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308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

Dietary Iron Consumption and its Relation with Stress Symptoms of Adolescents

Saime Küçükkömürler¹ and Fatma Arpacı²

¹Department of Food and Nutrition Education, Gazi University, Ankara, Turkey

²Department of Family Economics Education, Gazi University, Ankara, Turkey

Abstract: The aim of this study is to investigate dietary iron consumption and its relation with stress symptoms of healthy adolescents. 39 voluntary and healthy university students from Ankara, Turkey at the age of 19-25 were included in the study. Nutrient intake of the volunteers was estimated from 24 h recall and averaged for 3 days and then adolescents were divided into two groups according to iron amounts they consume. The calculations also reveal the fact that dietary iron level of 92.3% of adolescents is low. A questionnaire containing stress symptoms was applied following the day when nutrients were recorded. Finally the relation of the stress symptoms and iron consumption was analyzed with t test. The results of the t test show that psychological stress change significantly according to the level of iron ($p>0.05$). Average scores of the adolescents having a normal level of iron (46.33 ± 12.98) was lower compared to those having a low level of iron (46.33 ± 12.89). It was determined that there was no significant difference between stress symptoms experienced by normal and low level dietary iron consumers ($p>0.05$). Though it was expected that stress symptom experience of adolescents were affected by dietary iron levels no significant evidence for this was experienced. For further experiments, groups including high and low dietary iron consumption or larger groups are suggested for more precise results.

Key words: Dietary, iron, adolescent, stress symptoms

INTRODUCTION

Adolescence is a transitional period between childhood and adulthood with specific physiological, psychological and social features that have a bearing on nutrition problems and intervention strategies. It is commonly regarded as a relatively healthy period of the life cycle. Indeed, adolescents are possibly more vulnerable to stress symptoms than they were at a younger age. This may contribute to their being somewhat neglected but also it may mean that there is at adolescence less interference with adequate physiological utilization of food nutrients (WHO, 2005). Adolescents make up roughly 20 % of the total world population. In Turkey, adolescents have an even higher demographic weight, for instance, roughly 22.4 %, compared to 14 % in USA (Anonymous, 2000; WHO, 2005). However, during the period of adolescence that nutrient needs are the greatest. Adolescents are in the process of establishing responsibility for their own health-related behaviors, including diet (WHO, 2005).

Stress is known to cause changes in the body's chemistry, altering the balance of hormones in systems in ways that can lower resistance to disease. As a result, people become more susceptible to flues, colds and other types of illness (Brown, 2005). Stress is the physiological and psychological reaction which occurs when people perceive an imbalance between the level of demand placed upon them and their capability to meet those demands (Cranwell-Ward, 1990). There is a high correlation between excessive stress and coronary

heart disease. Many other illnesses are stress related also. First, stress has direct physiological results, including an increase in blood pressure, an increase in hormonal activity and an overall decline in the functioning of the immune system. Second, stress leads people to engage in behavior that is harmful to their health, including increased nicotine, drug and alcohol use, poor eating habits and decreased sleep. Finally, stress produces indirect consequences that result in declines in health, which is a reduction in the likelihood of obtaining health care and decreased compliance with medical advice when it is sought (Feldman, 2005). Stress does not affect everyone in the same way and even symptoms in the same general area may show themselves in different ways. For example, one person may lose his appetite and not want to eat much at all, whereas another will find herself eating more, whether he or she is hungry or not (Atkinson, 1994). Both stress may cause deficiency of nutrients or deficiency of nutrients may result with stress symptoms.

Iron deficiency is known to affect the lives of more than 1.2 million people worldwide. Iron deficiency is the most common nutritional deficiency noted among children and adolescents (Bagchi, 2004) Several risk factors are associated with its development among adolescents, including rapid growth, inadequate dietary intake of iron-rich foods or high in vitamin C, highly restrictive vegetarian diets, calorie-restricted diets, meal skipping, participating in strenuous or endurance sports and heavy menstrual bleeding. The effects of iron- deficiency

anemia include delayed or impaired growth and development, fatigue, increased susceptibility to infection secondary to depressed immune system function, reductions in physical performance and endurance (Story *et al.*, 2000; WHO/FAO, 2004; Brown, 2005; Zimmermann and Hurrell, 2007). Adolescent administered a wide range of test of attention, learning and memory in an intervention trial (Bruner *et al.*, 1996). Researches have shown that iron has a significant role in development and operation of brain (Pintero *et al.*, 2000). However, no studies were found on the psychological effects of iron or its role about stress symptoms.

