

Dietary Calcium Consumption And Its Relation With Stress Symptoms Of Adolescents

F Arpaci, S Kücükkömürler

Citation

F Arpaci, S Kücükkömürler. *Dietary Calcium Consumption And Its Relation With Stress Symptoms Of Adolescents*. The Internet Journal of Nutrition and Wellness. 2006 Volume 4 Number 1.

Abstract

Objective: To investigate dietary calcium consumption and its relation with stress symptoms of healthy adolescents.

Method: 88 volunteer university students were included in the study. Nutrient intake was estimated from 24 hour recall. A questionnaire containing stress symptoms was applied following the day when nutrients were recorded.

Results: Dietary calcium level of adolescents of 70.5 % is low. Psychological stress does not change significantly according to the level of calcium ($p>0.05$). Average scores of the adolescents having a normal level of calcium were higher compared to those having a low level of calcium. It was determined that there was no significant difference between the levels of calcium and that they experience stress symptoms ($p>0.05$).

Conclusion: It was found that stress symptom experience of adolescents were not affected by dietary calcium levels and that both the adolescents having a low level calcium and those having normal level calcium experienced stress symptoms.

INTRODUCTION

Forming and maintaining bones are calcium's major roles in the body. However, calcium is important in many other processes as well. Calcium is essential for blood clotting and for muscle contraction. Blood calcium falls below a critical point and muscles can not relax after contractions, so the body stiffens and shows signs of tetany. In nerve transmission, calcium works to release neurotransmitters and permits the flow of ions in and out of nerve cells. Without sufficient calcium, nerve functions fails, bringing out to tetany. Finally, calcium helps regulate cellular metabolism by influencing the activities of various enzymes and hormonal responses. It is the hormonal regulation of blood calcium that keeps of all these processes going, even if it is failed to consume enough calcium on the daily basis₁. It trends to underestimate the negative calcium balance at low intake and overestimate the positive balance at high intake₂. Intakes of calcium have been known for many years to vary greatly from one country to another, as is clearly shown in FAO food balance sheets. This view of the global situation underpinned the very conservative adequate calcium intakes recommended by FAO/WHO in 1962₃. Animal protein intake has a major effect on the recommended calcium

allowances for adults. It also brings the allowances nearer to what actual calcium intakes are in many parts of the world₄. Much calcium absorption in the upper small intestine depends on the active vitamin D hormone₅. Many other factors end up enhancing calcium absorption, parathyroid hormone, dietary glucose, lactose and normal intestinal motility. Factors limiting calcium absorption include large amounts of phytic acid in dietary fibre from grains, which is great excess of phosphorus in the diet, polyphenols (tannins) in tea, a vitamin D deficiency; menopause, diarrhea and old age₁.

Diary products are rich food sources of calcium. Milk and other dairy foods are the major sources of calcium in the Turkish diet. However overzealous calcium consumes can also result in the development of kidney stones and other health problems_{1,5,6,7}. Much of the calcium in some leafy green vegetables, notably spinach, is not absorbed because of the presence of oxalic acid. This effect is not as strong, however, in kale, collard, turnip, and mustard greens. Overall, non-fat milk is the most nutrient-dense source of calcium because of its high bioavailability and low energy value, with some of the vegetables just noted following close

behind,

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. Adolescence is commonly regarded as a relatively healthy period of the life cycle. Indeed, adolescents are possibly less 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 nutrients⁸. Adolescents make up roughly 20 % of the total world population. In Turkey, adolescents have an even higher demographic weight, for instance, roughly 22.4 % in Turkey, compared to 14 % in USA^{8,9}. 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 behaviours, including diet⁸. In order to supplement the body and keep the health stable, adolescents need a positive calcium balance. In normal adolescents the difference between calcium intake and output at high calcium represents a very small difference between two large numbers¹⁰.

The term "stress" was introduced by Selye in the 1930s into the fields of psychology and medicine. He defined stress as the reaction of the organism to a threatening or oppressing situation. He distinguished between the "stressor" as the external cause and "stress" as the reaction of human body^{11,12,13}. Stress usually involves a state of tension. It is considered a process rather than an end state a process implies that changes occur over time and across different situations. A person who is stressed experiences several stages or levels of stress¹¹. The effects of stress on health can be far-reaching. Some of the conditions often associated with stress include insomnia, high blood pressure, tension headaches, anxiety, depression, decreased mental function, and drug or alcohol abuse. 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 illness¹⁴. 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 demands¹⁵. There is a high correlation between excessive stress and coronary heart disease. Many other illnesses are stress related also¹⁵. 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 behaviour 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 sought¹⁶. 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 she is hungry or not¹⁷.

