

## Factors predisposing to the occurrence of hypertension in a population of young adults

Czynniki predysponujące do występowania nadciśnienia tętniczego w populacji młodych dorosłych

Iwona Gorczyca-Michta<sup>1</sup>, Joanna Kucfir<sup>2</sup>, Beata Wożakowska-Kapłon<sup>1,2</sup>

<sup>1</sup>First Clinical Department of Cardiology, Świętokrzyskie Cardiology Centre, Kielce, Poland

<sup>2</sup>Faculty of Health Science, Jan Kochanowski University, Kielce



Doktor nauk medycznych Iwona Gorczyca-Michta jest absolwentką I Wydziału Lekarskiego Warszawskiego Uniwersytetu Medycznego (2007 r.). Jej rozprawa doktorska dotyczyła oceny zalecanej profilaktyki przeciwzakrzepowej u hospitalizowanych chorych z migotaniem przedsionków. Doktor Gorczyca-Michta, obecnie w trakcie specjalizacji z kardiologii, jest autorką jednej monografii oraz autorką lub współautorką 5 rozdziałów w książkach i 45 artykułów (18 oryginalnych, 17 poglądowych, 10 kazuistycznych), z łącznym dorobkiem naukowym IF 9,461 punktu, MNIŚW 440 punktów. W kręgu jej zainteresowań medycznych pozostają: epidemiologia, powikłania zakrzepowo-zatorowe oraz terapia przeciwkrzepliwa migotania przedsionków, hipertensjologia, diagnostyka niewazyjna chorób układu krążenia – echokardiografia, całodobowe monitorowanie ciśnienia tętniczego.

W wolnym czasie zajmują ją jazda konna, literatura i kulinaria.

Doktor Gorczyca-Michta pracuje w I Klinice Kardiologii i Elektroterapii Świętokrzyskiego Centrum Kardiologii w Kielcach (Kierownik: prof. dr hab. n. med. Beata Wożakowska-Kapłon). Jest to referencyjny 46-lóżkowy ośrodek współpracujący z Uniwersytetem Jana Kochanowskiego w Kielcach. Dysponuje możliwością diagnostyki i terapii chorób układu krążenia w pełnym zakresie. Klinika specjalizuje się w diagnostyce i leczeniu zaburzeń rytmu serca (implantacje kardiostymulatorów, ICD, CRT oraz badania elektrofizjologiczne i zabiegi ablacji). Lekarze Kliniki prowadzą również konsultacje ambulatoryjne w ramach Specjalistycznych Poradni Przyklinikowych: Zaburzeń Rytmu Serca, Niewydolności Serca, Nadciśnienia Tętniczego oraz Kontroli Kardiowerterów-Defibrylatorów.

### Abstract

**Introduction.** Hypertension (HTN) is a major cardiovascular risk factor and a major cause of mortality worldwide. HTN is increasingly commonly diagnosed in young adults. The aim of this study was to evaluate prevalence of HTN in young adults and to identify factors predisposing to the development of HTN.

**Material and methods.** We studied 203 university students aged 19–25 years who resided in a student dormitory. Four home blood pressure (BP) measurements were performed in all subjects according to the Polish Society of Hypertension guidelines. HTN was defined as mean systolic BP  $\geq$  135 mm Hg and/or diastolic BP  $\geq$  85 mm Hg or a history of HTN.

**Results.** The mean age in our study group was  $21.4 \pm 1.4$  years, and women were 54.2% of 203 subjects ( $n = 110$ ). The study group was divided into subjects with the diagnosis of HTN [HTN(+), 49 subjects (24.1%)] and subjects without the diagnosis of HTN [HTN(-), 154 subjects (75.9%)]. A systolic-diastolic HTN was found in 25 subjects (51% of those with HTN), isolated diastolic HTN in 22 subjects (44.9% of those with HTN), and isolated systolic HTN in two subjects (4.1% of those with HTN). Excessive body weight was found in 34 subjects (69.4%) with HTN and 35 subjects (22.7%) with normal BP ( $p < 0.0001$ ). Using salt during meal preparation was reported by 47 subjects (95.9%) in the HTN(+) group and 94 subjects (61%) in the HTN(-) group ( $p < 0.0001$ ). Current smoking was reported by 30 subjects (61.2%) with HTN and 112 subjects (72.7%) with normal BP ( $p = 0.1768$ ). Systematic physical activity was reported by 11 subjects (22.4%) in the HTN(+) group and 82 subjects (53.2%) in the HTN(-) group ( $p = 0.0003$ ). Multivariate analysis showed that the risk of HTN was increased by using salt during meal preparation [odds ratio (OR) 22.5], positive family history (OR 11.5), elimination of fruits and vegetables from the diet (OR 8), and abdominal obesity (OR 8).

