Physical Activity of Croatian Population: Cross-sectional Study Using International Physical Activity Questionnaire

**Aim** To determine the physical activity level of the Croatian population in different domains of everyday life.

**Methods** A random stratified sample of 1032 Croatians aged 15 years and older was interviewed using the official Croatian long version of the International Physical Activity Questionnaire (IPAQ). Total physical activity and physical activity in each of the 4 life domains – work, transport, domestic and garden, and leisure-time – were estimated. Physical activity was expressed as metabolic equivalent-hours per week (MET-hour/week).

**Results** Median total physical activity for the whole sample was 58.2 MET-hour/week. Median physical activity in MET-hour/week was 30.4 for work, 5.0 for transportation, 13.1 for domestic and garden, and 6.0 for leisure-time domain. The lowest physical activity was found in the 15-24 age group (42.7 MET-hour/week) and the highest in the 55-64 age group (72.0 MET-hour/week). Multiple regression analysis showed a significant relationship of socio-demographic and health-related characteristics (size of settlements, household income, educational level, age, body mass index, self-rated physical health, and self-rated mental health) with physical activity in all domains ($P < 0.001$).

**Conclusion** Studies on physical activity in transition countries should include the domains of work and domestic and garden, since if only leisure-time domain is examined, the total physical activity level could be underestimated. As the lowest physical activity was reported by adolescents and young adults, strategies for increasing physical activity in this age group should be developed.
Insufficient physical activity is related to the progress of different diseases (1-11), causing 1.9 million premature deaths per year globally (12). Furthermore, physical activity is closely related to mental health and well-being (13-17). Therefore, many strategies for promoting physical activity have been developed and implemented, such as “Global Strategy of Diet, Physical Activity and Health” (18) and “Healthy People 2010” (19). The development of these strategies created a need for standardization of physical activity measurements, which would allow the comparison between different studies from different countries. Although, there is no internationally accepted measure of physical activity (12), International Physical Activity Questionnaire (IPAQ) is widely used in physical activity studies across the world (20). The long form of IPAQ measures frequency, duration, and intensity of physical activity in 4 domains of life: work, transport, domestic and garden, and leisure-time. Studies have shown an acceptable validity and reliability of IPAQ for use in population-based studies of physical activity (21,22).

Although in the European Union and other developed countries a number of population-based studies on physical activity have been conducted, in transition European countries, such as Croatia, there is a lack of such data. In Croatia, there have been some studies on the prevalence of physical inactivity (23,24), but there has been no quantitative data on physical activity, especially with physical activity expressed as metabolic units (MET), which are the units that enable comparison between the studies. To the best of our knowledge, there has been no population-based study in Croatia which examined all 4 domains of physical activity. The aim of our study was to determine physical activity levels in a representative sample of Croatian population aged 15 years and older, using the long form Croatian version of IPAQ.

MATERIALS AND METHODS

Sample

The study was conducted in November 2007 on a random sample of Croatian inhabitants aged 15 years or older who lived in private households. The sample did not include people who lived in institutions (hospitals, nursing homes, etc.). The latest official 2001 census was used as a database for the selection of participants. The survey was conducted on a total of 1076 individuals. We used a double-stage stratified sample and the stratification was performed according to regions (6 Croatian regions) and the size of settlements (4 categories: less than 2000 inhabitants; 2001-10 000; 10 001-100 000; more than 100 000 inhabitants). Households included in the survey, as well as participants within each selected household, were chosen randomly in the following way: 1) selection of cities and villages where the surveying was going to take place; 2) random selection of the starting point in each city/village; 3) random selection of households; 4) random selection of a participant within the household. If the members of the selected household refused to take part in the study or were not at home, the household with the next house number was selected. The interviewers collected the data on sex and date of birth of all the members of the household, starting from the oldest to the youngest. The first household members, 15 years old or older, who had birthday after the date of the survey was included in the sample. If the selected household member was not at home at the time, the interviewers tried to arrange the next possible date for an interview. If the interview could not be arranged, the interviewers repeated the procedure in the household with the next house number. The interviews were held in the afternoon hours during weekdays or at weekends.

