

# Association of BMI and nutritional habits with hypertension in the adult population of Croatia

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## Abstract

*Objective:* The purpose of the present study was to investigate the distribution of hypertension, its nutritional and other determinants and their association in Croatia.

*Design:* Population-based, cross-sectional study.

*Setting:* Croatia.

*Subjects:* Representative random sample of 9070 adults (18 years and older) from all Croatian regions, selected using multistage sampling.

*Results:* Overall prevalence of hypertension (arterial blood pressure  $\geq 140/90$  mmHg) in Croatia was 45.5%, of which 40% were newly diagnosed hypertensives. There was no difference in the percentage of hypertensives between the continental and Mediterranean parts of Croatia. Newly diagnosed hypertension was found to be positively associated with increased BMI, age and alcohol consumption in the total sample and with moderate consumption of coffee in women, as well as inversely associated with regular consumption of fruits and vegetables in the total sample and high consumption of coffee in the total sample and in men. No association with newly diagnosed hypertension was recorded for use of animal fat, consumption of whole milk, smoked meat products, for adding salt, smoking and leisure-time physical activity.

*Conclusions:* Hypertension is a major public health problem in both continental and Mediterranean parts of Croatia. Maintenance of normal body mass, its reduction if already increased, and regular consumption of fruits and vegetables are proposed as priorities for primary prevention of hypertension in Croatia.

**Keywords**  
Croatia  
Hypertension  
BMI  
Nutritional habits  
Regional differences

High blood pressure is one of the most important health problems in Croatia owing to its association with IHD, which is the leading cause of death among Croatians<sup>(1)</sup>, and cerebrovascular disease<sup>(2–4)</sup>. In order to successfully reduce the prevalence of high blood pressure in Croatia, it is necessary to know and influence the factors which cause it.

A great number of studies on different populations have identified certain factors as being associated with high blood pressure. Some of them have been clearly associated with high blood pressure in the majority of studies, e.g. older age and increased body mass, while for many other factors, such as smoking, alcohol, coffee, nutrition, salt, physical activity and stress, results evaluating their association with high blood pressure have been conflicting<sup>(5–11)</sup>.

The previous studies conducted in Croatia were on smaller samples, often taken from one or a few settlements which could not be considered representative for a certain region nor for the country as a whole. Results from these studies were conflicting, with the prevalence of

high blood pressure varying from 16.7% up to 54% in the adult population of Croatia<sup>(12–15)</sup>. Studies on the difference in high blood pressure prevalence among the regions in Croatia also provided conflicting results: some stated a greater prevalence of hypertension in the continental part of Croatia<sup>(14,16)</sup>, others in the Mediterranean part<sup>(15)</sup>. In previous studies exploring the association of high blood pressure with different risk factors in the Croatian population, older age and increased body mass were shown to be constantly and most strongly associated with high blood pressure<sup>(12,14,17–19)</sup>.

The present study is part of the Croatian Adult Health Survey 2003. For the first time, the prevalence of high blood pressure and potential risk factors, including nutritional habits, have been recorded in a sufficiently large sample, representative of the entire population of Croatia and its regions. The results of this research will serve as the evidence base for developing policy to reduce the burden of CVD and preparing interventions for people with cardiovascular risk factors<sup>(20)</sup>. Therefore, it is of great importance to explore the association between blood pressure and

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possible risk factors causing its increase in the population of Croatia, as well as possible differences in the distribution of hypertension between the continental and Mediterranean parts of Croatia.

## Methods

### Sample

The sample comprised 10 766 people older than 18 years from six Croatian regions (northern, southern, eastern, western, central and city of Zagreb) which reflect natural geographic characteristics as well as specifics in population structure and origin, tradition and lifestyle. The northern, eastern and central regions as well as the city of Zagreb are situated in the continental part of Croatia in which nutritional habits and lifestyle resemble those in Central European countries (Hungary, Slovenia, Austria), while the western and southern regions mainly encompass the coastal area and are characterized by Mediterranean-type nutritional habits and lifestyle that have been reported as inversely associated with hypertension and cardiovascular mortality<sup>(21,22)</sup> (Fig. 1).

