

LEVELS AND CORRELATES OF DOMAIN-SPECIFIC PHYSICAL ACTIVITY IN UNIVERSITY STUDENTS: CROSS-SECTIONAL FINDINGS FROM CROATIA

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Abstract:

This cross-sectional study was conducted to determine domain-specific physical activity (PA) levels and their relationship with self-rated health, socio-demographic and lifestyle characteristics among Croatian university students. The data were collected using self-administered questionnaires on a random sample of 1,254 students (62.4% females) living in university residence halls in Zagreb, Croatia. PA levels were assessed by using the long version of the *International Physical Activity Questionnaire* (IPAQ), with additional questions asked on gender, age, current year of study, personal monthly budget, community size, smoking status, alcohol intake, body mass index, and self-rated health. The prevalence of insufficient PA was 28.4% (95% CI, 25.1–31.7) and 28.8% (95% CI, 24.6–33.1) among female and male students, respectively. No significant difference was found between genders ($p=.867$). Male students were significantly more active in the leisure-time domain, while female students reported significantly higher domestic PA ($p<.001$). A multiple regression analysis showed that leisure-time PA is negatively associated with smoking (partial correlation $[r_{XYZ}] = -.07$; $p=.028$), and positively associated with male gender ($r_{XYZ}=.06$; $p=.040$), year of study ($r_{XYZ}=.09$; $p=.003$), size of community ($r_{XYZ}=.08$; $p=.010$), and self-rated health ($r_{XYZ}=.13$; $p<.001$) (multiple $R=.23$; $p<.001$). In conclusion, low levels of PA are prevalent among Croatian university students, which indicates a need for PA promotion efforts among this population. Future interventions should especially target females, earlier years of study, students from smaller communities, smokers, and students reporting poorer general health status.

Key words: motor activity, exercise, college, IPAQ-long

Introduction

Previous research consistently shows that insufficient physical activity (PA) is a risk factor for development of several chronic diseases (Reiner, Niermann, Jekauc, & Woll, 2013). In spite of public health efforts, population levels of PA in Croatia and other European countries are still low (Jurakić, Pedišić, & Andrijašević, 2009; Sjöström, Oja, Hagströmer, Smith, & Bauman, 2006; Van Tuyckom, Van De Velde, & Bracke, 2013), suggesting the need for more focused approaches.

University students are an important target population for PA interventions as it seems that globally between 30 and 60% of them are insufficiently active (Irwin, 2004). An international study has shown even higher prevalence rates of leisure-time physical inactivity in European countries, ranging between 35 and 89% (Haase, Steptoe, Sallis, & Wardle, 2004). Moreover, it seems that PA beha-

viour of university students in Europe is not improving, as more recent studies show similarly high prevalence rates (Bergier, Kapka-Skrzypczak, Biliński, Paprzycki, & Wojtyła, 2012; Romaguera, et al., 2011; Sigmundová, Chmelík, Sigmund, Fel-tlová, & Frömel, 2013; Varela-Mato, Cancela, Ayan, Martín, & Molina, 2012). Furthermore, previous studies showed that the transition between secondary school to university may be associated with a significant decline in PA (Bray & Born, 2004). Physical inactivity may contribute to weight gain in early college years, often referred to as the 'freshman fifteen' (Kasperek, Corwin, Valois, Sargent, & Morris, 2008). Regular PA and exercise in this age group have been associated with higher health-related quality of life (Pedišić, Rakovac, Titze, Jurakić, & Oja, 2013; Rakovac, Pedisic, Pranic, Greblo, & Hodak, 2013) and greater lifelong maintenance of PA patterns (Sparling & Snow, 2002).

The importance of a systematic approach to PA promotion among university students in Croatia stems from the fact that they constitute a significant proportion of the overall population. In Croatia in the academic year 2008/2009, there were 115,205 tertiary students at university colleges, faculties, and arts academies, which is 2.6% of the overall population (Central Bureau of Statistics – Republic of Croatia, 2010). Moreover, each year approximately 40,000 new students enrol in university courses (Central Bureau of Statistics – Republic of Croatia, 2010). Based on these figures, we can assume that a 10-year planned strategy for PA promotion could reach approximately half a million students in Croatia. More than 70,000 students (which is somewhat less than 50% of all university students in Croatia) study at the University of Zagreb.

