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# Food Basket of Iranian Qashqa'i Women: Relationship to Anemia

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**Abstract:** In tribes' people like Qashqa'i, little information exists on nutrition status and diet habits of women. Anemia is a widespread problem among nomadic women and is most likely caused by iron (Fe) deficiency. In this study dietary intake was examined to determine whether it was related to hemoglobin (Hb) and Serum Ferritin (SF) and to ascertain if the intake of anemia pertinent nutrients differed between anemic and non anemic Qashqa'i women. The Hb and SF were measured, dietary intake (Mean of three days 24 h recall) was recorded and background socio-economic data were obtained from the study population. The results showed that dietary intake of Fe, Vitamin C and Folate was below the recommended levels in the majority of the anemic women. Women whose intake of Fe and vitamin C or Folate was around the Recommended Dietary Allowance (RDA) had significantly higher mean Hb and SF values. Collectively, our findings support the notion that the quality and quantity of food basket, particularly, its iron, vitamin C and folate contents are the major determinants of anemia status of Qashqa'i women.

**Key words:** Anemia, iron deficiency, dietary intake, nomadic women

## INTRODUCTION

Total body iron averages approximately 3.8 g in men and 2.3 g in women, which is equivalent to 50 mg $kg^{-1}$ body weight for a 75 kg man (Bothwell, 1995, 1979) and 42 mg $kg^{-1}$ body weight for a 55 kg woman (Bothwell, 1981). When the body has sufficient iron to meet its requirements, most iron (greater than 70%) may be classified as functional iron; the remainder is storage or transport iron. More than 80% of functional iron in the body is found in the red blood cell mass as Hb and the rest is found in myoglobin and intracellular respiratory enzymes.

The percentage of iron absorbed (i.e., iron bioavailability) can vary from less than 1% to greater than 50% (Bothwell, 1981). The main factor controlling iron absorption is the amount of iron stored in the body. The gastrointestinal tract increases iron absorption when the body's iron stores are low and decreases absorption when stores are sufficient. An increased rate of red blood cell production can also stimulate iron uptake several fold (Skikne and Baynes, 1994).

Iron deficiency is one of the most common nutritional deficiencies worldwide (DeMaeyer, 1989) and has several causes. Iron deficiency represents a spectrum ranging from iron depletion, which causes no physiological impairments, to iron-deficiency anemia, which affects the functioning of several organ systems. In iron depletion, the amount of stored iron (e.g., as measured by serum ferritin concentration) is reduced but the amount of functional iron may not be affected (Herbert, 1992; Baynes, 1994).

In iron-deficiency anemia, the most severe form of iron deficiency, the shortage of iron leads to underproduction of iron-containing functional compounds, including Hb. The red blood cells of persons who have iron-deficiency anemia are microcytic and hypochromic (Herbert, 1992; Baynes, 1994).

In adults (persons aged greater than or equal to 18 years), iron-deficiency anemia among laborers (e.g., tea pickers, latex tapers and cotton mill workers) in the developing world impairs work capacity; the impairment appears to be at least partially reversible with iron treatment (Li *et al*., 1994; Cook *et al*., 1994). It is not known whether iron-deficiency anemia affects the capacity to perform less physically demanding labor that is dependent on sustained cognitive or coordinated motor function (Cook *et al*., 1994).

During adolescence (ages 12-less than 18 years), iron requirements (NRC., 1989) and hence the risk for iron deficiency increase because of rapid growth (Yip and Dallman, 1996; Hallberg, 1992). Among boys, the risk subsides after the peak pubertal growth period. Among girls and women, however, menstruation increases the risk of iron deficiency throughout the childbearing years. An important risk factor for iron-deficiency anemia among

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non pregnant women of childbearing age is heavy menstrual blood loss (greater than or equal to 80 mL/month) (Bothwell, 1981), which affects an estimated 10% of these women in the United States (Bothwell, 1979, 1981). Other risk factors include use of an intrauterine device (which is associated with increased menstrual blood loss), high parity, previous diagnosis of iron-deficiency anemia and low iron intake (Walter *et al*., 1995; Sawaya *et al*., 1984). Use of oral contraceptives is associated with decreased risk for iron deficiency (Yip, 1994; Chanarin and Rothman, 1971).

Over the last few decades, there have been a number of studies indicating that anemia is a significant public health problem in the southern parts of Iran. Most of these studies have been performed on adult women or children. Some studies have included adolescents as a part of a larger sample. Overall, various studies have estimated the prevalence of iron-deficiency anemia to be between 25-55% among young adult women, 34.5% among non-pregnant women and 25-55% among pregnant and lactating women (Vilma, 2003). Most of these studies were based on an examination of Hb concentration. However, there are not published studies on nutrition and health status of nomadic girls and women.