The 2001 Croatian Census of Population was used to select a representative sample of households to be included in the present survey. In order to produce reliable estimates at regional level, the total sample was first allocated to the six regions proportionally to the square root of the estimated population in each region; this allocation strategy balances the reliability of the estimates for both regional and country levels. The country was stratified into twenty design strata which were based on city type (town/municipality) and counties in order to take into account the differences in the population. The sample size of each region was then proportionally allocated among the design strata. A sample of households was selected within each stratum through a three-stage process using the probability-proportional-to-size systematic random approach. Interviewers listed names of everyone aged 18 years and over living in the selected household and one individual was selected from the list using a table of random numbers. These individuals comprise the sample of the present survey.

Data were collected by public health nurses from April to June 2003. They took anthropometric measures such as height, weight and blood pressure, and interviewed respondents. Blood pressure was measured twice using a mercury sphygmomanometer, with respondents seated for 20 min between the measurements. Nutritional and other habits were reported by respondents and recorded on questionnaires by the public health nurses during the interviews.

Response was obtained from 9070 individuals, resulting in an overall response rate of 84.2%.

Each person who answered the survey was given a survey weight which corresponded to the number of



Fig. 1 Regions in Croatia

persons represented by the respondent for the entire population. The survey weight calculation procedure included adjustment for the multistage sample design and non-response as well as post-stratification, which was done to ensure that the sum of the final weights corresponded to the population counts at the regional level.

### Variables

Respondents who stated that they had never been diagnosed with hypertension, but whose average blood pressure calculated from two measurements was  $\geq 140$  mmHg for systolic or  $\geq 90$  mmHg for diastolic blood pressure, were categorized as newly diagnosed hypertensives. Respondents who stated that they had been diagnosed with hypertension prior to the survey were categorized as known hypertensives. The total number of hypertensives included newly diagnosed and known hypertensives, with the addition of five respondents who did not state whether they had been previously diagnosed with hypertension (so it was not possible to categorize them as either newly diagnosed or known hypertensives) and who had average blood pressure  $\geq 140/90$  mmHg.

The distribution of and association with newly diagnosed high blood pressure was analysed for the following variables: age (according to seven groups: 18–24, 25–34, 35–44, 45–54, 55–64, 65–74,  $\geq 75$  years), increased BMI, use of animal fat for food preparation, use of whole milk, moderate and high coffee consumption, regular fruits and/or vegetables consumption, smoked meat products consumption, adding salt, moderate and high alcoholic beverages consumption, smoking and leisure-time physical activity (Table 1).

### Statistical analyses

Hypertension prevalence was calculated for men and women separately in seven age groups, for the entire Croatian population and for the continental and Mediterranean parts. The prevalence of potential risk factors

**Table 1** Definition of variables

Variable	Definition
Increased BMI	BMI $\geq$ 25 kg/m <sup>2</sup>
Use of animal fat	Butter, pork lard or any kind of animal fat being used mostly for food preparation at home
Drinking whole milk	Usual use of milk or other milk products such as yoghurt and sour milk with 3.2% or more fat
Moderate coffee consumption	Drinking up to 2 cups of coffee daily
High coffee consumption	Drinking 3 or more cups of coffee daily
Eating fruits and/or vegetables regularly	Eating fruits or vegetables at least once daily, excluding potatoes and leguminous
Eating smoked meat products	Eating smoked meat, sausages, ham, bacon or similar products at least twice weekly or more often
Adding salt	Adding salt to meals
Moderate alcoholic beverages consumption	Up to 7 alcoholic drinks consumed during 1 week prior to the questionnaire (1 alcoholic drink was defined as one bottle (500 ml) of beer, one glass (200 ml) of wine, two glasses (200 ml) of wine with water or one glass (50 ml) of strong spirits)
High alcoholic beverages consumption	More than 7 alcoholic drinks consumed during 1 week prior to the questionnaire (1 alcoholic drink was defined as one bottle (500 ml) of beer, one glass (200 ml) of wine, two glasses (200 ml) of wine with water or one glass (50 ml) of strong spirits)
Smoking	Smoking at the present time (every day or occasionally)
Leisure-time physical activity	Doing physical exercise which makes the respondent at least mildly short of breath or perspire and lasts for at least 30 min at least two to three times weekly in respondent's leisure time