To identify strategies for PA promotion, it is important to understand the distribution and determinants of PA (Bauman, et al., 2012). To our knowledge, there are no recent data on PA patterns of Croatian university students. Therefore, the aim of this study was to determine the level and correlates of PA in a sample of university students enrolled in study programmes in Zagreb.

Methods

Participants

A cross-sectional, self-administered survey was conducted in June 2009, on a stratified random sample of Croatian university students. The sample did not include foreign students living in Croatia. The sampling frame for this survey comprised students from five university residence halls in Zagreb. Initially, 1,750 students were invited by the Zagreb Student Centre to participate in the survey. Participation in the survey was voluntary and anonymous, and participants provided informed consent. The study was approved by the Scientific and Ethics Committee of the Faculty of Kinesiology, University of Zagreb.

The final sample consisted of 1,254 participants (response rate: 71.7%). A further 7.3% were excluded as they failed to answer PA questions, or provided out-of-range responses (International Physical Activity Questionnaire, 2005). Therefore, the analyses were conducted on the sample of 1,163 students (62.4% females). A *post-hoc* power analysis showed that the sample size was large enough to detect a significant multiple correlation at $p < .05$ with a high power of .94, if the true effect size in the population was at least small (Cohen $f^2 \geq .02$) (Cohen, 1992).

All participants were students from 36 higher education institutions located in Zagreb and surroundings, including all 29 faculties of the University of Zagreb, located in the City of Zagreb.

Socio-demographic, lifestyle and health characteristics of participants in the current study are presented in Table 1.

Table 1. Sample characteristics

Variable / category	Mean (SD) / percentage ^a	
	Females	Males
Age (years)	21.47 (1.67)	21.52 (1.88)
Current year of study (%)		
first	19.2	22.7
second	20.8	19.0
third	18.6	22.2
fourth	20.4	14.9
fifth/sixth/graduate year	21.0	21.1
Personal monthly budget (€)	205 (97)	224 (113)
Size of community (%) ^b		
<2000	22.4	23.3
2001 – 10,000	33.8	31.3
10,001 – 100,000	34.0	35.0
>100,000	9.8	10.4
Smoking status (%)		
non-smoker	78.5	77.6
smoker	21.5	22.4
Alcohol intake (%)		
never/rarely	83.7	66.3
regularly (\geq once a week)	16.3	33.7
Body mass index (kg/m ²) (%) ^c		
<18.5	9.4	0.9
18.5 – 25	85.1	70.8
25 – 30	5.0	25.1
\geq 30	0.6	3.2
Self-rated general health (%) ^d		
Poor	1.5	0.9
Fair	14.2	9.0
Good	21.7	17.6
Very Good	46.6	45.5
Excellent	15.9	27.0

^a Mean (standard deviation) are presented for the quantitative and percentages for the qualitative variables

^b Number of inhabitants

^c Calculated based on the self-reported height and weight

^d Based on the single question "In general, how would you rate your health?"

Measures

We estimated PA using the Croatian long version of the *International Physical Activity Questionnaire* (IPAQ), which assesses 7-day recall of domain-specific PA (at work, transport-related, domestic & garden, and leisure-time PA). According

to the IPAQ analytic guidelines, the obtained data were presented as estimated energy expenditure in MET-hours/week in each domain (Craig, et al., 2003; International Physical Activity Questionnaire, 2005). Total PA was calculated as the sum across all four domains. Previous studies showed satisfactory reliability and validity of IPAQ (Craig, et al., 2003; Hallal & Victora, 2004; Pedišić, Jurakić, Rakovac, Hodak, & Dizdar, 2011).

