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PHYSICAL ACTIVITY ANALYSIS AND COMPARISON OF FEMALE STUDENTS IN URBAN AND RURAL SECONDARY SCHOOLS IN SLOVAKIA

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Abstract Our study aimed to assess and compare the physical activity levels of female students in urban and rural secondary schools in Slovakia, given the well-established health benefits of regular physical activity and the recognized risks of a sedentary lifestyle. Using a short version of the International Physical Activity Questionnaire delivered online via Google Forms, we gathered data from 1271 female students, averaging 17.34 years old, attending the final year of grammar and secondary vocational schools in specific Slovak regions. After categorizing participants based on their residence, statistical analyses, including two-sample t-tests and chi-square tests, were employed with a significance level set at $p < 0.01$ or $p < 0.05$.

Unexpectedly, participants residing in towns with over 30,000 inhabitants exhibited the highest levels of physical activity, yet they also spent the most time sitting during the week (354.69 minutes on average). Statistical significance was found in only two instances at the $p < 0.05$ level: walking physical activity between the first and second group and vigorous physical activity between the second and third group. These findings shed light on the nuanced relationship between residence and physical activity levels among female students in Slovakia.

Key words: IPAQ, physical activity, school

Introduction

As simple as it may sound, being physically active might be the very thing most people from across the world need to significantly change their lives for better. The last few decades have proven that sedentary lifestyle and physical inactivity are two of the leading causes of chronic diseases (Booth et al., 2012). It has gotten exponentially easier to become physically inactive in modern days. Many jobs are remote, as people can work comfortably

from home, there is no need to cook as everything can be ordered in mere seconds via our smartphones, and the whole world can be seen on the screen of a computer. Today, we can find numerous studies pointing out the health impacts of the ongoing decline in physical activity and increase in sedentary lifestyles (Guthold et al., 2018). The World Health Organization is amongst the loudest advocates for the idea of physical activity increasement in all the age groups. According to WHO, up to 6-10% of chronic disease and premature deaths are connected to physical inactivity (Booth et al., 2012). Looking at a survey with 1.9 million respondents, physical inactivity is prevalent in wide regions of the world: Africa (27.5%), America (43.3%), Europe (34.8%), Southeast Asia (17%) and Western Pacific (33.7%) (Guthold et al., 2018). As a response to concerning increasement of physical inactivity, WHO has introduced its global action plan on physical activity 2018 – 2030 called ''More Active People for a Healthier World'' (WHO, 2019). This plan targets a 15% reduction in the global prevalence of physical inactivity in adults and adolescents by 2030 (WHO, 2019). Creating active societies, active environments, active people, and active systems are four main objectives of this plan (WHO, 2019).

Noncommunicable diseases (NCDs) are usually long-lasting diseases of slow progression and there are four main types that are directly connected to physical inactivity: cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes (Reiner et al., 2013). Physical inactivity combined with excessive smoking, consumption of unhealthy food, too much alcohol, and an unhealthy lifestyle in general, are the primary reasons for most NCDs (Hu, 2012; Ambrose & Barua, 2004). Increased levels of physical activity and physical fitness have positive effect on our cardiovascular system. The relative risk of dying from a cardiovascular disease is reduced by 25–30% with regular exercise (Macera et al., 2003). Regular exercises reduce all risks of premature death (Warbuton et al., 2006). Exercise is associated with a 20–30% reduction in the incidence of breast cancer in women and a 30–40% reduction in colon cancer in both sexes (Lee, 2003). It is believed that one in 10 deaths could be avoided, had the person been more physically active (Lee et al., 2012). Overall benefits of exercise apply to all bodily systems including cardiovascular, musculoskeletal, respiratory, hormonal, and psychological (Sellami et al., 2018).

As recommended by WHO, adults aged 18–64 years should do at least 150–300 minutes of physical activity with moderate intensity or at least 75–150 minutes of physical activity with vigorous intensity throughout the week. This physical activity should also involve muscle-strengthening activities at moderate or greater intensity that involve all major muscle group for a period of 2 days a week. In addition to physical activity, adults should work on decreasing time spent being sedentary (WHO, 2022).

