

The Effect of Dietary Fiber Intake on Total Energy Consumption in Insufficiently Active Women

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Abstract: *51 healthy Latvian women aged 21-50 years, and who met the low physical activity criteria, participated in this study. A survey on time spent on physical activities during the last 7 days was used in order to assess the intensity of physical activity (IPAQ – International Physical Activity Questionnaire).*

Dietary intake was assessed using 3-day food record, 2 non-consecutive weekdays and 1 weekend day. Food records were analyzed using program NutriSurvey 2007 and the daily nutrient intake of total energy, protein, fat, carbohydrate, soluble, insoluble fiber and total fiber were calculated. Statistical analysis was performed using the programs MS Excel 2013 and SPSS version 22.0. Results expressed as mean, standard deviation. Significance was accepted at the 5% probability level.

The aim of the study was to evaluate the relation between dietary fiber intakes in insufficient active women with their total daily energy intake.

The result suggested, that it was significant differences of dietary fiber and total energy intake between overweight/obese and lean women group. Overweight/obese women consumed more total fat and calories, but less carbohydrate and dietary fiber than lean women. A negative correlation was concluded between dietary fiber intake and energy income.

Keywords: *dietary fiber, insufficient physical activity, BMI, women, energy intake.*

1. INTRODUCTION

Eating habits, a low-fiber diet and insufficient physical activity can lead to energy imbalance and weight gain.

According to Study of the Health Affecting Habits of Latvian Population [1] and The National Food Consumption Survey of LATVIA [3], found that Latvia showed dietary fiber and physical activity deficiency among the studied women.

Insufficient physical activity is defined as less than 30 minutes of moderate activity five times per week, or less than 20 minutes of vigorous activity three times per week, or equivalent. The World Health Organization (WHO) recommends that adults dedicate at least thirty minutes every day to physical activities [2], however, only 12.2% of Latvian inhabitants comply with this recommendation. The 2010 survey on health-influencing habits amongst the Latvian population shows that women were significantly less active (34.7%) than men (45.3%) [1].

According to European Food Society Association (EFSA) [4] and World Health Organization (WHO) the Recommended Dietary Fiber Intake has been suggested to be 25 grams per day for women. The Academy of Nutrition and Dietetics recommend consuming 7 to 13 grams of soluble fiber as part of the total fiber consumed.

Dietary fiber is an extremely beneficial component of diets. This is found only in plant products. A low-fiber diet can lead to weight gain and increase the risk of cardiovascular disease, development of constipation, high blood pressure, diabetes and other diseases. Consuming a diet rich in fiber is associated lower risk for certain diseases and obesity. The WHO recommends that at least 400g of vegetables and fruit be consumed daily [5], however, only 35.3% of Latvian

inhabitants consume fresh vegetables every day. Likewise, only 21.5% of Latvian inhabitants consume fruit and berries on a daily basis.

2. LITERATURE REVIEW

The survey indicates that in 2010, a total of 17.9% of the women surveyed were obese [1].

In accordance with the Eurobarometer survey [6], in Latvia 44% of the population does not engage in any physical or sporting activities at all, while the average percentage in EU is 39%. Likewise, it was found that in Latvia only 28% of inhabitants engage in physical or sporting activities one or two times a week, while the EU average is 40%. Latvian women do not eat enough dietary fiber, the average intake is 15.6 g/day. Observational studies have found that adults with higher intakes of dietary fiber are leaner [7] and less likely to be obese than adults with low-fiber intake [8]. In the Finnish Diabetes Prevention study an increase in dietary fiber intake was associated with a sustained weight reduction (>5%) [9]. The odds ratio for sustained weight loss at year 3 of the study (1 to 3 year follow up) was 2.04 (95% CI: 1.05 to 3.95) for subjects in the third quartile (3.1 to 3.7 g per MJ) and 2.67 (95% CI: 1.26 to 5.65) for subjects with a fiber intake in the upper quartile (>3.7 g per MJ), compared to subjects in the lowest quartile (< 2.6 g per MJ)[9].

Dietary fiber may influence food intake, energy metabolism and thus body weight by many mechanisms.

Tolhurst, G.*et al.* [10] studies suggest a high-fiber diet help keep weight by stimulating the release of appetite – suppressing hormones in the gut. Fermentation of soluble fiber and its products, short-chain fatty acids (SCFA) could stimulate satiety, improve insulin sensitivity, and thus exert a beneficial role in body-weight regulation [11].

