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Survey on dietary habit, consumption of iron rich food and awareness in females

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Abstract

Micronutrients are essential part of our life as they perform vital functions in the body. Iron is one of micronutrients which involved in major functions like gastrointestinal processes, immune system, regulation of body temperature, a component of heme in hemoglobin (the protein which is responsible for carrying oxygen throughout the body). Iron deficiency anaemia (IDA) is a major issue worldwide including Asian countries like India. Consumption of iron rich diet helps in preventing IDA and data collected for 25 female showed that females consuming iron rich diet on regular basis or either consuming any supplement for iron are having less chances of being anemic in comparison with females who have less or no consumption of iron rich diet or supplement. Additionally 11 of 25 females consuming vitamin C rich diet are having less chances to be anemic in comparison to others.

Keywords: Iron, absorption, symptoms, female

Introduction

Females falling under adolescence age group undergoes many changes which includes both physiological and mental or neurological. At this certain age group there is requirement of adequate amount of energy, vitamins and minerals (Wiafe *et al.* 2021) [21]. Vitamins and minerals both plays major role and they cannot be synthesized in human body, it must be obtained from diet (Godswill *et al.* 2020) [10]. A balanced diet including vegetables, fruits, dairy products can provide sufficient amount of vitamins and minerals (Tardy *et al.* 2020). Mineral deficiency and especially iron deficiency is the most common factor associated with morbidity and mortality among people across the world. Micronutrient deficiency is basically the state where either they are insufficient or are not being utilized properly.

34 Iron is one of the trace elements but is necessary in terms of human life. Iron helps in many vital functions in the body including erythropoiesis, immune system functioning, DNA replication and repair, mitochondrial functioning, enzymatic reactions and regulation of body temperature (Cronin *et al.* 2019) [4]. Individual from any age group may experience iron deficiency but pregnant women, adolescent girls and children are at greater risk of developing such deficiencies. Iron deficiency is most specifically seen in females due to increased iron loss during menstruation and increased demand during pregnancy period (Dugan *et al.* 2021).

35 Deficiency of iron can be seen as a result of high requirement and less intake in specific age group, excessive blood loss or abnormal absorption (Camaschella *et al.* 2019) [3]. Iron deficiency can result into clinical symptoms like: fatigue, cheilitis and dry mouth due to altered epithelial cells. In certain cases, iron deficiency for longer period may lead to angina or heart failure in older age group (Camaschella *et al.* 2019) [3]. Sometimes symptoms like headache and urge to eat non edible things (pica) like dirt can also be seen (Dugan *et al.* 2021). Deficiency of iron in children for long term also affects their cognitive development due to brain and mitochondrial damage (Jáuregui-Lobera *et al.* 2014) [13].

36 Dietary iron is basically present in two types: 1. Heme iron 2. Non-heme iron. Heme iron can be easily absorbed in our body and can be obtained from animal sources. 10% or more of total absorbed iron is heme iron (Ems *et al.* 2021) [8]. Non-heme iron is not well absorbed and it can be obtained from the plant-based sources (Cronin *et al.* 2019) [4]. Dietary iron can either be stored or can be transferred into the bloodstream by the protein ferroprotein. Around 30mg/kg iron present within RBCs (red blood corpuscles) as Hb (haemoglobin), 4mg/kg with muscle tissues as myoglobin and 2mg/kg as iron containing enzymes in cells (Moll *et al.* 2017) [16]. The homeostatic system which maintains normal range of iron in body is maintained by hepcidin, a peptide hormone (Percy *et al.* 2017) [18]. Dietary iron is absorbed by the mucosal part of the duodenum (0.6-1.5 mg/d) and proximal jejunum (3 mg/d).

Dietary habit plays major role like continuous consumption of plant-based food items caused low iron bioavailability in certain group of people (Saini *et al.* 2016)^[19]. The amount of iron absorbed depends upon the type of iron intake and circumstances and it ranges from 5- 35%. The common heme iron food sources are: meat, poultry, fish and the nonheme iron sources are: cereals, legumes, pulses, fruits and vegetables. Some major inhibitors of iron are phytic acid, polyphenols and calcium. Ascorbate and citrate acts as enhancers which enhances the iron absorption by solubilizing the metal in duodenum. Meat, fish and poultry also act as enhancer of iron (Abbaspour *et al.* 2014)^[1]. Thus this work is planned to conduct a survey on awareness on iron, sources and consumption of iron rich foods in females.

Materials and Methods

Data was collected for 25 females who have done their blood test reports from healthians. After analysing the reports oral dietary recall method was done to ask about their dietary habits under which several questions were asked like: (a) vegetarian or non-vegetarian; (b) consumption of vitamin C rich food; (c) consumption of tea/coffee; (d) how often there is consumption of iron rich foods. After evaluation dietary guidelines were recommended to iron deficient females depending upon the severity of the deficiency.

