Original Article

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Public Health Section

Prevalence of Iron Deficiency Anaemia among the Reproductive Age Group Women Attending the Unani Hospital, Bangalore, Karnataka, India

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ABSTRACT

Introduction: Iron Deficiency Anaemia (IDA) is the most widespread micronutrient deficiency. Globally, nearly two billion people are affected by anaemia. This disease most often affects children, women of child-bearing age, and pregnant women. Nearly half of the pregnant women in the world are estimated to be anaemic. Its prevalence varies according to region and socio-economic conditions. The majority of those who are anaemic live in developing countries where the problem is exacerbated by limited access to inadequate resources and appropriate treatment.

Aim: To find out the prevalence of IDA in the reproductive age group women and its associated factors.

Materials and Methods: This hospital based, cross-sectional study was conducted among 400 females, of age group 15-49 years. After obtaining the written informed consent, eligible subjects were inquired about socio-demographic variables, socio-economic status, anthropometric measurements and risk factors. Required investigations were done. All the information was recorded on the semi-structured schedule form. Chi-square/Fisher's-exact test was used to find the significance of study parameters on categorical scale between two or more groups.

Results: Prevalence of IDA was found to be 42% (168/400). Prevalence of IDA was significant with habitat (p=0.0180), exercise (p=0.0004), amount of blood loss during menstruation (p<0.0001), duration of flow during menstruation, (p=0.0020), consumption of fish (p=0.0002), consumption of legumes (p=0.002), consumption of green leafy vegetable (p<0.0001).

Conclusion: Results confirmed an increased prevalence of IDA in women of reproductive age group.

Keywords: Haemoglobin, Hypochromic and microcytic, Semi-structured schedule

INTRODUCTION

According to World Health Organisation (WHO), anaemia is defined as "a condition in which the content of blood haemoglobin is lower than the normal as a result of a deficiency of one or more essential nutrients, regardless of the cause of such deficiency". Anaemia is established if the haemoglobin is below the cut-off points recommended by WHO [Table/Fig-1] [1-3].

Age group and gender	Haemoglobin (g/dL)
Adult male	13
Adult female, non-pregnant	12
Adult female, pregnant	11
Children, 6 months to 6 years	11

[Table/Fig-1]: Haemoglobin cut-off levels for diagnosing anaemia, in accordance with the 2001 World Health Organisation definitions [1-3].

Out of types of the concern disease, the most significant contributor to the onset of anaemia is iron deficiency so that IDA and anaemia are used synonymously, and the prevalence of anaemia has often been used as a proxy for IDA [2-5]. According to National Family Health Survey-3 (NFHS-3), the prevalence of anaemic women in reproductive age groups (15-49 years) of India is 55.3% as a whole and 51.5% in Karnataka state [6]. In India, this silent emergency is rampant among women in the reproductive age group (15-49 years), children (6-35 months) and population of low socio-economic strata [3]. Women of child bearing age are at higher risk for developing IDA. Despite recent economic growth and preventive efforts, anaemia remains especially prevalent in India and is the key cause of disability across the world. Previous studies reported many possible causes of anaemia in the Indian context, such as poor intake of iron, reduced intake of vitamin C and lower gastric acidity in comparison to European descent populations. Repeated child bearing, lactation, and inadequate access to nutritional supplements after menarche and during pregnancy can cause anaemia or intensify it further among women [7]. Iron deficiency is associated with extreme health conditions such as diminished ability to function, fatigue, malaise, depression, neurological dysfunction, poor focus or attention etc., [8].

So, considering the gravity of the situation, the present study was undertaken to find the prevalence of anaemia in the above mentioned reproductive age group women and factors associated with it.

MATERIALS AND METHODS

This hospital-based cross-sectional study was conducted in the Department of Preventive and Social Medicine, National Institute of Unani Medicine, Bangalore, Karnataka, India. The duration of the study was one year from March 2015 to March 2016 and informed consent was taken prior to the participation. Before the commencement of the study, the Institutional Ethical Committee (IEC) approved the project (NIUM/IEC/2014-15/019/TST/05).

Inclusion and Exclusion criteria: All non-pregnant women of reproductive age group (15-49 years of age), attending OPD of Unani hospital were included except, critically ill and non-cooperative patients.

