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CROSS SECTIONAL ANALYSIS OF IRON DEFICIENCY ANEMIA AMONG FEMALE STUDENTS OF ABDUL WALI KHAN UNIVERSITY MARDAN

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ABSTRACT

Iron deficiency anemia (IDA) is a common nutritional disorder worldwide and possesses a major threat among females. This cross sectional study was conducted to estimate the frequency of IDA among the female students of Abdul Wali Khan University Mardan (AWKUM). Blood samples were collected from 50 female students (aged 19-25 years) of different departments' belonging to different socioeconomic status. Hemoglobin (Hb), hematocrit (Hct), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC) were used to determine the prevalence and classify anemia according to RBC indices and disease severity. Hemoglobin level of all 50 students was measured by using hematology analyzer during November–March 2016. In this study, 10% female students were found mild anemic having hemoglobin level below 10 g/dL while 40% students had Hb level around 13.5 g/dL which is normal status and 50% students had hemoglobin level in the range of 11-12 g/dL which is moderate level. BMI revealed that 80% students were normal, 10% were found underweight and 5% females were obese but the hemoglobin level of underweight students was normal. Regular breakfast taking habit showed significant (p = 0.035, 95% CI 0.1-0.3) influence on IDA compared to non-regular breakfast takers. Our study revealed that the 10% of university female students, were mild anemic by irregular food habits, intracellular infections, inflammations and lack of awareness. Anemia can be prevented by providing proper knowledge on healthful diet which will be fruitful to prevent IDA.

Keywords: IDA, iron deficiency anemia, HCT, hematocrit, MCV, mean cell volume, MCH, mean cell hemoglobin

INTRODUCTION

Anemia is a common blood disorder associated with abnormal reduction in red blood cell count (RBC), hemoglobin (Hb) or hematocrit (Hct) values below the established normal reference values. This reduces the hemoglobin available to supply body tissues and organs with the necessary oxygen to function effectively. Oxygen deprivation is the basis for the classical signs and symptoms seen in most anemic patients'. These include pale skin, early fatigue, shortness of breath, chest pain, headache, signs of edema, and other problems. According to a UNICEF report, two billion people suffer from anemia worldwide and most of them have IDA, especially in underdeveloped/developing countries, where 40 to 50% of children under age 5 are iron deficient [1]. In Iran, 30 to 50% of women and children, especially those in low-income families, are suffering from iron deficiency [2]. Anemia has been shown to affect mental development and learning capacity. In infancy it may cause a permanent loss of IQ later in life, shortened attention span, irritability, fatigue, difficulty with concentration, lethargy, weakness and increased susceptibility to infection. Iron is a crucial micronutrient required for oxygen transport, oxidative metabolism, cellular proliferation and physiological processes [3]. Iron absorption is up regulated by iron deficiency and increased erythropoiesis and is down regulated in inflammation resulting iron repletion. It is mediated by the regulator of iron homeostasis that block iron release from enterocytes and macrophages which result in anemia [4]. The World Health Organization (WHO) defines anemia as hemoglobin level below 130g/L in men and 120g/L in women and 110g/L in young females [5]. Its adverse health consequences affect peoples of all age groups and can result from nutritional and non-nutritional factors [6]. IDA is a famous nutritional disorder which results from long term negative iron balance develop slowly is not accidental until anemia becomes severe and is responsible for approximately 50 % of all anemia [7]. Accelerated development, hormonal changes, malnutrition or improper diet and menstrual cycle in females are the major causes of IDA [8]. The anemia prevention and strategies have focused on this deficiency by routine iron supplementation. Main aim of this study was to assess the prevalence and causes of IDA through laboratory evaluation of individual's hemoglobin, serum ferritin, mean cell volume, total iron binding capacity, and hematocrit levels. Various causes of anemia can be grouped into six categories:

Nutritional Anemia

Nutritional anemia is caused by a dietary deficiency of a factor needed for erythropoiesis. The production of RBCs depends on an adequate supply of essential raw ingredients, some of which are not synthesized in the body but must be provided by dietary intake.

