Diet habit and iron deficiency anemia in Libyan patients

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Abstract: The objective is to investigate the effect of some diet elements modification on iron deficiency anemia (IDA) patients. A total of 213 patients (68.1% females and 31.9% males) aged (15-50 years) were used in this study. They were examined clinically and blood samples taken and sent for complete blood count (CBC) and iron profile plus renal, liver function tests and stool for routine examination, after they filled a prepared questionnaire for their diet habit and type of nutrients in their main meals. All enrolled persons were fulfilled the criteria of IDA based on hemoglobin (Hb) levels, MCV, MCHC and iron profile (TIBC, S. iron and S. ferritin). Patients had IDA due to chronic blood loss or other chronic diseases were excluded. Hb less than 7 gm/dL reported in 22.5% of patients (11 male, 37 female), Hb between 7-10 gm/dL reported in 77.5% of patients (57 male, 108 female). The highest prevalence of IDA found between 22-39 years of age. Hb mean was 7.9 ± 0.08 before diet modification. After diet modification, the mean Hb was 12.9 ± 0.06 ($p < 0.0001$). Hb changes had the same pattern with the statistical significant ($p < 0.0001$) in both sexes. MCV increased significantly after diet modification (68.4 ± 0.3 to 82 ± 0.2, with $p \leq 0.0001$). TIBC decreased significantly from (549.6 ± 0.4 to 296 ± 0.2) ($p < 0.0001$). Total serum iron increased from 27.3 ± 0.4 to 95.4 ± 2.1 ($p < 0.0001$). Serum ferritin increased significantly from 5.1 ± 2.4 to 8.7 ± 0.7 ($p < 0.001$). Knowing food nutrients contents of meals is important while they have a significant effect on IDA prevention and treatment. Therefore, reducing or completely avoiding those nutrients will reduce IDA risk and cut health care costs. Legalizations and educational programs must be done to population and food-health careers to prevent IDA due to malnutrition.

Keywords: Iron deficiency, anemia, diet, Libya, phytate, hemoglobin

Introduction

Anemia is a pathological process in which Hb, hematocrit (Hct) and the concentration of red blood cells per unit volume are abnormally low. IDA is a form of anemia due to lack of sufficient iron to form normal red blood cells. Iron deficiency anemia is typically caused by inadequate intake of iron, chronic blood loss, or a combination of both. In normal person, Hct and Hb levels vary with age, gender, hormonal changes and environmental oxygen pressure (1). WHO criteria for anemia definition is Hb concentration < 13 gm/dL in men, and < 12 gm/dL in women, although there has been debate (10). In the UK alone by 2027, it is estimated people aged ≥ 65 years will be about 12 million (11) and in the USA, people aged ≥ 65 years will rise to 63 million by 2025 (12). This increase in number of this age group will raise the prevalence of IDA, while this age groups are about the use of these values particularly in elderly. There is not widely accepted alternative definition of anemia (2-5). Anemia is one of the commonest nutritional deficiency diseases worldwide. In 95% of cases, anemia associates with poor diet intake (6). Worldwide, anemia affects more than two billion people reported in 2004, were 50% of them due to iron deficiency according to WHO estimate (7, 8). IDA is not only the most prevalent, but is also the most neglected nutrient deficiency in pregnant women and children in developing countries (9). IDA accounts for 75-95% anemia type in pregnancy more liable to malnutrition and IDA development. A moderate degree of IDA affects approximately 610 million people worldwide. It is slightly more common in female (9.9%) than males (7.8%). Mild IDA affects another 375 million (13). UNICEF reported about 50,000

young women every year dying during pregnancy and childbirth due to severe IDA (14). Inadequate treatment of IDA leads to increased morbidity, poor life quality and in efficient daily activities (15,16). Early diagnosis, treatment and prevention reduce healthcare cost via reduction of unplanned hospital admissions and other health-services (17). In Libya as a part of Arabic world, drinking tea frequently with food and eating foods contain phytate can lead to less iron absorption. Therefore, this study was conducted prospectively to assess the effect of absentees from or at least reducing the amount and frequency of tea drinking and eating these types of foods on Hb, MCV and iron states during 6 months in IDA patients. The purpose of this study is to assess response of IDA patients after changing some diet habits in Libyan population.

Materials and methods

The study has been carried out in Medical department-Tripoli Central Hospital.