All participants had given their written consent for participating in the research before they were interviewed. According to data cleaning rules (25), 44 participants were excluded from further analyses, so the final sample included 1032 participants. The study protocol was approved by Scientific and Ethics Committee of Faculty of Kinesiology, University of Zagreb.

Measures in instruments

For estimating the level of physical activity, the official long form Croatian version of IPAQ was used. For the purpose of this study, the original English version of IPAQ was translated to Croatian and a pilot study was carried out in the Croatian population according to the official IPAQ procedure (25). The questionnaire consists of 27 questions that cover 4 domains of physical activity (work, transport, domestic and garden, and leisure-time) and time spent sitting. The items in IPAQ are structured to provide separate domain-specific scores for walking, moderate-intensity, and vigorous-intensity activity. All questions refer to the previous 7 days. The results were presented as the estimation of energy expenditure in metabolic equivalent-minutes per week (MET hours/week). According to IPAQ scoring protocol (25), MET hour/week of specific activity (walking or moderate intensity activity or vigorous intensity activity) is computed by multiplying MET value of particular activity (3.3 for walk-
ing, 4.0 for moderate intensity activity, and 8.0 for vigorous intensity activity) with hours spent in that particular activity (eg, walking MET-minutes/week at work = 3.3 x walking hours x walking days at work). To calculate physical activity scores, only the activities lasting at least 10 minutes at the time were taken into account. Algorithms for calculating the continuous physical activity scores were used to estimate physical activity based on participants’ answers (25). Total physical activity score was calculated, as well as separate scores for each of the 4 physical activity domains (25).

To investigate the parameters associated with physical activity, the following variables were additionally used: size of settlement, household income, educational level, body mass index (BMI, calculated using self-reported weight and height), and self-rated physical and mental health. Self-rated health was assessed using short-form health survey SF-36 (26). Summary measures of physical and mental health were calculated according to Ware et al (26).

### Data analysis

Normality of distributions of variables was tested by Shapiro-Wilk W-test. Median, 95% confidence interval (CI) for median, and interquartile range were calculated for each domain of physical activity separately, as well as for total physical activity, for 6 age groups of participants (age: 15-24, 25-34, 35-44, 45-54, 55-64, and 65 and older). Differences between age groups in physical activity were tested using Kruskal-Wallis ANOVA. The analyses were performed on the total sample of participants and separately for men and women. Sex differences in physical activity were tested using Kruskal-Wallis ANOVA. Additionally, least squares multiple regression was conducted in order to identify socio-demographic and self-rated health factors related to physical activity level. In the regression model, we used size of settlement (4 categories: fewer than 2000; 2001-10,000; 10,001-100,000; 100,000 inhabitants and more), household income, educational level (5 categories: 8 years and fewer, 9-12 years, 13-14 years, 15-18 years, 19 years and more), BMI (absolute values), and self-rated physical (scores: 0-100) and mental health (scores: 0-100) as independent variables. Furthermore, we used each of the 4 physical activity domain scores and total physical activity score as dependent variables. Since all physical activity variables were right-skewed and therefore not normally distributed, we conducted multiple regression based on Spearman rank correlation coefficients. The level of significance for all analyses was set at $P < 0.05$. Statistical analyses were performed by STATISTICA software, version 7.1 (StatSoft Inc., Tulsa, OK, USA).

### RESULTS

The sample included a total of 1032 participants (500 men and 532 women). The median (95% CI) of total physical activity for the whole sample was 58.2 (52.9-63.5) MET-hour/week (Table 1). Participants aged 55 to 64 years had the highest total physical activity score (72.0 [56.5-87.5] MET-hour/week), while participants aged 15 to 24 years had the lowest (42.7 [37.2-48.2] MET-hour/week). Croatian people are physically very active at work (30.6 [23.7-39.1] MET-hour/week) and in the domestic and garden domain (13.1 [11.6-14.6] MET-hour/week), as opposed to transportation (5.0 [4.3-5.6] MET-hour/week) and leisure (6.0 [5.2-6.8] MET-hour/week). In the domestic and garden domain, physical activity scores increased with age, so the lowest were reported by participants aged 15 to 24 (4.5 [3.0-6.0])

### TABLE 1. Physical activity in metabolic equivalents-hours per week (MET-hours/week) reported by participants aged 15 y and older (n = 1032) and test of differences between age groups

