

1 *Proceeding Paper*

2 **Dietary Habits and Diabetes Mellitus Prevalence in Men and** 3 **Women: National Health Survey in Serbia** †

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12 **Abstract:** This work aimed to assess the relationship between dietary habits and diabetes mellitus
13 prevalence in the Serbia. The use of dairy products (OR = 1.15, 95% CI = 1.03–1.30; $p = 0.017$) and
14 fruits (OR = 1.31, 95% CI = 1.19–1.44; $p < 0.001$) was associated with diabetes mellitus in males, while
15 use of margarine still reached statistical significance (OR = 5.33, 95% CI = 1.00–28.72; $p = 0.050$). The
16 use of margarine (OR = 4.69, 95% CI = 1.35–16.32; $p = 0.015$) and lard (OR = 2.38, 95% CI = 1.10–5.12;
17 $p = 0.027$) was associated with a higher prevalence of diabetes mellitus in females. A lower preva-
18 lence of diabetes mellitus in females was associated with bread consumption, such as use of
19 half-white bread ($p = 0.027$) and integral bread ($p = 0.011$).

20 **Keywords:** diet; diabetes mellitus; National Health Survey

22 **1. Introduction**

23 Diabetes mellitus is an important public health problem worldwide and although it
24 can be modified, it is a major risk for cardiovascular diseases, stroke, cancer [1,2]. Ac-
25 cording to the World Health Organization 2014 estimates, the prevalence of diabetes
26 was 422 million, while 1.5 million deaths were directly caused by diabetes [3]. In 2014,
27 8.5% of adults aged 18 years and older had diabetes worldwide, particularly in low-and
28 middle-income countries. Besides cardiovascular diseases and cancer, diabetes mellitus
29 is now an emergence public health problem in Serbia [2,4].

30 Prevalence of diabetes mellitus is attributed to the growth and aging of the popula-
31 tion and risk behaviors such as overweight, harmful use of alcohol, smoking tobacco,
32 insufficient physical activity, long-term stress exposure, hereditary factors, etc [5].
33 Among behavioral factors, dietary habits are of particular importance in etiology of di-
34 abetes mellitus [5,6].

35 There are numerous studies which showed that dietary habits may be associated
36 with diabetes, but results are inconsistent [6,7]. Besides, the relationship between diabe-
37 tes and certain foods and dietary factors is still complex and unclear. This work aimed to
38 assess the relationship between dietary habits and diabetes mellitus prevalence in Serbia.

39 **2. Materials and Methods**

40 This research was designed as a secondary analysis of database provided by the
41 National Health Survey conducted in Serbia in 2013 [8]. Data for this cross-sectional
42 study were obtained from the National Survey of the Population of Serbia in 2013 that
43 was carried out by the Ministry of Health of Serbia and the Institute of Public Health of
44 Serbia “Dr Milan Jovanović Batut”. The research was carried in the period October 7th,

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2013 to December 30th, 2013. The study population included adults ≥ 15 years old, permanent residents of the Republic of Serbia. The 2013 National Health Survey was performed in line with the EUROSTAT recommendations for performance of the European Health Interview Survey.

We performed univariable logistic regression, where the independent variable was the diet, and the results were presented as odds ratios (OR) with 95% confidence intervals (CIs). Association between diet and diabetes mellitus prevalence was evaluated separately among men and women. Statistical significance was considered when $p < 0.050$. All statistical analyses were conducted using the Statistical Package for Social Sciences software (v. 20.0, SPSS Inc., Chicago, IL, USA).

3. Results

The study sample consisted of 14,623 participants, 6759 (46.2%) men and 7864 (53.8%) women (Table 1). About half of study participants had urban place of residence and middle education level.

Table 1. Characteristics of study respondents by age, Republic of Serbia, 2013.

Variables	Males (<i>n</i> = 6759) Females (<i>n</i> = 7864)		<i>p</i>	
	No. (%)	No. (%)		
Age groups (years)				
	15–24	843 (12.5)	879 (11.2)	
	25–34	937 (13.9)	1024 (13.0)	
	35–44	1068 (15.8)	1123 (14.3)	
	45–54	1055 (15.6)	1273 (16.2)	
	55–64	1328 (19.6)	1553 (19.7)	
	65–74	875 (12.9)	1080 (13.7)	
	75–84	589 (8.7)	796 (10.1)	
	85+	64 (0.9)	136 (1.7)	0.000
Place of residence				
	Urban	3372 (5.1)	4502 (57.2)	
	Rural	3037 (44.9)	3362 (42.8)	0.008
Education level				
	Low	1673 (24.8)	2954 (37.6)	
	Middle	3972 (58.8)	3728 (47.4)	
	High	1114 (16.5)	1182 (15.0)	0.000

Abbreviations: *p*-Probability value according to univariate regression analysis.

Prevalence of diabetes mellitus was 8.4%, significantly more frequent in women (8.9%) than in men (8.0%), $p = 0.049$ (Table 2).

Table 2. Prevalence of diabetes mellitus, by sexes .