Two-hundred and thirteen patients participated (69 males and 144 females) were aged of 15 - 50 years. They presented with general symptoms suggestive of anemia as generalized weakness, lethargy, palpitation and dyspnea on exertion. After a complete history, physical examination and complete investigations such as CBC for Hb, MCV, renal and liver function, serum iron, TIBC and serum Ferritin. After confirming diagnosis of IDA, the enrolled patients had further investigations as, urine analysis for RBCs and stool analysis for occult blood and parasites. Gastroscopy with deep intestinal biopsy and colonoscopy to exclude other pathological causes of IDA as peptic ulcer, gastritis, IBD, diverticulitis, polyps, coeliac disease etc. Patients involved in this study had received specific diet protocol that contained meat, vegetables and vitamin C, with either food had not or reduced amount of nutrients that high in phytate as rice, bread and drinks as tea and coffee.

Statistical analysis: Demographic and parameters used to assess the changes in the symptoms of the patients were arranged in EXCEL program. Statistical analysis was done by SPSS program package version 19. Paired t-test used to assess the significance of changes in each parameter. P value < 0.5 is considered statistical significant change after 6 months of diet modification.

Results

In this prospective study, 213 patients had confirmed having IDA were agreed to participate. They were 145 female and 68 male patients, age between 15 to 50 years of age. One hundred eighty five patients improved clinically and by biochemical findings during 6 months after strict diet prescribed to them. Only 15 patients after 6 months period of diet modification did not show clinical and biochemical significant changes (tables 1 and 2).

The study conducted in Medical Department
Tripoli Central Hospital

	Frequency	percentage
Female	145	68.1
Male	68	31.9
Total	213	100.0

Table 1: Sex distribution

No. of pt. who improved with diet modification	195
No. of pt. who did not improved with diet modification	18
No. of total cases.	213

Table 2: Number of patients improved and not improved after diet modification

Hb at presentation ranged between 6.2-10.4 g/dL (7.9 ± 0.8) and (variance of 1.4). After 6 months of diet modified, Hb ranged between 10-15 g/dL with a mean of 12.9 ± 0.6 with a variance of 0.71. Comparing Hb before and after diet modification revealed significant increase in Hb mean ($p < 0.0001$) (tables 1 and 2). In female patients, Hb mean was 7.9 g/dL ± 0.1, and was after 6 months (12.7 ± 0.07). The increase in the mean of Hb was statistically significant ($p < 0.0001$) (tables 3 and 4). In male, the increase in Hb mean was also highly significant from 8.5 g/dl ± 0.14 before to 13.3 g/dL ± 0.09 after diet modification ($p < 0.0001$) (tables 5 and 6).

At start, MCV ranged between 54 -79 fL, with a mean of 68.4 ± 0.35 fL and a variance of 25.8 at presentation. After 6 months, MCV increased significant to 72 to 90 fL with a mean of 81.9 ± 0.22 ($P < 0.0001$) (tables 1 and 2). In female patients, MCV mean was 68.38 ± 0.4 before diet modification. After 6 months, MCV mean increased significantly to normal value (81.89 ± .03) ($p < 0.0001$) (tables 3 and 4). In male gender patients, MCV had the same as female gender patients increased significantly from 68.55 ± 0.7 at presentation to 82.4 ± 0.4 after 6 months of diet modification ($P < 0.0001$) tables 5, and 6. Serum iron had the same statistical pattern of Hb and MCV change. Before diet modification, mean serum iron was 68.4 ± 0.3. After 6 months of modified diet, mean serum iron was 95.3 ± 2.14. The changes in serum iron after 6 months was statistically significant ($p <0.0001$). Serum iron mean in female increased after 6 months following the strict prescribed diet from 25.64 ± 0.5 to 94.03 ± 2.5 ($p < 0.0001$) (table 4). In male gender patients, total serum iron increased significantly after 6 months of diet modification from 30.93 ± 0.6 to 104.78 ± 4.5 ($p < 0.0001$) (tables 5 and 6).

Total iron binding capacity (TIBC) had also significant improvement after 6 months of diet modification. TIBC at start was 470 - 651 with a mean of 549.6 ± 3.05. After 6 months of modified diet, mean TIBC reduced significantly (296.7 ± 4.5) ($p < 0.0001$). According to gender, mean TIBC reduced significantly from 553.4 ± 3.9 at start to 294 ± 5.5 after 6 months following prescribed diet $p < 0.0001$ (tables 3 and 4) in female patients, and in male patients mean reduced from 541.65 ± 4.7 to 104.78 ± 4.5 after 6 months of diet modification ($p < 0.0001$).