<table>
<thead>
<tr>
<th>Age</th>
<th>work</th>
<th>transport</th>
<th>domestic and garden</th>
<th>leisure</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-24</td>
<td>39.8 (23.2-56.4)</td>
<td>179</td>
<td>6.6 (5.3-8.0)</td>
<td>12.1</td>
<td>4.5 (3.0-6.0)</td>
</tr>
<tr>
<td>25-34</td>
<td>28.5 (10.8-46.2)</td>
<td>800</td>
<td>3.3 (1.8-4.8)</td>
<td>11.0</td>
<td>12.0 (9.1-14.9)</td>
</tr>
<tr>
<td>35-44</td>
<td>40.0 (13.1-66.9)</td>
<td>98.4</td>
<td>3.3 (2.0-4.7)</td>
<td>9.9</td>
<td>15.5 (11.3-19.7)</td>
</tr>
<tr>
<td>45-54</td>
<td>179 (6.1-29.7)</td>
<td>35.3</td>
<td>5.0 (3.2-6.7)</td>
<td>13.6</td>
<td>21.0 (18.1-23.9)</td>
</tr>
<tr>
<td>55-64</td>
<td>40.7 (21.4-60.0)</td>
<td>60.0</td>
<td>5.5 (3.3-7.7)</td>
<td>18.0</td>
<td>24.0 (18.1-29.9)</td>
</tr>
<tr>
<td>&gt;64</td>
<td>4.6 (2.1-7.0)</td>
<td>16.2</td>
<td>36.4 (23.2-49.6)</td>
<td>50.6</td>
<td>1.7 (0.0-6.6)</td>
</tr>
<tr>
<td>Overall</td>
<td>30.6 (23.7-39.1)</td>
<td>58.4</td>
<td>5.0 (4.3-5.6)</td>
<td>13.4</td>
<td>13.1 (11.6-14.6)</td>
</tr>
</tbody>
</table>

* Median for MET-hours/week calculated according to International Physical Activity Questionnaire (IPAQ) scoring protocol (25).
† Confidence interval (CI) for medians calculated based on the method proposed by Bonett and Price (27).
‡ Interquartile range (IQR) in MET-hours/week calculated according to IPAQ scoring protocol (25).
§ Kruskal-Wallis ANOVA.
MET-hour/week) and the highest by participants aged 65 and older (36.4 [23.2-49.6] MET-hour/week).

Collected data were separately analyzed for male (Table 2) and female (Table 3) participants. The group of male participants aged 35 to 44 showed the highest total physical activity score (80.8 [51.6-109.9] MET-hour/week) and the highest physical activity score at work-place (61.0 [27.2-94.7] MET-hour/week). In the domestic and garden domain, physical activity score in men increased with age, so the lowest was reported by participants aged 15 to 24 (1.5 [0.0-3.0] MET-hour/week) and the highest by participants aged 65 and older (45.0 [22.5-67.5] MET-hour/week).

In the leisure-time domain, men aged 15 to 24 were most physically active (10.2 [5.8-14.6] MET-hour/week), while men aged 65 and older were least physically active (0.0 [0.0-10.2] MET-hour/week). In women, total physical activity and physical activity in domestic and garden domain increased with age. The lowest total physical activity was reported by women aged 15 to 24 (37.2 [32.0-42.4] MET-hour/week) and the highest by women aged 55 to 64 (78.9 [58.5-99.4] MET-hour/week). In the domestic and garden domain, the lowest physical activity was reported by women aged 15 to 24 (6.0 [3.8-8.2] MET-hour/week) and the highest in women aged 65 and older (33.5 [22.8-44.2] MET-hour/week). In total physical activity, there was no significant difference between men and women (P = 0.108) (Table 4). Comparison of physical activity by sex through the domains revealed much higher physical activity at work in male participants (46.2 [32.3-60.1] MET-hour/week vs. 16.5 [9.5-23.5] MET-hour/week for women, P > 0.001).