Demographic questions included gender, age, current year of study, personal monthly budget, originating community size, smoking status, alcohol intake, body mass index (BMI) (calculated as self-reported weight/height² [kg/m²], and self-rated general health. The participants were categorized according to their current year of study as follows: (1) first year; (2) second year; (3) third year; (4) fourth year; and (5) fifth/sixth/graduate year. The community size of students' original area of residence was categorized as (1) less than 2,000 inhabitants; (2) 2,001–10,000; (3) 10,001–100,000; and (4) more than 100,000 inhabitants. The smoking question dichotomized the sample into non-smokers or smokers. Alcohol use was categorized as follows: never/rarely (<once a week) and more regularly (≥once a week). The single item self-perceived general health was rated on a five-point scale from 'poor' to 'excellent'.

Statistical analysis

The data on self-rated health, socio-demographic, and lifestyle characteristics are presented as mean (SD) for the quantitative and percentages for the qualitative variables. Because the total PA and domain-specific PA levels were positively skewed, they are presented as median and inter-quartile ranges, with 95% confidence limits for medians (Bonett & Price, 2002). Differences in PA levels by gender were tested using the Mann-Whitney U test. The prevalence rates of insufficient PA were reported as the percentages of students not meeting the standard PA recommendation (≥150 minutes of moderate, or ≥75 minutes of vigorous-intensity PA per week, or an equivalent combination of both) and PA recommendation for additional health benefits (≥300 minutes of moderate, or ≥150 minutes of vigorous-intensity PA, or an equivalent combination of both) (World Health Organization, 2010). To allow for generalization to the respective population, we also reported 95% confidence intervals for the prevalence rates and tested differences between genders using the two-proportion z-test.

The relationship of self-rated health, socio-demographic, and lifestyle characteristics (independent variables) with domain-specific PA levels (dependent variable) was assessed by four separate multiple regression analyses. The regression models were checked for: (1) normality of residuals

(using the normal probability plot), (2) linearity of the relationship between independent and dependent variables (using the scatterplot of each predictor vs. residuals), (3) multicollinearity (using the variance inflation factors), and (4) heteroscedasticity (using the predicted vs. residuals plot). Non-normal distributions of residuals were detected in all regression models, and hence we log-transformed the domain-specific PA levels. As the result of the regression analyses, we presented multiple correlations, partial correlations, and percent change in the dependent variable for one unit change in the independent variable (calculated based on the antilog of unstandardized regression coefficient). Multiple correlation coefficients were evaluated using Cohen's f^2 , with .02, .15, and .35 defined as the thresholds for small, medium, and large effect sizes, respectively (Cohen, 1992).

All analyses were performed using STATISTICA, version 10 (StatSoft, Inc., Tulsa, OK, USA) with statistical significance set at two-sided $p < .05$.

Results

The lower limits of 95% confidence interval showed that the median total PA in the population of female and male students was over 45 MET-hours/week and 49 MET-hours/week, respectively (Table 2). In both genders, significantly higher energy expenditure was observed for leisure-time and transport, compared to work and domestic domains. However, different PA patterns were noted by gender. The highest energy expenditure in male students was found in the leisure-time domain, whilst female students were most active in the transport domain. Furthermore, male students had significantly higher energy expenditure in the leisure-time domain, and female students had a significantly higher level of domestic PA ($p < .001$). No significant gender differences were found in the other PA domains and in total PA. The lower limits of 95% confidence intervals showed that in the student population at least 25.1% of females and 24.6% of males did not meet PA recommendations (World Health Organization, 2010) (Table 3). Besides, at least 37.9% of female and 37.0% of male students did not meet PA levels recommended for additional health benefits (World Health Organization, 2010). No significant gender differences were found for insufficient PA.

The variance inflation factors of the independent variables in the regression models ranged from 1.02 to 3.86, suggesting no evidence of multicollinearity. The relationship of self-rated health, socio-demographic, and lifestyle variables with work-related PA was not significant (multiple $R = .26$; $p = .053$) (Table 4). The only significant predictor in the regression model was personal monthly budget, explaining 2.9% of work-related PA ($p = .006$).

