Average saturated fatty acids daily intake in Sarajevo University students

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ABSTRACT

Introduction: There are wide variations in diet patterns among population subgroups. Macronutrients content analyses have become necessary in dietary assessment. The purpose of this study is to analyze dietary saturated fatty acids intake in students, detect differences between men and women, and compare with nourish status and nutrition recommendations.

Methods: A cross-sectional survey of 60 graduate students was performed during the spring 2013, at the Sarajevo University. Food-frequency questionnaire was conducted during seven days. Body mass index was used to assess students' nourish status. Statistical analyses were performed using the Statistical Package for Social Sciences software (version 13.0).

Results: Mean age of males was 26.00±2.72, and of females was 27.01±3.93 years. The prevalence of overweight was more common among males compared to females (55.56% vs. 6.06%). Median of total fat average intake for men and women was 76.32(70.15;114.41) and 69.41(63.23;86.94) g/d, respectively. Median of saturated fatty acids average intake for men and women was 28.86(22.41;36.42) and 24.29(20.53;31.60) g/d, respectively. There was significant difference in average intake of total fat between genders (Mann-Whitney U test: p=0.04). Macronutrient data were related to requirement of reference person. Total fat intake was beyond recommended limits in 37.04% of males and 54.55% of females. Saturated fatty acids intake was beyond the upper limit in 55.56% of males and 51.52% of females.

Conclusion: Diet pattern of the average student is not in accordance with the recommendations of saturated fatty acids contribution as a percentage of energy.

Keywords: Dietary assessment; energy intake; recommendations;

INTRODUCTION

The deficiency of macro- and micronutrients was the major nutrition problem relating to health. Beyond this traditional aspect of health, excess of some food with lack of others has become opposite disease risk (1). As the incidence of noncommunicable diseases rise, relationship between health and...
food consumption, dietary patterns, nutrition and lifestyles has been recognized (2). At the level of individuals macronutrients contribution in energy supply is as follow: carbohydrate 55-75%, protein 10-15% and total fat 15-30%. Contribution of single fat in energy intake ought to be: saturated fatty acids <10%, polyunsaturated fatty acids 6-10%, monounsaturated fatty acids 10-14% (3).

There are wide variations in diet patterns among subgroups within a population, so excess of some macronutrients are responsible for health risk. Macronutrients content analyses has become necessary in nutrition pattern evaluation.

Characteristics of student diet are: little number of daily meal, insufficient vitamins and minerals intake, excess in density energy drinks and food, high consummations of junk food.

The purpose of this study is to analyze dietary saturated fatty acids intake in students, detect differences between men and women, and compare with nourish status and nutrition recommendations.

METHODS

Study design
The study was designed as a cross-sectional survey conducted at the Sarajevo University during the spring 2013. A sample of 60 graduate students in 2012/13 generation recruited randomly.

Data Collection
Food-frequency questionnaire (FFQ) was conducted during seven days. In the first part of questionnaires students gave data about their anthropometrics measures (body height and weight). Body mass index (BMI) was used to assess students’ nourish status. BMI was calculated using the standard formula (weight (kg)/height (m^2)). According to guidelines stated by the World Health Organization (WHO), nourish status was classified into four categories: underweight (BMI ≤ 18.5), normal weight (BMI 18.5 – 24.9), overweight (BMI 25–29.9), and obese (BMI ≥ 30) (3).

In second part examiners registered their estimated food intake, as well as time of meals during seven days. According to United States Department of Agriculture (USDA) National Database (4) daily total fat intake was calculated, as well as saturated fatty acids intake. From seven days summarized value average daily intake was estimated.

Requirements of reference person
Intake data were related to requirement of reference person. By WHO definition reference male person has average weight of 65 kg, while reference female person of 55 kg (5). According to the National Academies Press (NAP) definition, the reference man has average weight of 70 kg, while reference female person of 58 kg (6). Reference person is 25 years old and its lifestyle is low active.

Basal Metabolic Rate (BMR) was predicted using age and gender specific equations (7), taking into account reference weights (healthy): BMR=14.9xW+496 kcal/d (reference female person aged 25); BMR=15.3xW+679 kcal/d (reference male person aged 25).

