

BMJ Open Association of the consumption of common food groups and beverages with mortality from cancer, ischaemic heart disease and diabetes mellitus in Serbia, 1991–2010: an ecological study

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ABSTRACT

Objectives: This paper reports association between mortality rates from cancer, ischaemic heart disease and diabetes mellitus and the consumption of common food groups and beverages in Serbia.

Design: In this ecological study, data on both mortality and the average annual consumption of common food groups and beverages per household's member were obtained from official data-collection sources. The multivariate linear regression analysis was used to determine the strength of the associations between consumption of common food groups and beverages and mortality rates.

Results: Markedly increasing trends of cancer, ischaemic heart disease and diabetes mellitus mortality rates were observed in Serbia in the period 1991–2010. Mortality rates from cancer were negatively associated with consumption of vegetable oil ($p=0.005$) and grains ($p=0.001$), and same was found for ischaemic heart disease ($p=0.002$ and 0.021 , respectively), while consumption of other dairy products showed a significant positive association ($p<0.001$ and $p=0.032$, respectively). In men and women, mortality rates from diabetes mellitus showed a significant positive association with consumption of poultry ($p=0.014$ and 0.004 , respectively). Consumption of beef and grains showed a significant negative association with cancer mortality rates in both genders ($p=0.002$ and $p<0.001$ in men, and $p<0.001$ and $p=0.014$ in women, respectively), while consumption of cheese was negatively associated only in men ($p<0.001$). Mortality from diabetes mellitus showed a significant positive association with consumption of animal fat and other dairy products only in women ($p=0.003$ and 0.046 , respectively).

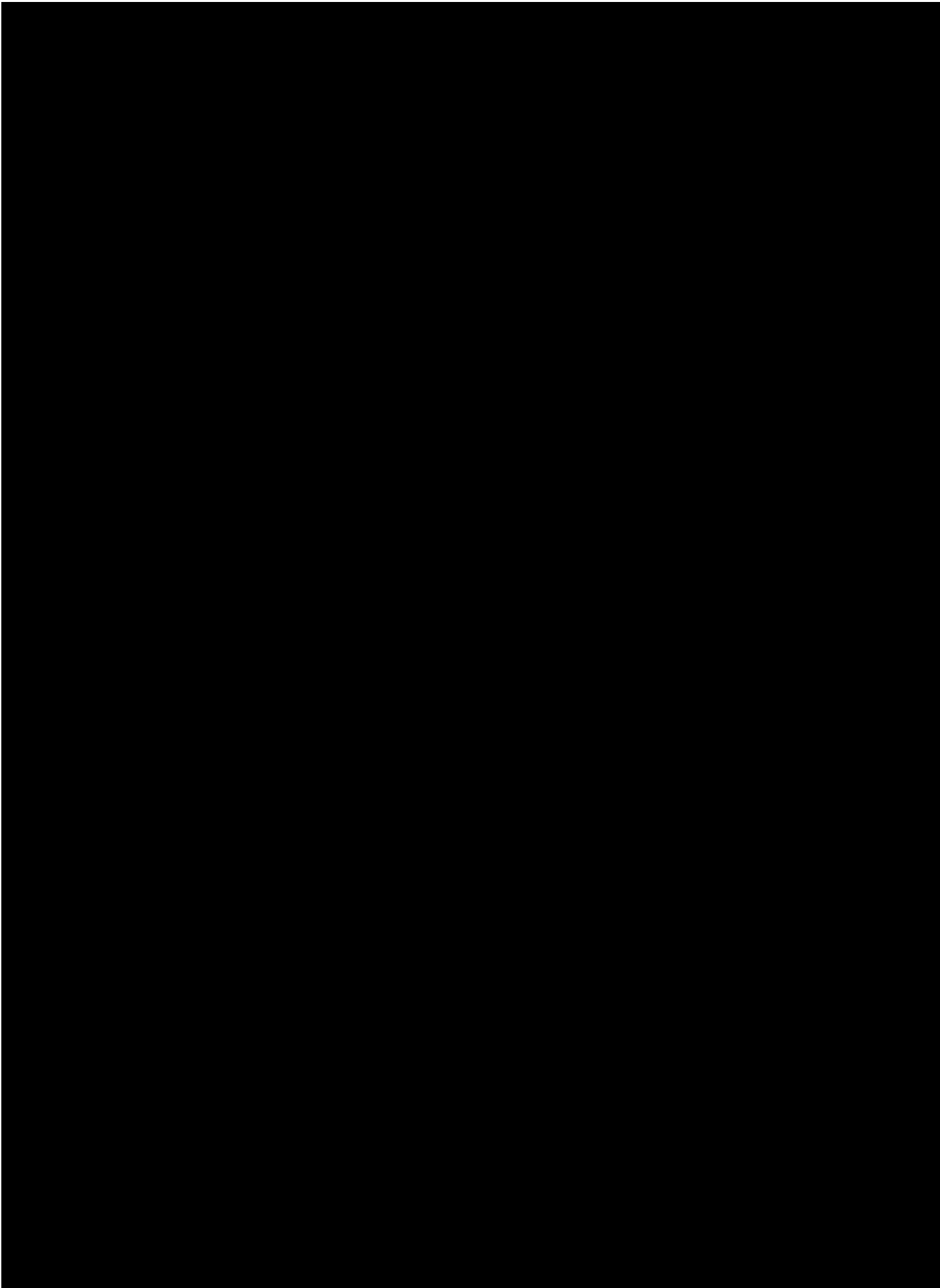
Conclusions: Association between unfavourable mortality trends from cancer, ischaemic heart disease and diabetes mellitus, and common food groups and beverages consumption was observed and should be assessed in future analytical epidemiological studies. Promotion of healthy diet is sorely needed in Serbia.