Results and Discussion

After consulting with total 25 females who have done their blood test reports from healthians, 20 out of 25 females falling under age (14-35y) were found to be mild, moderate and severe anemic, under different category of anemia. Out of 20 females, 11 females were found to be mildly anemic, 8 females were moderately anemic and 1 was severely anemic.

After evaluation oral dietary recall was taken to observe dietary habits in anemic females. It has been found that out of all 25 females 6 females were non-vegetarian and 19 were vegetarian. Out of all the 6 non-vegetarian females 4 were non-anemic and 2 were mildly anemic, out of all 19 vegetarian females 9 were mildly anemic, 8 were moderately anemic 1 was severely anemic and 1 was non anemic.

According to the data collected it has been found that females consuming vegetarian diet are more likely to be anemic in comparison to females consuming non-vegetarian diet. According to the meta-analysis which was a combination of data of total 24 cross-sectional study showed that there is lower level of serum ferritin found in vegetarians in comparison with non-vegetarians (Haider *et al.* 2018)^[12]. Higher percentage of vegetarian females, compared to nonvegetarian participants have low ferritin level below the deficiency cutoff level and also having high prevalence of low iron stores, iron depletion and IDA (iron deficiency anemia) according to the findings of the review by (Pawlak *et al.* 2018)^[17]. Vegetarians are having more iron intake in comparison with non-vegetarians but the total bioavailability of non-vegetarian sources are higher than the vegetarian sources of iron showing that the vegetarian females are at higher risk of iron deficiency anemia as per (McLean *et al.* 2020)^[15].

Out of total 25 females 14 females were not taking any vitamin C rich diet or supplement and 11 females agreed that either they are consuming vitamin C rich food in their regular routine diet or either they are taking vitamin C supplement (Figure 1). Out of 11 females who were consuming vitamin C

rich food in regular diet 5 females were non anemic, 4 females were mildly anemic and 3 were moderately anemic. While 14 females who were not consuming any vitamin C rich food in regular diet 7 were found to be mildly anemic and 6 females were moderately anemic and 1 was severe anemic. It was observed that females consuming vitamin C rich diet are having less chances to be anemic in comparison with who either have less consumption or don't have any consumption of vitamin C rich food sources. Vitamin C intake promotes iron's redox cycling and improves the availability of transferrin iron to chelate which increases the soluble form of iron (ferrous) hence, vitamin C enhances the efficacy of iron chelators and significantly enhances the hemoglobin levels according to discussed by (Elalfy *et al.* 2016)^[7]. Vitamin C enhances the nontransferrin mediated absorption of iron and transferrin mediated uptake of iron by intracellular reduction and by reducing the form of iron from ferric (Fe³⁺) to ferrous (Fe²⁺) (Granger *et al.* 2018). Vitamin C rich diet can enhance the absorption of iron in the intestine and transport of iron resulting into increased formation of ferritin (Astuti *et al.* 2018)^[2].

Out of total 25 females total 20 females agreed that they are consuming tea and coffee even more than 3 times a day, 3 females agreed that they are consuming tea and coffee once in a day and 2 females were not at all consuming tea and coffee (Figure 1). However 2 females who were not consuming tea and coffee at all were found to be non anemic. Out of 3 females who were consuming tea and coffee once in a day 2 of them found to be non anemic and 1 was mildly anemic. Out of 20 females who were consuming tea/coffee >3 times/day 10 were found to be mildly anemic, 8 moderately anemic, 1 severe anemic, 1 non anemic. According to the data collected it has been found that females having more consumption of tea and coffee are having more chances of having less iron, Hb levels in the body in comparison with females having less or no consumption of tea and coffee. High caffeine intake reduces the absorption of iron in the body by suppression of iron bioavailability and increasing inflammation (Dziembowska *et al.* 2022)^[6]. According to nutrition desk reference there should be minimum 1 hour gap between intake of any iron rich food, supplement and caffeine containing beverage because consumption of both the things together can reduced the absorption of iron up to 80% in the body which can lead to increased risk of IDA (Wolde *et al.* 2014)^[22].

Out of total 25 females 16 females were not taking any iron rich food or supplement and 9 females agreed that they are consuming iron rich food on regular basis (Figure 1). Out of 9 females who were consuming iron rich diet on regular basis 4 females were found to be non- anemic, 3 females found to be mildly anemic and 1 was moderately anemic. Those 16 females who were not consuming iron rich diet 8 were found to be mildly anemic, 7 were moderately anemic and 1 was found to be severe anemic and 1 was non anemic. According to the data collected it was found that females consuming iron rich diet on regular basis or either consuming any supplement for iron are having less chances of being anemic in comparison with females who have less or no consumption of iron rich diet or supplement. Daily iron supplementation effectively reduces the prevalence of anaemia and iron deficiency, raises hemoglobin and iron stores, it also reduces symptoms of IDA like symptomatic fatigue (Low *et al.* 2016)^[14].