The total daily energy expenditure (TEE) are related to the amount of physical activity expended in the course of everyday life, so BMR ought to be multiplied with Physical Activity Level (PAL). For lifestyle which involves low activity, PAL value is 1.4 - 1.69. In this study PAL assigned a value of 1.55:

- Reference female:
  TEE=BMR * PAL= (14.9x55+496) x1.55=1315.5 x1.55=2039.025≈2000 kcal/d (WHO)
  TEE=BMR * PAL= (14.9x58+496) x1.55=1360.2x 1.55=2108.310≈2100 kcal/d (NAP)
- Reference male:
  TEE =BMR * PAL= (15.3x65+679) x1.55=1673. 5x1.55=2593.925=2600 kcal/d (WHO)
  TEE =BMR * PAL= (15.3x70+679) x1.55=1750. 0x1.55=2712.500=2700 kcal/d (NAP)

According to recommended range (WHO and NAP) total fat intake (15-30% of daily energy intake) can vary from 42 to 87 g in daily meal of reference mail person, and from 32 to 68 g in daily meal of reference female person. The intake of saturated fatty acids (SFA) has to be < 10% of daily energy intake. It means SFA has to be restricted to less than 29 g in mails, and 23 g in females as it is showed in Table 1.
Statistical analysis
Data is presented by using means and SDs (for normally distributed continuous variables), medians and interquartile ranges (for abnormal distributed continuous variables), and frequencies and percentages (for categorical variables). Differences between variables were tested by using either an independent t test or the non-parametric Mann-Whitney U test. Correlation between variables was assessed by non-parametric Spearman’s rank correlation coefficient. P ≤ 0.05 was considered statistically significant. Statistical analysis was performed using SPSS (version 13.0, SPSS).

RESULTS

Age characteristics of the students’ sample
Mean age of male examiners was 26.00 ± 2.72 years. Maximum was 32 year, and minimum was 22 year. Mean age of female examiners was 27.01 ± 3.93 years. Maximum was 36 year, and minimum was 22 year. A independent t test showed no significant difference in age structure between gender (p = 0.22).

Students’ nourish status based on BMI categories
For male participated students BMI median was 25.96(24.88; 29.53) kg/m². Maximum was 31.02 kg/m², and minimum was 20.35 kg/m². For female participated students BMI median was 20.94(20.20; 22.22) kg/m². Maximum was 29.02 kg/m², and minimum was 18.07 kg/m². The majority of the students (60.00%) was of normal weight (25.92% of the male students compared to 87.88% of the female students). Based on BMI classification, the prevalence of overweight was more common among male students compared to females (55.56% vs. 6.06%). Obesity was found in 18.52% male students. In contrast, 6.06% female students were underweight as it showed in Table 2.

Mann-Whitney U test (p<0.0005) showed significant difference in BMI value between genders.

Fat intake
Average intakes of total fat and saturated fatty acids are showed in Table 3.
There was significant difference in average intake of total fat (Mann-Whitney U test: p = 0.04; p < 0.05), but no significant difference in average saturated fatty acids intake between genders (Mann-Whitney U test: p = 0.17; p > 0.05).

None of male students had average intake of total fat below recommendations. Total fat intake was between recommended limits in 62.96%, and beyond in 37.04% of males. One of female students had average intake of total fat below recommended values. Total fat intake was between recommended limits in 42.42%, and beyond in 54.55% of females (Table 4).

In group of male students whose average intakes of total fat were beyond recommended value, 40.00% had normal nourish status, 40.00% were overweight, and 20.00% were obese. In group of male students whose average intakes of total fat were in accordance with the recommendations, 17.65% had normal nourish status, 64.70% were overweight, and 17.65% were obese (Table 5).

TABLE 1. Recommended restrictions of total fat and saturated fatty acids daily intake

| Total energy expenditure and restrictions for total fat and SFA | Reference Man | Reference Woman |
|---------------------------------------------------------------|----------------|-----------------|
| WHO NAP | WHO NAP |
| Energy, kcal/d | 2600 | 2700 |
| Total fat, g (15-30% TEE) | 42-84 | 44-87 |
| SFA, g (<10% TEE) | 28 | 29 |
| TEE: The total daily energy expenditure, SFA: Saturated fatty acids, WHO: World health organization, NAP: National academies press |

| Nourish status | Males | Females | All |
|----------------|--------|---------|-----|
| Underweight (BMI ≤ 18.5) | 7 | 2 | 9 | 6.06 | 36 | 60.00 |
| Normal (BMI between 18.5-24.9) | 15 | 2 | 17 | 87.88 | 17 | 28.34 |
| Overweight (BMI between 25-29.9) | 5 | 5 | 5 | 21.73 | 13 | 22.13 |
| Obese (BMI ≥ 30) | 2 | 100.00 | 100.00 | 100.00 |