Strengths and limitations of this study

- To the best of our knowledge, this population-based ecological study is the first to document a relationship between mortality from cancer, ischaemic heart disease and diabetes mellitus, and consumption of food and beverages in Serbia.
- Mortality rates from cancer, ischaemic heart disease and diabetes mellitus in Serbia have increased during the past two decades, and Serbia tops the list of European countries with highest mortality rates.
- We found that the consumption of beef and grains was negatively associated with mortality rates from cancer in both genders, while consumption of other dairy products showed a significant positive association. Consumption of vegetable oil showed a significant negative association with mortality rates from ischaemic heart disease in both genders, while consumption of beer was positively associated. Association between consumption of poultry and mortality rates from diabetes mellitus was significantly positive both in men and women.
- The inability to fully control confounding factors in assessing relationships between mortality and consumption of food and beverages in Serbia is the limitation of this study.
- Findings have important implications for the promotion of a healthy diet in Serbia.

BACKGROUND

Cancer, ischaemic heart disease and diabetes mellitus are the most common causes of death in developed countries.^{1–3} The top two diseases, ischaemic heart disease and cancer, accounted for 47.5% of all deaths in the USA in 2010.^{2–3} Cardiovascular diseases are the main cause of death in the European Union: these account for 42% of all deaths in the total population.¹ Diabetes was the



statistics in Serbia as medium-quality (criterion used: completeness reporting is >90%, and ill-defined causes and injury deaths with undetermined intent appear on <10% of registrations).²³

The study comprised the entire population of the Republic of Serbia during the period 1991–2010. Data for 1998–2010 are not available for the Autonomous Province of Kosovo and Metohia, which declared itself independent in 2008. Data on the number and composition of the Serbian population by gender and age were presented according to 1991 and 2002 censuses, while for intercensus years the estimates of the resident population were obtained from the national Statistical Office database. The analysis was conducted on the entire Serbian population (approximately 7.5 million inhabitants).²¹ Since 1990s, Serbia had the largest internally displaced persons and refugee population in Europe (constituting 7% to 7.5% of its population) for whom data were included in the Serbian population and could not be set aside as a special group.

The study was conducted between June 2013 and September 2014. Cancer, ischaemic heart disease and diabetes mellitus mortality was estimated for the period 1991–2010.