Pernicious Anemia

Pernicious anemia i**s** caused by an inability to absorb enough ingested vitamin B12 from the digestive tract. Vitamin B12 is essential for normal RBC production and maturation. It is abundant in a variety of foods. The problem is a deficiency of *intrinsic factor,* a special substance secreted by the lining of the stomach Vitamin B12 can be absorbed from the intestinal tract only when this nutrient is bound to intrinsic factor. When intrinsic factor is deficient, and not enough ingested vitamin B12 is absorbed. The resulting impairment of RBC production and maturation leads to anemia.

Aplastic Anemia

Aplastic anemia is caused by failure of the bone marrow to produce enough RBCs, can be caused by destruction of red bone marrow by toxic chemicals (such as benzene) and heavy exposure to radiations.

Renal Anemia

Renal anemia may result from kidney disease. Because erythropoietin from the kidneys is the primary stimulus for promoting erythropoiesis, inadequate erythropoietin secretion by diseased kidneys leads to insufficient RBC production.

Hemorrhagic Anemia

Hemorrhagic anemia is caused by losing a lot of blood. The loss can be either acute, such as a bleeding wound, or chronic such as excessive menstrual flow.

Hemolytic Anemia

Hemolytic anemia is caused by the rupture of too many circulating erythrocytes. Hemolysis of RBCs, occurs either because otherwise normal cells are induced to rupture by external factors, as in the invasion of RBCs by malaria parasites, or because the cells are defective, as in sickle anemia. As anemia is mainly manifested in females with pregnancy, after pregnancy and in old ages or in environment where food scarcity and imbalanced nutrition is observed. IDA in young healthy students has been reported very little so far. So present study aimed at finding the Iron profile of young healthy students of AWKUM.

MATERIALS AND METHODS

Study Subjects

This study included 50 graduation level female students within age range of 19-25years. Study subjects with different socio economic background from six different departments of the university were selected.

Selection of students was random. Before collecting blood, participants were informed and their consent was taken.

Data Collection

Data were collected from all subjects. Before blood sampling height, weight, age and intake of regular breakfast as well as taking meat, tea, multivitamins and iron rich food consumption were recorded for each participant. Anthropometric measurements were taken at the initial participants meeting. Weight and height were measured and used to calculate body mass index (BMI) with the following formula

BMI=mass in kg/height (m^2)

Hematological Analysis

A 12 hour fasting blood sample (3ml) was collected from each participant and analyzed for hematological indices using Hematology analyzer machine. Measures included red blood cells, hemoglobin, hematocrit, mean carpuscular volume, mean carpuscular hemoglobin concentration, red cell diameter width, total proteins, serum iron, serum ferritin, total iron binding capacity (Tibc) and transferrin saturation was also assessed.

RESULTS AND DISCUSSION

RESULTS

Results show the prevalence of IDA in female students within the age range of 19-25 years (Table 1). Blood samples subjected to hematological analysis revealed that 10% females were found mild anemic having Hb level in range of 9-10 g/dl while 40% students had Hb level in between 13 and 13.8 g/dl which is normal range and 50% females carried Hb level in the range of 11-12 g/dl which is considered as moderate range of IDA. By measuring BMI, 65% subjects showed normal BMI (18.5kg/m^2) while 20% subjects had above 25 kg/m^2 showing abnormal BMI and 15% were observed as obese having BMI more than 30kg/m^2. Similarly 85% subjects showed normal body weight while 5% students were obese showed abnormal body weight and 10 % female students were underweight and for mild anemic students (p=0.001,. 95% CI 1.2-3.0) difference was observed. Similarly significance (p=0.030%, 95% CI 0.1-0.3) for non-anemic students.

MCV values were observed in different ranges of 60 fL-119fL as 30% females had MCV in the range of 60-80fL while 60% females had this range in between 90-100fL and 10% students had MCV range above 100fL. MCH values were also determined among students 40% students had mean cell hemoglobin in between 19-25 pg. while 10% had MCH in the range 30pg and 50% students had above 30pg up to 38pg respectively. Hematocrit values ranged from 34-47%. 25 % students had HCT in between 34-40% while 75% students had

Hct above 41% but in females Hct values should be up to 42% (table 4).

