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The Vitamine Source, Usual Food Intake at Students

Nafija Serdarevic[1,2], Arzija Pasalic[2], Vedran Djido[2], Muris Pecar[2], Namik Trtak[2], Refet Gojak[3]

[1]Institute for Clinical Biochemistry and Immunology University of Sarajevo Clinics Center, Sarajevo, Bosnia and Herzegovina

[2]Faculty of Health Studies, University of Sarajevo, Bosnia and Herzegovina

[3]Infectology Clinic, University of Sarajevo Clinics Center, Sarajevo, Bosnia and Herzegovina

Corresponding author: Prof. Nafija Serdarevic, PhD. Institute for Clinical Biochemistry and Immunology University of Sarajevo Clinics Center, Faculty of Health Studies, University of Sarajevo, Bosnia and Herzegovina. E-mail: serdarevicnafija@yahoo.com, ORCID iD. https://orcid.org: 0000-0001-7977-9819.

ABSTRACT

Introduction: Inadequate vitamin B 12, folate status and B6 are associated with an increased risk for chronic diseases that may have a negative impact on the health. **Aim:** The aim of our study was to investigate dietary intake of vitamin B12, B6 and folates from various foods among the university students. **Methods:** Dietary intake of foods having vitamins B12, B6 and folate was assessed among the students of University of Sarajevo, 19-22 years old, from 2017 to 2018. The participants were interviewed to collect information regarding age, socioeconomic status, B12, folate, B6 vitamin, and usual food intake during one week. **Results:** The main sources of vitamin B12 and B6 in the students' diet were chicken white meat (51.8-53.7 %), beef (45-63 %), cream (62.2 -72.1 %), sardines in oil (47.9-52.2 %), tuna (55.2 -60.4 %), cheese edamer (80.1%) and cheese feta (67.4%-73%). The foods with a high source of vitamin B12 and B6 but rarely consumed were fish, shellfish, salmon, roasted trout and mackerel. Sufficient folate intake was mainly achieved through dietary intake of beans (48.5-57.2%) and oatmeal (46.3-48.2%), while folate-insufficient diet resulted from intake of spinach (30.9-35 %), turkey (26.2-33.4 %), lentils (16.9-19.7 %) and soy (9.4-15.5%). **Conclusion:** Our results show that there is an important percentage of the students in Canton Sarajevo that do not meet the recommended intakes for vitamin B12 and B6 and folate. Additional research is needed to establish the best cost-effective public health approach to achieve sufficient intake of these vitamins.

Keywords: diet, folate, vitamin B12, vitamin B6, students.

1. INTRODUCTION

Inadequate vitamin B 12, folate status and B6 are associated with an increased risk for chronic diseases that may have a negative impact on the health. The average folate 400 µg/day in women and men and vitamin B6 intake is about 1.5 mg/day in women and 2 mg/day in men (1). Data from the 1999–2000 NHANES indicate that the median daily intake of vitamin B12 for the U.S. population is 3.4 mcg (2). The decrease of folic acid and vitamin B12 leads to increase of homocysteine and decreases process of remethylation. It could be postulated that elevated total homocysteine is a risk factor for atherothrombotic stroke in particular. The elevated levels of homocysteine can, therefore, cause damage to several key pathways in the central nervous system, either directly or by changing the methylation potential (3, 4). The increasing number of attacks increased concentrations of homocysteine which can lead to the evolution of vascular dementia after ischemic stroke (5-11). Besides folate deficiency may have different effects on the neurochemical processes of schizophrenia, because it works as a carbon donor in the synthesis of glycine from serine (12).

Homocysteinemia is a newly defined term connected to the increased risk of atherothrombotic and atherosclerotic systemic and retinal vascular occlusive diseases, and homocysteine might be the causative factor (13, 14).

The major vitamin B12, B6 and folate-containing food sources for the population in student population of Canton Sarajevo that we take in our investigation were: oatmeal, cheese (Edamer or Feta), chicken, spinach, turkey, beef, cream, salmon, beans, lentils, soy, trout, sardines, mackerel, and tuna.

2. AIM

The aim of our study was to investigate dietary intake of vitamin B12, B6 and folates from various foods among the university students.

Food intake	Every day	6	5	4	3	2	1	Do not use
Oatmeal								
Chicken white meat								
Spinach								
Turkey								
Beef								
Cream								
Salmon								
Beans								
Lentis, cooked								
Soy cooked								
Trout roasted								
Sardines in oil								
Mackerel								
Tuna								
Cheese (Edamer)								
Cheese (Feta)								

Table 1. The questionnaire used in the study to assess food intake by the students during one week. (How many times during a week you used each of the listed foods?).

3. METHODS

2.1. Subjects

IIn our study, we investigated students of Faculty of Health Studies, Faculty of Electrical Engineering, School of Economics and Business and Faculty of Educational Sciences from the University of Sarajevo 19-22 years old, from 2017 to 2018. The participants were interviewed to collect information regarding age, socioeconomic status, B12, folate, B6 vitamin, and usual food intake during one week. The subjects with diseases such as diabetes, cancer, cardiovascular disease, and kidney disease, the subjects taking medications affecting folate metabolism (methotrexate or cotrimoxazole) the subjects showing recent changes in appetite and food intake, and the subjects that did not complete their survey were excluded; therefore, final subjects were 960 students.