BMI: Body mass index

TABLE 2. Prevalence of obesity among students based on BMI by gender

| Nourish status | Males | Females | All |
|----------------|--------|---------|-----|
| Underweight (BMI ≤ 18.5) | - | - | 2 | 6.06 | 2 | 3.33 |
| Normal (BMI between 18.5-24.9) | 7 | 2 | 9 | 87.88 | 36 | 60.00 |
| Overweight (BMI between 25-29.9) | 15 | 2 | 17 | 21.73 | 13 | 22.13 |
| Obese (BMI ≥ 30) | 5 | 18.52 | - | - | 5 | 8.33 |
| Total | 27 | 100.00 | 33 | 100.00 | 60 | 100.00 |
In group of female students whose average intakes of total fat were beyond recommended value normal nourish status was detected in 94.44%. In group of female students whose average intakes of total fat were in accordance with the recommendations, 85.71% had normal nourish status, and 14.29% were overweight (Table 6).

Th e contribution of total fat as an energy source between students varied as it is indicated by Figure 1 and Figure 2.

Correlation between average daily intake of total fat and nourish status was not established (Males: Spearman’s rho Correlation Coefficient = - 0.36 and p = 0.06; Females: Spearman’s rho Correlation Coefficient = - 0.29 and p = 0.11).
Saturated fatty acids intake was beyond the upper limit in 55.56% of males and 51.52% of females (Table 7).

In group of male students whose average intakes of saturated fatty acids intake were below the upper limit, 16.67% had normal nourish status, 58.33% were overweight, and 25.00% were obese. In group of male students whose average intake of saturated fatty acids intake was beyond the upper limit, 33.34% had normal nourish status, 53.33% were overweight, and 12.33% were obese (Table 8).

In group of female students whose average intakes of saturated fatty acids were below the upper limit, 12.50% were underweight, 75.00% had normal nourish status, and 12.50% were overweight. All female students with average intakes of saturated fatty acids intake beyond the upper limit had normal nourish status (Table 9).

The contribution of saturated fatty acids as an energy source between students varied as it is indicated by Figure 3 and Figure 4.

Correlation between average daily intake of saturated fatty acids and nourish status was not established (Males: Spearman's rho Correlation Coefficient = -0.25 and p = 0.21; Females: Spearman's rho Correlation Coefficient = -0.18 and p = 0.33).

Correlation between average saturated fatty acids and average total fat intake in males and females are showed by Figure 5 and Figure 6.

### TABLE 7. Comparison dated SFAs intake with recommendation by gender

| Saturated fatty acids intake (g/d) | Gender |  |  |
|---|---|---|---|
|  | Males* | Females** |  |  |
| Below the upper limit | 12 | 44.44 | 16 | 48.48 |
| Beyond the upper limit | 15 | 55.56 | 17 | 51.52 |
| Total | 27 | 100.00 | 33 | 100.00 |

*upper limit for males: 29 g/d, ** upper limit for females: 23 g/d

### TABLE 8. Average saturated fatty acids intake of males compared with recommendation

| Nourish status | Males average intake of saturated fatty acids (g) |  |  |
|---|---|---|---|
|  | ≤29 | >29 |  |  |
|  | n | % | n | % |
| Underweight (BMI ≤18.5) | - | - | - | - |
| Normal (BMI between 18.5-24.9) | 2 | 16.67 | 5 | 33.34 |
| Overweight (BMI between 25-29.9) | 7 | 58.33 | 8 | 53.33 |
| Obese (BMI ≥30) | 3 | 25.00 | 2 | 12.33 |
| Total | 12 | 100.00 | 15 | 100.00 |

BMI-body mass index

### TABLE 9. Average saturated fatty acids intake of females compared with recommendation

| Nourish status | Females average intake of saturated fatty acids (g) |  |  |
|---|---|---|---|
|  | ≤23 | >23 |  |  |
|  | n | % | n | % |
| Underweight (BMI ≤18.5) | 2 | 12.50 | - | - |
| Normal (BMI between 18.5-24.9) | 12 | 75.00 | 17 | 100.00 |
| Overweight (BMI between 25-29.9) | 2 | 12.50 | - | - |
| Obese (BMI ≥30) | - | - | - | - |
| Total | 16 | 100.00 | 17 | 100.00 |

BMI-body mass index
Th ere was strong positive correlation between aver-
age daily intake of saturated fatty acids and total fat in males (Spearman’s rho Correlation Coefficient = 0.85 and p < 0.0005), as well as in females (Spearman’s rho Correlation Coefficient = 0.95 and p < 0.0005).