The National Statistical Office of the Republic of Serbia has conducted a survey of household and individual food and beverages consumption in Serbia—the Household Budget Survey.²⁴ The Household Budget Survey in Serbia is conducted annually since the 1960s, and is harmonised with international standards and recommendations (Eurostat, International Labour Organisation and the United Nations) from 2003, which provides grounds for an international comparison of data. The Household Budget Survey covered the whole territory of the Republic of Serbia. The household, either multimember (a community of persons whose members live together in the same dwelling unit and spend realised income jointly) or one member (single person, living alone and spending one's own income), chosen according to the sample plan was the survey unit. Each year, the survey comprises a nationally representative sample of non-institutionalised persons residing in Serbia. The sample is a two-stage, stratified sample. The first stage units are enumeration districts, and the second stage units are households. Sample selection was carried out by selecting the first stage units (enumeration districts) in proportion to the number of households, and the second stage units (households) were selected with equal probability (simple random selection). According to the EUROSTAT recommendations, total number of households predicted for surveying is 4800 for the Republic of Serbia. Also, as recommended by EUROSTAT, out of the total number of households envisaged for the survey, the lowest percentage of households that must be surveyed is 85% (which was achieved for each year). Given that a household in Serbia consists on an average of three members, the household budget survey includes about 13 500–14 500 inhabitants.

Data were collected for the whole observed year (from 1 January to 31 December). Every 15 days, 200 households have been chosen to keep a diary on personal consumption of food and beverages (thereby taking into account effects that seasonal variations have on the diet). Diary method has been applied in this survey: each surveyed household keeps a diary (statistical form D-1) for the reference period. The survey collects data on household consumption, that is, data on basic elements of individual consumption. The substitution of households is not predicted. Diary of the consumed quantities of food and beverages in every household was kept by a chosen person (it was the person responsible for food in the house, most often a housewife). Specially trained surveyors visit the households at least three times for the purpose of helping with filling in the diary.

Measures

Three types of death rates were calculated: crude, specific (age-specific, sex-specific) and age-standardised. Foremost, number of deaths from cancer, ischaemic heart disease and diabetes mellitus were included in the numerator for mortality rates, while Serbian population data was used as the denominator for each year. Then, the standardisation was performed by direct method (Segi's World standard population was used as standard population, stratified by 5-year age strata).²⁵ Age-standardised mortality rates are expressed as deaths per 100 000 persons. Linear trend model was used to examine trend of mortality rates from cancer, ischaemic heart disease and diabetes mellitus.

There are about 80 food items listed in the Household Budget Survey. For ease of presentation of the consumption, list of consumed quantities of food and beverages is aggregated into several groups: meat (beef—fresh and frozen, pork—fresh and frozen, poultry—fresh and frozen, fish—fresh and frozen and canned, other kind of meat—fresh and frozen mutton and goat meat and dried and processed meat—including dried bacon, salami and sausages, hot dogs and deb-reziner, and other sausage products, canned and manufactured meat), eggs, dairy (milk, cheese and other dairy products (including yoghurts, butter, cream and sour cream), fats (animal fat: including pork fat, suet, lard, raw bacon) and oils (sunflower oil, and other vegetable oils), fruits (citrus fruits, bananas, apples, grapes, other kind of fruits and manufactured fruits), vegetables (potatoes, cabbage, tomatoes, peppers, bean, carrots, parsley, celery and similar vegetables, onion, garlic and leek, other kind of vegetables and manufactured vegetables), coffee, alcohol beverages (beer, wine, hard drinks), sweets and sweeteners (biscuits, chocolate, honey, sugar) and grains (bread and cereals, flour and products from flour, pastas and other similar products, rice). Food groups and beverages were represented by following units: meats (kg), eggs (piece), milk (L), cheese (kg), other dairy products (L), animal fat (kg), vegetable oil (L), fruits (kg), vegetables (kg), coffee

Table 1 Pearson's correlation coefficients (r) for *per capita* food and beverages consumption with mortality from cancer, ischaemic heart disease and diabetes mellitus (age-standardised mortality rates per 100 000 persons, using direct method, by Segi's World Standard Population) in Serbia, 1991–2010