was also calculated among men and women separately, for Croatia overall and separately for the continental and Mediterranean parts of the country. The association between newly diagnosed hypertension and different potential risk factors was assessed by multiple logistic regression analyses, separately for men and women. Respondents with known hypertension were not included in these calculations because of the possibility that they had changed their habits owing to awareness of hypertension.

Statistical analyses were performed using the Statistical Package for the Social Sciences statistical software package version 14.01 (SPSS Inc. Chicago, IL, USA) and the BOOTVARE\_V21.SPS program version 2.1 (Statistics Canada, Ottawa, Canada), which computes variances for ratios and logistic regression models using the bootstrap method that accounts for sample design information when calculating variance estimates. The CV calculated by the BOOTVARE\_V21.SPS program was used for measuring the potential size of the sampling error in order to determine whether estimates from the survey could be applied to the general population<sup>(23–25)</sup>.

## Results

### *Prevalence of hypertension*

The overall prevalence of hypertension in the Croatian population older than 18 years was 45.5%. Out of the entire number of hypertensives, 60% were known hypertensives and 40% were newly diagnosed. Hypertension prevalence was the lowest in the age group 18–24 years and the greatest in the age group  $\geq$ 75 years. In the age groups 18–24, 25–34 and 35–44 years, the prevalence of hypertension was greater among men, while in older age groups the prevalence was greater among women. The percentage of newly diagnosed hypertensives

was greater in men than in women for all age groups (Table 2). There were no differences between the continental and Mediterranean parts of Croatia in either the total percentage of hypertensives or the percentage of newly diagnosed hypertensives (Table 3).

### *Prevalence of increased BMI and nutritional and other habits*

The percentage of men with increased BMI ( $\geq$ 25 kg/m<sup>2</sup>) was greater than that of women in both continental and Mediterranean parts of Croatia. No differences were recorded between continental and Mediterranean Croatia in the percentage of men with increased BMI, while the percentage of women with increased BMI was greater in the continental part. Use of animal fat for food preparation was much more common in continental Croatia, with no differences between men and women. More men drank whole milk in continental than in Mediterranean Croatia, while such difference was not present among women. In the continental part, more women than men reported moderate coffee consumption, while there were no differences between men and women in high coffee consumption. Larger percentages of both men and women in continental than in Mediterranean Croatia reported high coffee consumption, while such difference was not present for moderate coffee consumption. Regular consumption of fruits and vegetables was more common among women than among men in the continental part of Croatia, while no such difference was observed for the Mediterranean part. A greater percentage of men than women consumed smoked meat products in both parts and more women in continental Croatia consumed smoked meat products compared with Mediterranean Croatia. In the continental part more men than women reported moderate alcoholic beverages consumption, while such difference was not present in