RBC in all female students ranged from 3.25 to 5.02/µL. Among them 80% students had RBC range from 3.5 to 4.0/ µL and 10% students had this range up to 4/µL and 10% students had 4-5/µL RBC level (Table 3, 4 and 5).

Table 1: Hematological Profile of female students from AWKUM

Total students	Subjects	Normal	Moderate	Mild anemic	Anemic	Severe anemic
50	100% females	40%	50%	10%	Nil	Nil

Table 2: Hematological analysis of all the studied subjects

S. No.	Variable	N=50 Mean	P value
1	Hb(g/dL)	13.5g/dL	0.030
2	Moderate Anemic Hb<12g/dL	10g/dL	0.001
3	Anemic Hb<10g/L	*	*
4	Severe anemic Hb<7g/dL	*	*
5	HCT (38-42%)	41%	0.020
6	MCV (80-100fL)	99fL	0.030
7	MCH (27-32pg)	33.3pg	0.026

(Hb, hemoglobin, HCT, hematocrit.MCV, mean carpuscular volume, MCH, mean carpuscular hemoglobin, MCHC, mean carpuscular hemoglobin concentration)

Table 3: IDA related data for mild anemic subjects in current study.

Hb	MCV	MCH	HCT	RBC	PLT	WBC	Status
10.2g/dL	65fL	30.3pg	32%	3.72/µL	220/ µL	7.9 µL	Mild anemic
10.1	65	30.2	31.5	3.25	220	*	*
10.1	65	30.1	31.3	3.25	218	*	*
9.5	60	30	31.1	3.51	218	*	*
9.5	59	30	30	3.50	218	*	*
9.3	59	28.3	30	3.50	215	7.7	*
9.3	59	28	30	3.49	212	7.5	*
9.1	55	28	30	3.48	212	7.5	*

Table 4: List of subjects with moderate range of hematologic profile

HGB	MCV	MCH	HCT	RBC	PLT		
13.5 g/dL	99.6 fL	33.3 Pg	40.3%	4.35/µL	246/µL	7.1 /µL	Normal
13.5	88.8	29.8	40.2	4.5	332	7.7	*
13.3	92.1	31.4	38.9	4.23	328	7.5	*
13.1	90	33.1	40.1	3.95	212	6.9	*
13.5	91.3	29.5	42	4.61	318	7.8	*
13.5	88.2	30.5	38.9	4.42	242	7.3	*
13.8	92.2	31.7	40.1	4.35	231	6.4	*
13.4	89.4	30.8	38.7	4.34	433	9.6	*
13.8	87.2	29.5	40.7	4.67	275	5.5	*
13.6	91.3	30.6	40.5	4.44	192	8.4	*
13.5	108.1	30.4	40.9	5.02	177	7.2	*

Table 5: List of subjects with normal hematological profile

Hb	MCV	MCH	HCT	RBC	PLT	WBC	Status
11.4g/dL	91.8fL	30.3pg	34.5%	3.76/µL	224/µL	5.5/µL	Moderate range
12.5	88.7	29.2	37.9	4/uL	171	9.8	*
12.8	87.9	30	37.4	4.26	280	5.9	*
12.5	84.2	28.7	36.6	4.31	223	7	*
12.3	90.3	30.5	33.3	4.03	374	6.9	*
12.2	82.5	26.9	37.3	4.33	370	6.9	*
11.7	94	32.2	34.1	3.63	235	4.3	*
12	87.3	28.5	36.6	4.2	207	8.1	*
12.9	94.8	31.3	38.9	4.11	328	7.4	*
12.9	93.1	31.1	37	4.10	320	7.1	*
11.2	91.4	29.9	34.1	3.74	200	10	*
11.4	97.4	30.8	36	3.70	220	4.4	*
11.9	93.8	30.7	36.3	3.87	214	5.8	*
11.6	87	28.5	35.4	4.07	240	10.7	*
11.4	78	25.8	34.3	4.41	286	6.5	*
12.3	93.1	31.5	36.3	3.9	242	4.9	*
12.6	92.2	31.5	36.8	4	210	6.8	*
11.3	81.2	27	33.8	4.17	243	11	*
12	86	3O	39	4	230	8	*
12	76.5	27.9	34.2	3.99	165	8.9	*
12	80.3	28	38	3.88	210	7.3	*
12.6	87.2	30	36.6	4.20	296	9.3	*
12.1	98	29.2	42.3	4.14	278	4	*
11.2	93.9	27.7	37.8	4.03	226	9.3	*