Food groups and beverages (unit)	Cancer mortality	Ischaemic heart disease mortality	Diabetes mellitus mortality
Meats			
Beef (kg)	−0.740**	−0.565**	−0.363
Pork (kg)	+0.147	−0.346	+0.164
Poultry (kg)	+0.895**	+0.314	+0.748**
Fish (all kinds) (kg)	+0.861**	0.349	+0.612**
Other meat (kg)	−0.577*	−0.541*	−0.265
Dried meat (kg)	+0.878**	+0.235	+0.692**
Eggs (piece)	+0.890**	+0.544*	+0.680**
Dairy			
Milk (L)	−0.695**	−0.168	−0.301
Cheese (kg)	+0.100	−0.298	+0.131
Other dairy products (L)	+0.880**	+0.357	+0.625**
Fats and oils			
Animal fat (kg)	−0.892**	−0.473*	−0.501*
Vegetable oil (L)	+0.674**	−0.092	+0.606**
Fruits (all kinds) (kg)	+0.760**	+0.300	+0.737**
Vegetables (all kinds) (kg)	+0.749**	+0.265	+0.723**
Coffee (kg)	+0.558*	+0.015	+0.516*
Alcohol beverages			
Beer (L)	+0.492	+0.379	+0.600*
Wine (L)	−0.571*	−0.655**	−0.349
Hard drinks (L)	−0.974**	−0.519*	−0.691**
Sweets and sweeteners (kg)	+0.536*	−0.151	+0.464*
Grains (kg)	−0.843**	−0.346	−0.397

* 0.01< p<0.05; **p<0.01.