Although there is a long history of research on stress and its effect, stress among adolescents has only recently received consideration in Turkey. Stress is a lifelong fact. Adolescents, most of who are in their teens and early twenties, are living in or emerging from a stressful life period. Boredom and school burnout are often stressors during the high school years. They have career ambitions and life goals. But for all the pluses, the college years also have some negatives-stressors in the form of relationships, grades, and emotional and physical problems. Uncertainty about what lies ahead is an ever present stressor¹¹. There have been some relations of nutritional deficiencies, vitamin, and supplements with stress^{18,19}, no study was encountered examining the relation between stress symptoms and diet calcium. The aim of this study was to investigate dietary calcium consumption and its relation with stress symptoms of healthy adolescents.

MATERIALS AND METHODS

The study sample included 88 adolescents from a public university in Ankara, the capital city of 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 and the values of BMI were accounted and they were taken as volunteer healthy 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 hour recall. It was deliberated that the first day was a non-working day. Calcium 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 Turkey²⁰. 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 minutes. 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 11.0. 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 being the ones having a calcium level of 599 mg or lower as “low group” and those having 600-1200 mg as “normal group”^{1,3,21,22}. A higher rate of calcium consumption was not encountered during the consumption of nutrient. The relation of the stress and calcium consume was analyzed with t test whether it was meaningful statistically depending the variable of the calcium level of adolescents as physiological stress symptoms and psychological stress symptoms.

RESULTS

29.5 % of the adolescents taken into the study are at the age of 21. The average age is 22.27 1.35. 48.9 % of adolescents are girls, while 51.1 % are boys. 17.0 % of adolescents are students of 2nd grade and 14.8 % of them have minor health problems (Table 1).

Figure 1

Table 1: Demographic characteristics of adolescents (n=88)

	Number	%		Number	%
Age (year)			Grades		
≤21	26	29.5	1 st Grade	8	9.1
22	23	26.2	2 nd Grade	15	17.0
23	24	27.3	3 rd Grade	16	18.2
24≥	15	17.0	4 th Grade	49	55.7
Sex			Having whether a minor health problem		
Girl	43	48.9	Yes	13	14.8
Boy	45	51.1	Yes	75	85.2

It was found that dietary calcium level of the adolescents (70.5 %) is low (Table 2).

Figure 2

Table 2: Calcium levels of adolescents (n=88)

	Number	%
Calcium level		
Low	62	70.5
Normal	26	29.5

In the Table 3 are shown the average, standard deviation, t values and the value of significance of stress symptoms of students.

It was determined that the average scores of the adolescents having a normal level of dietary calcium are higher than the ones who have a low level at the stress symptoms of chest pain, chronic fatigue and tiredness, boredom, back and neck pain, thirstiness and dryness in the mouth, shortness of breath when climbing stairs, constipation, diarrhea which take place at the subscale of physiological stress symptoms. On the other hand, average score of those with a low level of dietary calcium is higher than the adolescents with a normal level at the symptom of sudden cramp. Of the stress symptoms of adolescents, experiencing the symptom of physiological stress do not change significantly depending on the level of dietary calcium (p>0.05).

At the symptoms of excessive sleep desire, nervousness, clipping, fatigue, over-smoking, quick excitement, hearth palpitation, which take place at the subscale of psychological stress symptoms, the adolescents having a normal dietary calcium level have a high average score compared to those having a low level of calcium. At the symptoms of insomnia, over drinking, overeate or lack of appetite adolescents having a low level of calcium have a higher score than those with a normal level of calcium. There is no significant difference between calcium level of adolescent and psychological stress symptoms (p>0.05).

When stress symptoms average total scores were examined according to calcium level depending on nutrient consumption of adolescents, it was found that average score of the adolescents having normal level of calcium (47.15 10.72) is higher than those with a low level of calcium (44.66 10.11). As a result of t-test applied in order to determine whether this difference was significant, it was found out that there was no significant difference between calcium levels of adolescents and their experiencing of stress symptoms ($p>0.05$).