Sample size: Sample size calculation was based on the prevalence of anaemia which was taken from a study by Kaur K, to be as 56% [9]. It was calculated with, precision percentage of 90, allowable error 10% of prevalence as 314 which was calculated with formula $4pq/l^2$ and was further round figured to 400.

Measurement of Study Variables

a. **Socio-demographic variables:** Patients were inquired about their name, age, sex, marital status, address, religion, and occupation.

b. **Socio-economic status:** Kuppuswamy Modified classification of socioeconomic status scale-January 2014 scale was used for this purpose. Scores ranged as follows: 26-29 were (Upper class I), 16-25 (Upper Middle class II), 11-15 (Lower Middle class III), 5-10 (Upper Lower class IV), and <5 (Lower class V) [10,11].

c. **Anthropometric measurements:** Weight was measured in kilograms using a weighing scale to the nearest measurement of 0.1 Kg. Height was measured by a wall fixed tape with a movable headboard to the nearest centimetre with participants standing upright without shoes and their backs against the wall and heels together. Obesity was assessed by calculating the Body Mass Index (BMI) using the weight and height of the participants by a formula as: Weight in kilograms/height^2 in centimetres and BMI was classified according to WHO classification into underweight (BMI <18.50) Kg/m^2, normal (BMI ranging from 18.5-24.99) Kg/m^2, pre-obese (BMI ranging from 25-29.99) Kg/m^2, obese class I (BMI ranging from 30-34.99) Kg/m^2, obese class II (BMI ranging from 34.99-39.99) Kg/m^2 and obese class III (BMI 40 and above) Kg/m^2 [3,12].

Risk Factor Assessment

A semi-structured schedule was constructed to assess the risk factors of the participants based on the following parameters.

a) **Tobacco usage:** No tobacco use was considered in those who had either never used any tobacco products or had quitted for five years or more.

b) **Alcohol usage:** Participants who had either never used alcohol or had quit for five years or more were considered non-alcoholic.

c) **Diet:** History of dietary habits regarding vegetarian and non-vegetarian diet was taken from the participants. Questions regarding skipping of meals and frequency of some foods; (red meat, chicken, fish, legumes, green leafy vegetables, citrus fruits, whole grains, tea/coffee, and milk) were also asked.

d) **Exercise:** Level of physical activity was assessed by asking the participants the nature of their activity and classified accordingly into mild, moderate, and heavy exercise as per Human energy requirements: Report of a joint FAO/WHO/UNU (Food and Agriculture Organisation/World Health Organisation/ United Nations University) Expert consultation. The activity factors are mentioned below [13].

Sedentary or light activity lifestyle- 1.53

Active or moderately active lifestyle- 1.76

Vigorous or vigorously active lifestyle- 2.25

e) **Menstrual and obstetrics history:** Menstrual history was taken with regards in pattern of cycle (regular or irregular), duration of flow in days (1-3, 4-6, >7 days), amount of blood loss (scanty, moderate, heavy) based on standards described in committee opinion of The American college of obstetricians and gynaecologists [14]. Obstetrics history was asked in terms of gravida, parity, abortion, and time duration between children as child spacing.

History of Diseases

Information about menorrhagia, metrorrhagia, haemoptysis, epistaxis, haematuria, haematemesis, prolonged fever with cough, bleeding piles, chronic infection, injury (accidental bleeding), bleeding gums, worms infestation, jaundice were taken.

Investigations

All required investigations were done at the biochemistry laboratory of the hospital of NIUM for the diagnosis of anaemia.

Hb (gm%): Haemoglobin percentage was figured out by Sahli's method. Normal range: Female: 12-18 gm%. The rest of investigations were done by using automated analyser and these are as follows:

MCV (Mean Corpuscular Volume): Normal range: 80-100 fL.

MCHC (Mean Corpuscular Haemoglobin Concentration): Normal range: 32-36 gm/dL.

MCH (Mean Corpuscular Haemoglobin): Normal range: 26.5-33.5 pg.

PCV (Packed Cell Volume): Normal range: (40±6)%

Patients having MCV <80 fL and MCH <26.5 pg (microcytic and hypochromic anaemia) were considered suffering from IDA [15,16].