Table 2. Domain-specific pattern of physical activity in university students

Physical activity	Median; IQR ^a (95% CI) ^b		p ^c
	Females	Males	
Work-related ^d	6.60; 34.00 (0.13 - 13.07)	4.95; 35.30 (0.00 - 13.18)	.858
Transport-related	13.20; 17.60 (10.77 - 15.63)	13.20; 17.10 (10.77 - 15.63)	.833
Domestic & garden	7.33; 18.25 (6.35 - 8.31)	3.00; 14.00 (2.18 - 3.82)	<.001
Leisure-time	12.25; 26.73 (10.58 - 13.92)	19.30; 36.85 (15.89 - 22.71)	<.001
Total	49.65; 64.85 (45.13 - 54.17)	54.03; 69.40 (49.34 - 58.71)	.316

^a Median; quartile range (MET-hours/week)

^b 95% confidence interval for median

^c p-value according to Mann-Whitney U test

^d Parameters describing work-related physical activity level were calculated on the participants that reported having either paid or unpaid job at the time of survey

Table 3. Prevalence of insufficient physical activity among university students

Units of physical activity per week ^a	Percentage (95% CI) ^b		p ^c
	Females	Males	
<150 ^d	28.4 (25.1 - 31.7)	28.8 (24.6 - 33.1)	.867
<300 ^e	41.5 (37.9 - 45.0)	41.6 (37.0 - 46.3)	.950

^a Units of physical activity calculated as minutes of moderate-intensity physical activity + 2×minutes of vigorous intensity physical activity

^b Prevalence (%) and 95% confidence interval

^c p-value calculated using the two-proportion z-test for the difference in prevalence of insufficient physical activity among female and male students

^d Not meeting the standard physical activity recommendation (≥150 minutes of moderate, or ≥75 minutes of vigorous-intensity physical activity, or an equivalent combination of both)

^e Not meeting the physical activity recommendation for additional health benefits (≥300 minutes of moderate, or ≥150 minutes of vigorous-intensity physical activity, or an equivalent combination of both)

For each 100 € decrease in the personal monthly budget, work-related PA increased by 24%. The set of predictors explained 3.6% of transport-related PA ($p < .001$). Age was negatively related, whilst the current year of study, size of originating community and self-rated health were positively related to PA in transport domain. Regular alcohol consumption was positively associated with transport-related PA. The significant predictors individually explained 0.4–1.4% of transport-related PA variance. Although the multiple correlation with PA in the domestic & garden domain was relatively high (multiple $R = .21$; $p < .001$), gender was the only independent variable to show significant association. Female gender was

independently associated with on average 47.1% higher PA level. Around 5.3% of the variance of leisure-time PA was accounted for self-rated health, socio-demographic, and lifestyle characteristics ($p < .001$), with individual predictors contributing 0.4 to 1.7%. Female gender was associated with 18.1% increase in leisure-time PA, being enrolled in a higher year of study with 13.8% increase, and originating from a larger community with 9.4% increase. Being non-smoker and reporting one category higher self-rated health were both associated with approximately 16.0% increase in leisure-time PA.

Table 4. Results of multiple regression analyses with self-rated health, socio-demographic, and lifestyle characteristics as independent and domain-specific physical activity (PA) levels as dependent variables

Independent variable list	Dependent variable (PA domain) ^a / B ^b (p) ^c ; r _{xyz} ^d			
	Work ^e	Transport	Domestic & garden	Leisure-time
Gender (female=0; male=1)	19.38 (.569); .04	-4.78 (.572); -.02	-47.06 (<.001); -.18	18.06 (.040); .06
Age (years) ^f	-0.61 (.958); .00	-14.07 (<.001); -.12	1.50 (.748); .01	-6.28 (.073); -.05
Current year of study ^g	-3.88 (.787); -.02	21.29 (<.001); .12	-1.38 (.804); -.01	13.78 (.003); .09
Personal monthly budget (€) ^f	-0.24 (.006); -.17	0.00 (.992); .00	0.00 (.931); .00	0.06 (.082); .05
Size of community ^h	-17.04 (.142); -.09	9.58 (.015); .07	-4.92 (.259); -.03	9.39 (.010); .08
Smoking status (non-smoker=0; smoker=1)	22.36 (.486); .04	4.32 (.624); .01	17.41 (.119); .05	-16.21 (.028); -.07
Alcohol intake (never/rarely=0; regularly=1)	56.92 (.123); .10	29.35 (.003); .09	-17.37 (.063); -.06	-0.44 (.957); .00
Body mass index (kg/m ²) ^f	-1.18 (.816); -.01	0.16 (.912); .00	3.36 (.055); .06	1.01 (.454); .02
Self-rated general health ⁱ	1.39 (.906); .01	7.55 (.047); .06	6.61 (.144); .04	16.02 (<.001); .13
Multiple R (p)	0.26 (.053)	0.19 (<.001)	0.21 (<.001)	0.23 (<.001)