Sexes	Diabetes Mellitus		<i>p</i>
	Absent	Present	
	No. (%)	No. (%)	
Males	6199 (92.0)	536 (8.0)	
Females	7139 (91.1)	695 (8.9)	0.049
Total	13338 (91.6)	1231 (8.4)	

Abbreviations: *p* (Probability, χ^2 -test).

The use of dairy products (OR = 1.15, 95% CI = 1.03–1.30; $p = 0.017$) and fruits (OR = 1.31, 95% CI = 1.19–1.44; $p < 0.001$) was associated with diabetes mellitus in males, while use of margarine still reached statistical significance (OR = 5.33, 95% CI = 1.00–28.72; $p = 0.050$) (Table 3). The use of margarine was associated with a higher prevalence of diabetes

mellitus in females (OR = 4.69, 95% CI = 1.35–16.32; $p = 0.015$), as well as use of lard (OR = 2.38, 95% CI = 1.10–5.12; $p = 0.027$). A lower prevalence of diabetes mellitus in females was associated with bread consumption, such as use of half-white bread (OR = 0.32, 95% CI = 0.12–0.88; $p = 0.027$) and integral bread (OR = 0.27, 95% CI = 0.10–0.74; $p = 0.011$). No association was found between vegetables and fish intake and the prevalence of diabetes mellitus in either males or females.

Table 3. Association of dietary habits with diabetes mellitus prevalence, in Serbia, by sexes; National Health Survey.

	Prevalence of Diabetes Mellitus					
	Males			Females		
	OR	(95% CI)	<i>p</i> Value	OR	(95% CI)	<i>p</i> Value
Dietary items						
Dairy	1.15	(1.03–1.30)	0.017	1.07	(0.97–1.19)	0.190
Bread						
White	1.89	(0.66–5.38)	0.234	0.58	(0.21–1.59)	0.291
Half-white	1.11	(0.38–3.21)	0.846	0.32	(0.12–0.88)	0.027
Integral	0.43	(0.15–1.26)	0.125	0.27	(0.10–0.74)	0.011
All types	1.56	(0.54–4.51)	0.413	0.41	(0.15–1.13)	0.085
None	1.00 *			1.00 *		
Fat						
Lard	2.00	(0.77–5.18)	0.153	2.38	(1.10–5.12)	0.027
Margarine	5.33	(1.00–28.72)	0.050	4.69	(1.35–16.32)	0.015
Vegetable oil	1.37	(0.54–3.49)	0.513	1.51	(0.71–3.20)	0.287
None	1.00 *					
Fish	1.00	(0.99–1.24)	0.866	0.96	(0.82–1.13)	0.599
Fruits	1.31	(1.19–1.44)	0.000	0.97	(0.88–1.03)	0.259
Vegetables	1.10	(0.99–1.24)	0.083	1.01	(0.91–1.12)	0.837

Abbreviations: OR-Odds Ratio; 95%CI-Confidence Interval; p -probability value according to uni-variate regression analysis; * Reference category.

4. Discussion

One of the main findings in this study was high prevalence of diabetes mellitus in Serbia in both sexes. The use of dairy products and fruits was associated with diabetes mellitus in males, while use of margarine still reached statistical significance. The use of lard and margarine was associated with a higher prevalence of diabetes mellitus in females. A lower prevalence of diabetes mellitus in females was associated with use of half-white and integral bread. No association was found between vegetables and fish intake and the prevalence of diabetes mellitus in either males or females.

The association between consumption of food and diabetes mellitus has been found to vary in significance and magnitude across countries [9]. In Latin America, the per capita supply of milk showed a strong positive correlation with incidence of childhood type 1 diabetes mellitus [10]. Studies inquiring into the role of other dairy products as a heterogeneous food group (including specific low-fat and high-fat dairy foods, butter) in diabetes mellitus mortality have not yielded consistent results [11].

Our results are consistent with findings from previous meta-analyses investigating the associations of high versus low fat and fatty acid intakes with diabetes mellitus incidence [12]. Current dietary guidelines on the prevention of diabetes mellitus recommend a diet low in total fat and animal fat, and high in vegetable fat [13]. Moreover,

dose–response relationships have not yet been examined for the majority of these associations. Besides, substantial differences according to sexes could be attributed to different exposure to lifestyle-related risk factors such as smoking habits, obesity and diabetes.

This study has some limitations. In addition to the well-known shortcomings of cross-sectional studies, such as ‘ecological fallacy’, there were lack of control of confounding, some of collinearity and correlation that may not be linear.

5. Conclusion

Dietary habits are of a large importance for prevalence of diabetes mellitus in Serbia. Consequently, adherence to a healthy dietary pattern at the population and individual level should be encouraged. Further epidemiological analytical studies are needed to investigate a possible causative association.

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Informed Consent Statement: Not applicable. No patient approvals were sought nor required for this study. Namely, as our model-based analysis used aggregated data, patients were not involved in the research.

Data Availability Statement: Data is contained within the article.

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