STATISTICAL ANALYSIS

Descriptive and inferential statistical analysis was carried out in the present study. Results on categorical measurements were presented in number (%). Significance was assessed at 5% level of significance. Chi-Square/Fisher's-exact test was used to find the significance of study parameters on categorical scale between two or more groups.

RESULTS

[Table/Fig-2] shows total prevalence of IDA (Hypochromic and microcytic) as 42%. A higher prevalence of IDA were found in subjects living in rural habitat 54 (65.85%), not exercising 143 (56.52%), regularly menstruating 122 (58.94%), having a longer duration of flow and heavy bleeding during menstrual cycle [Table/Fig-3].

[Table/Fig-4] shows significant association of IDA with gravida and parity; whereas data recorded in [Table/Fig-5] confirms strong association among menorrhagia, metrorrhagia and prevalence of IDA.

Cell morphology on peripheral smear exam	No. of patients	Percentage
Subject without anaemia (Hb ≥12 gm/dL)	139	34.75
Subject with anaemia (Hb <12 gm/dL)		
Hypochromic and normocytic	70	17.50
Hypochromic and microcytic	168	42
Normochromic and microcytic	4	1
Normochromic and normocytic	19	4.75

[Table/Fig-2]: Prevalence of IDA among patients (n=400).

[Table/Fig-6] presents association of dietary factors with prevalence of IDA and shows that red meat, chicken, fish, citrus fruits, green leafy vegetables play protective role and prevent IDA while frequent tea consumption acts as a promoter.

DISCUSSION

Prevalence of IDA (hypochromic and microcytic anaemia) was 42% in the present study which is comparable to the report of NFHS-4 showing prevalence of 44.8% as the most significant contributor to the onset of anaemia is iron deficiency so that IDA and anaemia are used synonymously [17] (comparison was made with NFHS-4, India but it did not mention the type of anaemia so authors drew an inference that as IDA is most common so among the 44.8%, common contributor would be iron deficiency) [18].

Regarding habitat, prevalence among rural and urban dwellers was 65.85% and 50.67%, respectively with a statistically significant association (p=0.0180). According to NFHS-3; rural pregnant women consumed iron folic acid for 90 days or more was 34.7% while urban mothers were 48.9% simply means rural mothers will show higher prevalence of IDA that is accordance to the finding of present study. It may be also due to the fact that rural population might have lesser awareness about diet and it's relation to health [6,17,19].

Variables	Non-anaemic (n=139)	IDA (n=168)	Total (307)	p-value
Age in years[a]				
15-19	18 (48.65%)	19 (51.35%)	37 (100%)	0.522
20-29	39 (49.37%)	40 (50.63%)	79 (100%)	
30-39	38 (39.18%)	59 (60.82%)	97 (100%)	
40-49	44 (46.80%)	50 (53.20)	94 (100%)	
Marital status[a]				
Married	105 (45.06%)	128 (54.94%)	233 (100%)	0.984
Unmarried	33 (45.83%)	39 (54.17)	72 (100%)	
Divorced	1 (50%)	1 (50%)	2 (100%)	
Religion[a]				
Islam	97 (42.73%)	130 (57.27%)	227 (100%)	0.1312
Hindu	42 (52.5%)	38 (47.5%)	80 (100%)	
Christian	0 (0%)	0 (0%)	0 (0%)	
Habitat[a]				
Rural	28 (34.15%)	54 (65.85%)	82 (100%)	0.0180*
Urban	111 (49.33%)	114 (50.67%)	225 (100%)	
Kuppuswamy classification of socio-economic status[a]				
Upper	2 (66.67%)	1 (33.33%)	3 (100%)	0.7189
Upper middle	21 (51.22%)	20 (48.78%)	41 (100%)	
Lower middle	57 (44.88%)	70 (55.12%)	127 (100%)	
Upper lower	59 (43.38%)	77 (56.62%)	136 (100%)	
Lower	0 (0%)	0 (0%)	0 (0%)	
BMI classification[a]				
Under weight	11 (44%)	14 (56%)	25 (100%)	0.5354
Normal	55 (44%)	70 (56%)	125 (100%)	
Pre obese	45 (41.67%)	63 (58.33%)	108 (100%)	
Obese I	22 (56.41%)	17 (43.59%)	39 (100%)	
Obese II	3 (75%)	1 (25%)	4 (100%)	
Obese III	3 (50%)	3 (50%)	6 (100%)	
Diet[a]				
Mixed	127 (44.25%)	160 (55.75%)	287 (100%)	0.2560
Vegetarian	12 (60%)	8 (40%)	20 (100%)	
Smoking				
No	139 (45.28%)	168 (54.72%)	307 (100%)	-
Yes	0 (%)	0 (%)	0 (%)	
Alcohol				
No	139 (45.28%)	168 (54.72%)	307 (100%)	-
Yes	0 (0%)	0 (0%)	0 (0%)	
Tobacco[b]				
No	136 (46.58%)	156 (53.42%)	292 (100%)	0.0608
Yes	3 (20%)	12 (80%)	15 (100%)	
Exercise[a]				
No	110 (43.48%)	143 (56.52%)	253 (100%)	0.0004**
Mild	24 (53.33%)	21 (46.67%)	45 (100%)	
Moderate	5 (55.56%)	4 (44.44%)	9 (100%)	
Menstrual cycle[a]				
Regular	85 (41.06%)	122 (58.94%)	207 (100%)	0.0194*
Absent	31 (63.26%)	18 (36.74%)	49 (100%)	
Irregular	23 (45.09%)	28 (54.91%)	51 (100%)	
Duration of flow[a]				
Nil	31 (63.26%)	18 (36.74%)	49 (100%)	0.002**
1-3 days	26 (35.61%)	47 (64.39%)	73 (100%)	
4-6	81 (46.28%)	94 (53.72%)	175 (100%)	
>7 days	1 (10%)	9 (90%)	10 (100%)	
Amount of blood loss[a]				
Nil	31 (63.26%)	18 (36.74%)	49 (100%)	<0.0001**
Scanty	7 (16.66%)	35 (83.34%)	42 (100%)	
Moderate	100 (48.31%)	107 (51.69%)	207 (100%)	
Heavy	1 (11.11%)	8 (88.89%)	9 (100%)	