On the other hand, women were more active than men in the domestic and garden domain (17.5 [15.2-19.8] MET-

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### Table 2: Physical activity in metabolic equivalents-hours per week (MET-hours/week) reported by male participants aged 15 y and older (n = 500) and test of differences between age groups

<table>
<thead>
<tr>
<th>Age</th>
<th>Work</th>
<th>transport</th>
<th>domestic and garden</th>
<th>leisure</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-24</td>
<td>49.1 (170.8-1.1)</td>
<td>39.6</td>
<td>6.3 (3.7-8.9)</td>
<td>12.6</td>
<td>1.5 (0.0-3.0)</td>
</tr>
<tr>
<td>25-34</td>
<td>48.2 (13.8-82.6)</td>
<td>133.5</td>
<td>2.2 (0.7-3.8)</td>
<td>9.9</td>
<td>8.4 (3.2-13.5)</td>
</tr>
<tr>
<td>35-44</td>
<td>61.0 (27.2-94.7)</td>
<td>117.5</td>
<td>2.2 (0.0-4.7)</td>
<td>11.6</td>
<td>9.5 (4.4-14.6)</td>
</tr>
<tr>
<td>45-54</td>
<td>10.8 (0.0-31.0)</td>
<td>32.0</td>
<td>3.3 (0.0-6.7)</td>
<td>16.5</td>
<td>19.0 (14.5-23.5)</td>
</tr>
<tr>
<td>55-64</td>
<td>46.2 (7.9-84.5)</td>
<td>1090</td>
<td>3.6 (1.4-5.9)</td>
<td>11.6</td>
<td>13.5 (5.3-21.7)</td>
</tr>
<tr>
<td>&gt;64</td>
<td>5.0 (0.0-15.2)</td>
<td>23.1</td>
<td>4.5 (0.0-65.7)</td>
<td>51.0</td>
<td>0.0 (0.0-10.2)</td>
</tr>
<tr>
<td>Overall</td>
<td>46.2 (32.3-60.1)</td>
<td>85.0</td>
<td>3.3 (2.6-4.0)</td>
<td>14.2</td>
<td>9.3 (6.7-11.8)</td>
</tr>
<tr>
<td>P</td>
<td>&lt;0.001</td>
<td>0.040</td>
<td>&lt;0.001</td>
<td>0.002</td>
<td>0.133</td>
</tr>
</tbody>
</table>

* Median in MET-hours/week calculated according to International Physical Activity Questionnaire (IPAQ) scoring protocol (25).
† Confidence interval (CI) for medians calculated based on the method proposed by Bonett and Price (27).
‡ Interquartile range (IQR) in MET-hours/week calculated according to IPAQ scoring protocol (25).
§ Kruskal-Wallis ANOVA.

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### Table 3: Physical activity in metabolic equivalents-hours per week (MET-hours/week) reported by female participants aged 15 y and older (n = 532) and test of differences between age groups

<table>
<thead>
<tr>
<th>Age</th>
<th>Work</th>
<th>transport</th>
<th>domestic and garden</th>
<th>leisure</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-24</td>
<td>24.5 (2.8-46.1)</td>
<td>4.8</td>
<td>6.6 (4.8-8.5)</td>
<td>10.2</td>
<td>6.0 (3.8-8.2)</td>
</tr>
<tr>
<td>25-34</td>
<td>3.3 (0.0-12.4)</td>
<td>31.8</td>
<td>5.5 (3.9-7.1)</td>
<td>13.2</td>
<td>13.5 (10.4-16.6)</td>
</tr>
<tr>
<td>35-44</td>
<td>24.8 (1.0-48.6)</td>
<td>87.6</td>
<td>4.4 (2.8-6.0)</td>
<td>9.9</td>
<td>21.0 (15.5-26.5)</td>
</tr>
<tr>
<td>45-54</td>
<td>20.3 (6.0-34.6)</td>
<td>41.7</td>
<td>6.1 (4.1-8.0)</td>
<td>9.9</td>
<td>24.5 (19.5-29.6)</td>
</tr>
<tr>
<td>55-64</td>
<td>33.0 (9.9-56.2)</td>
<td>33.0</td>
<td>6.7 (4.0-9.4)</td>
<td>20.4</td>
<td>30.0 (13.6-40.4)</td>
</tr>
<tr>
<td>&gt;64</td>
<td>4.1 (1.1-72.3)</td>
<td>10.5</td>
<td>3.3 (2.2-44.2)</td>
<td>50.3</td>
<td>1.7 (0.0-7.8)</td>
</tr>
<tr>
<td>Overall</td>
<td>16.5 (9.5-23.5)</td>
<td>40.6</td>
<td>5.5 (4.7-6.3)</td>
<td>12.0</td>
<td>17.5 (15.2-19.8)</td>
</tr>
<tr>
<td>P</td>
<td>&lt;0.001</td>
<td>0.033</td>
<td>&lt;0.001</td>
<td>0.013</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

