

## Prevalence and Risk Factors of Anemia among Adolescents in Denizli, Turkey

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### Abstract

**Objective:** The aim of this study was to evaluate the prevalence and risk factors of anemia among adolescents in Denizli where Mediterranean cuisine (fresh fruit and vegetables) is adopted.

**Methods:** We accepted hemoglobin values below 12 g/dl for girls and 13 g/dl for boys as the criteria of anemia. We recorded a detailed history including nutritional habits, consumption of animal source foods especially red meat, consumption of fresh fruit and vegetables, presence of parasitic infestation, psychosocial status, school success and any materials consumed except ordinary food.

**Findings:** We investigated the prevalence of anemia in 1120 children (672 girls and 448 boys), aged 12 to 16 years. We found that the overall prevalence of anemia was 5.6%. 8.3% of the girls and 1.6% of the boys were anemic. We diagnosed iron deficiency anemia in 37(59%) anemic patients and combined iron deficiency and vitamin B12 deficiency anemia in 26 (41%) anemic patients. None of the patients had folic acid deficiency.

**Conclusion:** Our results suggest that the socioeconomic status of the family, traditional eating habits of the region, the fear of gaining weight and irregular eating habits are of great importance in the development of adolescent anemia in Denizli.

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**Key Words:** Adolescence; Anemia; Ferritin; Vitamin B<sub>12</sub>; Traditional Eating

### Introduction

Anemia is one of the most important health problems throughout the world [1]. Adolescent children are one of the major risk groups for anemia [2]. The prevalence of anemia among adolescents is 27% in developing countries, and 6% in developed countries [3]. In Turkey, the prevalence ranges from 1.5% to 12.5% [4,5]. Iron deficiency anemia (IDA) constitutes the major anemia during adolescent period. Accelerated

development, hormonal changes, malnutrition and starting of menstrual periods in girls are major causes in this period [2,6]. Because iron is an essential element for the function of various organs, its deficiency may lead to impaired perception and learning difficulties ending up with declined school success [7].

In childhood, the most frequent cause of megaloblastic anemia is the deficiency of vitamin B<sub>12</sub> and folic acid. Fresh vegetables and fruits contain folic acid, but the only source of vitamin

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B<sub>12</sub> is foods of animal origin [8]. Deficiency of vitamin B<sub>12</sub> may cause neuropsychiatric problems, impaired behavior, lack of attention, learning difficulties and a decline in the success of the affected students [9]. Prevalence of vitamin B<sub>12</sub> and folic acid deficiency vary among different communities with different eating habits and socioeconomic levels.

The studies about adolescent anemia including vitamin B<sub>12</sub> and folic acid deficiency are very limited in Turkey [4,5]. In this study we aimed to investigate the prevalence of anemia and risk factors among adolescents in a southwest province of Turkey where Mediterranean diet (fresh fruit and vegetables) is adopted.

### Subjects and Methods

The population of study was recruited from 12-16 year-old patients who applied to pediatric outpatient clinics between December 2008 and December 2009 in Denizli State Hospital. This study was approved by regional ethic committee. Informed written consent was obtained from legal representatives of patients. The criteria of anemia were accepted as the hemoglobin value below 12g/dl for girls and 13g/dl for boys. Thalassemia traits, patients having chronic illness, or taking medication were excluded from the study.

The patients with anemia were investigated in the hematology outpatient department. A detailed history including eating habits, consumption of animal source foods especially red meat, fresh fruit and vegetables, presence of parasitic infestations, psychosocial status, school success and any materials consumed except ordinary food were recorded. Vitamin B<sub>12</sub>, folic acid and ferritin

levels were measured in the venous blood obtained in the morning after 8 to 10 hours of fasting. Ferritin was measured using chemiluminescent technique (Advia Centaur, Siemens, USA). Vitamin B<sub>12</sub> and folic acid levels were measured using chemiluminescent technique by 2000 (Immulite, Diagnostic Products Corporation, USA). Serum iron and iron binding capacity were measured by Abbott Architect C 8000 Biochemistry Analyzer. The anemic patients who had ferritin <15ng/dL and transferrin saturation <14% were diagnosed as having IDA. Vitamin B<sub>12</sub> and folic acid levels below 200pg/ml and 4ng/ml respectively were accepted as vitamin B<sub>12</sub> and folic acid deficiency.

### Findings

A total of 1120 patients (672 girls and 448 boys) aged 12-16 years admitted to pediatric outpatient clinic during this period comprised the study group. Sixty-three of 1120 (5.6%) children were diagnosed as being anemic. When the gender was considered, 8.3% of the girls and 1.6% of the boys had anemia. Thirty-seven (59%) patients were diagnosed as having IDA, and 26 (41%) were diagnosed as having combined iron deficiency and vitamin B<sub>12</sub> deficiency anemia (Table 1).

In anemic patients, blood parameters were distributed as shown on Table 2. None of the patients were diagnosed as having folic acid deficiency. No parasitic infestation was detected. Five patients were strictly vegetarians. These patients had combined vitamin B<sub>12</sub> and IDA.

Fifty (88%) of 57 girls with anemia had menstrual bleeding. Nine (16%) girls had irregular menstrual bleeding in form of menometrorrhagia.

