

Full Length Research Paper

The prevalence of obesity and hypertension among first-year students at Trnava University in Slovakia

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The prevalence of cardiovascular disease (CVD) is considered to be high in Slovaks and it could affect young adult University students. The aim of this study was to estimate anthropometric CVD risk predictors associated with environmental conditions among university students. The study population consisted of 122 first-year students (18% males and 82% females, 19.82 ± 0.5 years) attending Trnava university faculties that include the following: 65.5% of young adults from Faculty of Education and 34.5% of other faculties (33.3% from the Faculty of Law, 33.3% from the Faculty of Philosophy and Arts and 33.3% from the Faculty of Health Care and Social Work). Anthropometric measurements, including weight, height [for body mass index (BMI)] and percentage of body fat (BF) were evaluated. Measured blood pressure (BP) was used to classify for prehypertension, and I and II degree hypertension. A total 22.1% of university students were found to be prehypertensive and 18% hypertensive. Compared with future teachers who showed higher means of body fat ($24.20 \pm 5.14\%$) and frequent sedentarism, we noted higher means of all other anthropometric parameters and a higher prevalence of hypertension, being overweight and obesity among students of other faculties. By faculty grouping, the highest prevalence of being overweight and hypertension, the highest BMI and cigarette smoking were determined among the students from the Faculty of Philosophy and Arts. Students from other faculties differed in prevalence of obesity and body fat distribution ($p < 0.001$), hypertension (0.03), leisure-time physical activity and cigarette smoking ($p < 0.05$). We found significant association between hypertension and obesity, body fat, cigarette smoking and also body fat/physical inactivity ($p < 0.001$) among students. Our results indicate the need for implementing effective preventive reduction to the major CVD factors related to an unfavorable exogenous condition among young adult Slovaks with their specific educational trend.

Key words: Obesity, hypertension, life style, gender, university students, Trnava University.

INTRODUCTION

Recent data concluded cardiovascular disease (CVD) has become a leading cause of mortality in Slovakia resulting in 54.5% of deaths a year; statistics now show that CVD related deaths is 48.1% among Slovak males and 62% among Slovak females (Main demographic aspects of development in Slovakia, 2009). Respectively, of the 508 deaths recorded last year, per 100,000 inhabitants, 28,265 of those were from CVD (Fábryová, 2010). CVD combined with lower lifespans (about 10 years lower for the average male and female Slovak than

for the average in the Eurozone (Baráková, 2009) reflect the consequences of long-term overvalues of key risk biopredictors associated with unhealthy life style habits. Due to education, an important determinant of health, populations with a basic education were found to be less healthier and more disadvantaged than well-educated populations (Jarrah et al., 2011). However, numerous epidemiological studies have previously reported relatively high prevalence of obesity and hypertension among highly educated university students in Scotland

(Smith et al., 2001), Sweden (Margareta et al., 2005), Germany (Stock et al., 2001), Hungary (Antal et al., 2006), Greece-Crete (Bertsias et al., 2003), Libya (Greiv et al., 2010; Tayem et al., 2012), Nigeria (Adams-Campbell et al., 1988; Familoni and Familoni, 2011), United Arab Emirates (Amine and Samy, 1996), Saudi Arabia (Sabra et al., 2007), Iran (Mahmoudi et al., 2004), USA (Huang et al., 2003), Brazil (Costa Silva Zemdegs et al., 2011; Rabelo et al., 1999), Chile (Chiang-Salgado et al., 1999), Malaysia (Lee et al., 2010) and Colombia (Feliciano-Alfonso et al., 2010; Hernández-Escolar et al., 2010) as well as other parts of the world (Haase et al., 2004).

Overall, university students are often being exposed to environmental condition such as cigarette smoking, inefficient nutrition from cheap energetic diets, sedentary life style, etc. which can lead to an increase of CVD risk prevalence (Giroto et al., 1996). By Steptoe and Wardle (2001), East European university students from the German Democratic Republic, Hungary and Poland compared with West Europeans from Austria, Belgium, the Federal Republic of Germany, the Netherlands and Switzerland, have shown less healthy lifestyles.