[Table/Fig-3]: Distribution of IDA with socio-demographic status and menstrual history.
[a]Chi-Square test, [b]Fisher's-exact test were applied to find the significance; *p<0.05 statistically significant; **p<0.001 statistically highly significant

Variable	Non-anaemic (n=139)	IDA (n=168)	Total (307)	p-value
Gravida[a]				
0	43 (46.23%)	50 (53.77%)	93 (100%)	0.0404*
1-2	53 (54.64%)	44 (45.36%)	97 (100%)	
3-5	38 (35.19%)	70 (64.81%)	108 (100%)	
>5	5 (55.55%)	4 (44.45%)	9 (100%)	
Parity[a]				
0	45 (45.91%)	53 (54.09%)	98 (100%)	0.0463*
1-2	57 (52.78%)	51 (47.22%)	108 (100%)	
3-5	34 (35.05%)	63 (64.95%)	97 (100%)	
>5	3 (75%)	1 (25%)	4 (100%)	
Abortion[a]				
0	125 (46.99)	141 (53.01%)	266 (100%)	0.1167
1	7 (26.92%)	19 (73.08%)	26 (100%)	
2	6 (60%)	4 (40%)	10 (51.35%)	
3	1 (20%)	4 (80%)	5 (51.35%)	

[Table/Fig-4]: Distribution of IDA according to obstetrical history.
[a]Chi-Square test were applied to find the significance; *p<0.05 statistically significant

Variable	Non-anaemic (n=139)	IDA (n=168)	Total (307)	p-value
Menorrhagia				
Present	26 (35.13%)	48 (64.87%)	74 (100%)	0.0442*
Absent	113 (48.50%)	120 (51.50%)	233 (100%)	
Metrorrhagia				
Present	17 (30.35%)	39 (69.65%)	56 (100%)	0.0131*
Absent	122 (48.60%)	129 (51.40%)	251 (100%)	

[Table/Fig-5]: Distribution of IDA according to past history.
Chi-Square test was applied to find the significance; *p<0.05 statistically significant

Regarding socio-economic status, subjects belonging to upper class showed a prevalence of 33.33%, upper middle class 48.78%, lower middle class 55.12%, and upper lower class showed 56.62% prevalence, respectively. The above results indicate that IDA was more prevalent among lower middle and Upper lower classes. This may be due to low literacy status and poor nutrition among the respective classes as confirmed in a study by Kumar CA et al., [20].