**Conclusions.** Hypertension was found in one fourth of the studied subjects aged 19–25 years, and isolated diastolic HTN was present in half of them. A disturbingly high proportion of smokers was found in our study group of young subjects. Subjects with HTN were older, more frequently overweight or obese, and had more abdominal obesity compared to those with normal BP. Subjects with HTN more frequently reported complete elimination of vegetables, fruits, and fish from their diet, and more frequently reported no participation in sports compared to those without HTN, while normotensives more frequently reported not consuming any fast-food, salty snacks, and sweetened beverages compared to subjects with HTN. Factors increasing the risk of HTN included using salt during meal preparation, positive family history of cardiovascular disease, elimination of fruits and vegetables from the diet, and abdominal obesity. Knowledge regarding recommended physical activity and daily intake of fruits and vegetables was associated with a decreased risk of HTN among young adults.

Key words: hypertension, young adults, smoking

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## Introduction

Hypertension (HTN) is a major cardiovascular risk factor and a cause of about 30% of deaths worldwide [1]. The proportion of hypertensives in the general population continues to increase. In the 2002 NATPOL study in the Polish population aged more than 18 years, HTN was found in 29% of men and 29% of women [2]. In 2011, the NATPOL 2011 study results were reported, indicating the presence of HTN in 32% of subjects aged 18–79 years [3]. The proportion of hypertension increases among both the elderly and the young subjects, including children and adolescents. A rising incidence of HTN among young adults is particularly concerning. Increasing rates of HTN in young adults are mostly related to adverse lifestyle (improper diet, no regular physical activity) in this group. Worldwide prevalence of HTN among young adults (aged 18–39 years) has been estimated at 20% among men and 15% among women [4, 5], and it was 14.8% in the Polish population [6]. Results of European and American studies should not be extrapolated to the Polish population due to social and cultural differences. As there are only sparse data available on the prevalence of HTN in young Polish adults, we attempted to evaluate the prevalence of HTN

in a population aged 19–25 years and to identify factors affecting occurrence of HTN. The aim of this study was to evaluate the prevalence of HTN in young adults and to identify factors predisposing to HTN.

## Material and methods

We studied 203 university students aged 19–25 years who resided in a student dormitory. The study was performed from January to April 2013. Blood pressure (BP) measurements were performed according to the 2013 European Society of Hypertension (ESH)/European Society of Cardiology (ESC) guidelines on the management of HTN [7]. Measurements were performed using a validated automatic device after at least 10 minutes of rest, in a sitting position, on the right and left arm. The arm with a higher systolic blood pressure (SBP) value was selected for further measurements, and if SBP was the same in both arms, further measurements were performed on the arm with a higher diastolic blood pressure (DBP) value. BP was measured twice 1–2 minutes apart. Additional two BP measurements, also 1–2 minutes apart, were performed 4–6 days later at the same time during the day. Overall, 4 measurements on the chosen reference limb were performed in all subjects,

and the measured values were averaged. HTN was defined as mean systolic BP  $\geq 135$  mm Hg and/or diastolic BP  $\geq 85$  mm Hg or a history of HTN. The criteria for home BP measurements were used, as the measurements were performed at the place of residence (student dormitory) by a trained fellow student. None of the subjects was taking antihypertensive medications. Anthropometric measurements were also performed in the study group. Abdominal obesity was defined as waist circumference  $\geq 94$  cm in men and  $\geq 80$  cm in women. The waist-to-hip ratio (WHR) was also determined, with values  $\geq 0.9$  in men and  $\geq 0.8$  in women considered abnormal. Students were also administered a closed-question questionnaire that included questions on the diagnosis of HTN and its management, family history of cardiovascular disease, lifestyle, and knowledge regarding recommended lifestyle. The collected data were entered into an Excel spreadsheet.

Statistical analysis included the chi-square test for comparisons of categorical variables and relations between pairs of characteristics, the Student t test for comparisons of normally distributed continuous variables, and the Mann-Whitney test for comparisons of non-normally distributed continuous variables.  $P < 0.05$  was considered statistically significant. Uni- and multivariate logistic regression ana-

lysis was used to determine prognostic value of selected variables.

## Results

The mean age in our study group was  $21.4 \pm 1.4$  years, and women were 54.2% of 203 subjects ( $n = 110$ ). The study group was divided into subjects with the diagnosis of HTN [HTN(+), 49 subjects (24.1%)] and subjects without the diagnosis of HTN [HTN(-), 154 subjects (75.9%)].

In the HTN(+) group, 23 subjects (46.9% of those with HTN) had a previous diagnosis of primary HTN and abnormally high BP was found in all these subjects. In 26 subjects (53.1% of those with HTN), HTN was diagnosed for the first time based on abnormal BP values measured during the study. None of the subjects with previously diagnosed HTN was taking antihypertensive medications. SBP  $\geq 140$  mm Hg and/or DBP  $\geq 90$  mm Hg was found in 35 subjects (17.2%). SBP and DBP values in individual measurements in the HTN(+) and HTN(-) groups are shown in Table 1.

A systolic-diastolic HTN was found in 25 subjects (51% of those with HTN), isolated diastolic HTN in 22 subjects (44.9% of those with HTN), and isolated systolic HTN in two subjects (4.1% of those with HTN).