	N	Minimum	Maximum	Mean		Variance
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Age	213	14	55	34.46	.739	116.362
HB-Start	213	6.2000	10.4000	7.938967	.0800509	1.365
Hb after 6 months	213	10.5	15.0	12.881	.0577	.710
MCV -Start	213	54	79	68.44	.348	25.814
MCV after 6 months	213	72	90	81.95	.227	10.969
S.Iron-Start	213	12	42	27.33	.402	34.495
s.iron	213	29	300	95.36	2.141	976.713
TIBC-Start	213	470	651	549.63	3.053	1985.187
TIBC after 6 months	213	116	485	296.72	4.520	4350.807

Table 3: Descriptive statistic of Hb, MCV, serum iron and TIBC at presentation and after 6 months after diet modification

	Paired Differences				t	Sig. (2-tailed)
			95% Confidence Interval of the Difference			
	Mean	Std. Error Mean	Lower	Upper		
HB_S - Hb	4.940	.09	5.119	4.763	54.691	.000
MCV_S - MCV	13.512	.4	14.371	12.652	30.988	.000
S.Iron_S - s.iron	68.033	2.1	72.245	63.820	31.835	.000
TIBC_S - TIBC	252.911	5.0	242.956	262.866	50.081	.000

Table 4: Paired samples t-test comparing the means of Hb, MCV, S. iron and TIBC at presentation and after 6 months of diet modification

	Mean	Std. Error Mean
HB- Start	7.88	.098
Hb after 6 months	12.70	.066
MCV- Start	68.38	.405
MCV after 6 months	81.89	.286
S.Ironf- Start	25.64	.470
s.iron after 6 months	94.03	2.531
TIBC- Start	553.37	3.871
TIBC after 6 months	294.04	5.511

Table 5: Female parameter before and after 6 months from presentation.

	Paired Differences				t	Sig. (2-tailed)
			95% Confidence Interval of the Difference			
	Mean	Std. Error Mean	Lower	Upper		
HBfs–Hbf	4.8	.109	5.035	4.6	43.851	.000
MCVfs–MCVf	-13.5	.504	-14.506	12.515	26.831	.000
S.Ironfs - s.ironf	-68.393	2.573	-73.479	63.307	26.580	.000
TIBCfs–TIBCf	259.331	5.979	247.514	271.149	43.375	.000

Table 6: Paired t-test of the parameters before (S) and after diet modification in female participant

	Mean	Std. Error Mean
HB-S	8.05	.137
HB after 6 months	13.30	.09
MCV-S	68.55	.679
MCV after 6 months	82.40	.402
S.Iron-S	30.93	.557
S.Iron after 6 months	104.78	4.511
TIBC-S	541.65	4.724
S.TIBC after 6 months	104.78	4.511

Table 7: Paired Samples Statistics for male participants before and after 6 months

	Paired Differences				t	Sig. (2-tailed)
	Mean	Std. Error Mean	95% Confidence Interval of the Difference			
			Lower	Upper		
HBS - HB	5.251	.150	5.55	4.950	34.830	.000
MCVS - MCV	13.851	.760	15.368	12.333	18.223	.000
S.Iron-S.Ironm	73.853	4.435	82.704	65.001	16.654	.000
TIBC-S - TIBC	436.868	7.279	422.339	451.397	60.017	.000

Table 8: Paired t-test for means of the parameters in male participant
S mean before modification, -F after 6 months of diet modification.