The present study revealed that prevalence of IDA was 56.52%, 46.67% and 44.44% among those who did not do any exercise, mild exercise and moderate exercise, respectively with highly significance association (p=0.0004).

Above data revealed, highest prevalence among those who did not do any exercise which reflects the fact that exercise training stimulates erythropoiesis and elevates total haemoglobin and red cell mass, which enhances oxygen carrying capacity. This adaptation might help improve anaemia and fitness in patients. The results of the research available to date are controversial, and it seems that significant methodological limitations exist. In spite of this, performing exercise can be an effective method to improve anaemia even though efficacy as well as the appropriate mode, intensity, and frequency of exercise training in different types of anaemia are yet to be established and require more research [21].

Prevalence of IDA was 58.94%, 36.74%, 54.91% among regular, absent, and irregular menstrual cycle, respectively. Statistical

Frequency times/ week	Non-anaemic (n=139)	IDA (n=168)	Total (307)	p-value
Red meat				
Never	57 (48.31%)	61 (51.69%)	118 (100%)	0.0249*
Daily	1 (50%)	1 (50%)	2 (100%)	
1-2	64 (39.02%)	100 (60.98%)	164 (100%)	
3	14 (77.77%)	4 (22.23%)	18 (100%)	
4-6	3 (60%)	2 (40%)	5 (100%)	
Chicken				
Never	30 (50.84%)	29 (49.16%)	59 (100%)	0.0404*
Daily	1 (50%)	1 (50%)	02 (100%)	
1-2	93 (41.15%)	133 (58.85%)	226 (100%)	
3	14 (77.77%)	4 (22.23%)	18 (100%)	
4-6	1 (50%)	1 (50%)	2 (100%)	
Fish				
Never	96 (39.34%)	148 (60.66%)	244 (100%)	0.0002**
Daily	10 (100%)	0 (0%)	10 (100%)	
1-2	31 (63.26%)	18 (36.74%)	49 (100%)	
3	1 (33.33%)	2 (66.67%)	3 (100%)	
4-6	1 (100%)	0 (0%)	1 (100%)	
Legumes				
Never	1 (50%)	1 (50%)	2 (100%)	0.0020**
Daily	75 (48.38%)	80 (51.62%)	155 (100%)	
1-2	2 (33.34%)	4 (66.66%)	6 (100%)	
3	10 (38.46%)	16 (61.54%)	26 (100%)	
4-6	51 (43.22%)	67 (56.78%)	118 (100%)	
Green leafy vegetables				
Never	1 (14.29%)	6 (85.71%)	7 (100%)	<0.0001**
Daily	93 (57.05%)	70 (42.95%)	163 (100%)	
1-2	13 (23.64%)	42 (76.36%)	55 (100%)	
3	18 (34.62%)	34 (65.38%)	52 (100%)	
4-6	14 (46.67%)	16 (53.33%)	30 (100%)	
Citrus fruits				
Never	21 (29.17%)	51 (70.83%)	72 (100%)	0.0236*
Daily	15 (57.69%)	11 (42.31%)	26 (100%)	
1-2	90 (48.64%)	95 (51.36%)	185 (100%)	
3	9 (50%)	9 (50%)	18 (100%)	
4-6	4 (66.66%)	2 (33.34%)	6 (100%)	
Whole grain				
Never	1 (100%)	0 (0%)	1 (100%)	0.5687
Daily	134 (45.27%)	162 (54.73%)	296 (100%)	
1-2	1 (100%)	0 (0%)	1 (100%)	
3	1 (33.33%)	2 (66.67%)	3 (100%)	
4-6	2 (33.33%)	4 (66.67%)	6 (100%)	
Tea				
Never	41 (58.57%)	29 (41.43%)	70 (100%)	0.022*
Daily	94 (40.51%)	138 (59.49%)	232 (100%)	
1-2	2 (100%)	0 (0%)	2 (100%)	
3	1 (100%)	0 (0%)	1 (100%)	
4-6	1 (50%)	1 (50%)	2 (100%)	

[Table/Fig-6]: Distribution of IDA according to dietary preferences.
Chi-Square test was applied to find the significance; *p<0.05 statistically significant; **p<0.001 statistically highly significant

analysis revealed moderately significant relation of IDA with regular menstrual cycle (p=0.0194). Typically, non-menstruating women lose about 1 mg of iron per day, while menstruating women lose an additional 10 mg of iron per day during menses [3]. Then combined with greater and heavier blood loss during menstruation even regular menstrual cycle can cause IDA as found in present study [3]. Present study showed prevalence of IDA was highly significant with duration of flow and amount of blood loss during menstruation. (p=0.002 and p<0.0001). Menstrual cycle pattern in the terms of days of flow and amount of flow is also significantly associated with IDA because it signifies greater blood loss on an average during one menstrual cycle [22-24].