Decreasing physical activity and increasing sedentary time in Europe are concerning issues. The Special Eurobarometer 525 on Sport and Physical Activity (2022) reports that 45% of Europeans never exercise or engage in physical activity. This figure shows a stabilization compared to previous surveys, such as the 2018 Eurobarometer.

A group of experts developed the EU Physical Activity Guidelines aiming to increase physical activity across the EU (European Commission, 2008). In 2014, World Health Organization in cooperation with the European Commission established the EU Physical Activity Points Network, to work on changing the ongoing decline in physical activity (WHO, 2015).

Material & Methods

Pursuant to the research objective, the focal group encompassed female adolescents enrolled in the final year (4th year) of grammar and vocational secondary schools in the regions of Banská Bystrica and Zvolen, Slovakia. The data collection and questionnaire responses were conducted between April and May 2023. To ensure

a purposeful selection of the target population, the recruitment methodology was periodically adjusted, taking into account factors such as age, gender, and academic year. The criteria for inclusion in the survey group were as follows: a) gender; b) the survey group comprising students from the same academic year in secondary school. To meet the goals of our study, we utilized a condensed version of the International Physical Activity Questionnaire (IPAQ), which consisted of a series of seven questions. The questionnaire was created online using Google Forms. Subjects were enlisted via the Edupage school information system and physical education teachers. The research adhered to the General Data Protection Regulation (GDPR). The study's protocol underwent evaluation and approval from both the physical education teachers of the enrolled students and the principals of the schools attended by the students. Each participant granted verbal consent to partake in the study after reviewing the participant information sheet and demonstrating a satisfactory comprehension of the presented questions. The questionnaire was administered anonymously to ensure the confidentiality of participants' responses.

Data analysis

Statistical analysis in this study was carried out using SPSS (Statistical Packe for the Social Sciences). Summary statistics were computed to describe the characteristics of the study participants, while chi-square tests were applied to investigate associations between categorical variables. Additionally, independent samples t-tests were utilized for analyzing continuous variables. A significance level of $\alpha = 0.05$ and $\alpha = 0.01$ was set for statistical tests were apliable.

Upon satisfying the criteria for inclusion in the survey group, a total of 1271 female students from grammar and vocational secondary schools were incorporated into the process of interpreting the study data. The study group was divided into three groups according to the size of population of a town or village, where the schools they attend are located: a) a village with less than 5,000 inhabitants (n = 511), b) a small town with more than 5,000, but less than 30,000 inhabitants (n = 313), c) a town with more than 30,000, but less than 100,000 inhabitants (n = 446).

Table 1. Characteristics of the survey group of grammar and vocational school female students

Survey group characteristics	Village × < 5000 inhabitants	Small town 5,000 < × > 30,000 inhabitants	Town with × > 30,000 inhabitants	Overall
Age	17.14	17.30	17.60	17.34
Number of participants	511	313	446	1271

Scoring and data reduction

The data acquired from the questionnaire were transformed into Metabolic Equivalent of Task (MET) units, specifically MET-minutes per week. The calculation of MET-minutes per week involved multiplying the number of minutes engaged in physical exercise per day by the number of exercise sessions per week and then by the corresponding MET coefficient for the intensity level of the physical activity. For instance, vigorous physical activity had a MET coefficient of 8, moderate physical activity had a coefficient of 4, and walking had a coefficient of 3.3. The MET coefficient, which reflects the intensity of exercise, is an indicator of a person's oxygen consumption during physical activity compared to their resting oxygen consumption. Subsequently, survey participants were categorized into three distinct groups using the following criteria:

1. High physical activity – for the classification of high physical activity, individuals were considered to be in this category if they engaged in vigorous physical exercise for three or more days, accumulating a minimum of 1,500 MET-minutes per week. Alternatively, individuals who participated in any combination of vigorous exercise, moderate exercise, and walking for seven or more days, reaching a total of over 3,000 MET-minutes per week, were also classified as having high physical activity.
2. Moderate physical activity – to be classified as engaging in moderate physical activity, individuals needed to meet one of the following criteria: three or more days of vigorous physical exercise, with each session lasting at least 20 minutes; or five or more days of moderate exercise or walking, with each session lasting at least 30 minutes; or five or more days of a combination of vigorous exercise, moderate exercise, and walking, resulting in a total of over 600 MET-minutes per week.
3. Low physical activity – low physical activity refers to a lack of adherence to the criteria for moderate or high physical activity classifications, indicating an accumulation of less than 600 MET-minutes per week.