**Table 1.** Individual systolic and diastolic blood pressure measurements in subjects with or without hypertension

	Group	Mean	SD	Median	95% CI	p
SBP 1 <sup>st</sup> and 2 <sup>nd</sup> measurement	HTN(+) n = 49	136.3	8.3	135.5	133.6–138.9	< 0.0001
	HTN(-) n = 154	116	11.2	120	117.2–121	
DBP 1 <sup>st</sup> and 2 <sup>nd</sup> measurement	HTN(+) n = 49	89.4	5.2	90.5	89.5–91.5	< 0.0001
	HTN(-) n = 154	73.1	8.3	75.3	73–77.5	
SBP 3 <sup>rd</sup> and 4 <sup>th</sup> measurement	HTN(+) n = 49	137.6	7.4	135.5	134–139.5	< 0.0001
	HTN(-) n = 154	116	11	120	118.5–120.5	
DBP 3 <sup>rd</sup> and 4 <sup>th</sup> measurement	HTN(+) n = 49	91.4	4.2	91.5	90–93.4	< 0.0001
	HTN(-) n = 154	74.5	7.8	75.8	74.5–78	
SBP All measure- ments	HTN(+) n = 49	136.9	7.4	136.8	133.4–138.6	< 0.0001
	HTN(-) n = 154	116	10.7	120	117.5–120.7	
DBP All measure- ments	HTN(+) n = 49	90.4	5.1	91	89.8–92	< 0.0001
	HTN(-) n = 154	73.1	8.1	76.5	73.2–77.8	

SBP – systolic blood pressure; HTN – hypertension; SD – standard deviation; CI – confidence interval; DBP – diastolic blood pressure

**Table 2.** Comparison of HTN(+) and HTN(-) groups – gender, age, anthropometric measurements, and family history

	HTN(+) n = 49	HTN(-) n = 154	p
Male gender	25 (51%)	68 (44.2%)	0.4994
Mean age (SD)	21.8 (± 1.5)	21.3 (± 1.4)	0.0492
Anthropometric measurements			
BMI < 20 kg/m <sup>2</sup>	1 (2%)	26 (16.9%)	0.0154
BMI 20–24.9 kg/m <sup>2</sup>	14 (28.6%)	93 (60.4%)	0.0002
BMI 25–29.9 kg/m <sup>2</sup>	26 (53.1%)	33 (21.4%)	< 0.0001
BMI ≥ 30 kg/m <sup>2</sup>	8 (16.3%)	2 (1.3%)	< 0.0001
Waist circumference ≥ 80 cm (F), ≥ 94 cm (M)	39 (79.6%)	42 (27.3%)	< 0.0001
WHR ≥ 0.8 (F), ≥ 0.9 (M)	18 (36.7%)	52 (38.8%)	0.8350
Family history			
Positive family history for myocardial infarction, stroke	10 (20.4%)	20 (13%)	0.2797
Positive family history for hypertension	37 (75.5%)	68 (44.2%)	0.0003

HTN – hypertension; SD – standard deviation; BMI – body mass index; M – males; WHR – waist-to-hip ratio; F – females

HTN was equally prevalent in women and men. Mean body mass index (BMI) was  $26.6 \pm 3.1$  kg/m<sup>2</sup> in the HTN(+) group and  $22.9 \pm 2.9$  kg/m<sup>2</sup> in the HTN(-) group ( $p < 0.0001$ ). Excessive body weight was found in 34 subjects (69.4%) with HTN and 35 subjects (22.7%) with normal BP ( $p < 0.0001$ ). Comparison of the HTN(+) and HTN(-) groups is shown in Table 2.

We evaluated dietary habits in the study groups. Five meals per day were consumed by 2 subjects (4.1%) in the HTN(+) group and 6 subjects (10.5%) in the HTN(-) group ( $p = 0.7827$ ). The most commonly chosen meat consumed during the main meal in the HTN(+) and HTN(-) groups included red meat in 24 (49%) and 38 (24.7%) subjects, respectively ( $p = 0.0024$ ), poultry in 22 (44.9%) and 83 (53.9%) subjects, respectively ( $p = 0.3504$ ), and fish in 3 (6.1%) and 33 (21.4%) subjects, respectively ( $p = 0.0258$ ). Table 3 shows the frequency of intake of various products in the HTN(+) and HTN(-) groups. Using salt during meal preparation was reported by 47 subjects (95.9%) in the HTN(+) group and 94 subjects (61%) in the HTN(-) group ( $p < 0.0001$ ). Students in the HTN(+) and HTN(-) groups consumed sweetened beverages (sodas and energy drinks) with the following frequencies: intake on few days a week was reported by 22 (44.9%) and 73 (47.4%) subjects, respectively, ( $p = 0.8532$ ); intake on most days a week was reported by 20 (40.8%) and 22 (14.3%) subjects, respectively, ( $p = 0.0021$ ); and daily intake was reported by 5 (10.2%) and 2 (1.3%) subjects, respectively ( $p = 0.0115$ ). No intake of sweetened beverages was reported by 2 students (4.1%) in the HTN(+) group and 57 (37%) students in the HTN(-) group ( $p < 0.0001$ ).