^a Dependent variables were log-transformed prior to the analysis

^b Percent change in the dependent variable for a one unit change in the independent variable (calculated based on the antilog of unstandardized regression coefficient)

^c p-value for unstandardized regression coefficient and partial correlation

^d Partial correlation, i.e. correlation adjusted for all other independent variables

^e Analysis with work-related physical activity as dependent variable included only the participants that reported having either paid or unpaid job at the time of survey

^f Quantitative variable

^g Ordinal variable: first year (1); second year (2); third year (3); fourth year (4); fifth/sixth/graduate year (5)

^h Ordinal variable: <2000 inhabitants (1); 2001 – 10,000 (2); 10,001 – 100,000 (3); >100,000 (4)

ⁱ Ordinal variable: poor (1); fair (2); good (3); very good (3); excellent (4)

Discussion and conclusions

The present study showed a high prevalence of insufficient PA among Croatian university students. Lack of PA was associated with female gender, students enrolled in lower years of study, students originating from smaller communities, smokers, and students with a poorer general health status.

Physical activity pattern

The present results indicate lower total PA in the student population in comparison with the general population of adults in Croatia, both for women and men (Jurakić, et al., 2009). The students were more active in leisure-time and transport, while the adults in general population achieved a higher overall PA level, primarily due to higher work-related PA (Jurakić, et al., 2009). Furthermore, the leisure-time and transport-related PA medians in the student population were approximately twice as high as in the general population of youth (aged 15 to 24 years) (Jurakić, et al., 2009). It has been shown that the education level is positively related to PA (Bauman, et al., 2012), which may explain the higher PA among university students than in the general population of youth. Students in our sample had a higher overall PA level when compared to Colombian (Beltrán, Escolar, & Anaya, 2012), Polish (Bergier, et al., 2012), Turkish (Cengiz, Ince,

& Çiçek, 2009), and American university students (Musselman & Rutledge, 2010). However, these studies used the IPAQ-short to examine PA, which does not assess domain-specific PA. Hallal and Victora (2004) indicated that IPAQ-short most likely underestimates PA level in comparison to the long version of the questionnaire. Therefore, it might be that the obtained higher PA level of Croatian students was determined, to a certain extent, by the measures used. Total PA level of the students investigated in the current study was similar to the PA level of low income college students in the USA (Maglione & Hayman, 2009). Furthermore, the significantly higher leisure-time PA level in males than in females is consistent with the findings from the Croatian general population (Jurakić, et al., 2009), other adult populations (Bauman, et al., 2012) and university students (Reed & Phillips, 2005). The higher domestic PA level in female students is also in accordance with the findings from the Croatian general population (Jurakić, et al., 2009). The differences obtained in leisure-time and domestic PA domain might be explained by historical gender roles that are still present even across economically advanced countries (Boehnke, 2011).