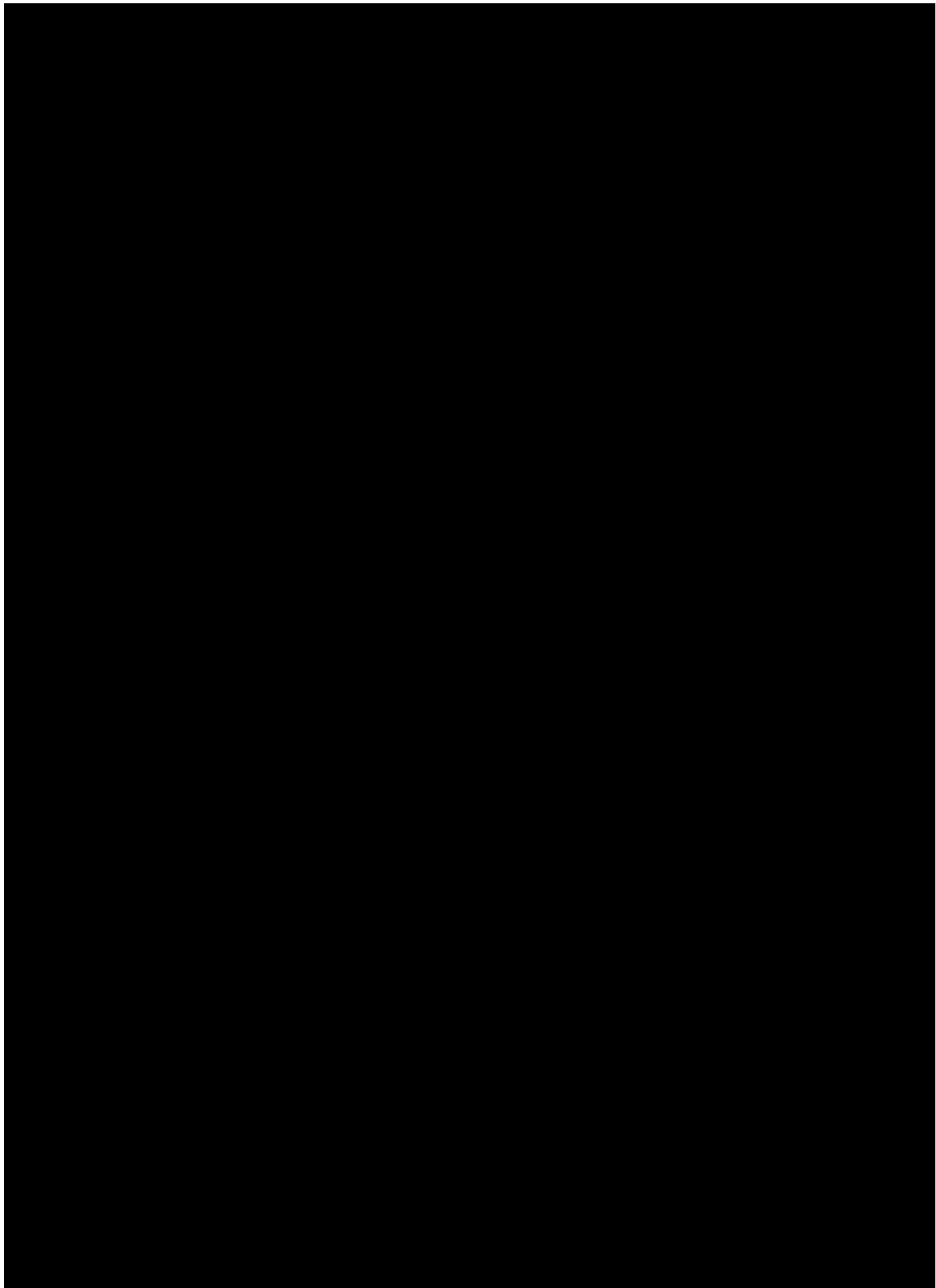
A multivariate linear regression analysis revealed positive association between cancer mortality rates and consumption of poultry ($\beta=+1.13$, 95% CI 0.62 to 1.65, $p<0.001$), milk ($\beta=+0.10$, 95% CI 0.02 to 0.17, $p=0.016$) and other dairy products ($\beta=+0.45$, 95% CI 0.30 to 0.60, $p<0.001$) and negative association with consumption of beef ($\beta=-1.42$, 95% CI -1.93 to -0.92 , $p<0.001$), vegetable oil ($\beta=-1.34$, 95% CI -2.21 to -0.48 , $p=0.005$) and grains ($\beta=-0.13$, 95% CI -0.21 to -0.06 , $p=0.002$; table 2). Also, the multivariate linear regression analysis showed positive association between ischaemic heart disease mortality rates and consumption of beer ($\beta=+1.36$, 95% CI 0.72 to 2.00, $p<0.001$) and other dairy products ($\beta=+0.49$, 95% CI 0.05 to 0.92, $p=0.032$), and negative association with consumption of vegetable oil ($\beta=-4.82$, 95% CI -7.20 to -2.45 , $p=0.001$), cheese ($\beta=-2.50$, 95% CI -4.41 to -0.59 , $p=0.014$) and grains ($\beta=-0.25$, 95% CI -0.47 to -0.04 , $p=0.021$). Between the consumption of poultry and mortality rates from diabetes mellitus a positive association was observed ($\beta=+0.61$, 95% CI 0.33 to 0.90, $p<0.001$).

The animal fat, eggs and other dairy products consumption was significantly positively related with cancer mortality rates in men ($p<0.001$; table 3). Beef and grains consumption showed a significant negative association with cancer mortality rates in both genders ($p=0.002$ and $p<0.001$ in men, respectively; $p<0.001$ and

$p=0.014$ in women, respectively), while consumption of cheese was negatively associated with mortality rate in men only ($p<0.001$). For both genders, the consumption of vegetable oils was negatively ($p<0.001$ in men, and $p=0.001$ in women) and beer consumption was positively ($p=0.018$ in men, and $p<0.001$ in women) associated with mortality rates from ischaemic heart disease. Association between poultry consumption and mortality rates from diabetes mellitus was significantly positive in men and women ($p=0.014$ and 0.004, respectively). Consumption of animal fat and other dairy products showed significant positive association with mortality from diabetes mellitus only in women.