Figure 3

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

Stress Symptoms Scale	Low Group	Normal Group	t	p
	n=62 Mean ± SD	n=26 Mean ± SD		
Physiological Symptoms Subscale				
Chest pain	2.41 ± 1.16	2.53 ± 1.27	-0.42	0.672
Chronic fatigue and tiredness	1.77 ± 1.04	2.11 ± 1.24	-1.31	0.191
Boredom	2.58 ± 1.04	2.96 ± 1.11	-1.52	0.131
Back and neck pain	2.24 ± 1.14	2.53 ± 1.20	-1.09	0.277
Thirstiness and dryness in the mouth	2.61 ± 1.04	2.84 ± 1.15	-0.92	0.357
Shortness of breath when climbing stairs	2.50 ± 1.21	2.80 ± 1.29	-1.06	0.290
Constipation	2.30 ± 0.98	2.53 ± 1.17	-0.95	0.344
Diarrhea	2.29 ± 0.99	2.30 ± 1.15	-0.07	0.944
Sudden cramp	1.93 ± 1.12	1.88 ± 1.07	0.19	0.845
Psychological Symptoms Subscale				
Excessive sleep desire	2.88 ± 0.99	3.07 ± 0.97	-0.82	0.413
Nervousness	2.29 ± 0.99	2.42 ± 1.10	-0.55	0.582
Clipping	1.88 ± 0.79	1.96 ± 0.91	-0.38	0.702
Fatigue	2.82 ± 1.07	3.15 ± 1.15	-1.28	0.202
Over-smoking	2.22 ± 1.23	2.23 ± 1.27	-0.01	0.986
Quick excitement	2.24 ± 1.05	2.34 ± 0.89	-0.44	0.659
Heath palpitation	2.62 ± 1.01	2.73 ± 1.04	-0.42	0.671
Insomnia	2.19 ± 0.92	2.11 ± 1.07	0.34	0.730
Over drinking	2.14 ± 1.32	1.96 ± 1.11	0.61	0.538
Overeat or lack of appetite	2.67 ± 0.93	2.61 ± 1.32	0.24	0.804
TOTAL SCORE	44.66 ± 10.11	47.15 ± 10.72	-1.03	0.303

Sd = 86

DISCUSSION

Nearly all (99 %) of total body calcium is located in the skeleton. The remaining 1 % is equally distributed between the teeth and soft tissues, with only 0.1 % in the extra cellular fluid (ECF). In the skeleton it constitutes 25 % of the dry weight and 40 % the ash weight. The ECF contains ionized calcium at concentrations of about 4.8 mg/100 ml maintained by the parathyroid-vitamin D system as well as complexed calcium at concentrations of about 1.6/100 ml. In the plasma there is also a protein-bound calcium fraction, which is present at a concentration of 3.2 mg/100 ml²³. Calcium is an essential nutrient that plays a vital role in neuromuscular function, many enzyme-mediated processes and blood clotting, as well as providing rigidity to the

skeleton by virtue of its phosphate salts. Its non-structural roles require the strict maintenance of ionized calcium concentration in tissue fluids at the expense of the skeleton if necessary and it is therefore the skeleton which is at risk if the supply of calcium falls short of the requirement. The adequate intake for calcium for adults ranges from 1000 to 1200 milligrams per day. In the United States, average calcium intakes range from only approximately 600 to 800 for women and 800 to 1000 for men. Thus, dietary intakes of calcium by many women, especially young women, are below the adequate intake, whereas intakes by most men are roughly equivalent to the adequate intake. The greater food consumption by men, to support their higher energy outputs, accounts for part of the difference. An easy way for women to increase calcium intake is to increase their physical activity and, in turn, their food consumption. It is especially important for vegetarians to focus on eating good plant sources of calcium as well as on the total amount of calcium ingested¹.

It was found that dietary calcium level of the adolescents is low. Bagley²⁴ said that sixty percent or more of the university women students report two mineral deficiencies. Sixty percent or more of the university women students report symptoms, totalling 20 points designated items, suggestive of a stress condition. Adolescents, particularly girls, are increasing conscious of their body and this has a bearing on their diet. Adolescent girls as a group may be at risk for inadequate intake of calcium⁸.