**Table 2** Distribution of hypertensives in Croatia: Croatian Adult Health Survey 2003

	Total hypertensives			Newly diagnosed hypertensives		
	%	95% CI	CV (%)	% total hypertensives	95% CI	CV (%)
Croatia – total	45.5	43.8, 47.1	1.9	40.1	38.4, 41.9	2.3
Sex/age groups						
Men (years)						
18–24	15.5	8.6, 22.4	22.7	72.6	51.0, 94.2	15.2
25–34	23.8	17.0, 30.7	14.6	82.2	73.0, 91.3	5.7
35–44	35.0	29.3, 40.7	8.3	59.3	50.2, 68.3	7.8
45–54	55.8	50.8, 60.8	4.6	48.5	41.1, 55.9	7.8
55–64	64.5	59.3, 69.8	4.2	43.2	35.0, 51.5	9.8
65–74	74.8	71.0, 78.7	2.6	40.0	34.6, 45.5	6.9
≥75	81.7	76.6, 86.7	3.2	30.5	24.5, 36.6	10.1
Total	46.7	44.3, 49.1	2.6	49.6	46.3, 52.9	3.4
Women (years)						
18–24	7.6	4.5, 10.8	20.9	17.2	1.8, 32.7	45.8*
25–34	11.0	8.3, 13.8	12.7	34.6	22.2, 46.9	18.2†
35–44	24.5	20.9, 28.2	7.6	41.6	34.4, 48.8	8.8
45–54	47.2	43.6, 50.8	3.9	35.4	30.8, 40.0	6.7
55–64	67.0	63.4, 70.6	2.7	35.2	31.7, 38.7	5.1
65–74	81.6	78.5, 84.7	2.0	24.4	21.2, 27.6	6.7
≥75	81.6	78.3, 84.8	2.0	26.7	22.2, 31.2	8.6
Total	44.4	42.8, 46.0	1.9	31.3	29.5, 33.1	2.9

\*Unacceptably high sampling variability; this estimate cannot be applied to the entire population.

†High sampling variability is associated with this estimate.

**Table 3** Distribution of hypertensives in continental and Mediterranean parts of Croatia: Croatian Adult Health Survey 2003

	Total hypertensives			Newly diagnosed hypertensives		
	%	95% CI	CV (%)	% of total hypertensives	95% CI	CV (%)
Continental part – total	46.1	44.2, 48.0	2.1	39.5	37.4, 41.5	2.6
Men	46.5	43.8, 49.1	2.9	49.0	45.4, 52.7	3.8
Women	45.7	43.7, 47.8	2.3	30.9	28.9, 32.8	3.3
Mediterranean part – total	44.2	40.9, 47.5	3.8	41.6	38.4, 44.9	4.0
Men	47.1	41.8, 52.5	5.8	50.7	43.8, 57.5	6.9
Women	41.5	38.9, 44.1	3.2	32.3	28.7, 36.0	5.8

the Mediterranean part. In both regions many more men reported high alcohol consumption than women. No significant differences were recorded between continental and Mediterranean Croatia in the percentage of women with moderate or high alcohol consumption. More men had high alcohol consumption in the Mediterranean part compared with the continental part, while such difference was not recorded for moderate alcohol consumption. In both regions, more men than women added salt to their meals and smoked, while no differences were recorded for leisure-time physical activity, either between sexes or between regions (Table 4).

#### **Association between possible risk factors and hypertension**

As the next step, we analysed the association between possible risk factors and newly diagnosed hypertension using multiple logistic regression models.

Hypertension was significantly positively related to increased BMI and age among both men (BMI: OR = 2.6,  $P < 0.001$ ; age: OR = 1.4,  $P < 0.001$ ) and women (BMI: OR = 2.5,  $P < 0.001$ ; age: OR = 1.9,  $P < 0.001$ ). Moderate

coffee consumption was positively related to the risk of hypertension in women (OR = 1.5,  $P = 0.014$ ), while high coffee consumption was inversely related to the risk of hypertension in men (OR = 0.5,  $P = 0.001$ ) and in the total sample (OR = 0.6,  $P = 0.001$ ). Consumption of fruits and/or vegetables at least once daily reduced the risk of hypertension among the total sample (OR = 0.7,  $P = 0.011$ ), but it was not significant among men or women separately. Moderate and high alcoholic beverages consumption were positively related to the risk of hypertension in the total sample (moderate alcohol consumption: OR = 1.2,  $P = 0.039$ ; high alcohol consumption: OR = 1.5,  $P = 0.009$ ). No other significant associations were recorded (Table 5).

#### **Discussion**

The prevalence of hypertension in the adult population of Croatia is among the higher of the prevalences recorded in studies on world populations, which vary between 5.2% in northern India<sup>(26)</sup> and 55.3% in Germany<sup>(27)</sup>.