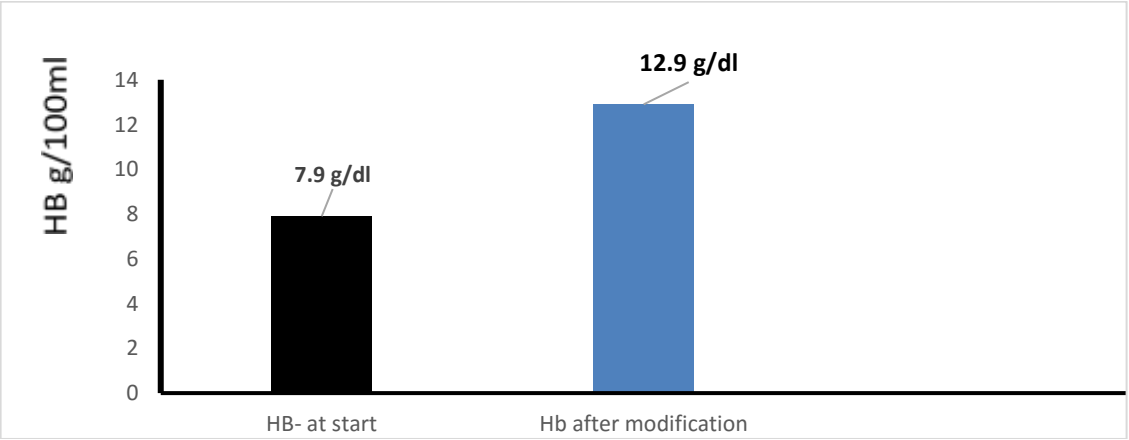

Figure 1: Mean of Hb at presentation and after 6 months from diet modification.

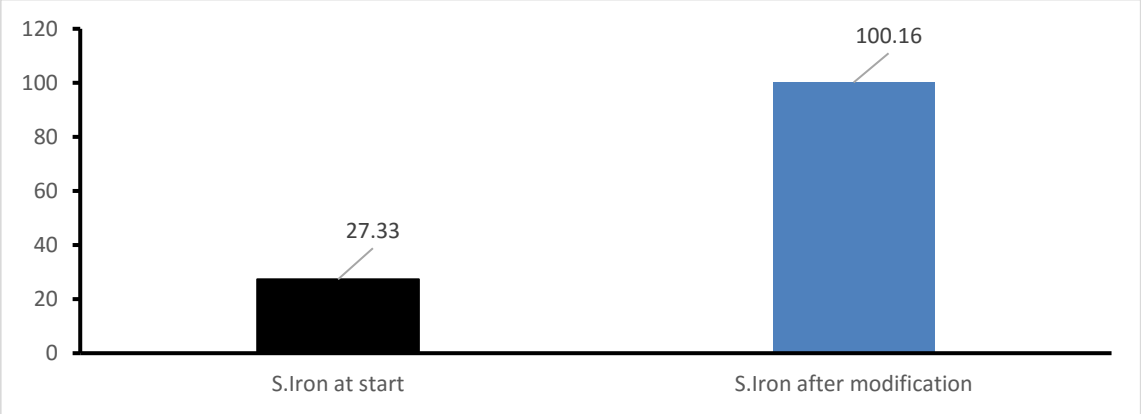

Figure 2. Mean of total serum iron at presentation and after 6 months from diet modification.

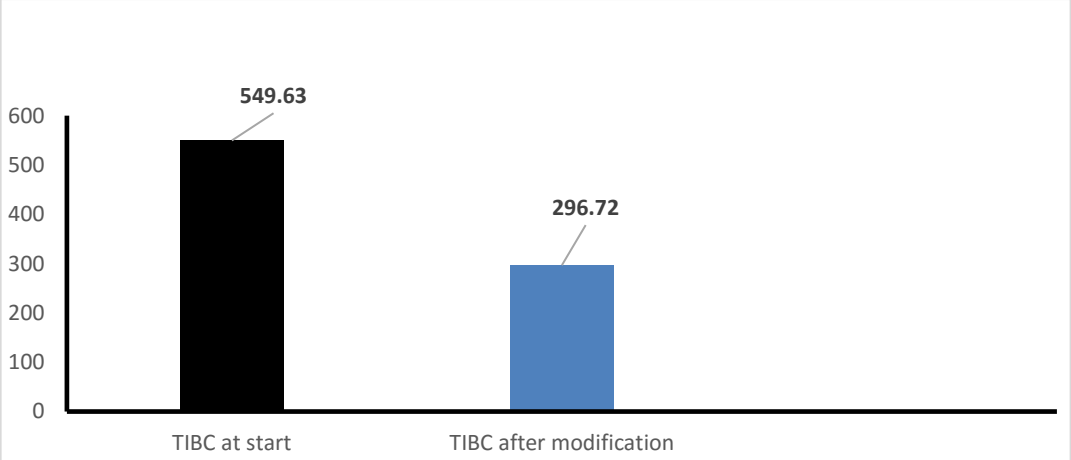

Figure 3: Mean of TIBC at presentation and after 6 months from diet modification.