Recent research published in Nature Communications journal, by Gary Frost et al. concluded that the increased intake of dietary fiber that is fermented in the colon by the micro biota decrease body weight. This study authors present, that acetate derived from the colonic fermentation of dietary fiber acts to directly suppress appetite through central hypothalamic mechanisms involving changes in trans cellular neurotransmitter cycles. This, therefore, opens up new research directions into the promotion of acetate production by colonic micro biota and therapeutic strategies for the prevention and treatment of obesity [12].

3. AIM

The aim of the study was to evaluate the relation between dietary fiber intake in insufficient active women with their total daily energy intake.

4. METHODOLOGY

4.1. Selection of Subjects for the Study

This observational study was approved by the University of Latvia Ethics Committee. Consent was obtained in written from all the subjects who confirmed to participate in the study.

51 women from Latvian capital Riga and its region, who met the low physical activity criteria, participated in the study. A survey on time spent on physical activities during the last 7 days was used in order to assess the intensity of physical activity (*IPAQ – International Physical Activity Questionnaire*) [13].

Subjects were excluded if they were pregnant or lactating. Based on BMI, the participants of the search were divided into 2 groups: one with BMI > 25 (n=27, average age - 36 years) and other with BMI < 25 kg/m² (n=24, average age - 32 years).

4.2. Collection of Data and Statistical Analysis

Dietary intake was assessed using 3-day food record, 2 non-consecutive weekdays and 1 weekend day. All subjects were given detailed written and oral instructions.

Food records were analyzed using program *NutriSurvey2007* [14] and the daily nutrient intake of total energy, protein, fat, carbohydrate, soluble, insoluble fiber and total fiber were calculated.

Statistical analysis was performed using the programs *MS Excel2013* and *SPSS version 22.0*. Results expressed as mean standard deviation. Significance was accepted at the 5% probability level.

5. RESULTS AND DISCUSSION

Table 1. Means and standard deviations (SD) of analyzed variables between overweight/obese and lean women group and significance of differences (p values)

Variables	BMI<25kg/m ² (n=24)		BMI>25kg/m ² (n=27)		p value*
	Means	SD	Means	SD	
Energy, kcal	1607.0	287.0	2250.0	174.0	p<0.001
Protein, E%	19.0	4.8	18.0	3.4	p>0.050
Fat, E%	36.0	7.0	4.0	4.8	p<0.001
Carbohydrate, E%	45.0	9.1	37.0	6.3	p<0.001
Solublefiber, g/d	6.7	2.3	5.0	1.0	p<0.010
Solublefiber, g/1000 kcal	4.2	1.2	2.2	0.5	p<0.001
Insolublefiber, g/d	13.2	3.6	11.0	2.5	p<0.050
Insolublefiber, g/1000 kcal	8.3	1.9	4.9	1.1	p<0.001
Totalfiber, g/d	19.9	5.7	16	3.4	p<0.001
Totalfiber, g/1000 kcal	12.5	2.9	7.1	1.5	p<0.001

*t-test

Table 1 presents the significant different amounts of fat and energy intake between two groups (p<0.001). The deficiency of dietary fiber was found to be greater among the overweight/obese subjects.

Intervention studies provide evidence that high fat (>35 E%), low carbohydrate (<50 E%) diets are associated to adverse short- and long-term effects on body weight, although data are not sufficient to define a Lower Threshold of Intake (LTI) for carbohydrates[4].

These findings suggest that composition of a diet, especially low dietary fiber and high fat and total energy in take, plays a role in the etiology of obesity.

Table 2. Means, standard deviations (SD), and Pearson's correlations between research variables

Variables	N	Min	Max	Mean	SD	1	2	3	4
1. Energy, kcal	51	1084.0	2576.0	1947.1	398.3	-			
2.Soluble fiber (g/1000 kcal)	51	1.5	7.5	3.2	1.3	-.623	-		
3.Insoluble fiber (g/1000 kcal)	51	2.6	11.6	6.5	2.3	-.662	.905	-	
4. Total fiber (g/1000 kcal)	51	4.3	18.0	9.7	3.5	-.662	.961	.987	-

p<0.01

The findings of the correlation matrix (Table 2) indicate that soluble, insoluble and total dietary fiber were negatively related to total energy intake (r=-0.623, p < 0.01; r = -0.662, p<0.01; r = -0.662, p<0.01).

These findings suggests that deficiency of dietary fiber causes an excess energy intake in insufficiently active women. Our finding may support a beneficial role of higher intake of dietary fiber, in prevention of body-weight and waist circumference gain.

6. CONCLUSION

The result suggested, that it was significant differences of dietary fiber and total energy intake between overweight/obese and lean women group. Overweight/obese women consumed more fat and calories, but less carbohydrate and dietary fiber than lean women. A negative correlation was concluded between dietary fiber intake and energy income.

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