**Table 4** Distribution of increased BMI, nutritional habits, smoking and physical activity: Croatian Adult Health Survey 2003

	Croatia – total			Continental part			Mediterranean part		
	%	95% CI	CV (%)	%	95% CI	CV (%)	%	95% CI	CV (%)
<b>Men</b>									
Increased BMI	63.3	60.8, 65.9	2.1	63.1	60.3, 65.9	2.3	63.7	59.0, 68.5	3.8
Use of animal fat	27.2	25.0, 29.5	4.2	35.5	32.8, 38.2	3.9	10.0	5.8, 14.2	21.3*
Drinking whole milk	33.8	30.5, 37.1	5.0	38.2	34.2, 42.1	5.3	24.8	18.4, 31.1	13.1
Moderate coffee consumption	47.6	44.9, 50.3	2.9	45.4	42.5, 48.3	3.2	52.3	46.1, 58.4	6.0
High coffee consumption	28.2	25.5, 30.9	4.9	31.2	27.9, 34.4	5.3	22.0	17.0, 27.1	11.6
Eating fruits and/or vegetables regularly	71.5	68.3, 74.8	2.3	71.1	67.9, 74.3	2.3	72.3	64.5, 80.2	5.5
Eating smoked meat products	64.4	62.1, 66.7	1.8	65.6	62.6, 68.5	2.3	62.0	58.8, 65.2	2.6
Adding salt	63.3	60.6, 83.3	2.2	64.7	61.6, 67.8	2.5	60.3	55.0, 65.7	4.5
Moderate alcoholic beverages consumption	42.0	39.4, 44.6	3.2	44.2	41.3, 47.1	3.4	37.4	32.3, 42.5	6.9
High alcoholic beverages consumption	30.4	27.6, 33.2	4.7	27.3	24.5, 30.1	5.2	36.8	30.2, 43.5	9.2
Smoking	37.9	35.3, 40.5	3.5	38.0	34.9, 41.1	4.2	37.7	32.5, 42.9	7.1
Leisure-time physical activity	56.9	52.8, 60.9	3.6	54.8	50.1, 59.4	5.5	61.2	53.6, 68.8	6.3
<b>Women</b>									
Increased BMI	54.1	52.6, 55.7	1.5	56.0	54.3, 57.8	1.6	50.1	47.0, 53.3	3.2
Use of animal fat	25.3	23.4, 27.2	3.9	32.4	30.0, 34.8	3.8	10.3	7.1, 13.5	15.7
Drinking whole milk	32.8	30.0, 35.6	4.3	35.4	32.0, 38.9	4.9	27.2	22.3, 32.0	9.1
Moderate coffee consumption	58.8	57.1, 60.6	1.5	57.8	55.9, 59.7	1.7	61.1	57.5, 64.7	3.0
High coffee consumption	25.5	23.8, 27.1	3.4	27.4	25.5, 29.2	3.4	21.4	17.9, 24.9	8.4
Eating fruits and/or vegetables regularly	77.8	75.9, 79.8	1.3	78.2	75.9, 80.6	1.5	77.0	73.1, 80.8	2.5
Eating smoked meat products	45.7	43.8, 47.5	2.1	48.2	45.9, 50.5	2.5	40.3	36.8, 43.7	4.4
Adding salt	40.3	37.6, 42.9	3.4	41.5	39.0, 44.1	3.2	37.6	31.4, 43.7	8.3
Moderate alcoholic beverages consumption	33.2	31.4, 35.0	2.8	32.0	29.9, 34.1	3.4	35.7	31.8, 39.6	5.6
High alcoholic beverages consumption	2.5	2.0, 3.0	10.2	1.9	1.5, 2.4	12.3	3.7	2.4, 4.9	17.2*
Smoking	25.2	23.7, 26.7	3.0	23.9	22.2, 25.6	3.5	27.8	24.6, 31.0	5.8
Leisure-time physical activity	51.9	47.9, 55.9	3.9	50.8	45.3, 56.2	5.5	54.4	49.4, 59.5	4.7

\*High sampling variability is associated with this estimate.