Active smoking was reported by 30 (61.2%) students with HTN and 112 (72.7%) students with normal BP ( $p = 0.1768$ ). Systematic physical activity was reported by

11 students (22.4%) in the HTN(+) group and 82 students (53.2%) in the HTN(-) group ( $p = 0.0003$ ). However, physical activity was limited to once per week in 10 students in the HTN(+) group (90% of those reporting participation in sports). In the HTN(-) group, 42 students (51.2% of those reporting participation in sports) were engaged in sport activities 2–3 times a week, 5 students (6% of those reporting participation in sports) were engaged in sport activities 4–5 times a week, 33 students (40.2% of those reporting participation in sports) were engaged in sport activities once a week, and only one student (1.2% of those reporting participation in sports) was engaged in sport activities daily.

Knowledge regarding healthy nutrition and physical activity in the HTN(+) and HTN(-) groups is summarized in Figure 1.

Table 4 shows univariate logistic regression analysis and two models of multivariate logistic regression analysis that included variables affecting the occurrence of HTN, one for anthropometric data and lifestyle factors and the other for knowledge regarding lifestyle.

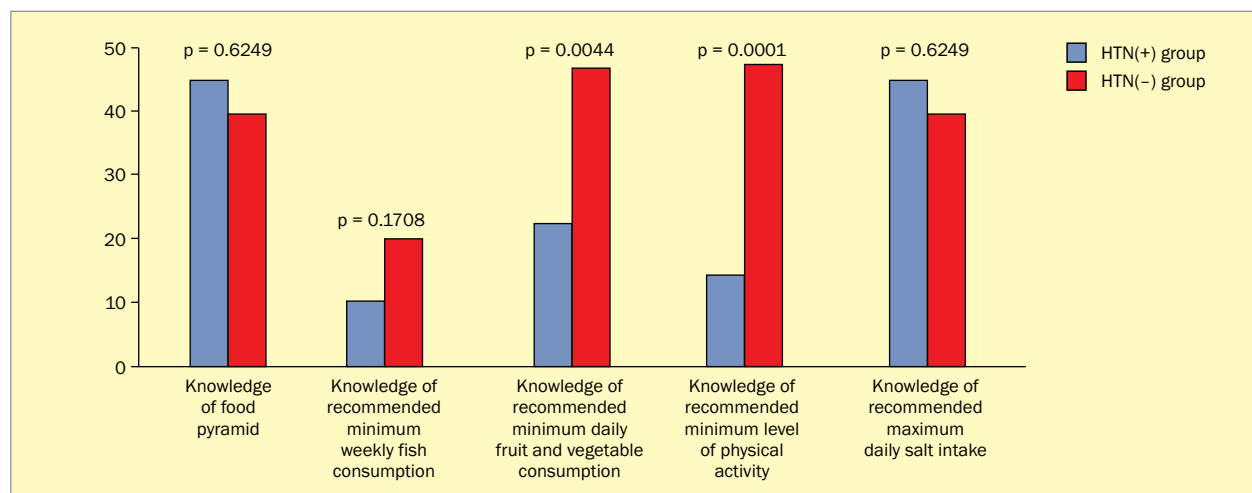
## Discussion

The prevalence of HTN among young adults in the Polish population seems underestimated. Abnormally high BP was found in 24% of subjects in the present study. Krzych et al. [6] showed HTN in 14.8% of 532 students, while Ślusarska et al. [8] studied 104 students and found SBP ≥ 140 mm Hg in 2.9% and DBP ≥ 85 mm Hg in 8.7% of these subjects. Comparing of the rates of HTN in these studies is difficult as our study was the only one in which BP was measured twice on two occasions (4 BP measurements overall). In the studies by Krzych et al. [6] and Ślusarska et al. [8], two

**Table 3.** Frequency of intake of selected products in HTN(+) and HTN(-) groups

Frequency of intake of specific products	HTN(+) n = 49	HTN(-) n = 154	p
Fish consumption during a week			
Daily	0	0	
Most days	5 (10.2%)	9 (5.9%)	0.3326
Few days	27 (55.1%)	122 (79.2%)	0.1752
None	17 (34.7%)	23 (14.9%)	0.0048
Number of fruit and vegetable servings during a day			
5	2 (4.1%)	4 (2.6%)	0.6053
3-4	3 (6.1%)	48 (31.2%)	0.0039
1-2	38 (77.6%)	99 (64.3%)	0.4557
None	6 (12.2%)	3 (1.9%)	0.0080
Fast-food consumption during a week			
Daily	0	1 (0.6%)	0.5730
Most days	6 (12.2%)	8 (5.2%)	0.1194
Few days	37 (75.6%)	79 (51.3%)	0.1331
None	6 (12.2%)	66 (42.9%)	0.0040
Salty snack consumption during a week			
Daily	0	0	
Most days	13 (26.5%)	15 (9.7%)	0.1260
Few days	31 (63.3%)	71 (46.1%)	0.2414
None	5 (10.2%)	68 (44.2%)	0.0014