There have been some relations of nutritional deficiencies, vitamin and supplements with stress (Miller, 1996), no study was encountered examining the relation between stress symptoms and dietary iron. The aim of this study was to investigate dietary iron consumption and its relation with stress symptoms of healthy adolescents.

MATERIALS AND METHODS

The study sample included 39 adolescents from a public university in Ankara, Turkey. At the establishment of sample group, a student group of 100 individuals was informed about the purpose of the study. Heights and weights of the subjects were taken, the values of BMI were accounted and they were taken as volunteer, healthy, normal BMI (19-21) student between 19-25 years of age in this study. Data were collected in a period of 8 months, between June 2005 and February 2006.

Students were asked for recording the food they consumed on three successive days (Sunday, Monday and Tuesday) into the form developed. Nutrient intake was estimated from 24 h recall. It was deliberated that the first day was a non-working day. Iron values at the content of the food consumed every day were calculated separately and an average of three days were taken from the chart of food prepared for Turkey (Anonymous, 1991). It was also paid attention that the adolescent girls were not at the period of menstruation and they were asked to record after this period. At the day following food recording, a questionnaire including stress symptoms was applied. Each subject participated into a face-to-face interview lasting approximately 15 min. During the interviews, participants provided with demographic information (age, sex, the grade, having whether a minor health problem). Stress symptoms measure is a tool consisting of 9 physiological stress symptoms and 10 psychological stress symptoms. Stress symptoms have been measured by the answers given to Likert type sentences consisting of 19 items. Items are rated on a 5-point scale (always:5 usually:4, sometimes:3, seldom:2, never:1).

Internal reliability coefficient (Chonbach's alpha) of the stress symptoms scale used for the students taken

within context of sampling is as follows; physiological stress symptoms (items 9) 0.72; psychological stress symptoms (items 10) 0.78 and stress symptoms scale (items 19) 0.85. The data from the food consume and questionnaire was analyzed using SPSS version 13.0. Of the demographical characteristics belonging to the adolescents taken into the study, absolute and percentage values of the variables of age, sex, the grade, having whether a minor health problem were given. Adolescents were divided into two groups as low and normal dietary iron level groups. Low dietary iron level group consisted of males with less than 7.9 mg daily iron intake and females with less than 17.9 mg daily iron intake. Normal dietary iron level group included individuals with 8/18-45 mg daily iron intake. None of the adolescents with more than 45 mg daily iron intake attended to the experiments, therefore there was no such group as high dietary iron level group. (Anonymous, 1999; Wardlaw, 2003; WHO/FAO, 2004). A higher rate of iron consumption was not encountered during the consumption of nutrient. The relation of the stress and iron consume was analyzed with t test whether it was meaningful statistically depending the variable of the iron level of adolescents as physiological stress symptoms and psychological stress symptoms.

RESULTS

28.2 % of the adolescents taken into the study are at the age of 21. The average age is 22.17 ± 1.23 . 48.7% of adolescents are girls, while 51.3% are boys. 15.4 % of adolescents are students of 1st grade and 17.9% of them have minor health problems (Table 1).

It was determined that the average scores of the adolescents having a normal level of dietary iron are higher than the ones who have a low level at the stress symptoms of chest pain, boredom, back and neck pain and thirstiness and dryness in the mouth which take place at the subscale of physiological stress symptoms. On the other hand, average score of those with a low level of dietary iron is higher than the adolescents with a normal level at the symptoms of shortness of breath when climbing stairs, sudden cramp, constipation and diarrhea. The stress symptom of chronic fatigue and tiredness differ significantly according to dietary iron level ($p < 0.05$).