DISCUSSION

One of the main findings in this study was the significant increase of mortality from cancer, ischaemic heart disease and diabetes mellitus within the observed period in Serbia. According to the WHO estimates, in recent years Serbia has been the country with the highest mortality due to cancer and diabetes mellitus in Europe, while mortality from ischaemic heart disease was lower in comparison to the rest of the European Region countries.^{1 22} Although mortality from coronary heart diseases has continued to decline in the European Union (27 countries), the USA, Australia, Japan and most Latin



vary in significance and magnitude across countries.^{6 11 15 35}

Numerous ecological studies showed association between cancer mortality rates and consumption of some animal products (meat, milk, fish and eggs), sweeteners, some fats, grains and vegetables.^{36 37} The most consistent association was between cancer mortality and animal fat consumption,^{38 39} but was not confirmed in some other studies.^{15 40} In our study, consumption of animal fat and eggs was associated with cancer mortality in men only. This probable effect has been related to specific micronutrients (cholesterol, fatty acids, etc) contained in egg yolk and fats.⁴¹ Secular mortality trend from colorectal cancer in Spain has been positively correlated with consumption of poultry, vegetables and fruit.³⁵ Northern Europe seems to have adopted a healthier dietary pattern during recent decades, possibly due to both the improvements in availability of food groups (such as olive oil, fruits, vegetables, fish and seafood) and the implementation of nutrition education.³⁰ We found that the consumption of beef and grains was negatively associated with mortality from cancer in both genders, while consumption of other dairy products showed a significant positive association. These results could be explained with the intake of nutrients which contain grains, beef and dairy products (such as high-quality proteins, fibres, vitamins and minerals) which may have anticarcinogenic properties.⁴² Besides, substantial differences according to gender may be the result of different exposure to lifestyle-related risk factors such as smoking habits, sedentary life-style, obesity and diabetes.

According to the Data Food Networking (DAFNE) project, coronary heart disease mortality was not significantly correlated with per capita consumption of meat, fish, milk and dairy products, eggs and ethanol.⁴⁰ In 18 European countries, coronary mortality was negatively correlated with olive oil consumption.^{26 34} Increased consumption of palm oil and other oil crops is related to higher ischaemic heart disease mortality rates in developing countries.^{15 33} Our study revealed that vegetable oil consumption was negatively associated with mortality rates from ischaemic heart disease in both genders, while consumption of beer was positively associated. Some studies have produced different findings.^{43 44} Beer consumption has been associated with an increased coronary mortality rate probably due to a decrease in antioxidant capacity and changes in lipid profiles and inflammatory markers (eg, C reactive protein, interleukin 6, tumour necrosis factor α).⁴⁵ Decreased mortality has been associated with the consumption of vegetable oils, which are rich with monounsaturated and polyunsaturated fatty acids with well-known cardioprotective effects.⁴⁶ A positive correlation between mortality from coronary heart disease and eggs consumption was observed in a study involving 40 countries,⁴⁷ in contrast to the results in some other studies.¹⁵ Our study failed to demonstrate association

between eggs consumption and mortality from ischaemic heart disease, which could be explained with the hidden intercorrelations among some components of food and beverages which were aggregated into several groups or with confounding effects of some lifestyle factors (age, smoking, physical inactivity, hypertension and diabetes mellitus).

Consumption of poultry had a positive association with mortality from diabetes mellitus in both genders in Serbia. Although the saturated fat load in poultry may be lower than that in typical red meats, poultry provides no fibres or complex carbohydrates, and this could be the possible explanation for the association. Positive association between consumption of animal fat and other dairy products and mortality from diabetes mellitus was noticed in women in Serbia. The detrimental effects reported for animal fat and dairy products may be due to the effects of saturated fatty acids in these food sources.⁴⁸ 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.⁴⁹ This positive association may be confounded by genetic, psychosocial, or lifestyle-related factors (eg, cigarette smoking, obesity, physical inactivity, etc).

Strengths and limitations of the study

This study is the first to document a relationship between increased mortality from cancer, ischaemic heart disease and diabetes mellitus, and consumption of food and beverages in Serbia.

The longitudinal nature of our national-level data enabled us to analyse the link between mortality trends and food and beverages consumption. The Serbian mortality statistics data is considered comprehensive and reliable according to the WHO standards.²³ Also, the proportion of deaths assigned to ill-defined cause-of-death codes (revision 9 codes 780-799 and revision 10 codes R00-R99) in the observed period in Serbia was on average 6.8%, with a non-significant decreasing trend ($p=0.137$).²¹ Consequently, changes in the ICD classification over the time period studied could not have a substantial effect on changes in the mortality rates from cancer, ischaemic heart disease and diabetes mellitus in Serbia. Also, the Household Budget Survey in Serbia was harmonised with the international standards and recommendations.²¹ Assessment of the quality of data on consumption of foods and beverages was performed quarterly in each of the households by phone on a random sample (10% of surveyed households). Finally, our study may be useful in the generation of new hypotheses concerning the dietary aetiology of these most common chronic diseases in Serbia, which should be evaluated by further analytical epidemiological researches.