HTN – hypertension

**Figure 1.** Knowledge of the recommendations regarding lifestyle in groups with hypertension [HTN(+)] and without hypertension [HTN(-)]

BP measurements were performed during one visit. Vos et al. [4] diagnosed HTN based on a single BP measurement in 16.7% of Dutch adolescents. In addition, HTN in our study was diagnosed based on home BP criteria, i.e. SBP  $\geq$  135 mm Hg and/or DBP  $\geq$  85 mm Hg. BP measure-

ments were performed at the place of residence by a trained person who was not a healthcare provider, and thus it seems that the white coat effect was eliminated. Reliability of these BP measurements has been confirmed by their reproducibility. SBP and DBP values in the 1st and 2nd

**Table 4.** Factors affecting the risk of hypertension in the study group in uni- and multivariate analysis

Variable	Univariate analysis			Multivariate analysis		
	OR	95% CI	p	OR	95% CI	p
BMI $\geq 25$ kg/m <sup>2</sup>	7.71	3.8–15.8	< 0.0001			
Positive family history for hypertension	3.90	1.89–8.05	0.0001			
Consumption of salty snacks most days a week	3.14	1.30–7.56	0.0128			
Fast-food consumption most days a week	2.93	0.94–9.18	0.0728			
Fruit and vegetable consumption most days a week	0.14	0.04–0.49	0.0001			
Systematic physical activity	0.25	0.12–0.53	0.0003			
Male gender	1.32	0.69–2.5	0.4016			
					Model 1	
Using salt during meal preparation	15.00	3.51–64.06	< 0.0001	22.54	3.47–146.32	0.0011
Positive family history for myocardial infarction, stroke	4.68	1.73–12.65	0.0026	11.49	2.53–52.13	0.0016
Diet lacking fruits and vegetables	7.02	1.69–29.25	0.0056	7.98	1.12–57.02	0.0384
Abdominal obesity	7.71	3.78–15.75	< 0.0001	7.93	3.07–20.46	< 0.0001
Consumption of sweetened beverages most days a week	6.25	1.75–22.37	0.0049	2.50	0.37–16.76	0.3465
Diet lacking fish consumption	3.03	1.45–6.32	0.0038	1.25	0.47–3.29	0.6525
No smoking	0.59	0.30–1.16	0.1320	0.75	0.32–1.77	0.5144
					Model 2	
Knowledge of recommended minimum level of physical activity	0.18	0.08–0.44	< 0.0001	0.19	0.07–0.51	0.0009
Knowledge of recommended minimum daily fruit and vegetable consumption	0.33	0.16–0.69	0.0034	0.38	0.17–0.88	0.0232
Knowledge of recommended maximum daily salt intake	0.45	0.23–0.89	0.0207	0.53	0.24–1.14	0.1023
Knowledge of recommended minimum weekly fish consumption	0.45	0.16–1.23	0.1204	0.88	0.40–1.89	0.7373

OR – odds ratio; CI – confidence interval; BMI – body mass index

measurement and in the 3rd and 4th measurement in the HTN (+) groups were similar. We expected BP values in the 3rd and 4th measurement to be lower but no differences were found compared to the 1st and 2nd measurement when measurement conditions were the same. In our study group, SBP  $\geq 140$  mm Hg and/or DBP  $\geq 90$  mm Hg was found in 17.2% of subjects. Thus, if the criteria for the diagnosis of HTN used in the study by Krzych et al. [6] are adopted, the prevalence of abnormally high BP values is higher in our study. A higher proportion of students with abnormally high BP values compared to the study by Krzych et al. [6] may also result from the fact that our study among students of the Jan Kochanowski University in Kielce was

performed 9 years later than the study by Krzych et al. [6]. It seems that numerous adverse changes have occurred in the lifestyle of young adults in recent years that affect a rising rate of HTN.

In our study, DBP elevation only was seen in half of students with HTN. Isolated diastolic HTN is diagnosed most commonly in young adults. A small difference between SBP and DBP is typical for young persons, resulting from preserved arterial compliance. With age, vessels stiffen and become less compliant and DBP values decrease. Few studies are available that evaluated the epidemiology of isolated diastolic HTN and its effect on outcomes. In a Swedish study, more than 1 million conscripts (mean

age 18 years) were evaluated and followed up for 24 years. In this population of young men, DBP was more strongly associated with mortality than SBP, with a clear threshold DBP value of 90 mm Hg. It has been estimated that 20% of deaths in the studied population of young men were associated with abnormal DBP values [9]. Ślusarska et al. [8] showed abnormal DBP in a larger proportion of the studied students compared to abnormal SBP. According to the 2013 ESH/ESC guidelines, drug treatment may be considered in these young patients, particularly if isolated diastolic HTN is accompanied by other cardiovascular risk factors [7]. Rywik et al. [10] in the Polish part of the Worldwide Isolated Systolic Hypertension Prevalence Evaluation Study (WISHE) study in 22,880 patients showed an interesting course of isolated diastolic HTN in an adult population. In that study, BP was measured 4 times on 3 visits, during which drug treatment was not changed or not initiated if the patient was not treated previously. It was shown that at the third visit (visits were 7–21 days apart), isolated diastolic HTN was confirmed in only 12.2% patients with this diagnosis at the first visit. It is thus possible that the course of isolated diastolic HTN is not very stable. In our study, DBP in the 3rd and 4th measurement in the HTN(+) group was not lower than in the 1st and 2nd measurement. A question thus arises whether DBP in young subjects may decrease significantly with age. Young persons with isolated diastolic HTN surely deserve careful follow-up.