It was determined that the average scores of the adolescents having a normal level of dietary calcium are higher than the ones who have a low level at the stress symptoms of chest pain, chronic fatigue and tiredness, boredom, back and neck pain, thirstiness and dryness in the mouth, shortness of breath when climbing stairs, constipation, diarrhea which take place at the subscale of physiological stress symptoms. On the other hand, average score of those with a low level of dietary calcium is higher than the adolescents with a normal level at the symptom of sudden cramp. Of the stress symptoms of adolescents, experiencing the symptom of physiological stress do not change significantly depending on the level of dietary calcium ($p>0.05$). This case indicates that both the adolescents having a low level of calcium and the ones with a normal level of calcium experience physiological stress symptoms. An intake of more than 2000 milligrams of calcium per day in some people can cause high blood and urinary calcium concentrations, irritability, headache, kidney failure, soft tissue calcification, kidney

stones, decreased absorption of other minerals, and possibly prostate cancer. It is also clear that the upper level for calcium intake is 2500 milligrams per day, based on the observation that greater intakes increase the risk for some forms of kidney stones.¹ Calcium intake and bone deposition in adolescence are key factors of bone mineral mass later on in life, along with other determinants.⁸ At the symptoms of excessive sleep desire, nervousness, clipping, fatigue, over-smoking, quick excitement, heart palpitation, which take place at the subscale of psychological stress symptoms, the adolescents having a normal dietary calcium level have a high average score compared to those having a low level of calcium. At the symptoms of insomnia, over drinking, overeat or lack of appetite adolescents having a low level of calcium have a higher score than those with a normal level of calcium. There is no significant difference between calcium level of adolescent and psychological stress symptoms ($p>0.05$). In this respect, Miller¹⁸ found that as special changes are applied to diet, symptoms of psychological stress reduce.

The stress symptoms total scores result show that adolescents' experiencing of stress symptoms are not affected by the levels of dietary calcium and that both the adolescents having a low level of calcium and the ones with a normal level of calcium experience stress symptoms.

Southgate,¹⁹ found that both the placebo and the vitamin supplement proved beneficial but the multivitamin complex with calcium and magnesium had a greater effect in reducing and helping to manage stress. Spooner²⁵ said that there were no significant differences between the experimental and control groups on any of the measures employed in college students. Within the limits set by this experimental design, a diet plus a mineral formula, both of which were designed to balance metabolic disturbances, did not produce a significantly greater effect on psychological functioning than did the diet alone. When people worrying so much they can't sleep, getting adequate rest becomes impossible. 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.¹⁴ In a study carried out by Lowell²⁶ vitamin and mineral supplementation practices of 502 college students were examined. It was determined that 25.6 % of students has been using calcium supplement. Attitude was found significant predictor of intention to take calcium supplements based on exposure to promotional pamphlets, while normative influences (family, friends and physicians) were much less strong. Common misconceptions like

vitamins and minerals increase pep and energy, reduce stress and prevent the common cold need to be refuted and scientifically based nutritional recommendation must be emphasized. The calcium requirement of an adolescent is generally recognized to be the intake required to maintain calcium balance and therefore skeletal integrity. The mean calcium requirement of adolescent is therefore the mean intake at which intake and output are equal.

CONCLUSION

It was found that dietary calcium consumption of more than half of the adolescents is lower than 599 mg /day. No relation was found between dietary calcium level and stress symptoms in this study. However, both adolescents having a low level of dietary calcium and those with a normal level experience stress symptoms. 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. It was recommended that dietary calcium consumption be increased. For this reason, as well as healthy eating, supplements are also recommended. On the other hand, education of adolescents is required. It is likely to compare the difference between low and high consumption levels of dietary calcium to determine the relation between dietary calcium consumption and stress symptoms efficiently, as well.

CORRESPONDENCE TO

Fatma Arpacı Department of Family Economics Gazi University Faculty of Vocational Education, Ankara, Turkey. Email: arpacif@gazi.edu.tr.

