



Average saturated fatty acids daily intake in Sarajevo University students

Amra Čatović^{1*}, Amela Dervisević², Orhan Lepara², Semir Gorčević³, Jasna Gorčević⁴

¹Department of Hygiene, Faculty of Medicine, University of Sarajevo, Bosnia and Herzegovina, ²Department of Human Physiology, Faculty of Medicine, University of Sarajevo, Bosnia and Herzegovina, ³Cantonal Institute for Occupational Health and Sports Medicine in The Zenica-Doboj Canton, Bosnia and Herzegovina, ⁴Health Center Zenica, Bosnia and Herzegovina

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

Corresponding Author: Amra Čatović,
Department of Hygiene, Faculty of Medicine,
University of Sarajevo, Čekaluša 90, 71000 Sarajevo,
Bosnia and Herzegovina.
E-mail: amra.catovic@mf.unsa.ba

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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 (m²)). 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 life style which involves low activity, PAL value is 1.4 - 1.69. In this study PAL assigned a value of 1.55:

- Reference female:

$$TEE=BMR * PAL= (14.9 \times 55 + 496) \times 1.55 = 1315.5 \times 1.55 = 2039.025 \approx 2000 \text{ kcal/d (WHO)}$$

$$TEE=BMR * PAL= (14.9 \times 58 + 496) \times 1.55 = 1360.2 \times 1.55 = 2108.310 \approx 2100 \text{ kcal/d (NAP)}$$

- Reference male:

$$TEE = BMR * PAL = (15.3 \times 65 + 679) \times 1.55 = 1673.5 \times 1.55 = 2593.925 \approx 2600 \text{ kcal/d (WHO)}$$

$$TEE = BMR * PAL = (15.3 \times 70 + 679) \times 1.55 = 1750.0 \times 1.55 = 2712.500 \approx 2700 \text{ kcal/d (NAP)}$$

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. $P \leq 0.05$ 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/m^2 . Maximum was 31.02 kg/m^2 , and minimum was 20.35 kg/m^2 . For female participated students BMI median was $20.94(20.20; 22.22)$ kg/m^2 . Maximum was 29.02 kg/m^2 , and minimum was 18.07 kg/m^2 .

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 (55.556% 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

	Reference Man		Reference Woman	
	WHO	NAP	WHO	NAP
Total energy expenditure and restrictions for total fat and SFA	2600	2700	2000	2100
Energy, kcal/d	42-84	44-87	32-65	34-68
Total fat, g/d (15-30% TEE)	28	29	22	23
SFA, g (<10% TEE)				
TEE: The total daily energy expenditure, SFA: Saturated fatty acids, WHO: World health organization, NAP: National academies press				

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

Nourish status	Males		Females		All	
	n	%	n	%	n	%
Underweight (BMI ≤ 18.5)	-	-	2	6.06	2	3.33
Normal (BMI between 18.5-24.9)	7	25.92	29	87.88	36	60.00
Overweight (BMI between 25-29.9)	15	55.56	2	6.06	17	28.34
Obese (BMI ≥ 30)	5	18.52	-	-	5	8.33
Total	27	100.00	33	100.00	60	100.00

BMI: Body mass index

TABLE 3. Average intakes of total fat and saturated fatty acids

Average intake	Males				Females				P value
	Median	IQR	Max	Min	Median	IQR	Max	Min	
Total fat (g/d)	76.32	70.15-114.41	141.64	59.58	69.41	63.23-86.94	136.63	28.55	0.04
SFA (g/d)	28.86	22.41-36.42	52.54	17.09	24.29	20.53-31.60	47.71	7.25	0.17

SFA: Saturated fatty acids, IQR: Interquartile ranges, Max: Maximum, Min: Minimum, P values were estimated by using a Mann-Whitney U test

TABLE 4. Comparison dated total fat intake with recommendation by gender

Total fat intake (g/d)	Gender			
	Males*		Females**	
	n	%	n	%
Below recommendations	-	-	1	3.03
Between recommended limits	17	62.96	14	42.42
Beyond recommendations	10	37.04	18	54.55
Total	27	100.00	33	100.00

*recommended limits for males: 42-87 g/d, **recommended limits for females: 32-68 g/d

TABLE 5. Average total fat intake of males compared with recommendation

Nourish status	Males average intake of total fat (g)					
	<42		42-87		>87	
	n	%	n	%	n	%
Underweight (BMI ≤18.5)	-	-	-	-	-	-
Normal (BMI between 18.5-24.9)	-	-	3	17.65	4	40.00
Overweight (BMI between 25.0-29.9)	-	-	11	64.70	4	40.00
Obese (BMI ≥30)	-	-	3	17.65	2	20.00
Total	-	-	17	100.00	10	100.00

BMI: Body mass index

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).