The prevalence of insufficient PA largely depends on the threshold used (Sarkin, Nichols,

Sallis, & Calfas, 2000). Therefore, the prevalence in our sample was compared only with the results of previous studies that used a similar definition of insufficient PA (based on the recommendations for $\geq 5 \times 30$ minutes/week or ≥ 150 minutes/week of moderate-to-vigorous intensity PA). The prevalence of insufficient PA in Croatian students was lower than among university students in China (Chen & Liu, 2008), Israel (Shuval, Weissbluth, Brezis, Araida, & DiPietro, 2009), Mexico (Salazar, Feu, Vizuete Carrizosa, & de la Cruz-Sánchez, 2013), Portugal (Brandão, Pimentel, Silva, & Cardoso, 2008), United Arab Emirates (Muttappallymyalil et al., 2010), Spain (Romaguera, et al., 2011; Varela-Mato et al., 2012), and the USA (Musselman & Rutledge, 2010), similar as in a private US university (Quintiliani, Allen, Marino, Kelly-Weeder, & Li, 2010), and higher than in Brazilian students (Bianchini de Quadros, Petroski, Santos-Silva, & Pinheiro-Gordia, 2009). Sarkin et al. (2000) indicated that application of different questionnaires might explain different prevalence estimates. Since only three above mentioned studies (Bianchini de Quadros, et al., 2009; Musselman & Rutledge, 2010; Shuval, et al., 2009) used IPAQ to assess PA, the comparisons should be interpreted with caution.

Although the prevalence was lower than in most other countries, almost 30% of insufficiently active students in our sample suggests an important public health issue. The prevalence of this chronic disease risk factor was almost two times higher than frequent alcohol consumption, and 6% higher than smoking. This suggests the need for PA strategies to target Croatian university students. Furthermore, given the significant between-gender differences in leisure-time PA, future interventions should be particularly tailored for female students.

Correlates of physical activity

According to Cohen (1992), multiple correlations of self-rated health, socio-demographic, and lifestyle variables with PA levels in all domains were within the range of small effect sizes ($.04 \leq \text{Cohen } f^2 \leq .07$). Female gender was positively associated with domestic, and negatively associated with leisure-time PA. The lower PA level in females is a common finding (Abdullah, Wong, Yam, & Fielding, 2005; Bauman, et al., 2012; Beltrán, et al., 2012; Bergier, et al., 2012; Fernandes, Arts, Dimond, Hirshberg, & Lofgren, 2013; Romaguera et al., 2011; Sigmundová et al., 2013; Varela-Mato, et al., 2012). However, our results suggest that the association between gender and PA is domain-specific. Therefore, assessing the association between total PA and gender might mask the true relationship.

Students' age was significantly related only to PA level in transport domain. Inverse correlation of age and PA is a constant finding in adults (Bauman, et al., 2012). Interestingly, we found a nega-

tive relationship between age and PA despite the fact that almost all surveyed students belong to the same age group. This finding suggests that the future promotion of active transportation should focus on older students. No relationship found between age and PA in the other domains is congruent with the results of some (Cruz, et al., 2013; Muttappallymyalil, et al., 2010; Shuval, et al., 2009), but not all previous studies of university students (Romaguera, et al., 2011).

Being enrolled in a higher year of study was associated with higher levels of PA, both in transport and leisure-time domain. This was an unexpected finding because previous studies on university students showed an inverse (Driskell, Kim, & Goebel, 2005; Racette, Deusinger, Strube, Highstein, & Deusinger, 2005; Wang, Ou, Chen, & Duan, 2009) or non-significant relationship (Abdullah, et al., 2005; Molina, et al., 2012). It may be that Croatian students in later years of study were more likely to use active modes of transportation and engage in leisure-time physical activities because they had more spare time.

Personal monthly budget was significantly related only to PA in the work domain. However, we cannot exclude the likelihood that the relationship was bidirectional. For example, it is possible that students with a lower budget accepted physically demanding jobs (personal budget \rightarrow work PA). However, it may also be that students working in offices had a higher income than the blue-collar student-workers (work PA \rightarrow personal budget). Furthermore, students with a higher monthly budget may have more opportunities to join exercise and sport programmes that charge a fee. However, contrary to our assumption, we observed a non-significant relationship between personal monthly budget and leisure-time PA. This was in accordance with the findings of some (Cruz, et al., 2013; Rodríguez Rodríguez, et al., 2013), but not all previous studies (Adegoke & Oyeyemi, 2011; Marcondelli, Da Costa, & Schmitz, 2008; Ulla Díez & Pérez-Fortis, 2010). It is possible that Croatian students of a lower socio-economic status bypassed the monetary barrier by engaging in free-of-charge activities, such as walking, jogging, and cycling.

