

# The Prevalence of Anemia and Associated Nutritional Factors: Students at Knowledge University as a Case Study

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## ABSTRACT

Nutritional anemia is one of the most common types of anemia worldwide and is considered a major public health problem especially in developing countries. Therefore, this study was conducted to determine the prevalence and risk factors of anemia among university students in the Kurdistan region. A cross-sectional study of 151 healthy university's students aged between 18 and 28 years was performed between November and February 2019-2020. Blood was collected to measure hemoglobin, and a questionnaire was designed to determine participants' nutrition habits. A Pearson's chi-square test was used to reveal anemia risk factors. The anemia prevalence was 17.9%. The factors associated with an elevated anemia risk were inadequate vegetables and red meat intakes, in addition to drinking tea after meals. This study revealed that a considered part of university students have anemia that might become worse by malnutrition. Our results suggest that anemia can be prevented by encouraging the consumption of rich dietary iron, folic acid, and B12 sources and by raising awareness of the food and drinks which facilitate or hinder the bioavailability of these nutrients.

**Keywords:** Anemia, Nutrition, Iron-deficiency anemia, Knowledge University.

## 1. Introduction

Anemia is a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet physiologic needs, which vary by age, sex, altitude, smoking, and pregnancy status [1].

Nutrient-deficiency or nutritional anemia refers to the type of anemia that can be directly attributed to nutritional disorders. Thus, the term nutrient deficiency or nutritional anemia covers any anemia resulting from a deficiency of nutrients essential for red blood cell formation, for example,

iron; vitamins, especially vitamin B9 (folate), and vitamin B12 (cobalamin), more rarely vitamin A, and vitamin E [2].

Iron-deficiency anemia is anemia caused by a lack of iron, which is caused by blood loss, insufficient dietary intake, or poor absorption of iron from food. Sources of blood loss can include heavy periods, childbirth, uterine fibroids, stomach ulcers, colon cancer, and urinary tract bleeding. Poor absorption of iron from food may occur as a result of either some nutrients inhibiting the absorption of iron like polyphenol in the tea, or by an intestinal disorder such as

inflammatory bowel disease or celiac disease, or surgery such as a gastric bypass. In the developing world, parasitic worms, malaria, and HIV/AIDS increase the risk of iron deficiency anemia [3].

Iron-deficiency anemia affected about 1.48 billion people in 2015. A lack of dietary iron is estimated to cause approximately half of all anemia cases globally. Women and young children are most commonly affected [4].

Good sources of dietary iron include: Animal sources (called “heme iron”) include meat, fish, and poultry, the bodies easily absorb this type of iron, and plant sources (called “non-heme iron”) include dried beans, peas, and lentils and some fruits and vegetables (e.g. spinach) [5].

A deficiency of folate can occur when the body's need for folate is increased (pregnancy and breastfeeding), or when dietary intake or absorption of folate is inadequate as in celiac disease, and with some medications that interfere with the body's ability to use folate (e.g. phenytoin). Folate is found in leafy green vegetables, fortified cereals, and organ meats. When cooking, the use of steaming or a microwave oven can help keep more folate content in the cooked foods, thus helping to prevent folate deficiency.

Vitamin B12 deficiency anemia, of which pernicious anemia is a type, is a disease in which not enough red blood cells are produced due to a deficiency of vitamin B12.

Pernicious anemia refers to anemia that results from a lack of intrinsic factors. Lack of intrinsic factor is most commonly due to an autoimmune attack on the cells that create it in the stomach [6].

Other causes of low vitamin B12 include not enough dietary intake (such as in a vegan diet), celiac disease, or tapeworm infection. Beef liver and clams are two of the best sources of vitamin B-12. Other good sources include fish, meat, poultry, and eggs.

The aim of this study: To determine the prevalence of anemia among apparently healthy students of the university, and analyze the dietary pattern and nutritional status of essential nutrients for red blood cell formation.