Results

The first section of our findings examines the participants' general levels of physical activity. As seen in figure 1, females from towns with more than 30,000, but less than 100,000 inhabitants engaged in high physical activity the most, which was a surprising result as we expected the females from the smallest villages to dominate this category. On the other hand, we can see a contrast in the fact that females from the towns with the highest population have also engaged in the low physical activity the most. The highest percentual difference in moderate physical activity levels that have not exceeded 600 MET-minutes per week can be seen between the females from small towns (more than 5,000, but less than 30,000 inhabitants) and those from the towns with more than 30,000 inhabitants. When comparing our results with those from across the world, we've decided to look at female students from Saudi Arabia. On average, 43% were highly active, 28% were moderately active and 29% participated in low levels of physical activity (Aljehani et al., 2022).

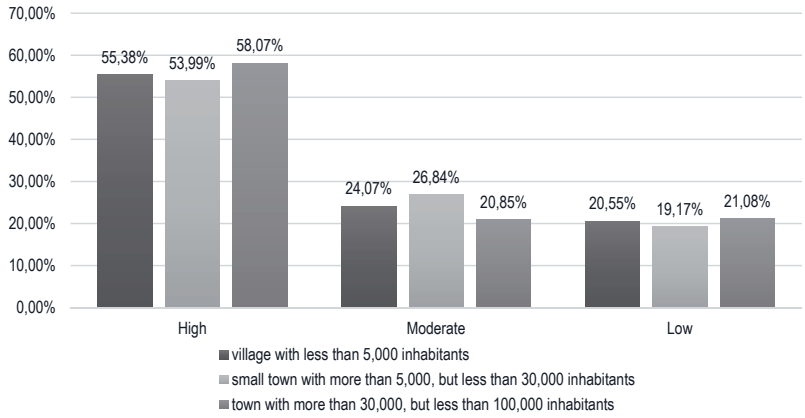

Figure 1. Physical activity levels of female students according to their residence

Table 2. Vigorous intensity level of physical activity of female students attending grammar and vocational schools expressed in MET-minutes/week, time of engagement in physical activity in minutes and days per week

Vigorous intensity	Village × < 5000 inhabitants	Small town 5,000 < × > 30,000 inhabitants	Town with × > 30,000 inhabitants	Overall
Days/week mean	2.20 p > 0.05 (p = 0,569)	2.13 p > 0.05 (p = 0,780)	2.17 p < 0.01 (p = 0,759)	2.17
Time/min median	30 p > 0.05 (p = 0,981)	30 p > 0.05 (p = 0,161)	30 p > 0.05 (p = 0,184)	30
Total Mets/week mean	974.79 p < 0.01 (p = 0,147)	870.52 p > 0.05 (p = 0,323)	1050.26 p < 0.05 (p = 0,019)*	975.60
Total Mets/week median	640	640	720	720

Looking at table 2 we can see that the females living in towns with more than 30,000 inhabitants engaged in physical activity with vigorous intensity the most (1050.26 MET-min/week). All of our results were statistically examined for differences that were $p < 0.05$ statistically significant. When comparing the results of MET-min/week between females from small towns with more than 5,000, but less than 30,000 inhabitants and females from towns with more than 30,000 inhabitants, we have found a statistically significant difference at the level of $p < 0.05$ ($p = 0.019$).