A further interesting finding was that the students from larger hometowns engage more often in leisure-time physical activities and active transportation. In the general population of Croatia the same was true only for leisure-time PA (Jurakić, et al., 2009). However, Jurakić et al. (2009) classified the size of communities according to the number of inhabitants in the participants' current area of residence, while in the present study we defined the community size categories according to the number of inhabitants in the towns/cities from which the students originated. Whether the positive relationship between the originating community

size and PA was brought about by pre-university acquired habits or some other factors, should be elucidated in future studies.

Previous studies also found a negative association between students' smoking status and leisure-time PA (Magoc, Tomaka, & Thompson, 2010; Olchowski, Graham, Beverly, & Dupkanick, 2009; Romaguera, et al., 2011). In contrast, some studies indicate that non-domain-specific moderate-to-vigorous-intensity PA may not be associated with smoking status (Molina, et al., 2012). The longitudinal study by Olchowski et al. (2009) has found that cigarette consumption is a cause of a lower PA level, but not vice versa. Hence, the PA promotion among smokers seems to be of particular importance in the university setting.

Excessive alcohol consumption is well recognized among university student athletes (Martens, Dams-O'Connor, & Beck, 2006), and has been positively associated with PA in leisure-time and total PA (Abdullah, et al., 2005; Musselman & Rutledge, 2010). However, no previous studies have reported positive association of alcohol consumption and transport-related PA in university students. It is assumed that the relationship is mediated by motivational factors, personality traits and mood, whereas both higher alcohol consumption and participation in PA are positively associated to extrinsic motivation, extraversion, sensation seeking, and negative affect (Musselman & Rutledge, 2010). It is also possible that some students tend to put maximum effort in all activities of their lives, which embraces alcohol consumption and PA ("work hard, play hard" concept), or that they try to reduce the alcohol induced damage by engaging in physical activities (Musselman & Rutledge, 2010). Our findings suggest that the future studies on the above mentioned explanatory mechanisms should take into account transport-related PA, and not only total or leisure-time PA. Furthermore, some studies have shown higher alcohol consumption among insufficiently active students (Romaguera, et al., 2011), whilst other found no association between these characteristics (Molina, et al., 2012). This indicates that the nature of the 'alcohol vs PA' association may be population-specific.

Our findings indicate that BMI is not related to PA, which is in accordance with most previous studies among adults (Bauman, et al., 2012). Studies among university students were inconsistent, reporting either positive (Romaguera, et al., 2011), inverse (Kasperek, et al., 2008; Salazar, et al., 2013), or no relationship between BMI and PA (Cruz, et al., 2013; Shuval, et al., 2009). It might be that the negative link between these variables is more consistent in older age groups or among less educated people. However, this needs to be confirmed in future studies. In the interim, our data indicate that PA promotion solely may not be an effective measure

for obesity prevention among Croatian university students.

As expected, self-rated health status showed a positive relationship with transport-related and leisure-time PA, as observed previously with adults (Bauman, et al., 2012) and university students (Mikolajczyk, et al., 2008). By contrast, a study of Malaysian university students found no association between total PA and self-rated health (Sreerama-reddy, Kutty, Jabbar, & Boo, 2012). However, Olchowski et al. (2009) demonstrated a longitudinal impact of PA on self-rated health of university students. Since we did not use a longitudinal study design, no inferences about the directionality of the relationship were possible. It might be that the higher PA level was either a consequence or a cause of the better health status, or that the relationship was bidirectional.

The significant predictors individually explained between 0.4 and 3.2% of PA variance in different domains, which may seem low. However, taking into account the complexity of PA behaviour, that is, numerous factors it depends on (Bauman, et al., 2012), it would be unreasonable to expect that any of these variables solely accounts for much higher percentage of its variance. Besides, it is plausible that a substantial amount of random error in IPAQ measures and other self-reported variables resulted in smaller effect sizes. Therefore, the relatively low correlations observed in the present study may be considered practically significant.