Admittedly, this ecological study has some limitations. First, this ecological study has examined relationship between outcome and exposure at the population level,

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12. Knoop KT, de Groot LC, Kromhout D, *et al.* Mediterranean diet, lifestyle factors, and 10-year mortality in elderly European men and women: the HALE project. *JAMA* 2004;292:1433–9.
13. Collado-Mesa F, Barceló A, Arheart KL, *et al.* An ecological analysis of childhood-onset type 1 diabetes incidence and prevalence in Latin America. *Rev Panam Salud Publica* 2004;15:388–94.

14. Gaskill SP, McGuire WL, Osborne CK, *et al.* Breast cancer mortality and diet in the United States. *Cancer Res* 1979;39:3628–37.
15. MacDonald J, Brevard PB, Lee RE, *et al.* Link between diet and cardiovascular disease in Latin America and the Caribbean using geographic information systems. *Rev Panam Salud Publica* 2009;26:290–8.
16. Zatonski WA, McMichael AJ, Powles JW. Ecological study of reasons for sharp decline in mortality from ischaemic heart disease in Poland since 1991. *BMJ* 1998;316:1047–51.
17. Government of the Republic of Serbia. *The Republic of Serbia: facts about Serbia*. Belgrade, 2015. <http://www.srbija.gov.rs/pages/intro.php?id=5> (20 September 2015).
18. Ilic M, Ilic I. Prostate cancer mortality in Serbia, 1991–2010: a joinpoint regression analysis. *J Public Health* 2015. doi:10.1093/pubmed/fdv064
19. Marković-Denić L, Vlainić H, Živković S, *et al.* Cancer mortality among men in Central Serbia: 1985–2006 survey study. *Croat Med J* 2008;49:792–8.
20. Vujčić IS, Sipetić SB, Dubljanin ES, *et al.* Trends in mortality rates from coronary heart disease in Belgrade (Serbia) during the period 1990–2010: a joinpoint regression analysis. *BMC Cardiovascular Disorders* 2013;13:112.
21. Statistical Office of the Republic of Serbia. *Demographic Yearbook in the Republic of Serbia, 1991–2010*. Belgrade, Serbia: Statistical Office of the Republic of Serbia, 2011.
22. World Health Organization Regional Office for Europe. *European Health for All Database (HFA-DB)*. Copenhagen, 2015. <http://data.euro.who.int/hfad/> (20 September 2015).
23. Mathers CD, Fat DM, Inoue M, *et al.* Counting the dead and what they died from: an assessment of the global status of cause of death data. *Bull World Health Organ* 2005;83:171–7.
24. Statistical Office of the Republic of Serbia. *Bulletins—Household Budget Survey for 1991–2010*. Belgrade, 2011.
25. Jensen OM, Parkin DM, MacLennan R, Muir CS, Skeet RG, eds. *Cancer registration: principles and methods. IARC scientific publication No. 95*. Lyon: IARC Press, 1991.
26. Levi F, Chatenoud L, Bertuccio P, *et al.* Mortality from cardiovascular and cerebrovascular diseases in Europe and other areas of the world: an update. *Eur J Cardiovasc Pre Rehabil* 2009;16:333–50.
27. Bosetti C, Bertuccio P, Malvezzi M, *et al.* Cancer mortality in Europe, 2005–2009, and an overview of trends since 1980. *Ann Oncol* 2013;24:2657–71.
28. Roglic G, Unwin N. Mortality attributable to diabetes: estimates for the year 2010. *Diabetes Res Clin Pract* 2010;87:15–19.
29. Tominaga S, Kuroishi T. An ecological study on diet/nutrition and cancer in Japan. *Int J Cancer* 1997;71(Suppl 10):2–6.
30. Vareiro D, Bach-Faig A, Raidó Quintana B, *et al.* Availability of Mediterranean and non-Mediterranean foods during the last four decades: comparison of several geographical areas. *Public Health Nutr* 2009;12:1667–75.