The prevalence of IDA among women who had been gravida for 0 times (no gravida) was 53.77%, followed by 45.36% in 1-2 times gravida, 64.81% in 3-5 times gravida and 44.45% in >5 times gravida, respectively. Statistical analysis had shown significant relation of IDA with number of gravida (p=0.0404). Pregnancy is also a significant cause of iron loss i.e., single pregnancy is associated with an iron loss of approximately 1000 mg in a 55 kg woman. Thus, IDA and number of pregnancy walk together [25,26].

In present study, findings revealed significant relation between prevalence of IDA and parity (p=0.0463) when compared to nullipara women. Uche-Nwachi EO et al., and Shah T et al., also found in their studies that the grade of anaemia increased with parity [27,28].

Statistical analysis revealed that only past history of menorrhagia and metrorrhagia show a significant relationship with IDA (p=0.0442, 0.0131), respectively. Reason may be that being female based study, menorrhagia and metrorrhagia contributes significantly to the problem of iron loss among females [23]. A study conducted by Panigrahi A and Sahoo PB also revealed that anaemia was significantly associated with excessive menstrual bleeding [29].

Red meat consumption was moderately significant with IDA (p=0.0249).

As per this study, chicken consumption plays a protective role in the occurrence of IDA as it was found to be significant with IDA (p=0.0404). The reason behind this may be that iron contained in meat (2-4 mg/100 gms) and chicken (0.4-2.0 mg/75 gms) is absorb more easily than iron from plant sources [3,30]. Another evidence comes from the study conducted by AlQuaiz JM showed that low consumption of diets, such as red meat, vegetables, fruits, cereals has been reported to be associated with IDA [31].

While participants who consumed fish had lesser prevalence of IDA as compare to participants who did not consume the same. (p=0.0002). Although having lesser iron content (0.7-3 mg/100 gm) than meat, fish is still a good source of iron as the iron found in fish is more bioavailable [3,22].

Lesser prevalence of IDA was found in the group of people consuming green leafy vegetables consumption and relation was statistically significant. (p<0.0001). With the possible exception of vitamin B_{12}, green leaves are rich sources of carotenes, calcium, iron, and vitamin C (iron absorption promoter) [6,32]. This finding of present study is in accordance with the study of Chaturvedi D et al., and Turner T et al., [32,33].

Consumption of citrus fruits had significant relation of IDA. (p=0.0236). The probable explanations of this finding may be that citrus is an excellent source of vitamin C. Vitamin C (ascorbic acid) is a water-soluble essential nutrient which acts as an antioxidant, is involved in iron metabolism as iron absorption promoter [3,22,34].

Increased tea consumption showed significant relationship with IDA (p=0.022). Similarly, study conducted by Kaltwasser JP et al., found that if the test meal was accompanied by tea instead of water then iron absorption was reduced [34]. Similarly, Chaturvedi D et al., found that there was increased association on consumption of tea and coffee post-meals [32]. As well as, according to National Institute of Nutrition, Hyderabad, India, tannin present in tea and coffee hinders with proper absorption of iron of food stuffs [35].

Limitation(s)

First, serum ferritin as diagnostic test was not used, as it is the more accurate marker of iron deficiency. Second, the dietary data was measured as frequency and not as portion size.

CONCLUSION(S)

Prevalence of IDA was found to be 42%. Results confirmed an increased prevalence of IDA in women of reproductive age group. These results conclude association of higher prevalence of IDA with rural habitat, not exercising, regular menstrual cycle, heavy blood loss, menorrhagia, metrorrhagia, multiple gravida, higher parity and habit of drinking tea. The factors like consumption of fish, green leafy vegetable, red meat, and citrus fruit may have a protective role.

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