Limitations

The interpretation of our results is subject to several limitations. The cross-sectional collection of data precludes conclusions on the causal relationship between the analysed characteristics. Furthermore, only the residents of student residence halls in Zagreb participated in this study, which may limit the generalizability of our conclusions. Additionally, data were collected by a questionnaire and may have been limited by measurement error inherent to self-reports. Despite that, this internationally comparable measure has been widely used in population-level comparative research (Bauman, et al., 2009). Additionally, some students might have considered their studies as an unpaid work, which could have affected estimations of work-related PA levels. However, given a clear distinction between 'studying at the university' and 'unpaid work' in the Croatian language and culture, this is very unlikely, and, therefore, could not have significantly biased our results. Furthermore, although it may be that the levels and correlates of PA differed between specific study programmes, our study focused only on the overall student population.

In conclusion, the current study identified that at least 25.1% of female and 24.6% of male Croatian

university students were not sufficiently physically active. Targeted interventions are required for insufficiently active students to increase their PA levels. Our results emphasize the need for future interventions to focus on females, students enrolled in lower years of study, students originating from

smaller communities, smokers, and students with a poorer general health status. Furthermore, our findings showed that correlates of PA are domain-specific, and not universal, indicating the importance of domain-specific analysis of PA correlates in future studies.

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RAZINA I KORELATI TJELESNE AKTIVNOSTI U RAZLIČITIM DOMENAMA KOD STUDENATA: REZULTATI TRANSVERZALNOG ISTRAŽIVANJA IZ HRVATSKE

Ovo transverzalno istraživanje provedeno je s ciljem utvrđivanja povezanosti tjelesne aktivnosti u različitim domenama sa samoprocijenjenim zdravljem, sociodemografskim karakteristikama i obilježjima životnog stila studenata u Hrvatskoj. Podaci su prikupljeni upitnikom na slučajnom uzorku od 1254 studenta, stanara studentskih domova u Zagrebu (62,4% ženskog spola). Tjelesna aktivnost je procijenjena Međunarodnim upitnikom tjelesne aktivnosti (IPAQ), a dodatnim pitanjima prikupljene su informacije o spolu, dobi, godini studija, mjesečnom budžetu, veličini mjesta iz kojega dolaze, pušenju, konzumaciji alkohola, indeksu tjelesne mase i samoprocijenjenom zdravlju. Prevalencija nedovoljne razine tjelesne aktivnosti iznosila je 28,4% (95% CI: 25,1–31,7) među studenticama i 28,8% (95% CI: 24,6–33,1) među studentima, pri čemu razlika između spolova nije bila statistički značajna ($p=0,867$). Studenti su bili statistički značajno aktivniji u domeni slobodnog vremena,

a studentice u domeni kućanstva ($p<0,001$). Multiplom regresijskom analizom utvrđeno je da viša razine tjelesne aktivnosti u slobodnom vremenu obilježava muške studente (parcijalna korelacija [$r_{X,Y,Z}$]=0,06; $p=0,040$), nepušače ($r_{X,Y,Z}=-0,07$; $p=0,028$) te studente viših godina studija ($r_{X,Y,Z}=0,09$; $p=0,003$), iz većih naselja ($r_{X,Y,Z}=0,08$; $p=0,010$) i više razine samoprocijenjenog zdravlja ($r_{X,Y,Z}=0,13$; $p<0,001$) (multipla korelacija=0,23; $p<0,001$). Visoki udio studenata s nedovoljnom razinom tjelesne aktivnosti upućuje na potrebu za strateškim djelovanjem kojemu je cilj unapređenje/promjena takvog ponašanja. Javno-zdravstvene intervencije za povećanje razine tjelesne aktivnosti trebale bi se fokusirati prvenstveno na pušače, studentice, studente nižih godina studija, one iz manjih mjesta i one s nižom razinom samoprocijenjenog zdravlja.

Ključne riječi: tjelesna aktivnost, vježbanje, fakultet, IPAQ duga verzija