**Table 5** Odds of having newly diagnosed hypertension according to the presence of risk factors: Croatian Adult Health Survey 2003

	Total			Men			Women		
	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
Age	1.6	1.5, 1.7	<0.001	1.4	1.3, 1.6	<0.001	1.9	1.8, 2.1	<0.001
Increased BMI	2.7	2.1, 3.4	<0.001	2.6	1.8, 3.6	<0.001	2.5	1.9, 3.3	<0.001
Use of animal fat	1.0	0.8, 1.3	0.767	1.0	0.7, 1.4	0.931	1.1	0.9, 1.5	0.322
Drinking whole milk	1.0	0.8, 1.3	0.950	0.9	0.6, 1.3	0.531	1.1	0.9, 1.4	0.428
Moderate coffee consumption	0.9	0.7, 1.1	0.300	0.7	0.5, 1.1	0.127	1.5	1.1, 2.0	0.014
High coffee consumption	0.6	0.5, 0.8	0.001	0.5	0.3, 0.7	0.001	1.1	0.8, 1.6	0.520
Eating fruits and/or vegetables regularly	0.7	0.6, 0.9	0.011	0.8	0.5, 1.1	0.156	0.8	0.6, 1.0	0.071
Eating smoked meat products	1.0	0.9, 1.2	0.721	0.9	0.7, 1.2	0.458	1.1	0.9, 1.3	0.403
Adding salt	1.1	0.9, 1.3	0.331	1.0	0.7, 1.3	0.838	1.0	0.8, 1.3	0.772
Moderate alcoholic beverages consumption	1.2	1.0, 1.5	0.039	1.2	0.8, 1.8	0.328	1.0	0.8, 1.2	0.752
High alcoholic beverages consumption	1.5	1.1, 2.0	0.009	1.2	0.8, 1.8	0.396	0.9	0.4, 2.2	0.867
Smoking	1.2	0.9, 1.5	0.177	1.4	1.0, 1.9	0.083	0.9	0.7, 1.1	0.347
Leisure-time physical activity	1.1	0.9, 1.3	0.263	1.3	1.0, 1.7	0.052	0.9	0.7, 1.1	0.356

This emphasizes the importance of careful follow-up of the geographic distribution and trends in hypertension in Croatia, as well as the need to plan public health interventions. Hypertension prevalence in Croatia recorded in the present study is higher than that reported for other countries in transition: 39.1% in the Czech Republic<sup>(28)</sup>, 37% in Hungary<sup>(29)</sup>, 29% in Poland<sup>(30)</sup> and 31.8% in Albania<sup>(31)</sup>. However, as the mentioned prevalences were not standardized according to age and sex, it is not possible to establish whether the differences in prevalence are due to different age and sex structures of these populations, differences in research methodologies or some other reasons.

The present study showed significant sex differences in the prevalence of hypertension in Croatia, with men being more likely to be hypertensive than women, similar to results from other countries in transition<sup>(31,32)</sup>, and is due to the several times higher prevalence of hypertension in young men than in young women (<45 years).

Differently from the results of previous studies, in the present study we found no differences between continental and Mediterranean parts of Croatia in the prevalence of hypertension. Therefore, hypertension is an important problem which should be one of the priorities for public health action in all regions of Croatia, both continental and coastal.

We found several significant differences between continental and Mediterranean parts in some nutritional habits, i.e. use of animal fats, whole milk consumption and consumption of smoked meat products, which indicates that traditional differences in nutrition might still remain, at least partly. These results are in accordance with previous research which showed a high frequency of olive oil consumption in the population of four Croatian islands (situated in the Mediterranean part of Croatia), but also suggested possible decreased intake of typical Mediterranean foodstuffs and increased meat intake<sup>(19)</sup>. However, further studies should explore in more depth whether traditional differences in lifestyle between continental and coastal Croatia have reduced significantly, which provides a possible explanation for the lack of difference in hypertension prevalence, or whether differences in lifestyle still continue to exist but do not exhibit influence on hypertension.