An association between overweight and obesity and the development of HTN has been proven in all age groups [11, 12]. In our study, excessive body weight was found in 39% of subjects, more frequently in students with HTN. In univariate analyses, obesity or overweight was associated with a nearly 8-fold increase in the risk of HTN in our study group. Krzych et al. [6] showed overweight or obesity in 15.4% of students. Poręba et al. [13] in a study in 240 students also showed a lower proportion of subjects with BMI  $\geq 25$  kg/m<sup>2</sup> (7.7%) compared to our study. A surprisingly low rate of obesity (1%) was reported by Ślusarska i wsp. [8], while overweight was found in 19% of students in that study.

Differences in the rates of overweight and obesity reported by various authors are related to different lifestyle of the studied subjects. In our study, systematic physical activity was reported by 45.6% of students. In other Polish studies, this proportion ranged from 16 to 55% [6, 8, 13]. Thus, adverse dietary habits are more likely factors that affected a higher proportion of patients with abnormal body weight and an increased rate of elevated SBP values in our study compared to studies performed in other Polish universities. In our study, the highest odds ratio in a multivariate analysis among factors affecting the occurrence of HTN was found for using salt during meal preparation. The latter was reported by nearly all (96%) subjects in the HTN(+) group and 61% of subjects in the HTN(-) group. This percentage is higher than in the study

by Krzych et al. [6] who reported using salt during meal preparation by 39% of subjects with HTN and 29.6% of subjects without HTN. In our study, subjects in the HTN(+) group were more likely to nearly completely eliminate fish, fruits and vegetables from their diet compared to those in the HTN(-) group. Elimination of vegetables from the diet was associated with a nearly 8-fold increase in the risk of HTN among students. Only a small proportion of subjects in both groups consumed recommended daily amounts of fruits and vegetables (5 servings per day). In the study by Ślusarska et al. [8], fruits and vegetables were consumed at least three times a day by 16% of subjects. In our study, students in the HTN(-) group were more likely to eliminate fast food (43% vs. 12%) and salty snacks (44% vs. 10%) compared to those in the HTN(+) group.

Of note, a very large proportion of smokers (70%) was found in our study. In other Polish study, this was proportion was smaller and ranged from 21 to 25% [6, 8, 13]. Interestingly, the proportion of smokers did not differ between the HTN (+) and HTN(-) groups. Clinical studies showed higher BP values in both normotensive and hypertensive smokers, which is associated with sympathetic activation by nicotine [14, 15]. It might be expected that multiple public campaigns to stop smoking, along with laws prohibiting smoking in public places would result in reduction of smoking. However, young subjects seem to require other messages to reduce smoking. The observed high proportion of smokers in our study might have resulted from the fact that the studied subjects lived in a student dormitory, which is an addiction-promoting environment.

Multivariate analysis indicated that knowledge regarding recommended physical activity and daily intake of fruits and vegetables was associated with a significantly reduced risk of HTN. The HTN(+) and HTN(-) groups did not differ in regard to the knowledge regarding recommended maximum daily salt intake (45% vs. 39%). Surprisingly, half of subjects with HTN used salt during meal preparation despite their knowledge regarding recommended maximum daily salt intake.

Our study evaluated lifestyle-related factors and the presence of HTN in a population of students of various faculties of our university living in a student dormitory. A high proportion of subjects with HTN was found, along with the presence of elevated DBP only in half of them. Large differences between various studies that evaluated Polish students in different cities during the last decade should be noted. It seems that the varying rates of HTN, overweight and obesity, and adverse lifestyle depend not only on international but also regional differences, including regional differences in regard to health promotion, socio-economic status, or availability of various forms of leisure activities. Undoubtedly, studies should be continued to identify factors that predispose to the growing rate of HTN among young adults.

## Conclusions

1. Hypertension was found in one fourth of the studied subjects aged 19–25 years, and isolated diastolic HTN was present in half of them.
2. A disturbingly high proportion of smokers was found in our study group of young subjects.
3. Subjects with HTN were older, more frequently overweight or obese, and had more abdominal obesity compared to those with normal BP.
4. Subjects with HTN more frequently reported complete elimination of vegetables, fruits, and fish from their diet, and more frequently reported no participation in sports compared to those without HTN, while normotensives more frequently reported not consuming any fast-food, salty snacks, and sweetened beverages compared to subjects with HTN.
5. Factors increasing the risk of HTN included using salt during meal preparation, positive family history of cardiovascular disease, elimination of fruits and vegetables from the diet, and abdominal obesity.
6. Knowledge regarding recommended physical activity and daily intake of fruits and vegetables was associated with a decreased risk of HTN among young adults.