The prevalence of sedentarism varied with cultural and economic developmental factors, averages 23% North-Western Europe and the United States, 30% in Central and Eastern Europe, 39% in the Mediterranean, 42% of Pacific Asia, and 44% in developing countries. In addition, cigarette smoking varied widely, being the highest in case studies from Southern European countries and the lowest in developing countries such as Thailand, South Africa, South America. The pattern of tobacco smoking in well-educated young adults appears to conform with the wider international patterns of tobacco use (Steptoe et al., 2002).

Although, multiple health risk behaviors have been identified as a problem in young university students, only a few reports have dealt with medical Slovakian university students. By gender, 16% of males and 2% of females had body mass index (BMI) of over 25 kg/m² (Baska et al., 2001). In a study done a year later, mild obesity was determined in 22.2% of males and 8.7% of females. 4.8% of males and 5.4% of females showed an android type of obesity. 45.6% of them recorded higher fat composition than recommended value (Janušová et al., 2002). Though medical students are known to have less CVD risk than other students.

The purpose of the present study is to characterize anthropometric risk factors of CVD, which is to investigate body fat (BF), body mass index (BMI), and blood pressure (BP) to evaluate hypertension and various degrees of obesity, and exogenous interaction (physical inactivity and cigarette smoking) in both the male and female genders within different faculties include the Faculty of Education, the Faculty of Law, the Faculty of Philosophy and Arts and the Faculty of Social Health, within the University of Trnava. CVD among varying Trnava University faculties has never been analyzed, to

date. The research recorded may provide more up-to-date information on health status, and clarify possible effects of specific educational (faculty) differences in order to possibly lower potential risks.

METHODOLOGY

Study population

This research study was completed in 2012 at Trnava University in the south-west of Slovakia. The randomly selected population consisted of 122 first year students: 18% male and 82% of female between the ages of 18 and 22 (averaging 19.82 ± 0.5 years). Healthy anonymous participants (each volunteers) were randomly contacted and recruited in proportion to the full population of Trnava University students (65.6% of all 399 full-time students from Faculty of Education and 34.4% from other faculties such the Faculty of Law, the Faculty of Philosophy and Arts and the Faculty of Health Care and Social Work). The underwent physical examinations of each student (measurements regularly used in anthropometric practices) took place at the Trnava university and at its hall of residence.

Data included information on lifestyle obtained from a questionnaire which was designed to evaluate how daily physical activities and cigarette smoking can affect CVD. Smokers were classified by smoking more than one cigarette per day for at least three months. Non-smokers were defined as those who had not been smoking for the last three months and had never smoked. This study has been approved by the ethical committee of the University of Trnava.

Only non-lipid laboratory measures of CVD indicators were studied: BF, BMI, systolic and diastolic BP. All anthropometric data was measured at two separate times and the average values recorded. Body fat was measured by bioelectrical impedance (evaluated BF > 30% for female and BF > 20% for male). Anthropometric measurements (height and weight) were taken using a stadiometer. Height was measured barefoot in standing position to the nearest 0.5 cm using a secured metal ruler, and weight was measured in light clothing using calibrated scales. BMI used for the assessment of the prevalence of being overweight (BMI > 25 kg/m²; overweight group is considered having a BMI between 25.0 kg/m² and 29.99 kg/m²), the prevalence of obesity (BMI > 30 kg/m²) and the prevalence of being morbidly obese (BMI > 35 kg/m²), was calculated as a quotient of weight and squared height in meters (kg m⁻²). Blood pressure was measured from the right arm using a standard mercury sphygmomanometer with the subject in sitting position (both values were taken after 5 min rest). Over-values of tension was defined as sBP >130 mmHg, and diastolic blood pressure as > 85 mmHg, hypertension I as sBP > 140 mmHg dBP > 90 mmHg and hypertension II as sBP > 160 mmHg dBP > 100 mmHg.