(*) indicate equality

DISCUSSION

IDA is the most ubiquitous disorder throughout the world. Severe situations occur when IDA is left untreated because this deficiency occurs gently not accidently. In this study 10% female students were mild anemic. Possible reasons are their irregular diet, menstrual blood loss and absence of knowledge about IDA and nutritional status. Beside this several studies showed that in Peshawar universities and several other regions in Pakistan these type of studies are conducted but on males mostly just for the sake of comparison between two sexes but targets are mostly females because females are getting diet of inferior quality in most families, loss of severe blood during menstrual cycle and irregular diet, absence of consumption of heam meat in daily diet and also internal traumas which cause IDA. However, 42 mg of iron loss per menstrual cycle has been reported in females with heavy blood flow, which may lead to anemia. Both mild anemic and non-anemic showed normal BMI. In this study regular breakfast, daily diet showed statistically significant differences among non-anemic and anemic (p=0.001, 95% CI 1.2-3.0) and for non-anemic (p=0.030, 95%CI 0.1-0.3) respectively. Among mild anemic students 50% were irregular in their breakfast intake while 50% students were skipping breakfast because of late awaking, not being hungry in morning time. The size and

number of RBC decreases which affect the whole system of the body and causes IDA. So, proper supplementation of iron is needed to reduce the prevalence of IDA. Results of this study indicates the irregular habits of food intake, and nutritional imbalance is responsible for these diseases. According to our findings, only balanced diet and proper supplementation can prevent IDA. This finding may be helpful to conduct such type of research among other university students to aware people for taking balanced diet to prevent them from anemia. Also in our study exercise capacity revealed statistical significant difference (P= 0.040) in students with ID and IDA compared to control. Heme iron (from meat) provides 10 to 20% of iron intake. However, non-heme iron absorption is influenced by the iron status of subjects and the balance between enhancers and inhibitors present in the food, much more than heme iron [9]. Other study revealed similar results that female subjects consuming red meat and vegetables (less than two servings of red meat and vegetables per week) inadequate response may be related to continued blood loss (e.g., heavy menses), inflammation, ineffective absorption, or poor compliance. After the hemoglobin has returned to normal, continuing to take a low dosage of iron (e.g., 30 mg/day) for an additional one to two months will replace iron stores and decrease the likelihood of recurrence of anemia [10]. Lack of compliance as well as premature discontinuation of iron tablets are the likelihood of recurrence of anemia. Moreover, dietary habits within a family should be properly investigated to identify the inhibitors and enhancers of iron absorption.

CONCLUSIONS

IDA is a common nutritional disorder all around the world. In most cases this happens due to improper and unbalanced and irregular diet in daily routine but in case of females major cause is loss of severe blood during menses. The present study indicates that mostly females are affected by IDA and the possible reason is because of irregular and insufficient diet in routine. So a fruitful health based knowledge is necessary to enhance consciousness about this disease in society survivors and unnecessary food should be avoided. The government should take initiative to make sure prevention of IDA among the students of public and private universities.

RECOMMENDATIONS

Nutrition education programs should be conducted especially for the females to advocate healthy dietary habits. Primary physician education is needed to ensure a greater awareness of ID and IDA and the

testing is needed to establish diagnosis as well as underlying causes.

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