## Conflict of interest

None declared.

## Streszczenie

**Wstęp.** Nadciśnienie tętnicze (HTN) jest istotnym czynnikiem ryzyka sercowo-naczyniowego i stanowi częstą przyczynę zgonów na świecie. Coraz częściej HTN rozpoznaje się u młodych dorosłych. Celem pracy jest ocena częstości występowania HTN u młodych dorosłych oraz identyfikacja czynników predysponujących do ich wystąpienia.

**Materiał i metody.** Badaniem objęto 203 studentów wyższej uczelni w wieku 19–25 lat mieszkających w domu studenckim. U badanych wykonywano 4 domowe pomiary ciśnienia tętniczego zgodnie z zaleceniami Polskiego Towarzystwa Nadciśnienia Tętniczego. Jako kryterium rozpoznania HTN przyjęto średnią wartość ciśnienia skurczowego  $\geq 135$  mm Hg i/lub ciśnienia rozkurczowego  $\geq 85$  mm Hg lub HTN w wywiadzie.

**Wyniki.** W badanej grupie obejmującej 203 osoby średnia wieku wynosiła 21,4 ( $\pm 1,4$ ) roku. Kobiety stanowiły 54,2% badanych (110 osób). Badaną grupę podzielono według występowania HTN na grupy: HTN(+) – 49 badanych (24,1%), u których rozpoznano HTN; HTN(–) – 154 badanych (75,9%), u których nie rozpoznano HTN. U 25 badanych (51% badanych z HTN) stwierdzono skurczowo-rozkurczowe HTN, u 22 badanych (44,9% badanych z HTN) – izolowane rozkurczowe HTN, a u 2 badanych (4,1% badanych z HTN) – izolowane skurczowe HTN. Nadmierną masę ciała stwierdzono u 34 badanych (69,4%) z HTN oraz u 35 badanych (22,7%) z prawidłowym ciśnieniem tętniczym (BP);  $p < 0,0001$ . Dosalenie posiłków zadeklarowało 47 badanych (95,9%) z grupy HTN(+) oraz 94 badanych (61%) z grupy HTN(–);  $p < 0,0001$ . Czynnymi palaczami papierosów było 30 badanych (61,2%) z HTN i 112 badanych (72,7%) z prawidłowym BP;  $p = 0,1768$ . Regularną aktywność fizyczną zadeklarowało 11 badanych (22,4%) z grupy HTN(+) oraz 82 badanych (53,2%) z grupy HTN(–);  $p = 0,0003$ . W analizie wieloczynnikowej wykazano, że czynnikami zwiększającymi szanse na wystąpienie HTN były: dosalenie pokarmów (iloraz szans [OR] 22,5), obciążony wywiad rodzinny (OR 11,5), eliminacja owoców i warzyw (OR 8), otyłość brzuszna (OR 8).

**Wnioski.** Nadciśnienie tętnicze stwierdzono u 1/4 badanych w wieku 19–25 lat, a u połowy z nich – izolowane nadciśnienie rozkurczowe. W badanej grupie obserwowano niepokojąco wysoki odsetek młodych osób palących tytoń. Badani z HTN byli starsi, częściej występowała u nich nadwaga, otyłość lub otyłość brzuszna niż u badanych z prawidłowymi wartościami BP. Osoby z HTN częściej niż osoby bez HTN całkowicie wyeliminowały ze swojej diety warzywa i owoce, ryby oraz nie uprawiały sportu, natomiast osoby z prawidłowymi wartościami BP częściej niż osoby z HTN w ogóle nie spożywały pokarmów typu *fast-food*, słonych przekąsek oraz słodzonych napojów. Czynnikiem zwiększającym niebezpieczeństwo wystąpienia HTN były: dosalenie potraw, obciążający wywiad rodzinny w kierunku schorzeń sercowo-naczyniowych, dieta eliminująca warzywa i owoce oraz otyłość brzuszna. Wiedza na temat zalecanej aktywności fizycznej oraz zalecanego dobowego spożycia warzy i owoców zmniejszała niebezpieczeństwo wystąpienia HTN u młodych osób dorosłych.

Słowa kluczowe: nadciśnienie tętnicze, młodzi dorośli, palenie tytoniu

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### prof. dr hab. n. med. Krystyna Widecka

Klinika Hipertensjologii i Chorób Wewnętrznych Samodzielnego Publicznego Szpitala Klinicznego 1 Pomorskiego Uniwersytetu Medycznego w Szczecinie

Nadciśnienie tętnicze u młodych osób stanowi coraz większy problem epidemiologiczny, diagnostyczny i terapeutyczny. Dzieje się tak za sprawą zmian cywilizacyjnych, rozwoju otyłości, stresu socjoekonomicznego oraz częstszego spożywania używek podwyższających ciśnienie tętnicze. Często stajemy przed dylematem sposobu leczenia samoistnego nadciśnienia tętniczego w coraz młodszych grupach wiekowych, szczególnie że leczenie nadciśnienia u osób młodych w dużym stopniu ma charakter empiryczny. Brakuje badań z długim okresem obserwacji, w których oceniono by skuteczność interwencji dietetycznej lub leczenia farmakologicznego. Decyzja często jest podejmowana indywidualnie

zależnie od przekonania i doświadczenia lekarza.