Table 3. Moderate intensity level of physical activity of female students attending grammar and vocational schools expressed in MET-minutes/week, time of engagement in physical activity in minutes and days per week

Moderate intensity	Village × < 5000 inhabitants	Small town 5,000 < × > 30,000 inhabitants	Town with × > 30,000 inhabitants	Overall
Days/week mean	2.02 p > 0.05 (p = 0,192)	2.17 p > 0.05 (p = 0,325)	2.12 p > 0.05 (p = 0,705)	2.09
Time/min median	30 p > 0.05 (p = 0,795)	30 p > 0.05 (p = 0,511)	40 p > 0.05 (p = 0,720)	30
Total Mets/week mean	470.87 p > 0.05 (p = 0,887)	476.79 p > 0.05 (p = 0,317)	509.82 p > 0.05 (p = 0,426)	486.01
Total Mets/week median	240	360	360	320

Physical activity with moderate intensity is the least performed PA amongst all our respondents when compared to others. Once again, female students from largely populated areas tend to engage in moderate PA more than their peers from more densely populated areas. Statistical analysis hasn't shown any statistically significant differences amongst the groups. European women aged 15–24 engage in moderate PA on average for 2.57 days a week, which is considerably higher when compared to our respondents – 2.09 days a week (Moreno-Llamas et al., 2022).

Table 4. Walking physical activity of female students attending grammar and vocational schools expressed in MET-minutes/week, time spent walking in minutes and days per week

Walking PA	Village × < 5000 inhabitants	Small town 5,000 < × > 30,000 inhabitants	Town with × > 30,000 inhabitants	Overall
Days/week mean	3.69 >0.05 (p = 0,154)	3.52 p < 0.01 (p = 0,168)	3.84 p < 0.05 (p = 0,011)*	3.70
Time/min median	45 p < 0.01 (p = 0,522)	40 p > 0.05 (p = 0,591)	45 p < 0.01 (p = 0,864)	45
Total Mets/week mean	693.15 p < 0.01 (p = 0,412)	655.91 p < 0.01 (p = 0,687)	709.49 p > 0.05 (p = 0,255)	689.71
Total Mets/week median	495	416	512	495

Walking PA is the most performed PA amongst our participants. Females with different residence performed walking PA almost 4 days a week on average. 15–24 years old females in Europe walk on average 5 days a week, our participants have underperformed in this particular instance, when on average they haven't hit the 4 day mark. After statistical analysis we have found statistically significant differences between the females from small town with more than 5,000 and less than 30,000 inhabitants compared to those living in towns with more than 30,000 on a $p < 0.05$ level ($p = 0.011$).

Table 5. Time spent sitting in minutes (sedentary lifestyle measurement)

Time spent sitting	Village × < 5000 inhabitants	Small town 5,000 < × > 30,000 inhabitants	Town with × > 30,000 inhabitants	Overall
Time/min mean	354.03	341.88	354.69	351.27
Time/min median	360 p > 0.05 (p = 0,316)	360 p > 0.05 (p = 0,951)	360 p > 0.05 (p = 0,280)	360

Looking at table 5, we can see that female students from small towns with less than 30,000, but more than 5,000 inhabitants spent the least time sitting during the week compared to their counterparts from villages or larger towns. Median sitting time for adults in Europe reported by Loyen et al. (2016) was 300 minutes a week, our female students spent on average one more hour a week sitting, which is quite concerning. Statistical analysis has not shown any significant statistical difference in between groups of our students.

Discussion

Walking PA is the most spread physical activity worldwide. As it stands, it has been the most popular PA amongst our survey participants. Bauman et al. (2009) have screened more than 50,000 people aged 18–65 from 20 different countries. According to their results, it was only countries from Asia (Hong Kong, China) whose weekly MET consisted of more than 50% walking PA. When we compare the results of all the countries, walking PA contributed to only 20% of total weekly MET. Walking as a physical activity is recommended by numerous scholars (Ungvari et al., 2023). Scholars agree that with increased time spent walking a person can reduce risk of cardiovascular diseases, depression, stress, and even prevent strokes and treat anxiety. When we look at different

studies, from Germany for example, their female students have scored almost double of what our participants have – 3,636 MET-minutes/week (Edelmann et al., 2022).

As it stands, overall PA worldwide needs to be increased and there have already been numerous propositions on how we should it. Positive encouragement, health promotion, creating healthy working environment, surrounding ourselves with people, who are active are one of many of the steps a person can take on their path towards healthy lifestyle and increased physical activity (Tuso, 2015).