The results are expressed as mean ± standard deviation (SD). A normality test was performed with the Kolmogorov-Smirnov test. When the variables were normally distributed, we used the Anova test and evaluated the variables' distribution in gender and faculties related groups. Descriptive statistics for all studied variables and chi-square test were used. A "p" value of < 0.05 was considered to indicate statistical significance. Pearson correlation coefficient (r) tested association between anthropometric parameters. Statistical analyses were performed using the statistical package for social sciences (SPSS) System software package (2010).

RESULTS

The anthropometric parameters in the examined

Table 1. Characteristics of examined University students (Trnava University).

| Parameter | All (N=122) | Males (N=22) | Females (N=100) | Faculty of Education (N=80) | Other faculties (N=42) |
|--------------------------|--------------|--------------|-----------------|-----------------------------|------------------------|
| Age (years) | 19.82±0.5 | 19.91±0.68 | 19.47±0.72 | 19.36±0.77 | 19.90±0.48 |
| sBP (mmHg) | 133.63±16.99 | 134.05±18.79 | 125.06±16.27 | 122.86±15.8 | 133.95±17.09 |
| dBP (mmHg) | 81.18±12.53 | 82.86±13.06 | 78.56±10.64 | 77.94±10.00 | 82±12.83 |
| Pre/hypertension I (%) | 22.1/13.9 | 40.9/25.7 | 18/12 | 23.8/7.5 | 19/26.2 |
| Hypertension II (%) | 4.1 | 4.5 | 4 | 3.8 | 4.8 |
| BMI (kg/m ²) | 20.38±17.41 | 23.74±3.6 | 21.20±3.16 | 21.44±3.24 | 22.08±3.62 |
| Overweight/obesity (%) | 17.2/0.8 | 40 | 12/1 | 16.3/1.3 | 19 |
| BF(%) | 21.76±5.55 | 15.4±6.5 | 20.9±7.12 | 19.37±8.06 | 20.94±5.5 |
| Overvalues of BF (%) | 10.7 | 9.1 | 11 | 13.8 | 4.8 |
| Physical inactivity (%) | 38.5 | 18.2 | 43 | 40 | 35.7 |
| Cigarette smoking (%) | 22.1 | 36.4 | 19 | 16.3 | 33.3 |

Table 2. Anthropometric values and life style of students of other faculties, attending the University of Trnava.

| Parameter | Faculty of Law (N=14) | Faculty of Philosophy and Arts (N=14) | F. of Health Care and Social Work (N=14) |
|--------------------------|--------------------------|--|---|
| Age (years) | 19.86±0.36 | 19.93±0.27 | 19.93±0.73 |
| sBP (mmHg) | 135.15±18.91 | 133.07±14.67 | 133.64±18.59 |
| dBP (mmHg) | 84.43±14.55 | 81.57±11.18 | 80±13.1 |
| Pre/hypertension I (%) | 35.7/14.3 | 14.3/35.7 | 7.1/28.6 |
| Hypertension II (%) | 14.3 | - | - |
| Pulsation | 74.57±13.43 | 84±17.31 | 83.71±22.45 |
| BMI (kg/m ²) | 21.66±3.4 | 23.82±4.34 | 20.76±2.34 |
| Overweight (%) | 14.3 | 35.7 | 7.1 |
| BF (%) | 20.09±6.61 | 21.65±5.99 | 21.08±3.82 |
| Overvalues of BF (%) | 7.1 | 7.1 | 0 |
| Physical inactivity (%) | 42.9 | 28.6 | 35.7 |
| Cigarette smoking (%) | 28.6 | 57.1 | 14.3 |
| Consumers of fast food % | 7.1 | 14.3 | 14.3 |

university students (N = 122) divided according to different sex and faculty groupings are given in Table 1. Overall, we found that 22.1% of university students were prehypertensive, 13.9% of them showed hypertension I and 4.1% hypertension II. 17.2% of the students were overweight, 10.7% of participants had overvalues of BF, respectively.

The means of BMI, sBP and dBP in the males were higher in comparison with the females (who showed higher body fat, higher percentage of body fat overvalues, physical inactivity than males). Generally, the means of sBP were above the acceptable range in the males (mainly from the Faculty of Law). Males were more hypertensive and overweight than the females; although, women showed relatively high prevalence of body fat composition.