Na podstawie licznych konferencji i spotkań z lekarzami odnoszę wrażenie, że problemem mocno niedocenianym w narodowych zaleceniach i przez ekspertów, a sprawiającym ogromne trudności diagnostyczne i lecznicze w praktyce, jest nadciśnienie tętnicze u młodych osób.

Jestem głęboko przekonana, a wynika to z wieloletniego doświadczenia w pracy z młodymi chorymi z nadciśnieniem tętniczym, o konieczności przeprowadzenia szczegółowej diagnostyki biochemicznej, hormonalnej i obrazowej w grupie młodych dorosłych z nadciśnieniem. Wiele postaci nadciśnienia wtórnego ma bardzo podobny przebieg kliniczny jak nadciśnienie samoistne, ale zdecydowanie różni się sposobem postępowania i rokowaniem.

Przedstawiony Państwu artykuł oryginalny dotyczy bardzo ważnego z praktycznego punktu widzenia zagadnienia, tj. rozpowszechnienia nadciśnienia tętniczego oraz czynników predysponujących do jego rozwoju w populacji studentów Uniwersytetu Jana Kochanowskiego w Kielcach. Do oceny częstości występowania wymienionych wyżej czynników w badanej populacji użyto poprawnych i zgodnych z najnowszymi standardami metod diagnostycznych i statystycznych. Jak słusznie podkreślają Autorzy, w ostatnich latach zaszło wiele niekorzystnych zmian w stylu życia młodych dorosłych i można przypuszczać, że będzie to skutkowało zwiększeniem częstości występowania schorzeń układu sercowo-

-naczyniowego. Na podstawie uzyskanych wyników zwrócono szczególną uwagę na prawie całkowitą eliminację z diety ryb, owoców i warzyw na rzecz słonych przekąsek i pokarmów typu *fast-food*, co przekłada się na zwiększoną częstość otyłości trzewnej i nadciśnienia tętniczego. W badanej grupie obserwowano niepokojąco wysoki odsetek palaczy papierosów, wynoszący 70%, równie częsty w grupie studentów z nadciśnieniem tętniczym i bez nadciśnienia. Ponadto w grupie młodych dorosłych wykazano niepokojąco niski poziom wiedzy na temat prozdrowotnych zachowań. Być może, na co wskazują Autorzy, wynika to z regionalnych różnic w promocji zdrowia czy statusie ekonomicznym. Z pewnością rozszerzenie badania na większą i bardziej zróżnicowaną populację młodych dorosłych jest konieczne.

Do badanych czynników ryzyka dodałabym jeszcze ocenę wrażliwości na stres. Wyniki badań wskazują, że przewlekły stres może się wiązać z rozwojem nadciśnienia tętniczego. Zagadnienie to jest szczególnie ważne u młodych dorosłych ze względu na rolę stresu związanego z pracą zawodową, który może być szczególnie nasilony w tej grupie wiekowej. Należy również zaznaczyć, że wpływ przewlekłego stresu w tym okresie życia może skutkować wystąpieniem zdarzeń sercowo-naczyniowych w późniejszych dekadach życia. Podstawą wielu prac dotyczących roli stresu w patogenezie nadciśnienia tętniczego jest ocena wpływu bodźców stresowych na ciśnienie tętnicze i inne parametry hemodynamiczne w warunkach laboratoryjnych. Obiektywna ocena stresu w tych warunkach jest trudna, ponieważ nie wiadomo, czy odzwierciedlają one reakcję na stres w warunkach normalnej aktywności życiowej. Pewne znaczenie może mieć świadomość rozpoznania nadciśnienia tętniczego. Reakcja na stres może być uwarunkowana genetycznie i wiąże się z określonym typem osobowości cechującej się tłumioną wrogością powodującą zwiększenie aktywności współczulnej. Rola stresu związanego z pracą nabiera szczególnego znaczenia w warunkach współczesnego życia i często bezwzględniego współzawodnictwa, coraz większych wymagań dotyczących doskonalenia, braku stabilizacji i ryzyka utraty pracy. Wyniki badań wskazują na najsilniejszy związek między przewlekłym stresem a pracą charakteryzującą się dużymi wymaganiami i małą swobodą decyzji.

Duże zainteresowanie wzbudza znaczenie kliniczne ukrytego nadciśnienia tętniczego oraz zespołu metabolicznego. Wśród czynników mogących odpowiadać za ich występowanie wymienia się stres związany z pracą zawodową.

Związek między występowaniem nadciśnienia tętniczego a stanem emocjonalnym pacjenta jest powszechnie znany. Najczęstszą niekardiologiczną przyczyną zgłaszania się do lekarza młodych dorosłych pacjentów są napady lęku, którym towarzyszą nagły niepokój, uczucie „kołatania serca”, podwyższone ciśnienie tętnicze.

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