The 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

TABLE 6. Average total fat intake of females compared with recommendation

Nourish status	Females average intake of total fat (g)					
	<32		32-68		>68	
	n	%	n	%	n	%
Underweight (BMI ≤18.5)	1	100	-	-	1	5.56
Normal (BMI between 18.5-24.9)	-	-	12	85.71	17	94.44
Overweight (BMI between 25-29.9)	-	-	2	14.29	-	-
Obese (BMI ≥30)	-	-	-	-	-	-
Total	1	100.00	14	100.00	18	100.00

BMI: Body mass index

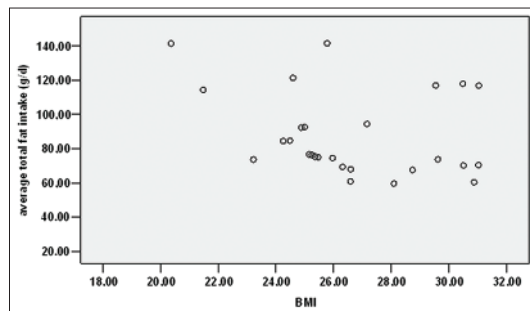


FIGURE 1. Link between BMI and total fat intake in male students

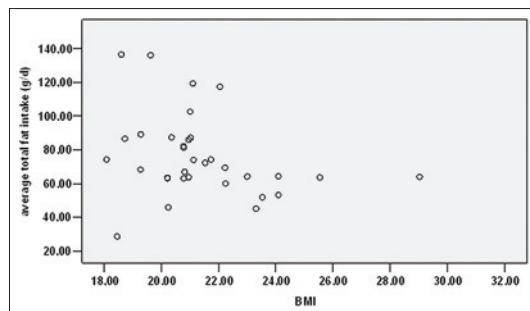


FIGURE 2. Link between BMI and total fat intake in female students

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.

TABLE 7. Comparison dated SFAs intake with recommendation by gender

Saturated fatty acids intake (g/d)	Gender			
	Males*		Females**	
	n	%	n	%
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

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.