Results of the present research confirm the association between increased body mass (measured by BMI) and hypertension in the Croatian population, which exists in both men and women. These results are in accordance with longitudinal studies which showed that increased body mass contributes to hypertension appearance regardless of age and sex<sup>(33–35)</sup>. However, as the present study was cross-sectional, it was not possible to establish the timeline between increase in body mass and hypertension.

Previous data concerning the association of coffee consumption with hypertension have been conflicting. Evidence from several studies has suggested a connection of coffee consumption with increased blood pressure<sup>(36–38)</sup>, but there are also studies which have recorded an inverse association between coffee consumption and blood pressure<sup>(39–41)</sup>. A stronger inverse connection between coffee consumption and blood pressure was observed for men than for women in a study in north Italy<sup>(42)</sup>. The positive association of coffee with hypertension in women and the inverse association in men recorded in the present study suggest that further research is needed, especially concerning possible differences between men and women in the effect of coffee on blood pressure.

A positive association between alcohol consumption and hypertension has been recorded in many studies<sup>(39,43–45)</sup> and was confirmed in the present study. Gradation of risk according to the level of consumption was also recorded, with the highest risk among those who drink more than 7 drinks weekly. However, as the gradation of alcohol consumption levels was relatively rough and a significant association of alcohol and hypertension was recorded only for the total sample, more detailed research into the association between consumption of alcoholic beverages and hypertension is needed in the future.

Numerous studies on various populations have shown that regular consumption of fruits and vegetables reduces the risk of hypertension and other circulatory diseases<sup>(46–49)</sup>, which can probably be explained by the

beneficial combination of different nutrients in fruits and vegetables, including fibre, K and folate<sup>(50)</sup>. The DASH (Dietary Approaches to Stop Hypertension) study showed that a diet with a low intake of fat and a high intake of fruits and vegetables can reduce blood pressure significantly in different sex and age groups<sup>(51–53)</sup>.

Increased salt consumption, which had been associated with hypertension in numerous previous studies<sup>(54–57)</sup>, was not proved as a risk factor for hypertension in the present research. However, salt consumption in the present study was measured only through adding salt to the meal. The majority of salt intake occurs through salt hidden in foods<sup>(58,59)</sup> like bread, meat products, soups, cheese and snacks, which we did not measure. Therefore, further research comprising detailed records of salt intake (both as added salt and salt hidden in food) is recommended in order to explore the association between salt intake and hypertension.

Certain limitations of the present study should be taken into account when interpreting its results. Classification of respondents as hypertensive was made on the basis of an average from only two blood pressure measurements made in a relatively short time span. For practical reasons, all measurements and interviews were made during a single visit of a public health nurse to the respondent's home. The fact that measurements were made by a public health nurse in the respondent's home could reduce the incidence of 'white coat hypertension'. Nutritional and other habits were reported by respondents as a part of a questionnaire and were therefore potentially prone to response and recall bias.

On the basis of the present results, we identified increased body mass as the main risk factor for hypertension in the Croatian population in general and in all regions. This finding suggests that priority for primary prevention of hypertension should be maintenance of normal body mass, as well as its reduction if it is already increased. It would be useful to perform further prospective studies (possibly as a follow-up of the present study on the same sample after a certain period) in order to explore the time aspect of the body mass–hypertension relationship. Regular consumption of fruits and vegetables could also be recommended as one of the means for preventing hypertension. Concerning coffee and alcoholic beverages consumption, additional research is necessary prior to any definite conclusions and recommendations.

The prevalence of total and newly diagnosed hypertensives also emphasizes the importance of secondary prevention, i.e. early detection of hypertension by regular blood pressure measurements. As 40% of hypertensives were newly diagnosed (18% of the total adult population), improvement of secondary prevention by more frequent blood pressure measurements among healthy adults stands up as a priority for action, especially for men under 45 years of age, among whom the newly diagnosed outnumber the known hypertensives.

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