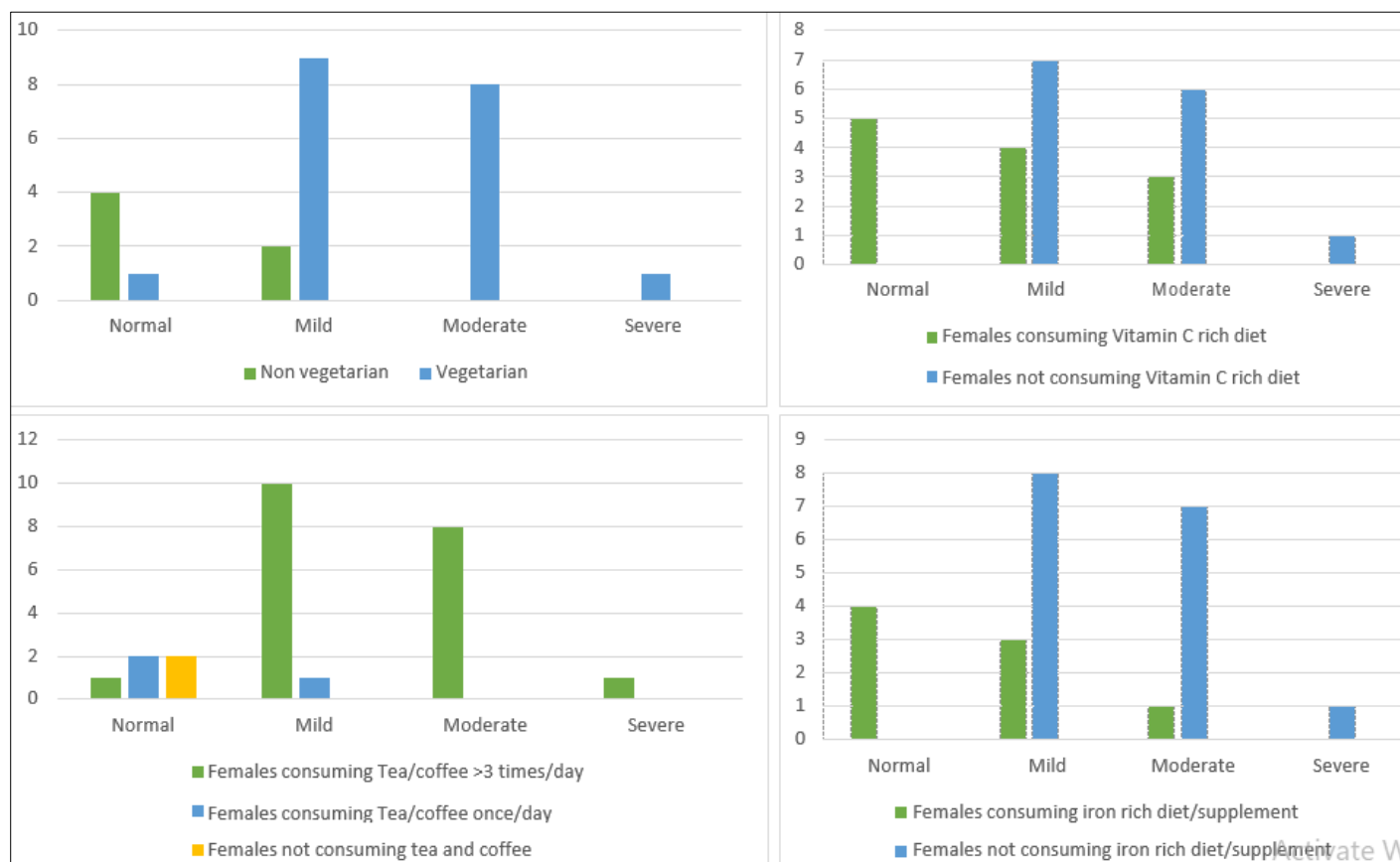


Fig 1 (A, B, C, D): Consumption pattern of 25 females selected for the study

Conclusion

All 25 females were falling under different anemic categories including mild, moderate and severe anaemia. After analyzing the reports dietary guidelines were recommended to iron deficient females depending upon the severity of the deficiency. Iron is one of the important trace elements which play many vital roles in our body. IDA is a major issue in Indian population and in many other developing countries across the world. Deficiency can be mostly due to lack of enough iron rich food or due to less bioavailability of the element. Antinutritional factors like tannins, phytates, polyphenols affect the absorption of iron can lead to its deficiency. Out of 25 females only 9 females were taking iron rich food and vitamin C rich diet. It was observed that due to consumption of tea and coffee are having more chances of having less iron, Hb levels in the body in comparison with females having less or no consumption of tea and coffee.

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