At the symptoms of insomnia, excessive sleep desire, nervousness, clipping and over-smoking which take place at the subscale of psychological stress symptoms, the adolescents having a normal dietary iron level have a high average score compared to those having a low level of iron. The stress symptoms of over drinking, show significant difference according to dietary iron level ($p < 0.05$). Heart palpitation also shows a significant difference ($p < 0.01$). At the symptoms of fatigue, overeat or lack of appetite and quick excitement, adolescents having a low level of iron have a higher

Table 1: Demographic characteristics of adolescents (n = 39)

Age (year)	Number	%	Grades	Number	%
<21	11	28.2	1 st Grade	6	15.4
22	18	35.9	2 nd Grade	3	7.7
23	8	20.5	3 rd Grade	7	17.9
24?	6	15.4	4 th Grade	23	59.0
Sex			Having whether a minor health problem		
Female	19	48.7	Yes	7	17.9
Male	20	51.3	Yes	32	82.1

It was found that dietary iron level most of the adolescents (92.3 %) is low (Table 2).

Table 2: Iron levels of adolescents (n = 39)

	Number	%
Iron level		
Low	36	92.3
Normal	3	7.7

score than those with a normal level of iron. There is no significant difference between iron level of adolescent and this psychological stress symptoms ($p>0.05$).

When average stress symptoms scores were examined according to iron level depending on nutrient consumption of adolescents, it was found that average score of the adolescents having normal level of iron (46.33 ± 12.89) is higher than those with a low level of iron (45.02 ± 10.18). As a result of t-test this difference was not found to be significant ($p>0.05$).

DISCUSSION

In this research it was found that dietary iron level most of the adolescents is low. Average frequencies iron deficiency are estimated at 43% and reach 85% in some populations (Bagchi, 2004). The problem is not restricted to those in poverty or to underdeveloped countries. For example in Japan young women %25, USA approximately 75% of college-aged women suffer iron deficiency (Theil, 2004). Iron deficiency is the most common single-nutrient deficiency disease in the world: An estimated 50% of women of reproductive age and a similar percent-age of adolescent are iron deficient (Beard and Connor, 2003). The safe limit especially for women of child bearing age is 18 mg/day (Oberleas *et al.*, 1999). The iron requirement for women of childbearing age (daily 0,5 mg) is higher than (10 mg/day) in order to meet the amount lost through menstruation.

It was determined that the average scores of the adolescents having a normal level of dietary iron are higher than the ones who have a low level at the stress symptoms such as chest pain, boredom, back and neck pain and thirstiness and dryness in the mouth which take place at the subscale of physiological stress symptoms. On the other hand, average score of those with a low level of dietary iron is higher than the adolescents with a normal level at the symptoms of shortness of breath when climbing stairs, sudden cramp, constipation and diarrhea. The stress symptom

of chronic fatigue and tiredness differ in relation to dietary iron level. It can be said that adolescents with low dietary iron levels tend do suffer more from this stress symptoms when compared to ones with normal dietary iron levels.

At the symptoms of insomnia, excessive sleep desire, nervousness, clipping and over-smoking which take place at the subscale of psychological stress symptoms, the adolescents having a normal dietary iron level have a high average score compared to those having a low level of iron. The stress symptom of over drinking shows a significant difference according to dietary iron level. Heart palpitation also differs significantly according to dietary iron level.

At the symptoms of fatigue, overeat or lack of appetite and quick excitement, adolescents having a low level of iron have a higher score than those with a normal level of iron there is no significant difference between iron level of adolescent and this psychological stress symptoms.

In this respect, Miller (1996) found that as special changes are applied to diet, symptoms of psychological stress reduce. When average stress symptoms scores were examined according to iron level depending on nutrient consumption of adolescents, it was found that average score of the adolescents having normal level of iron is higher than those with a low level of iron. As a result of t-test, it was found out that there was no significant difference between iron levels of adolescents and their experiencing of stress symptoms. This result shows that adolescents' experiencing of stress symptoms are affected by the levels of dietary iron and that both the adolescents having a low level of iron and the ones with a normal level of iron experience stress symptoms.