**DISCUSSION**

The purpose of this study was to assess dietary saturated fatty acids intake in a sample of Sarajevo University students, detect differences between men and women, and compare with nourish status and nutrition recommendations. Nourish status was assessed by using BMI. Based on BMI classification, findings of this study indicate that normal nourish status was more prevalent among females (87.88%) as compared to males (25.92%). None of female student was obese and none of male student was underweight. Overweight nourish status was more common among male than female students. Prevalence of overweight was 55.56% in males as compared to 6.06% in females. Significant difference in average BMI between genders is common in student population as it is reported in other studies. A cross-sectional survey in the Lebanese American University (LAU) campus during the fall 2006 semester of 220 students (43.6% male and 56.4% female), aged 20 ± 1.9 years showed the prevalence of overweight and obesity was more common among male students compared to females (37.5% and 12.5% vs. 13.6% and 3.2%, respectively) (8).

Diet is recognized as a key determinant of overweight and obesity. Eating behaviors that have been linked to overweight and obesity include snacking/eating frequency, binge-eating patterns, eating out (2). Researches of the possible health impact of diet composition (percentage energy intake from macronutrients) have introduced recommendation of macronutrients contribution in energy supply as follow: carbohydrate 55-75%, protein 10-15% and total fat 15-30%. Contribution of single fat in energy intake ought to be: saturated fatty acids <10%, polyunsaturated fatty acids 6-10%, monounsaturated fatty acids 10-14% (3). In this study macronutrient data were related to requirement of reference person.

Total fat intake was beyond recommended value in 37.04% of males and 54.55% of females. In group of male students whose average intakes of total fat were beyond recommended value, 40.00% had normal nourish status, 40.00% were overweight, and 20.00% were obese. In group of female students whose average intakes of total fat were beyond recommended value one student was underweight, normal nourish status was detected in 94.44%, and overweight was detected in 5.56%. Significant correlation between nourish status and average intake of total fat was not found.

Saturated fatty acids intake was beyond upper limit in 55.56% of males and 51.52% of females. In group of male students whose average intakes of
saturated fatty acids were beyond the upper limit, 33.34% had normal nourish status, 53.33% were overweight, and 12.33% were obese. All female students with average intakes of saturated fatty acids intake beyond the upper limit had normal nourish status. Significant correlation between nourish status and average intake of saturated fatty acids was not found.

Although diet pattern has recognized as adiposity development risk factor (3), effect of diet quality on body weight, is insufficiently understood. The role of specific nutrients, particularly carbohydrates (9) and fats (10, 11), is controversial. Patterns of long-term weight changes differ by age, sex, physical activity and smoking status (12). Lowering total fat intake in adults compared with not lowering fat intake was associated with reductions in body mass index. On the other hand, each additional 5 kg/m² was associated with 30% greater total mortality (with contributions from deaths related to vascular, renal, hepatic, and respiratory disease, cancer, and diabetes) (13).

Results of this study has revealed the tendency of overweight and obesity among students, particularly males. Increase of total fat intake has been associated with increase of saturated fatty acids intake. Although there is no evidence of direct link between an increased risk of obesity and the quantity of daily total fat or saturated fatty acids intake, saturated fatty acids consumption should be limited to enable the goals of reduced intake of total fat. Total fat energy of at least 20% is consistent with good health. Highly active groups with diets rich in vegetables, legumes, fruits and wholegrain cereals may sustain a total fat intake of up to 35% without the health risk (3).

**CONCLUSION**

The tendency of overweight and obesity among students, particularly males was established. The association between consumption of dietary fat or saturated fatty acids and obesity in students is not very important. Diet pattern of the average student is not in accordance with the recommendations of saturated fatty acids contribution as a percentage of energy. This diet, loaded with saturated fatty acids might, over time, lead to more excess body fat deposition. These finding suggest individual measures ought to be done in correction eating habits in student population.

**COMPETING INTERESTS**

The authors declare that they have no competing interests.

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