Discussion

Worldwide, anemia is mainly due to poor diet intake of the required needs for erythropoiesis as folic acid, vitamin B_{12} and iron (6). In USA and UK only, it has been estimated that after about 10 years, nearly 75 million people will be aged more than 65 years (11, 12). This age group is more prone to malnutrition and IDA development than other adult age groups. Goddard et al. observed; delay in diagnosis and/or inadequate treatment of IDA have adverse effect on morbidity, mortality and the quality of life in the affected persons (13). It is being reported also in the U.K, early diagnosis and treatment reduce the NHS cost of patients' admission due to IDA (16). IDA is the commonest cause of anemia worldwide and is frequently seen in general practice (19). It is the commonest type of anemia in the developing countries, and has huge health and economic cost implications (18, 20). Low iron intake, iron mal-absorption and iron loss lead to IDA, and iron deficiency due to mal-nutrition is a most frequent - affecting about of population 30% - health problem in the world (20). WHO reported recently, 1.62 billion of the world population is anemic (21). IDA main cause is a poor diet and/or certain intestinal diseases that affect adversely iron absorption or nutrient consumption by parasitic infestation(22). Iron fortified food is effective in improving and maintenance of Hb in general population especially during child-bearing age. Asibey-Berko et al. reported that 19.5% increase in the prevalence of anemia among rural Ghanaian women who had not iron-fortified salt in their diet (23). Viteri at al. reported that iron store increased after three years of fortified sugar supplement for non-pregnant Guatemalan women, with reserves increasing by about 40 mg/year after three years of iron supplement intake (24). Vietnamese studies concluded; iron stores improve significantly following ingestion of iron fortified fish sauce for 6 to 12 months (25, 26). Comparable results were documented with dietary supplements containing iron and iron fortified milk (27, 28).

Substances reduce iron absorption as phytates, tannates. tannates are the most potent inhibitors of non-haem iron absorption (29). Tea- especially black tea- rich in tannates and it is a popular beverage in many parts of the world including Libya (30). General anemia is one of the common diseases in developing countries, and it is more frequent in third world and Arab countries. In Saudi Arabia, the overall prevalence of iron deficiency anemia was 30–56% (29). IDA is also common in Arab countries including Libya in young children, preschool age, school age as well in older ages especially in female during child bearing age. IDA prevalence in Libyan community seems to be not different from other Arab and developing countries, there were not studies carried in Libya to assess the effect of usual Libyan diet on IDA. Therefore, this study was carried to assess the effect of diet modification on IDA patients.

In this study, all patients presented with complains of most common anemia symptoms as tiredness, fatigue, inability to do usual daily jobs, breathless etc. They were diagnosed clinically as anemic patients. After doing Hb, MCV, MCHC, total serum iron, serum ferritin and TIBC, they were diagnosed as IDA patients. All patients had filled prepared questionnaire; asking mainly about their symptoms and diet habits (as the common type of food they are eating). Most of the participant patients were female aged between 20-40 years, and had mean Hb of 7.8 g/dl. On the other hand, male patient aged between 18 to 45 years, and they had mean Hb of 8 g/dl without significant statistical significant at presentation. After six months adherence to the prescribed diet that - had no phytate (bread and rice), avoiding drinking tea with main meals and avoiding non-fresh and gases drinks -, Hb increased significantly in both gender. The increase in MCV was also significantly different after six months. Total serum iron and serum ferritin increased also significantly after six months of diet modification. The significant improvement in general condition and the symptoms of the patients, as well, the significant change in the parameters studied following adherence of enrolled patients to the strict diet prescribed are important. The importance of these parameters

improvement are; removing or at least reducing those substances from food contents of usual Libyan diet will reduce the risk and prevalence of IDA in the population. Insisting and applying the existing rules and legalization by government and tight control on bakers, and on imported food will certainly have positive effect on reducing IDA risks in Libyan population. Activating the existing nutrition department in hospitals and creating new advisory nutritional departments in district hospitals is essential. Educating primary health care personal in community and schools about the healthy food by well-organized programs are important. Media has also an essential role in this issue by doing educating programs concerning healthy food contents and diet wrong habits. Local newspapers and local authorities have also a major role, and they have to participate in this problem. All these agents have to target the importance of recognizing the healthy nutritional habits and body's requirements from the different nutrients at different stage of age. Therefore, avoiding reducing agents in many usual Libyan diet is essential plus other some diet habits as drinking tea especially black tea with food have to be changed to reduce risks of IDA. Health programs targeting public awareness to improve the health and nutritional status and habits to reduce the risk of IDA in our community are essential. Well organized programs between ministry of health and local authorities are required. All these measures will lead to reduction of IDA risks. IDA prevention especially in country as Libya who had economic crisis due to the local conflict issues will cut more health cost and avoid short and long term complication of anemia.

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