2.2. Methods

The data were collected by the questionnaire and by the interview of the students. The survey gave information about socioeconomic data, general characteristics of the study participants and weekly intake of food containing vitamins B12, folate and B6. The survey about the usual food intake of B12, B6, and folate is shown in Table 1.

Main outcome of our study was whether weekly intake of certain food was sufficient or insufficient in regard to the recommended dietary reference intake of vitamins B12, B6 and folate (15). The dietary intake was considered insufficient if answers on the questions from the questionnaire were “0,1,2 times weekly intake”, and sufficient if the answers were “3,4,5, 6, 7 times weekly intake”.

3.3. Statistical analysis

In our study, after returning all completed survey the data were entered the statistical package for social SPSS version 13.0 software (SPSS Inc, Chicago USA sciences) and Microsoft EXCEL. The absolute (N) and relative frequencies (%), and then crosstabulated with the sex, faculty attending, year of study, the status of studies, usual week food intake, place of residence (town; village; suburb) and parents education. The differences between the study groups were tested for significance by the Pearson $\chi 2$ test. The differences between the study groups were considered to be significant if probability of zero-hypothesis was equal or less than 0.05.

4. RESULTS

The total number of 960 students from the University of Sarajevo participated in the study and returned the completed survey. Characteristics of the study sample are shown in the Table 2.

Variable		N	%
Gender	Male	304	31.7
	Female	656	68.3
Faculties of the University of Sarajevo	Faculty of Health Studies	366	38.1
	School of Economics and Business	292	30.4
	Faculty of Electrical Engineering	237	24.7
	Faculty of Educational Sciences	65	6.8
Year of study	First	593	61.8
	Last	367	38.2
Status of studies	regular	409	42.6
	self-refusing	488	50.8
	extraordinary	63	6.6

Table 2. General characteristics of the study sample.

The questionnaire consisted of socioeconomic data had five questions. The students lived in an apartment 662 (69%); rented apartment 187 (19.5) or a dormitory 111 (11.6). More then half of the student population lived with their families 648 (67.5), with friends 230 (24 %) and alone 82 (8.5 %). In the rural areas (village) lived 62 (6.5 %) students,in suburbs 259 (27 %) students and in towns or cities 639 (66.6%) students. Parents of the students were mostly employed 759 (80.6 %), with minority being unemployed 95 (10.1 %) and retired 88 (9.3 %). The faculty degree had 443 (47.5 %) parents and high school degree 517 (52.5 %) parents.

According to the Table 3 one of the main sources of vitamin B12 and B6 in meat and meat products were chicken white meat (51.8-53.7 %), beef (45-63 %), cream (62.2 -72.1 %), sardines in oil (47.9-52.2 %), tuna (55.2 -60.4 %), cheese edamer (80.1%) and cheese feta (67.4%-73%). The foods with high source of vitamin B12 and B6 but rarely consumed were fish, shellfish, salmon (18.7-22.6%), roasted trout (39.9-37.8 %) and mackerel (26.8-33.2). Sufficient folate intake was mainly achieved through dietary intake of beans (48.5-57.2%) and oatmeal (46.3-48.2%), while folate-insufficient diet resulted from intake of spinach (30.9-35 %), turkey (26.2-33.4 %), lentils (16.9-19.7 %) and soy (9.4-15.5%).

5. DISCUSSION

Our study showed that for majority of students the recommended dietary allowances of vitamins B12 and B6 are provided through intake of chicken, beef, cheese, sardines and tuna, while folate is absorbed from beans and oat meals. The students rarely eat other types of fish (other than sardines and tuna), shellfish, salmon, turkey, lentils and soy. Prolonged B-12 deficiency has been associated with cognitive deficits (16). The most frequent clinical expression of vitamin B12 deficiency is megaloblastic anemia; and it has also been associated with many neurological disorders, although neurological signs might appear earlier than hematological (17, 18). Beginning in 1998, U.S. Federal law required that all cereal grain products be fortified with folic acid in order to reduce the birth prevalence of neural tube defects. A standard level of 140 µg folic acid per 100 grams of grain was required (14). High levels of folic acid may "mask" evidence of vitamin B-12 deficiency (16, 20). Moreover, the most well-known adverse effect of supplementation and food fortification with FA is the masking of the diagnosis of vitamin B12 deficiency (21-23). Majority of the students satisfied their needs for vitamins B12 and B6 by chicken while meat (87.7-88.3 %), regardless of sex (p=0.804). The chicken is significant source of vitamin B12 (0.31 mcg), folate (3.1 mcg) and B6 (500 mcg per 100g of food). Red meat is the main source of vitamin B12, therefore beef (45.2-63 %) was a satisfying diet with vitamin B12 3.4-4.5 mcg; folate 7-17 mcg and B6 280-410 mcg, but more for males than for females The milk product such as diet cream (66.2-72.1%) has vitamin B12 0.2 mcg and folate 4.8 mcg in both genders. Another study showed that meat and meat products (27.9%), milk and dairy products (25.3%) and fish and shellfish (19.4%) were the main sources of vitamin B12 for men while in females, milk and dairy products (29.2%); meat and meat products (24.8%) fish and shellfish (22.6%) (24). More then half of the investigated students were taking oatmeal more than 3 times a week. Although the students attending the last year of study used more oatmeal in nutrition in our study, age of the students was associated with food intake p> 0.05. The main source of folates beside oatmeal in student population were beans (48.5-57.2 %) that students take a few time a week. The folate-rich food such as spinach, soya or lentils the students take in diet rarely. In both groups, more than two-thirds do not take spinach in diet satisfactorily (p = 0.208). Lentils are also low in nutrition, as well as the soy. The other authors showed that sufficient intake of folate could be achieved by selecting fruit and vegetables rich in folate, by providing liver paste as a sandwich filling, and by adding an egg yolk to sauces and salad dressings. Fruit and vegetables were the main sources, providing 73% of the additional folate. Unfortified bread and cereals are important sources of folate in the general population (25, 26).

