nutrients of the 10-12 year old female school going children	Difference between ranges of 10-12 year old female school going children	Percentage of of 10-12 year old female school going children)
Energy(kcal)	2010	1600	-410	125.625
Protein(g)	40.04	31	-9.04	129.161
Fat(g)	35	23	-12	152.17
Calcium(mg)	800	550	-250	145.45
Iron(mg)	27	17	-10	158.82
Retinol(µg)	600	400	-200	150
Vitamin C (mg)	40	26	-14	153.84

Source- ICMR, (2010)

Table 4- shows the average nutrients intake of all nutrients with reference to energy, protein, fat, calcium, iron, and retinol and vitamin C compared to the RDA given by the ICMR (2010). According to RDA energy intake is 2010 kcal and 125.625 percent is consumed by the (10-12 year old female) school going children which shows that they intake energy in low amount, Similarly protein intake 40.04 and percent is 129.161 which means that protein intake in the (10-12 year old female) school going children is low, the recommend fat intake is 35 gm and 152.17 percent is consumed by the female children is very low. The recommended Calcium intake is 800 mg and 145.45 percent is consumed by the female children that is also low intake amount to consume, the recommended Iron intake is 27 mg and 158.82 percent is consumed by the female children that is also low intake amount to consume. The recommended retinol and vitamin c intake is 600ug and 40 mg and the percentage of the intake amount of these nutrients are 150 mg and 153.84 mg that is also very low amount to intake respectively. iron deficiency anemia is the most common cause of anemia. However, other conditions like nutritional deficiencies, acute and chronic inflammation, parasitic infections, growth spurt, increase in iron requirements, increased iron loss from the body during the menstruation, inherited or acquired disorders of hemoglobin synthesis, RBC production, or survival are also considered cause of anemia (WHO 2014).

Table 5: Distribution of the (10-12 year old female) school going children according to the food consumption frequency

Food group	Daily		Occasionally		Never	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Cereals	30	100	-	-	-	-
Pulses	13	43.33	14	46.66	3	10
Milk & Milk products	14	46.66	16	53.33	-	-
GLVs	10	133.33		43.33	7	23.33
Roots & tubers	25	83.33	5	16.66	-	-
Fruits	6	20	16	53.33	8	26.66
Meat & Poultry	4	13.3	11	36.66	15	50
Fats & Oils	30	100	-	-	-	-
Sugars	30	100	-	-	-	-

Table 5-- shows that the food consumed daily by (10-12 year old female)school going children included cereals, pulses, milk and milk products, green leafy vegetables, roots and tubers, fruits, meat and poultry, fats and oils and sugar. Regarding the consumption of cereals, it was found that 10-12 year old female school going children consumed cereals daily by 100 percent. Pulses were consumed daily by 43.33 percent, occasionally 46.66 percent and some children never intake the pulses by 10 Percent respectively. Milk and milk products were consumed daily by 46.66 percent, occasionally 53.33 percent. Green leafy vegetables were consumed daily by 133.33 percent, occasionally 43.33 percent and some children never intake the GLV by 23.33 percent respectively. Roots and tubers were consumed daily by 83.33 percent, occasionally 16.66 percent respectively. Fruits were consumed daily by 20 percent, occasionally 53.33 percent and some children never intake the Fruits by 26.66 percent respectively. Meat and poultry were consumed daily by 13.33 percent, occasionally 36.66 percent and some children never intake the meat and poultry by 50 percent respectively. Fats and oils, sugars are consumed daily by 100 Percent respectively. The impact of anemia among adolescent girls is still public health problem globally although there are specific actions like encouraging consumption of iron-rich foods through dietary change, nutritional education, treatment and prevention of parasitic infections, weekly iron supplementation to prevent iron-deficiency anemia, and improving iron status among adolescent girls (WHO and World Health Bank 2011).

Table 6: Distribution of (10-12 year old female) school going children according to their clinical sign and symptoms.

Signs and Symptoms	Frequency	Percentage
Obesity		
Absent	8	26.66
Present	22	73.33
Swelling on the Face		
Absent	12	40
Present	18	60
Disease		
Carpal tunnel syndrome (hand tingling or pain).	12	40
Cold.	8	26.66
Low blood pressure	10	33.33
Eye		
Stare double vision	4	13.33
Difficulty in closing the eyes.	7	23.33
Watery eyes.	9	30
Dry eyes.	10	33.33
Tongue		
Furred	18	60
Light brown	12	40
Skin		
Scaly skin	12	40
Patchy and dry skin	10	33.33
Loss of hair	8	26.66

Table-6 shows that obesity was present 26.66 and it absent 73.33 percent and swelling on the face was present in 40 percent and absent 60 percent. Disease like carpel tunnel syndrome (hand tingling or pain) was 40 percent, cold was 26.66 percent and low blood pressure was 33.33 percent respectively.In eye there was stare double vision was observed 13.33 percent and difficulty in closing the eyes were observed 23.33 percent. Watery and dry eyes was observed 30 percent and 33.33 percent. Furred tounge was observed 60 percent and light brown 40 percent respectively. Scaly skin and paddy dry skin was examined 40 percent and 33.33 percent respectively. Loss of hair was seemed 26.66 percent respectively. Iron is necessary for healthy function and development of brain. There is evidence that its deficiency without anemia causes fatigue. It can affect visual and auditory functioning and is weakly associated with poor cognitive development in children Lozoff *et al.*, 2007.

Conclusion

This study provides, clinical symptoms, nutritional profile, and Consumption pattern among the (10-12 year old female) school going children. Iron deficiency, and the anemia that results from it, is a major health problem affecting more than 3.5 billion people in developing countries, reducing vitality

for the young and old alike, and impairing the cognitive development of children. Anemia is most often a hidden deficiency among female school going children.

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