In comparison within the faculties, students from the Faculty of Education had higher values of BF (and overvalues of BF) and were more physically inactive

(40%) than participants from other faculties. On the contrary, the students from other faculties showed excessive values of sBP, a higher prevalence of hypertension (31%), being overweight (19%) and cigarette smoking (33%) and a sedentary life style (35.7%)

In other faculties (Table 2), the highest means of BMI were interestingly recorded in the students from the Faculty of Philosophy and Arts, and excessive values of sBP in the students from the Faculty of Law. The highest-risk values of dBP were again measured in the students of Faculty of Law (and hypertension II). The students from the Faculty Philosophy and Arts showed the highest hypertension I prevalence. More than half of the students from the Faculty of Philosophy and Arts demonstrated the greatest presence of cigarette smoking. The students from the Faculty of Law had the lowest level of leisure time physical activity (after the participants from the Faculty of Education).

Table 3. Pair sample test (ANOVA) - relation of CVD risk predictors in the Trnava university students.

| Pair | p |
|----------------------------------|-------|
| Gender-sBP | 0.000 |
| Gender-obesity | 0.000 |
| Gender-body fat | 0.000 |
| Gender-physical inactivity | 0.000 |
| Gender-cigarette smoking | 0.000 |
| Faculty grouping-hypertension | 0.001 |
| Faculty grouping-obesity | 0.007 |
| Faculty grouping-body fat | 0.000 |
| Hypertension-obesity | 0.000 |
| Hypertension-body fat | 0.000 |
| Hypertension-physical inactivity | 0.011 |
| Hypertension-cigarette smoking | 0.000 |
| Obesity-body fat | 0.032 |
| Obesity-physical inactivity | 0.001 |
| Body fat-physical inactivity | 0.000 |
| Body fat-cigarette smoking | 0.019 |

Statistical significance $p < 0.05$.

Table 4. Pearson correlation of some parameters in the examined university students.

| Pearson correlations (r) | dBP | BF | BMI |
|--------------------------|---------|---------|---------|
| Age | 0.816** | 0.210* | 0.313** |
| sBP | - | - | 0.263** |
| dBP | - | 0.508** | - |

Statistical significance * < 0.05 and ** < 0.01 .

Statistically significant differences of $p < 0.001$ were detected in the values of BF, BMI, sBP and dBP in university students just as strongly for males and females. By gender, significant differences were found in obesity ($p = 0.005$), hypertension ($p = 0.025$) and physical inactivity ($p = 0.03$). The students from other faculties (with the exception of the Faculty of Education) significantly differed in being hypertensive, physically inactive and cigarette smoking ($p < 0.05$). χ^2 test also confirmed that three faculty subgroups were statistically different in presence of cigarette smoking ($p = 0.028$). By faculty grouping, surprisingly significant differences in prevalence of hypertension ($p = 0.03$), obesity and excessive BF ($p < 0.001$) were evaluated among the students. By a pair samples test, significant association was also analyzed in hypertension/obesity, hypertension/body fat, cigarette smoking/hypertension, physical inactivity/body fat ($p < 0.001$) (Table 3). The variables presented in Table 4 showed the middle strong Pearson's correlation BMI and BF ($r = 0.508^{**}$), mild relation sBP and BMI ($r = 0.313^{**}$) and BF and sBP ($r =$

0.210^{*}).

DISCUSSION

We can state that the presence of some cardiovascular risk factors is rather high among first-year Trnava University students. 22.1% of university students were prehypertensive, 13.9% of them showed hypertension I and 4.1% hypertension II. 17.2% of the participants were overweight, 10.7% of participants showed overvalues of BF. The males (in comparison with the females) had higher excessive means of sBP (134.05 ± 18.79 mmHg). They showed a higher prevalence of prehypertension (40.9%), hypertension I (22.7%) and hypertension II (4.5%), being overweight (40.9%) and cigarette smoking (36.4%). We counted the higher means of BF ($22.85 \pm 5.39\%$) and physical inactivity (43.2%) in females. Significant gender differences were analyzed in all parameters ($p < 0.001$). We found correlations between gender-obesity (0.005), gender- hypertension (0.025), gender-physical inactivity (0.03). The excessive means of sBP (133.95 ± 17.09 mmHg) were determined in the students from other faculties.