		Male N (%)	Female N (%)	χ2
Oatmeal	insufficient dietary intake	137 (46.3%)	307 (48.2%)	0.079
	sufficient dietary intake	159 (53.7)	330 (51.8 %)	
Chicken white meat	insufficient dietary intake	35 (11.7%)	80 (12.3%)	0.804
	sufficient dietary intake	264 (88.3%)	572 (87.7%)	
Spinach	insufficient dietary intake	206 (69.1%)	419 (65%)	0.208
	sufficient dietary intake	92 (30.9%)	22 (35%)	
Turkey	insufficient dietary intake	197 (66.6%)	476 (73.8%)	0.022
	sufficient dietary intake	99 (33.4%)	169 (26.2%)	
Beef	insufficient dietary intake	111 (37.0%)	354 (54.8%)	
	sufficient dietary intake	189 (63%)	292 (45.2%)	0.0001
Cream	insufficient dietary intake	101 (33.8%)	180 (27.9%)	0.064
	sufficient dietary intake	198 (66.2%)	466 (72.1%)	
Salmon	insufficient dietary intake	239 (81.3%)	498 (77.4%)	0.183
	sufficient dietary intake	55 (18.7%)	145 (22.6%)	
Beans	insufficient dietary intake	128 (42,8%)	332 (51,5%)	0.013
	sufficient dietary intake	171 (57,2%)	313 (48.5%)	
Lentils cooked	insufficient dietary intake	237 (80.3%)	527 (83.1%)	0.301
	sufficient dietary intake	58 (19.7%)	107 (16.9%)	
Soy cooked	insufficient dietary intake	246 (84.5%)	568 (90.6%)	0.007
	sufficient dietary intake	45 (15,5%)	59 (9.4%)	
Trout roasted	insufficient dietary intake	186 (62.2%)	385 (60.1%)	0.531
	sufficient dietary intake	113 (37.8%)	256 (39.9%)	
Sardines in oil	insufficient dietary intake	143(47.8%)	336(52.1%)	0.223
	sufficient dietary intake	156(52.2%)	309(47.9%)	
Mackerel	insufficient dietary intake	197(66.8%)	462 (73.2%)	0.044
	sufficient dietary intake	98 (33.2%)	169 (26.8%)	
Tuna	insufficient dietary intake	133 (44.8%)	255(39.6%)	0.133
	sufficient dietary intake	164 (55.2%)	389 (60.4%)	
Cheese (Edamer)	insufficient dietary intake	60 (19.9%)	122 (19%)	0.728
	sufficient dietary intake	241 (80.1%)	521 (81.0%)	
Cheese (Feta)	insufficient dietary intak	98 (32.6%)	174 (27.0%)	0.080
	sufficient dietary intake	203 (67.4%)	470 (73.0%)	

Table 3. Dietary intake of vitamin B6, B12 and folate in the study sample referenced with the recommended dietary allowances.

In our study small number of students used fresh fish, while more than half used fish in a cans, like sardines in oil and tuna, containing folate as well as vitamins of B group. The study of Park (27) showed that 11% of folate came from animal sources, and 15% was from other groups of food such as potatoes, nuts, and beverages, but little from spices (28). One of the disadvantages of our research is that through the survey we did not capture the information about amount of total food intake and way of preparation (time of cooking or temperature). The main problem of insufficient folate intake could be solved by possible fortification of grain products.

6. CONCLUSION

Our results show that there is an important percentage of the students in Canton Sarajevo that do not meet the recommended intakes for vitamin B12 and B6 and folate. The B12 and B6 are mostly supplied from meat and meat products and lower from fish. The canned fish (sardines in oil and tuna) are a great source of vitamins in student populations. The food sources with folates in the student population were mainly oatmeal and beans but insufficient folate was consumed from spinach, lentils, and soy. Additional research is needed to establish the best cost-effective public health approaches to achieve sufficient intake of these vitamins.

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- **Conflict of interest:** There are no conflict of interest.

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