## 2. Material and Methods

### 2.1. Study design

This cross-sectional study was designed to determine the prevalence of anemia among apparently healthy university students by analyzing blood samples to measure packed cell volume (PCV). Moreover, a questionnaire survey was

conducted to participants to evaluate their health conditions and nutritional habits.

The survey was done in Knowledge University between November and February 2019-2020.

### 2.2. Study Subjects

The present study included 151 students randomly selected, with the exclusion of smokers, chronic diseases patients, and female students with a heavy menstrual cycle. Participants were informed about the objectives of the study and the protocol of the experiment.

### 2.3. Data and Samples Collection

The questionnaire was designed to collect information of the participants which includes the types of foods taken during the week, especially the food that is rich in iron, vitamin B12, and folic acid. The information was classified into the following: No intake, infrequently ( $\leq 2$  servings/week), and frequently ( $> 2$  servings/week). For the consumption of tea after meals, the answers were classified into two groups yes, or no.

Two milliliters of venous blood was collected from each student into K3EDTA tubes to measure packed cell volume (PCV) by using a hematocrit centrifuge and PCV reader. Typically, anemia is determined by measuring hemoglobin (Hb) concentration. However, packed cell volume (PCV) has been widely used as an alternative to hemoglobin for screening purposes. A standard threefold conversion between the two measures ( $Hb = PCV/3$ ) is commonly used to define cut-offs for estimating the prevalence of anemia [7].

The packed cell volume (PCV) is determined by centrifuging the blood in a capillary tube at 10,000 RPM for five minutes. This separates the blood into layers. The volume of packed red blood cells divided by the total volume of the blood sample gives the PCV.

### 2.4. Statistical Analysis

The collected data were analyzed using SPSS for Windows program (version 23.0, SPSS). Pearson's chi-square test was used to investigate the association between the dependent variables (anemia) and the independent (dietary intake).

Variables having a p-value of less than or equal to 0.05 were considered statistically significant for the development of anemia.

Table 1: Distribution of anemic and nonanemic students according to frequency intake of food items

Variable	Anemic	Nonanemic	P value
<b>Frequency of vegetables intake</b>			
Frequent (>2servings/week)	5 (7.8%)	59 (92.2%)	P<0.001
Infrequently (≤2 servings/week)	10 (21.3%)	37 (78.7%)	
No intake	12 (30%)	28 (70%)	
<b>Frequency of fruits intake</b>			
Frequent (>2servings/week)	14 (11.9%)	104 (88.1%)	P=0.1
Infrequently (≤2 servings/week)	10 (50%)	10 (50%)	
No intake	3 (23.1%)	10 (76.9%)	
<b>Frequency of red meat intake</b>			
Frequent (>2servings/week)	2 (5.7%)	33 (94.3%)	P=0.02
Infrequently (≤2 servings/week)	9 (14.8%)	52 (85.2%)	
No intake	16 (29.1%)	39 (70.9%)	
<b>Frequency of fish intake</b>			
Frequent (>2servings/week)	17 (30.4%)	39 (69.6%)	P=0.1
Infrequently (≤2 servings/week)	5 (8.2%)	56 (91.8%)	
No intake	5 (14.8%)	29 (85.2%)	
<b>Frequency of chicken intake</b>			
Frequent (>2servings/week)	21 (16.2%)	109 (83.8%)	P=0.5
Infrequently (≤2 servings/week)	4 (36.4%)	7 (63.6%)	
No intake	2 (20%)	8 (80%)	
<b>Frequency of egg intake</b>			
Frequent (>2servings/week)	15 (17.9%)	69 (82.1%)	P=0.5
Infrequently (≤2 servings/week)	8 (21.1%)	30 (78.9%)	
No intake	4 (13.8%)	25 (86.2%)	
<b>Frequency of legumes intake</b>			
Frequent (>2servings/week)	12 (16.7%)	60 (83.3%)	P=0.2
Infrequently (≤2 servings/week)	11 (19.3%)	46 (80.7%)	
No intake	4 (18.2%)	18 (81.8%)	
<b>Frequency of milk intake</b>			
Frequent (>2servings/week)	16 (19.3%)	67 (80.7%)	P=0.1
Infrequently (≤2 servings/week)	3 (12.5%)	21 (87.5%)	
No intake	8 (18.2%)	36 (81.8%)	
<b>Drinking tea after meal</b>			
Yes	21 (22.1%)	74 (77.9%)	P<0.001
No	6 (10.7%)	50 (89.3%)	