Although the participants from the Faculty of Education showed higher means of body fat ($24.20 \pm 5.14\%$) and sedentarism (40%), we compared higher means of all other anthropometric parameters and a higher prevalence of hypertension, being overweight and obesity in the students from other faculties. By faculty grouping, the highest prevalence of being overweight, hypertension I and the highest BMI was determined among the students from the Faculty of Philosophy and Arts. The students from other faculties (with the exception of the Faculty of Education) were significantly different in being physical inactive, hypertensive and cigarette smoking ($p < 0.05$). χ^2 test showed statistically significant association of faculty grouping and cigarette smoking ($p = 0.028$). Students from the varying faculties differed in the prevalence of hypertension (0.03), obesity and excessive BF ($p < 0.001$).

By a pair samples test, significant association was also analyzed in hypertension/obesity, hypertension/body fat, hypertension/cigarette smoking, and body fat/physical inactivity ($p < 0.001$). The middle strong relation BMI and BF ($r = 0.508^{**}$), mild relation sBP and BMI ($r = 0.313^{**}$) and BF and sBP ($r = 0.210^{*}$) were proved. A significant correlation between being overweight and BP ($p < 0.001$) was also determined.

Regarding to CVD risk variables, our findings are in agreement with several studies performed on young adults (Keller et al., 2008). We strengthened previous reports with a relevant conclusion indicating significant relation between hypertension/obesity, hypertension/body fat, hypertension/cigarette smoking, and body fat/physical inactivity ($p < 0.001$).

It has been proved several times that gender is the

factor to which CVD factors are associated (Garaibeh et al., 2012), as well as our results confirmed by statistically significant gender variations in obesity, hypertension and leisure-time physical activity ($p < 0.05$). Similar to Jordan and Hungarian students, our examined males were more likely to be overweight and have higher BMI than females, who additionally recorded higher physical inactivity similar to Portuguese female university students.

A relatively high proportion of students from other faculties (compared with Faculty of Education) and males (than females) were predictably determined in a higher risk of obesity and hypertension. Consistently, several reports demonstrated a higher occurrence of elevated blood pressure, and a higher percentile distribution of being overweight, abdominal obesity according to the male group generally less interested in health enhancing activities and being more physically inactive (Pihl et al., 2002; Gupta and Kopor, 2010). Lower rates of hypertension among women may be affected by protective estrogen and non-smoking (Faraijan et al., 2008). 38.5% of all participants (43% of females) do not practice any type of physical exercise, which can be regarded as a warning sign. Accordingly the often inadequate diet (caloric intake at meals and fast foods) which can result in poor nutritional habits (Irazusta et al., 2007), CVD family history and childhood obesity could be the other important contributors to the development of obesity among students of both genders over time.

Generally, all population of university students showed a high risk of sedentarism (38.5%). Our study noted prehypertension in almost a quarter of the population from the Faculty of Education, which may be affected by the 43% of sedentarism, especially among females that predominated in the sample. 42.9% of students from the Faculty of Law also preferred a sedentary life style which can certainly be associated with a higher prevalence of hypertension (compared with other faculties), too. The beneficial effects of leisure time physical exercises should change an inactive lifestyle leading to reduction of obesity and hypertension among colleges. 22% of Trnava University students admitted being smokers, somewhat lower than the population of university students from Chile (39.8%) (Palomo et al., 2006). Surprisingly, a rather high frequency of cigarette smoking was determined among students from other faculties (33.3%) which significantly varied in those faculties ($p < 0.05$). Alarmingly, a high proportion from the Faculty of Philosophy and Arts recorded 57.1% of cigarette smoking which may be the main cause of a high prevalence of hypertension I (35.7%). Relating cigarette smoking to the analysed risk predictors of CVD among our young university students was strong. Nonetheless, it could reach epidemic proportions and may worsen the health status among well-educated Slovak inhabitants in the future.