The Qashqa'i forms approximately half a million of Turkish-speaking ethnic nomadic pastoralist tribes' people, living in Fars Province. Qashqa'i confederation structurally is divided into six large tribes, some smaller tribes and many sub tribes. Despite some differences, there has been a repertoire of customs, values, world views and practices, all linked through the Qashqa'i Turkish language, that can be called 'Qashqa'i culture'. While some Qashqa'i has settled, most of them still practice seasonal migration and mobile schools are provided to teach their children. School teachers and elders have been playing major roles among the Qashqa'i as influential people (Shahbazi, 1998).

The purpose of the present study was two fold: First, to determine whether the dietary intake of nomadic women was related to their Hb concentrations and/or their serum ferritin. Second, to ascertain if the dietary intake of anemia relevant nutrients differed between anemic and non anemic Qashqa'i nomadic women.

## MATERIALS AND METHODS

**Sample:** This study that began in August 2002 and lasted for two years was part of a more comprehensive study, the results of which have been published, in part, elsewhere (Salehi *et al*., 2004).

Subjects were selected from two confederations of tribes. The study population, therefore, consisted of two groups. The first group, 128 women from a random selection of 190 households among 28 sub-tribes of the Qashqa'i in Fars province who agreed to participate in the study, of which one hundred and nineteen subjects remained in the study until the end. The second group consisted of 135 randomly selected women from other sub-tribes of Qashqa'i, living in an area 6 h walking distance away from the residential place of the first group. Surprisingly, the authors noted that these groups were significantly different in their mean values of the hemoglobin and serum ferritin. As they were identical as far as the significant demographic and socioeconomic parameters are concerned, this peculiar finding prompted the authors to investigate the food basket of them in an attempt to find out the reason behind this observation. All women in the two selected confederations of tribes were informed as to the purpose of the study and they signed an informed consent form.

Dietary information was collected using the mean of three days 24 h recall method. Dieticians, with long experience in nutrition surveillance explained the purpose of the dietary information and instructed the girls on how to report quantities using food basket. Iranian food processor was used to enter and analyze nutrient intakes. Weights and heights were measured using established equipment and techniques and BMI values were calculated as weight (in kg) divided by height $m^2$. Cut of point for BMI was chosen 18.5 (Garrow *et al*., 2000).

Capillary blood was collected from the finger. Hb was measured in g $L^{-1}$ by the HemoCue hemoglobinometer. Calibration of the photometer was checked daily with a control cuvette supplied with the hemoglobinometer. The authors utilized SF concentration $<15\ \mu g\ L^{-1}$ and Hb $<120$ g $L^{-1}$ for non pregnant women to characterize iron deficiency anemia (Hallberg, 1992).

**Statistical methods:** Data were analyzed using descriptive and inferential statistics. Means and frequencies were calculated for Hb, ferritin and various socio-demographic variables (such as age). The independent two-sided t-test and chi-square were used to compare various means between first and second groups. Statistical significance was accepted when a p-value was = 0.05. The analysis was conducted on a personal computer using version 10.0 of the Statistical Package for the Social Sciences statistical (SPSS).

## RESULTS

The average daily food of anemic group(first group) consisted of 490 g Bread, 100 g Rice, 220 g Yogurt, 45 g Egg, 1.5 g Parsley, 46 g Leek, 300 g Cucumber and 28 g

Table 1: The average weight (mean±SD) of food among women‡

| Food (g) | Anemic women | Non anemic women | p-value |
|---|---|---|---|
| Bread | 490.0±65.2* | 420±87.4 | <0.0001 |
| Rice | 100.0±11.7 | 100±11.2 | 0.5 |
| Yogurt-plain | 220.0±15.5* | 450±65.7 | <0.0001 |
| Egg-fried in butter- | 45.0±7.4* | 90±8.3 | <0.0001 |
| Lemon-Raw-peeled | - | 74±15.6 | <0.0001 |
| Parsley-Raw-Chopped | 1.5±0.9* | 1±0.6 | <0.0001 |
| Leek-raw | 46.0±6.8* | 62±8.6 | <0.0001 |
| Cucumber-raw- | 300.0±81.4 | 300±52.2 | 0.5 |
| Date- natural- dried- | 28.0±4.9* | 83±10.5 | <0.0001 |

‡ Dietary recall 3 days, * Significantly different from its corresponding value for nonanemic women