Sedentary lifestyle is associated with various health risks such as type 2 diabetes, depression or even cancer (Mclaughlin et al., 2020). According to Egan et al. (2019) adolescents spend 50% of their days sedentary and on average during school days this time reaches 63%. Our study participants sedentary behaviour showed signs of worsening when compared to the same age European median. As it stands now, there are multiple actions being made to decrease sedentary behaviour and physical inactivity in workplace (Dieterich et al., 2020). Other studies have shown that a decrease in sedentary behaviour in students can have a positive impact on their academic performance, sleep, or mental development (Pilcher et al., 2017).

Increasing PA is one of the most effective ways of starting to live a healthy lifestyle. As we have proven in this paper, sport and physical activity in general are not only natural, but also essential for us as human beings. In general, older we get, more physically inactive we are (King et al., 2009). Healthy lifestyle is more associated with women, more developed countries and better educated individuals. Good education, correct sources and right leadership allow not only us, but also our children to lead a healthy lifestyle and develop correctly both physically and mentally. Guthold et al. (2018) connect physical inactivity with less developed and poorer countries. According to polish researchers Iwon et al. (2021) it is the Scandinavian countries (Finland, Sweden and Denmark), who are amongst the leaders in physical activity in the world, on the other hand countries like Bulgaria and Greece are amongst the least active people in the world. Aljehani et al. (2022) reported that female students from Saudi Arabia spent median of 30 minutes a week engaging in vigorous PA, which is the same as our participants. Although when looking at total MET/week median, their female students reported a score of 240 compared to our female students score of 720. When we look at the results of Aljehani et al. (2022), again we can say that their participants have spent more median time engaging in moderate PA (60 minutes a week) than our participants (30 minutes a week). Female students from Saudi Arabia are also outperforming our participants, when showing slightly better results at 693 MET-minutes/week on average compared to our 689.71. Our findings are also being compared to those of Llamas et al. (2022), who conducted a screening of results from various parts of Europe. European females aged 15–24 reportedly walk an average of 5 days per week, but our participants have fallen short, averaging less than 4 days weekly in this regard.

Conclusion

Our study was conducted with use of widely used International Physical Activity Questionnaire (IPAQ). It has been widely adopted and used in numerous global and European surveillance programs and is considered as one of the most utilized validated physical activity questionnaires. Furthermore, the Eurobarometer incorporates questions from this PAQ, making it a crucial resource for decision-making within the European Union (Sember et al., 2020).

The mean sum of total physical activity interpreted in MET-minutes/week of our female participants was 2151.32. Comparing these results with female students from Saudi Arabia, we can state that our participants slightly overperformed their counterparts from the Middle East by 117.32.

According to a study by Loyen et al., (2016) average sitting time across European countries in the age group of 18–24 years old is a median of 300 minutes a day. Comparing that number with our results, we can see that all our surveyed groups have spent 60 more minutes or one hour a day more than that. Looking at these results, we can conclude that after 7 years since the original article has been published, we are moving closer to physical inactivity.

Physical inactivity as a fast-spreading phenomenon has lately been on raise as not so long ago, we as humanity have witnessed another pandemic (COVID-19) and once again locked ourselves in our homes and not exercised as much as before. It's been more than 3 decades since WHO issued its first recommendations for sufficient exercise and thus trying to increase physical activity. Considering the latest global estimates revealing that a significant proportion of the population falls short of meeting the recommended guidelines for aerobic exercise, with approximately 27.5% of adults and a staggering 81% of adolescents failing to do so, there arises an immediate and pressing necessity to enhance levels of physical activity.

In our study, we have demonstrated substantial variations in physical activity levels based on gender and a comparison of different nationalities. Hence, it can be inferred that these activity levels also differ according to culture and nationality. This research holds the potential to inform students about their own physical activity levels, offer guidance on methods to enhance them, specify the recommended duration of active engagement for maintaining good health, and potentially facilitate a comparison between students of the same age from diverse countries.

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