Our examined students from the various faculties significantly differed in being physically inactive, hyper-

tensive and the prevalence of cigarette smoking ($p < 0.05$, the latter being detected by χ^2 test) and in a prevalence of obesity and excessive BF ($p < 0.001$). Keeping this in mind, some variation in CVD predictors between faculty subgroups in university students may especially be explained by their specific educational trend (Abdullahi and Amzat, 2011). Some discrepancies hypothetically exist between individual level of the knowledge CVD risks and the practice of lifestyle. As expected, the lowest prevalence of CVD risk factors was assessed among participants from Faculty of Health Care and Social Work. The research oriented towards and tested on medical students, who naturally deal with more issues regarding health information, proved that the level of education has a positive impact on the knowledge and prevalence of CVD factors and complications (Almas et al., 2008). However, there are some studies that report notably high cardiovascular risks in young medical students (Brandao et al., 2011). Furthermore, the high representation of university education is located in Slovak cities (Trnava is the nearest city to the capital city of Slovakia). Urbanization with its negative changes can also force high-educated Slovaks to adopt an unfavorable life style. Due to the phenomenon that has existed among Eastern European university students, the same students had placed a higher value on their health contrasting with their less favourable lifestyles, which has equally contributed to poor health status among Slovak University students despite their assumed higher level of the education and knowledge about health.

The present study is limited by a relatively small number of population. In view of that fact, we can regard representative sample from the Faculty of Education and the study that provides gender differences. Furthermore, current study has shown a predisposition to obesity and hypertension related to environmental university condition among young Slovaks. Despite some limitation, there has not been any Slovak study undertaken on University students to monitor faculty variation in the prevalence of CVD risk predictors.

Further limitation of this pilot study is an absence of assessment of different socioeconomic (Johnson et al., 1994) and occupational stressors. We also could not investigate all cardiovascular factors (biochemical markers) because of lacks of financial funds. The next research might be able to explore and longitudinally study the other risk predictors and negative effect of CVD on college students. By some striking findings, the following recommendations (not only for our examined students) are summarized:

1. A sedentary life style certainly related to higher composition of body fat. It is especially recommended that the females from the Faculty of Education should participate in more leisure-time physical exercises. University students from the Faculty of Law should also modify physical inactivity. As previously mentioned, the

physical activity emphasizes the importance of enhancing positive attitudes for healthier lifestyles (Abdel-Megeid et al., 2011).

2. The need to eliminate the risk of high body fat not only in female students, but also on a reduction and normalization of weight and hypertension among males. A high prevalence of cigarette smoking among males has been linked to the prevalence of hypertension.

3. Other recommendation for students from the Faculty of Philosophy and Arts is to reduce BMI and cigarette smoking. Its related complications should be improved by a better quality of life (Oncel et al., 2011; Martínez et al., 2012). Students from the Faculty of Law should mediate blood pressure overvalues with high presence of hypertension II and sedentarism.

The alarming list of health disadvantages could continue to grow among first year university students who adapt to the common, mostly sedentary and unhealthy life style that can be found at universities. The possible roles of lifestyles, knowledge about important roles of some CVD predictors, health and behaviour awareness should be integrated into specific educational programs for first-year Slovak University students in Trnava.

Conclusion

These findings accent a CVD risk among young university students, which a lot of surveys of different nations have just highlighted. Evidently, the negligible percentage of first-year university students showed some degree of obesity, hypertension, cigarette smoking and a sedentary lifestyle which should be modified. Our results indicate the need for implementing effective preventive reduction to the major CVD factors related to an unfavorable exogenous condition among young adult Slovaks with their specific educational trend.

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ABBREVIATIONS

CVD, Cardiovascular disease; **BF**, body fat percentage; **BMI**, body mass index; **BP**, blood pressure; **sBP**, systolic blood pressure; **dBp**, diastolic blood pressure; **RF**, risk factors.

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