31. Kunitz SJ. The making and breaking of Yugoslavia and its impact on health. *Am J Public Health* 2004;94:1894–904.
32. Briefel RR, Johnson CL. Secular trends in dietary intake in the United States. *Annu Rev Nutr* 2004;24:401–31.
33. Chen BK, Seligman B, Farquhar JW, *et al.* Multi-Country analysis of palm oil consumption and cardiovascular disease mortality for countries at different stages of economic development: 1980–1997. *Global Health* 2011;7:45.
34. Naska A, Berg MA, Cuadrado C, *et al.* Data Food Networking (DAFNE) Participants. Food balance sheet and household budget survey dietary data and mortality patterns in Europe. *Br J Nutr* 2009;102:166–71.
35. Béjar Prado LM, Gili M, Ramírez G, *et al.* Dietary changes and colorectal cancer trends in Spain during 1951–2007. *Rev Esp Enferm Dig* 2010;102:159–68.
36. Armstrong B, Doll R. Environmental factors and cancer incidence and mortality in different countries, with special reference to dietary practices. *Int J Cancer* 1975;15:617–31.
37. Grant WB. A multicountry ecological study of cancer incidence rates in 2008 with respect to various risk-modifying factors. *Nutrients* 2013;6:163–89.
38. Besson H, Paccaud F, Marques-Vidal P. Ecologic correlations of selected food groups with disease incidence and mortality in Switzerland. *J Epidemiol* 2013;23:466–73.
39. Jarosz M, Sekula W, Rychlik E. Trends in dietary patterns, alcohol intake, tobacco smoking, and colorectal cancer in Polish population in 1960–2008. *Biomed Res Int* 2013;2013:183204.
40. Lagiou P, Trichopoulou A, Henderickx HK, *et al.* Household budget survey nutritional data in relation to mortality from coronary heart disease, colorectal cancer and female breast cancer in European countries. DAFNE I and II projects of the European Commission. Data Food Networking. *Eur J Clin Nutr* 1999;53:328–32.
41. Lee SA, Shu XO, Yang G, *et al.* Animal origin foods and colorectal cancer risk: a report from the Shanghai Women's Health Study. *Nutr Cancer* 2009;61:194–205.
42. Jansen MC, Bueno-de-Mesquita HB, Buzina R, *et al.* Dietary fiber and plant foods in relation to colorectal cancer mortality: the Seven Countries Study. *Int J Cancer* 1999;81:174–9.
43. Artaud-Wild SM, Connor SL, Sexton G, *et al.* Differences in coronary mortality can be explained by differences in cholesterol and saturated fat intakes in 40 countries but not in France and Finland. A paradox. *Circulation* 1993;88:2771–9.
44. Grønbaek M, Becker U, Johansen D, *et al.* Type of alcohol consumed and mortality from all causes, coronary heart disease, and cancer. *Ann Intern Med* 2000;133:411–19.
45. Di Castelnuovo A, Rotondo S, Iacoviello L, *et al.* Meta-analysis of wine and beer consumption in relation to vascular risk. *Circulation* 2002;105:2836–44.
46. Romeo J, Warnberg J, Diaz LE, *et al.* Effects of moderate beer consumption on first-line immunity of healthy adults. *J Physiol Biochem* 2007;63:153–9.
47. Willett WC. Dietary fats and coronary heart disease. *J Intern Med* 2012;272:13–24.
48. Feskens EJM, Virtanen SM, Räsänen L, *et al.* Dietary factors determining diabetes and impaired glucose tolerance. A 20-year follow-up of the Finnish and Dutch cohorts of the Seven Countries Study. *Diabetes Care* 1995;18:1104–12.
49. Patterson E, Larsson SC, Wolk A, *et al.* Association between dairy food consumption and risk of myocardial infarction in women differs by type of dairy food. *J Nutr* 2013;143:74–9.