### 3. Discussion

Nutritional anemia is the main nutritional disorder worldwide. The present research focused on establishing the prevalence of anemia among university students in the Kurdistan Region of Iraq and identifying the risk factors of nutrition status associated with this disease. The current showed the prevalence of anemia among university students is (17.9%).

In developing countries, the overall prevalence of anemia has been estimated at 43%, but in highly developed countries, it has been reported at a far lower level of 9% [8]. To take an example, research in the Yemen setting reported a prevalence of 30.4% among university students [9], and widespread anemia has also been found among students in other developing countries such as Bangladesh at 55.3% [10]. In contrast, in Australia, a developed country, only a 3%

prevalence of anemia was found by a study using a sample of female university students [11].

The current study revealed that the prevalence of anemia in the female and males was (15.9%), and (20.3%) respectively, which doesn't agree with WHO's report that estimated the prevalence of anemia among non-pregnant women is 30.2% and among men is 12.7% [12]. The low prevalence of anemia among females in the current study because it is excluded heavy menstrual cycle females from the study which is the main cause of anemia among females, as the goal was the determination of nutritional risk factors of anemia. Moreover, the high prevalence of anemia among male because tea drinking is a popular custom across the Kurdistan region among men, and it is usually consumed both before and after all meals, as tea inhibit iron absorption.

On the other hand, the current study revealed a statistically significant difference ( $p < 0.001$ ) between nonanemic and anemic students based on vegetable intake as vegetables are a good resource of iron and folic acid. Previous studies on Bengali students and Saudi women have demonstrated that low consumption of vegetables is associated with anemia [13, 14]

Because any examination of the dietary contribution to the cause of anemia must evaluate the possible dietary factors which inhibit or enhance iron absorption, vitamin C (ascorbic acid) has previously been identified as a strong iron absorption enhancer for nonheme foods. so the current research explored the consumption of vitamin C which exist in high concentration in fruits [15].

The current study has found that most students of the low intake of fruits don't have anemia, in contrast to other researches which has associated low fruit consumption with an elevated risk of anemia [14, 16], that is because the students with low fruits consumption in the present study have a high vegetable consumption, as the vegetables are another source of vitamin C.

On the other hand, tea is a beverage that harmfully affects an individual's iron levels due to its high polyphenol content, which inhibits non-heme iron absorption [17]. This fact is confirmed by the current study, that the prevalence of anemia among students who drink tea after meals are higher (22.1% versus 10.7%). This finding is in line with previous studies which have found that anemic groups reported higher levels of tea consumption [14, 16, 18, 19].

Red meat is a key source of bioavailable heme iron and B12 [19], the current study has identified a negative

association between low levels of red meat consumption and an increased risk of anemia, this result corresponds with previous studies [11, 18, 20].

The current study revealed that there was no statistically significant association between low intake of fish, chicken, milk, egg, and legumes with an increased anemia risk, while previous studies reported low consumption of these items as a factor of anemia [9, 21, 22]. This discrepancy is explained by the that these items are not the main sources of the essential nutrients to hemoglobin formation, so it is easy to compensate by other sources such as red meat, and green leaves.

#### 4. Conclusion

This study found an overall prevalence of anemia among apparently healthy university students in the Kurdistan region of Iraq was 17.9%. The study also reported that the main nutrition risk factors with increase anemia were infrequent intakes of vegetables and red meat, in addition to drinking tea after meals.

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