Table 2: Nutrient values of women‡

| Nutrient | Anemic women | Non anemic women | p-value |
|---|---|---|---|
| Energy (kcal) | 2024.0±107.8* | 2242.0±230. 9 | <0.0001 |
| Protein (g) | 68.6±8.7* | 77.5±7.2 | <0.0001 |
| Vitamin A (μg) | 1006.0±187* | 1603.0±170.5 | <0.0001 |
| Vitamin C (mg) | 21.7±9.5* | 64.0±11 | <0.0001 |
| Folacin (μg) | 355.0±101.5* | 385.0±91.6 | 0.0074 |
| Vitamin B12 (μg) | 1.9±0.75* | 3.2±1.3 | <0.0001 |
| Calcium (mg) | 764.0±99.1* | 1058.0±121.9 | <0.0001 |
| Zinc (mg) | 13.7±5.4 | 14.3±4.7 | 0.1752 |
| Iron (mg) | 18.4±3.4* | 22.5±3.9 | <0.0001 |
| Copper (mg) | 1.5±0.7 | 1.6±0.9 | 0.1616 |
| Iodine (μg) | 112.0±15.6* | 229.0±27.2 | <0.0001 |
| Fluoride (μg) | 61.0±12* | 64.8±11.8 | 0.006 |

‡ Dietary recall 3 days, * Significantly different from its corresponding value for nonanemic women

Table 3: Age frequency distribution of women

| | Anemic women N = 119 | | Non anemic women N = 135 | | |
|---|---|---|---|---|---|
| Age (year) | No. | (%) | No. | (%) | p-value |
| Less than 20 | 4 | 3.4 | 8 | 6 | 0.9 |
| 20-29 | 29 | 24.4 | 28 | 21 | 0.5 |
| 30-39 | 35 | 29.4 | 38 | 28 | 0.8 |
| 40-49 | 27 | 22.7 | 39 | 29 | 0.3 |
| More than 49 | 24 | 20.1 | 22 | 16 | 0.5 |
| Sum | 119 | 100 | 135 | 100 | |

Table 4: Frequency distribution of women with regard to number of children

| | Anemic women N = 119 | | Non anemic women N = 135 | | |
|---|---|---|---|---|---|
| No. of children | No. | (%) | No. | (%) | p-value |
| Less than 4 | 45 | 37.6 | 43 | 32 | 0.4 |
| 4-8 | 68 | 57.1 | 80 | 59 | 0.8 |
| More than 8 | 6 | 5.1 | 12 | 9 | 0.3 |
| Sum | 119 | 100 | 135 | 100 | |

Table 5: Frequency distribution of women with regard to BMI

| | Anemic women N = 119 | | Non anemic women N = 135 | | |
|---|---|---|---|---|---|
| BMI | No. | (%) | No. | (%) | p-value |
| Less than 18.5 | 27 | 23 | 17 | 12.6 | 0.051 |
| 18.5-25 | 86 | 72 | 106 | 78.2 | 0.31 |
| More than 25 | 6 | 5 | 12 | 9.2 | 0.34 |
| Sum | 119 | 100 | 135 | 100 | |

Table 6: Biochemical parameters of the anemic and non anemic population

| Group | Hemoglobin (g $dL^{-1}$) | Ferritin (μg $L^{-1}$) | Albumin (g $dL^{-1}$) | Total protein (g $dL^{-1}$) |
|---|---|---|---|---|
| Anemic women N = 119 | 10.51±1.39* | 14.27±2.6* | 4.02±1.9 | 7.33±1.88* |
| Non anemic women N = 135 | 12.31±1.51 | 23.59±4.2 | 4.27±1.1 | 7.72±1.3 |
| p-value | <0.0001 | <0.0001 | 0.09 | 0.02 |

*significantly different from its corresponding value for nonanemic women

Date. However, the food basket of the second group (non anemic group) contained, 420 g Bread, 100 g Rice, 450 g Yogurt, 90 g Egg, 1 g Parsley, 62 g Leek, 300 g Cucumber, 83 g Date and 74 g Lemon (Table 1). Similarly, the daily food of anemic women contained 2024 kcal (68.6 g Protein, 1006 μg vitamin A, 21.7 mg vitamin C, 355 μg Folacin and 18.4 mg Fe (Table 2), while that of non anemic women contained 2242 kcal ( 77.5 g Protein, 1603 μg vitamin A, 64 mg vitamin C, 385 μg Folacin and 22.5 mg Fe (Table 2).

The average (mean±SD) age of the first group (anemic group) was 32±7.29 years. The corresponding value for the second group (non anemic group) was 33±6.47 and there was no significant difference between age distribution of both groups (Table 3). Table 4 displays the number of subject's children. As shown, about 37.6% of the first group and 32% of the second group had less than four children. BMI values of both groups are displayed in Table 5. As seen, no significant differences were noted among groups.

The results of biochemical tests among the anemic women revealed that mean value of hemoglobin was 10.51±1.39 g $dL^{-1}$, ferritin 14.27±2.6 μg $L^{-1}$, albumin 4.02±1.9 g $dL^{-1}$ and total protein 7.33±1.88 g $dL^{-1}$. The corresponding values for non anemic women were 12.31±1.51, 23.59±4.2, 4.27±1.1 and 7.72±1.3, respectively and the differences were statistically significant for all of these parameters but albumin (Table 6).