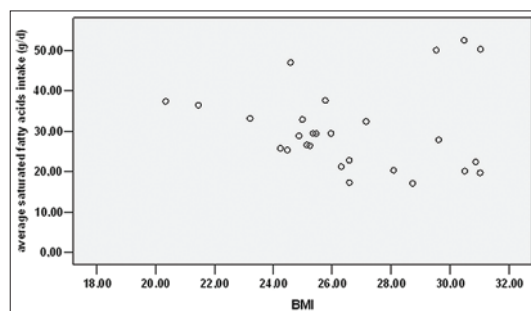


FIGURE 3. Link between BMI and SFAs intake in male students

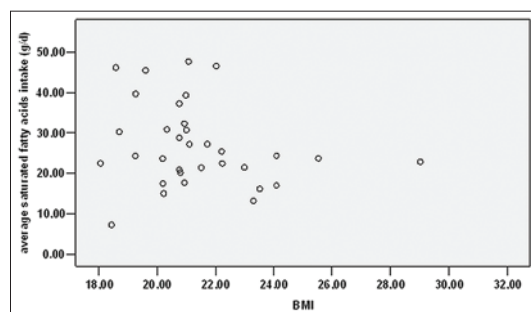


FIGURE 4. Link between BMI and SFAs intake in female students

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

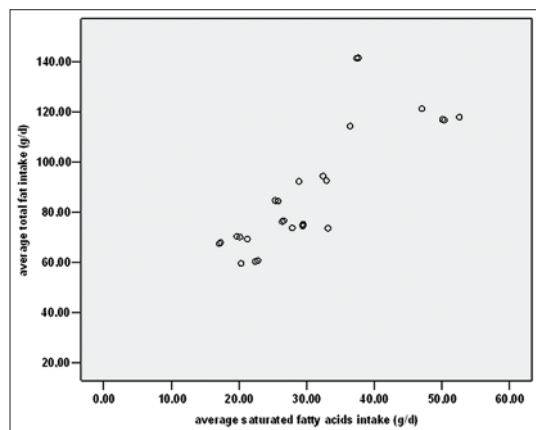


FIGURE 5. Link between SFAs and total fat intake in male students

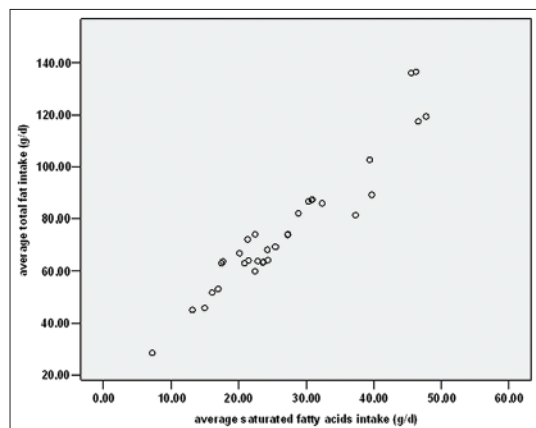


FIGURE 6. Link between SFAs and total fat intake in female students

There was strong positive correlation between average 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%, mono-unsaturated 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.

REFERENCES

1. Yoon PW, Bastian B, Anderson RN, Collins JL, Jaffe HW. Potentially Preventable Deaths from the Five Leading Causes of Death — United States, 2008–2010. *MMWR* 2014;63(17):369-74.
2. Go AS, Mozaffarian D, Roger VL, Benjamin EJ, Berry JD, Borden WB, et al; on behalf of the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2013 update: a report from the American Heart Association. *Circulation*. 2013;127:e6-e245 <http://dx.doi.org/10.1161/CIR.0b013e31828124ad>.
3. WHO: Diet, nutrition and the prevention of chronic diseases. Technical Report Series No. 916, WHO Geneva, 2003.
4. US Department of Agriculture, Agricultural Research Service, 2013, USDA National Nutrient Database for Standard Reference, Release 26. Nutrient Data Laboratory Home Page [cited 2013 August]. Available from: <http://www.ars.usda.gov/ba/bhnrc/ndl>.
5. WHO: Energy and protein requirements. Technical Report Series No. 724, WHO Geneva, 1985.
6. NAP: Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. Washington, DC, 2005.
7. Stanosavljević D, Danojević D, Bojanić J, Jandrić Lj. Vodič za pravilnu ishranu za zdravstvene profesionalce, Banja Luka, 2004.
8. Yahia N, Achkar A, Abdallah A, Rizk S. Eating habits and obesity among Lebanese university students. *Nutrition Journal* 2008;7:32 <http://dx.doi.org/10.1186/1475-2891-7-32>.
9. van Dam RM, Seidell JC. Carbohydrate intake and obesity. *Eur J Clin Nutr*. 2007;61 Suppl 1:S75–99 <http://dx.doi.org/10.1038/sj.ejcn.1602939>.
10. Willett WC. Dietary fat plays a major role in obesity: no. *Obes Rev*. 2002;3:59–68 <http://dx.doi.org/10.1046/j.1467-789X.2002.00060.x>.
11. Bray GA, Paeratakul S, Popkin BM. Dietary fat and obesity: a review of animal, clinical and epidemiological studies. *Physiol Behav*. 2004;83:549–55 <http://dx.doi.org/10.1016/j.physbeh.2004.08.039>.
12. Kimokoti RW, Newby PK, Gona P, Zhu L, Jassuja GK, Pencina MJ, et al. Diet Quality, Physical Activity, Smoking Status, and Weight Fluctuation Are Associated with Weight Change in Women and Men. *J. Nutr*. 2010;140:1287–12 <http://dx.doi.org/10.3945/jn.109.120808>.
13. Hooper L, Abdelhamid A, Moore HJ, Douthwaite W, Skeaff CM, Summerbell CD. Effect of reducing total fat intake on body weight: systematic review and meta-analysis of randomised controlled trials and cohort studies. *BMJ* 2012;345:e7666 <http://dx.doi.org/10.1136/bmj.e7666>.