**Table 1:** Characteristics of anemic patients

	N (%)
<b>Gender</b>	
Girls	56 (89)
Boys	7 (11)
<b>Iron Deficiency Anemia</b>	37 (59)
<b>Combined iron and vitamin B<sub>12</sub> deficiency anemia</b>	26 (41)
<b>Folic acid deficiency</b>	0

**Table 2:** Laboratory results in anemic patients

Variable	Mean (SD)	min-max
Hemoglobin (g/dl)	9.3 (1.7)	8.4-12.1
MCV (fl)	69.7 (8.9)	48-87
RDW (%)	17.8 (1.0)	16-20
Ferritin (ng/ml)	4.9 (5.1)	0-14
Vitamin B <sub>12</sub> (pg/ml)	169.2 (12.7)	150-190
Iron (U/L)	15.6 (6.2)	6-34
Iron binding capacity (µg/dL)	418.8 (58.0)	256-565

SD: Standard Deviation

Bleeding disorder or an abnormality in pelvic ultrasonography was not detected in these girls. Eating habits of anemic patients are shown in Table 3. Animal source food preference was low (32%) and families were mostly composed of moderate-poor socioeconomic status in our study (Table 3).

## Discussion

The number of studies investigating the prevalence of adolescent anemia is limited in Turkey [4,5,10]. In our study, we found the rate of anemia as 5.6%. This result was comparable with the average rate of anemia in Turkey. In adolescence period, the iron need is increased due to rapid growth. In order to increase the absorption of iron, the level of ferritin decreases. Additionally, the onset of menstruation in girls results in reduced ferritin levels. Irregular eating habits and the lower consumption of animal

source foods contributes to the development of anemia. Therefore, girls have higher incidence of anemia [6,11]. In our study, we diagnosed anemia in 8.3% of the girls compared to 1.6% of the boys. Similar to our study, Kara et al [12] and Yavuz et al [13] also found a higher incidence of anemia in girls compared to boys. The lower prevalence of anemia among pubertal boys can be explained by the physiological rise in hemoglobin concentration caused by sexual maturation as well as by decreasing requirements after completion of the growth spurt. In girls, the occurrence of menarche and menstrual irregularities halt an expected age related increase in hemoglobin concentration [14]. In our study, there were 50 menstruating girls, and 9 of them had irregular menstruation. In a previous study it was shown that the incidence of anemia was higher in developing countries than that of developed ones. Poverty limits the availability and consumption of foods of animal origin [14]. The prevalence of anemia in adolescent girls was 68.8% in Nepal [15] whereas the same rate detected as 2% in the USA [16]. Anemia prevalences also differ among the countries within

**Table 3:** Eating habits of anemic patients

Eating characteristics	Number of patients (%)	
Preferred eating habit in family	Fruit-vegetable	43 (68%)
	Animal sources food	20 (32%)
Frequency of animal source food consumption (egg, chicken, milk etc.)	Once every 2 to 3 days	10 (16%)
	Weekly or less often	53 (84%)
Frequency of red meat consumption	Once every 2 to 3 days	8 (13%)
	Weekly or less often	55 (87%)
Frequency of fresh vegetable and fruit consumption	Once every 2 to 3 days	63 (100%)
	Weekly or less often	0
Breakfast or lunch or both	At home	8 (13%)
	At canteen or café	52 (87%)
Socio-economic status	Moderate-well	15 (24%)
	Moderate-poor	48 (76%)

**Table 4:** Comparison of studies evaluating adolescent anemia from different countries within same geographical region

Study	Prevalence (%)	Age Group	Country
Al-Sharbati et al [18]	12.9 for rural region 17.6 for urban region	Adolescents	Iraq
Akramipour et al [19]	21.4	14-20 years	Iran
Mikki et al [20]	6.0-22.5 for male 9.2-9.3 for female	13-15 years	Palestine
El Sahn et al [21]	46.6	12-18 years	Egypt

same geographical region (Table 4) [17-20]. In our study, 76% of children with anemia had moderately poor socioeconomic level and 87% of anemic patients had red meat intake for once a week or less.

Denizli is a city of agriculture, industry and commerce and located in Southwest Aegean region of Turkey. Traditionally, a diet rich with fresh fruit and vegetables often referred as "Mediterranean Cuisine" is commonly used in this city. In our study, the families of 68% of the patients preferred fresh vegetable and fruit instead of animal source foods. We suggest that high proportion of manual labor workers in population and the traditional eating habits of them may contribute to the development of anemia in this region. The study conducted in Şanlıurfa is a good example showing the effects of eating habits on anemia. Şanlıurfa, a less developed city located on the southeast of Turkey, has a high rate of red meat consumption and has adolescent anemia prevalence of 1.5% [4]. In our study, vitamin B12 and iron deficiency due to the lower intake of animal source foods is a contributory cause. We did not see folic acid deficiency because of high levels of fruit/vegetable intake.

Iron deficiency anemia is the most common type of anemia in adolescents [2]. However, a detailed investigation is necessary for vitamin B<sub>12</sub> deficiency, the only source of which is animal origin foods. Christel et al [16] reported that vitamin B<sub>12</sub> was low in vegetarian patients. In one of the studies conducted in Nigeria, Vanderjagt et al represented that the lower intake of meat results in lower vitamin B<sub>12</sub> level [21]. In Turkey, the research is limited concerning vitamin B<sub>12</sub> deficiency in adolescents. Wetherilt et al [22]

reported 5.9% prevalence for vitamin B<sub>12</sub> deficiency among adolescents in Turkey. In our study, combined vitamin B<sub>12</sub> and iron deficiency were 2.3% in selected patient population. Five patients were vegetarians. Our findings can be attributed to lower intake of animal source foods, low socio-economic status, traditional eating habits, school-exam anxiety, irregular eating habits with consumption of the food which is deficient in vitamin B<sub>12</sub> (biscuits, chocolate, tea and coke in canteens or cafes), and anxiety of gaining weight.

## Conclusion

Our results suggest that the socioeconomic status of the family and traditional eating habits are of great importance in the development of anemia. In adolescents, the fear of gaining weight and not being liked, examination anxiety and, irregular eating habits are the major causes for the lower intake of animal source foods leading to anemia. Nutrition awareness education should be given both to parents and to children.

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**Conflict of Interest:** None

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