Stress can have an effect on eating habits, as well. Eating a balanced diet and getting adequate rest help body adapt and respond to the life events. The iron requirement of an adolescent is generally recognized to be the intake required to maintain iron balance and therefore balancing hemoglobin production carriage of oxygen to cells and usage of nutrients in cells. The mean iron requirement of adolescent is therefore the mean intake is essential element and especially for women.

Table 3: Stress symptoms of t test results depending on the iron level of adolescent

Stress Symptoms Scale	Low Group n = 36		Normal Group n = 3	
	Mean ± SD	Mean ± SD	t	p
Physiological Symptoms Subscale				
Chest pain	1.83 ± 0.91	2.33 ± 1.15	-0.89	0.374
Boredom	2.44 ± 0.93	3.00 ± 1.73	-0.92	0.361
Back and neck pain	2.44 ± 1.15	2.66 ± 1.52	-0.31	0.756
Thirstiness and dryness in the mouth	2.47 ± 1.05	2.66 ± 1.52	-0.29	0.767
Shortness of breath when climbing stairs	2.41 ± 1.20	2.33 ± 1.52	0.11	0.910
Sudden cramp	2.97 ± 1.05	1.66 ± 0.57	0.49	0.626
Constipation	2.25 ± 0.93	1.33 ± 0.57	1.65	0.106
Diarrhea	1.88 ± 0.74	1.33 ± 0.57	0.25	0.219
Chronic fatigue and tiredness	2.20 ± 1.20	1.33 ± 0.57	-1.64	0.044*
Psychological Symptoms Subscale				
Insomnia	2.58 ± 0.87	2.66 ± 1.15	-0.15	0.877
Excessive sleep desire	2.97 ± 1.05	3.66 ± 1.15	-1.08	0.283
Nervousness	2.94 ± 0.95	3.00 ± 0.00	-0.10	0.921
Clipping	2.05 ± 0.79	2.33 ± 0.57	-0.59	0.557
Over-smoking	1.75 ± 1.36	3.00 ± 1.73	-1.50	0.141
Over drinking	1.19 ± 0.52	2.00 ± 1.73	-2.06	0.046*
Heart palpitation	2.44 ± 0.80	3.00 ± 0.00	-1.17	0.000**
Fatigue	3.02 ± 1.10	2.66 ± 1.15	0.54	0.592
Overeat or lack of appetite	2.91 ± 1.13	2.66 ± 1.15	0.36	0.250
Quick excitement	2.91 ± 1.02	2.66 ± 0.57	0.41	0.681
Total score	45.02 ± 10.18	46.33 ± 12.89	-0.21	0.835

*p<005, **p<001, Sd = 37

Dietary iron deficiency can rapidly deplete brain iron concentrations and storage is able to normalize them. Iron-casual define roles of brain iron in neural development and functioning (Theil, 2004). iron therapy had any significant impact on cognitive process. Iron administered a wide range of tests of attention, learning and memory to inner-city girls in an intervention trial. Two months of iron therapy resulted in improvement in iron status and memory task but showed no difference measure of attention or vigilance. Most of these studies iron deficient anemic children had lower global intelligence scores at baseline (Beard and Connor, 2003). A number of intervention trials examined effects of iron deficiency on neural functioning in school-age, pre-adolescent and adolescent boys and girls (Groner *et al.*,1986; Pollit *et al.*,1986; Pollitt *et al.*,1989; Palti *et al.*,1985; Seshadri and Gopaldas, 1989; Stoltzfus *et al.*, 2002). However no research was found that shows the relation between iron deficiency and stress symptoms. It is thought that iron anemia may effect the function of nervous system and circulation system resulting stress symptoms.

Conclusion: It was found that dietary iron consumption of more than half of the adolescents is lower than 18 mg /day. According to average stress symptoms scores there wasn't found to be any relation between dietary iron level and stress symptoms in this study. As long as an individual lives, it is not likely for him to be in an environment without stress. Individual precautions to be used in preventing stress may provide the reduction and prevention of stress and stress symptoms. However

studies including more participants may give more precise results. It was recommended that dietary iron consumption be increased. For this reason, as well as healthy eating, supplements are also recommended. It is likely to compare the difference between low and high consumption levels of dietary iron to determine the relation between dietary iron consumption and stress symptoms efficiently, as well.

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