## DISCUSSION

Over the last few decades, there have been a number of studies showing that anemia is a significant public health problem in the Iranian people. These studies, based solely on assessing Hb concentration, could not indicate the etiology of the anemia seen. These findings were interpreted as indicating that Fe deficiency was highly probable in this population, since infection, parasites and hemoglobinopathies were generally rare. However in the absence of a battery of tests and dietary confirmation of low Fe and/or other nutrient intake, those results may be interpreted ambiguously. So still the question remained whether the majority of anemic women with low SF (serum ferritin) values really had subnormal dietary intakes of Fe? (Vilma, 2003).

SF has been recommended as a test to assess the prevalence of anemia in a population (Looker *et al*., 1997). However, in field situations in most developing countries it is not usually possible (due mainly to lack of trained personnel and lab facilities) to assess Fe deficiency using the recommended tests of lab measures, although ideally this would be highly desirable. Differentiating between anemia due to Fe deficiency (the most common cause of anemia worldwide) and anemia of infection (frequently assumed to be high) is difficult based on a single Fe status measure. Serum ferritin and other anemia and Fe status indicators are influenced by infection. Thus without biochemical or clinical evidence ruling out the presence of infection, interpretation of any one of Fe status indicators may be complicated.

There are a number of reports (Herbert, 1992; Baynes, 1994) to suggest that ferritin responds in an anticipated manner (i.e., is increased when Fe deficient and anemic individuals are given Fe supplementation over a number of weeks). Zanella *et al*. (1998) compared the sensitivity and specificity of serum ferritin and erythrocyte protoporphyrin for detecting Fe deficiency in women with uncomplicated Fe deficiency, using response to Fe supplements as evidence of Fe deficiency. They concluded that the sensitivity of SF were 60 and 79%, respectively in women, at a specificity of 95%. However, the sensitivity varied as a function of the Hb level. In the absence of anemia, the sensitivity dropped to 70% for SF.

Given the low sensitivity of individual measures, nutrition assessment has to rely on several lines of evidence, including diet, to corroborate laboratory assessment measures that lack high sensitivity.

This is the first study of anemia among tribal people to examine Hb concentrations, SF values and dietary intake simultaneously. Our dietary results suggest that the impairment in SF may indeed be due largely to inadequate Fe intake.

The current study shows that SF abnormalities are associated with poor dietary intake of hematinic nutrients, especially Fe and Folic acid. The low Hb concentrations are also associated with poor dietary intake of hematinic nutrients.

These data indicate that the intake of energy and important hematinic nutrients (such as Protein, Vitamin A, Vitamin C, Iron, Vitamin B12 and Folate) among anemic women were consumed at levels less than the RDA in a significant percentage of these non pregnant women. Moreover, women with below normal Hb concentrations displayed greater relative deficits in the intake of these nutrients.

Our diet findings are consistent with previous dietary studies conducted among Qashqa'i tribes by Salehi *et al*. (2004). Both studies found that significant percentages of tribes' women consumed lower than adequate amounts of recommended nutrients. Nearly 90% of our adolescent anemic population had Fe intake below the RDA. It is known that intestinal absorption of iron is highly dependent and enhances in the presence of vitamin C. Therefore, poor vitamin C content of anemic women food is thought to have adversely affected their iron uptake. Anemic women with lower intake of Fe also had lower mean Hb and mean SF values. Thus the dietary intake data support the Hb and SF data, buttressing the impression that Fe deficiency is a major contributor to anemia in this sample.

As we did not examine all the biochemical parameters, we cannot comment on the potential role that other nutrients, especially folic acid, may have played in anemia causation. However, it is clear from our dietary data, with the low overall mean intake and the high percentage of women with intake below the RDAs, that folic acid may have also played a role in their low Hb values.

Although the mean of three days 24 h Recall does not represent an individual's usual dietary intake, this technique has been shown to be a good reflective of average population intake. The 24 h Recall has been used in several surveys (Medlin and Skinner, 1988; Nelson and Bingham, 1997) and is generally recognized to provide a good reflection of group level intake. Though these data do not reveal a single dietary deficiency responsible for the low Hb concentrations, they do raise concern that there is a need for increasing awareness of the adolescents to consume adequate amounts of Fe and other hematinic nutrients.

More than one-half of these women were anemic, an even larger percentage had less than 15 $\mu g\ L^{-1}$ SF values and larger percentages had Fe intake below the RDA. It is reasonable to assume that Fe was a significant contributor to the anemia and probable iron Fe deficiency of these women. Improving the health and anemia status of women among tribes' people requires increased emphasis on public health education and/or the preventive supplementation.

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