References

1. Wardlaw GM. Contemporary Nutrition. Issues and Insights, New York: 5th ed., pp. 308-312, McGraw-Hill Companies, Inc., 2003.
2. Matkovic V, Heaney RP. Calcium Balance during Human Growth: Evidence for Threshold Behavior. American Journal of Clinical Nutrition. 1992; 55:992-996.
3. WHO/FAO. Vitamin and Mineral Requirements in Human Nutrition. Calcium. 2nd ed., pp. 59-93, 2004.
4. Whitney EN, Rolfes SR. Understanding Nutrition. New York: 9th ed., pp. 403-408, Wadsworth/Thomson Learning, Inc., 2002.
5. Curhan GC, et al. A Prospective Study of Dietary Calcium and other Nutrients and the Risk of Symptomatic Kidneys Stones. New England Journal of Medicine. 1993; 328:833-838.
6. Curhan GC, et al. Comparison of Dietary Calcium with Supplemental Calcium and Other Nutrients as Factors Affecting the Risk for Kidney Stones in Women. Annals of Internal Medicine. 1997; 126:497-504.
7. Miller GD, et al. The Importance of Meeting Calcium Needs with Foods. Journal of the American College of

Nutrition. 2001; 20: 168

8. WHO. Nutrition in Adolescence. Issues and Challenges for the Health Sector. 2005.

9. Anon. 2000 Census. Social and Economical Features of Population. Ankara: State Statistics Institute Publishing No: 2759, 2003.

10. Weaver CM, Martin BR, Plawecki KL, et al. Differences in Calcium Metabolism Between Adolescent and Adult Females. *Am J Clin Nutr.* 1995; 61:577-581.

11. Goldsmith EB. Resource Management for Individuals and Families. Canada; Second Edition, Wadsworth, Thomson Learning, 2000.

12. Kroemer KHE, Grandjean E. Fitting the Task to the Human. A Textbook of Occupational Ergonomics. London; Fifth Edition, pp.211-215, Taylor & Francis Ltd., 2001.

13. Murff SH. The Impact of Stress on Academic Success in College Students. *The ABNF Journal.* 2005; September/October: 102-104.

14. Carroll D, Ring C, Suter M, et. al. The Effects of an Oral Multivitamin Combination with Calcium, Magnesium, and Zinc on Psychological Well-Being in Healthy Young Male Volunteers: A Double-Blind, Placebo-Controlled Trial. *Psychopharmacology (Berl).* 2000; 150:220-225.

15. Cranwell-Ward J. Thriving on Stress. Self-Development for Managers. London: Published by Routledge, 1990.

16. Feldman RS. Understanding Psychology. New York.; Seventh Edition, pp.502. McGraw Hill, 2005.

17. Atkinson JM. To Cope with Stress at Work. How to stop

to worry and start to succeed. London: Published by Thorsons, Thorsons Business Series, 1994.

18. Miller M. Diet and Psychological Health: A Multiple Case Study. *DAI.* 1996; 57(05B):3416.

19. Southgate HMA. The Effects of Supplementary Multivitamins on Stress. *MAI.* 1999; 38:1115.

20. Anon. Components of Nutrients. Ankara: Türkiye Diyetisler Derneği Publishing, No:1, 1991.

21. Anon. Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D and Fluoride. *Nutr Rev.* 1997; 55: 332-336.

22. Anon. Calcium Requirements of Infants, Children and Adolescents Committee on Nutrition. *Pediatrics.* 1999; 104:1152-1157.

23. Robertson WG, Marshall RW. Ionized Calcium in Body Fluids. *Critical Reviews in Clinical Laboratory Sciences.* 1981; 15:85-125.

24. Bagley RT. The Relationship of Diet to Physical/Emotional Complaints and Behavioral Problems Reported by Women Students at Two Southern California Universities. *DAI.* 1980; 41, (10B):3926.

25. Spooner DC, Effect of Diet and Vitamin/Mineral Supplementation upon Psychological Functioning in Persons Classified by Psychological Type (Orthomolecular, Nutritional, Oxidizers). *DAI,* 1984; 46(01B):342.

26. Lowell AE. Prediction of Food Supplement Use among College Students: The Role of Beliefs, Attitude, Subjective Norm and Intention. *DAI.* 1991; 52(07B):3537.

Author Information

Fatma Arpacı

Department of Family Economics, Gazi University Faculty of Vocational Education

Saime Kücükömürler

Department of Food and Nutrition, Gazi University Faculty of Vocational Education