* Median in MET-hours/week calculated according to International Physical Activity Questionnaire (IPAQ) scoring protocol (25).
† Confidence interval (CI) for medians calculated based on the method proposed by Bonett and Price (27).
‡ Interquartile range (IQR) in MET-hours/week calculated according to IPAQ scoring protocol (25).
§ Kruskal-Wallis ANOVA.
hour/week vs 9.3 [6.7-11.8] MET-hour/week, \(P < 0.001\)). In the transport domain, women were also somewhat more active (5.5 [4.7-6.3] MET-hour/week) than men (3.3 [2.6-4.0] MET-hour/week, \(P < 0.001\)). In the leisure-time domain, men and women reported almost identical physical activity (6.0 [5.2-6.8] MET-hour/week vs 6.0 [4.3-7.7] MET-hour/week, \(P = 0.907\)).

Multiple regression analyses (Table 5) showed a significant relationship between socio-demographic and health-related characteristics with physical activity in all domains. The coefficient of multiple determination varied from 0.03 for physical activity in transport domain and work domain to 0.19 for physical activity in domestic and garden domain. Total physical activity was positively related to age and inversely related to the size of settlements. Physical activity in work domain was also inversely related to the size of settlements. Furthermore, physical activity in transport domain was inversely related to BMI and household income, while physical activity in domestic and garden domain was positively related to age and inversely related to the size of settlements and educational level. Finally, physical activity in leisure-time domain was positively related to the size of settlements, household income, and self-perceived mental health, while it was inversely related to BMI.

**DISCUSSION**

Our study showed that total physical activity in the representative sample of Croatian population was 58.2 MET-hour/week, which is equivalent to approximately 3 hours of moderate or one and a half hour of vigorous physical activity 5 days a week. This means that the majority of respondents (74%) reached the level of at least 30 minutes of moderate physical activity 5 days a week, which could be considered as the lowest level of physical activity for achieving health benefits (28). However, in most studies recommended levels of physical activity have been determined in relation to leisure-time physical activity, while other domains (work, transport, domestic and garden) were not equally considered (29). Therefore, studies using new integrated approach of determining physical activity throughout 4 domains, as is IPAQ, could find considerably lower levels of physical inactivity.

If we want to compare this study with similar studies conducted in other European countries, we have to bear in mind that the recent studies in the European Union countries used the short version of IPAQ (29,30). Although comparative studies have shown that results obtained by different versions of IPAQ can be compared (21), physical

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**TABLE 4. Differences in physical activity domains and total physical activity (median* (95% CI); IQR) according to sex**

<table>
<thead>
<tr>
<th>Physical activity</th>
<th>Men</th>
<th>Women</th>
<th>(P^*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>46.2 (32.3-60.1); 85.0</td>
<td>16.5 (9.5-23.5); 40.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Transport</td>
<td>3.3 (2.6-4.0); 14.2</td>
<td>5.5 (4.7-6.3); 12.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Domestic and garden</td>
<td>9.3 (6.7-11.8); 32.4</td>
<td>17.5 (15.2-19.8); 37.2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Leisure</td>
<td>6.0 (4.3-7.7); 17.9</td>
<td>6.0 (5.2-6.8); 16.6</td>
<td>0.907</td>
</tr>
<tr>
<td>Total</td>
<td>63.1 (55.4-70.7); 129.1</td>
<td>53.6 (45.7-61.4); 90.4</td>
<td>0.108</td>
</tr>
</tbody>
</table>

*Median in metabolic equivalents (MET)-hours per week calculated according to International Physical Activity Questionnaire scoring protocol (25).
†Confidence interval (CI) for medians calculated based on the method proposed by Bonett and Price (27).
‡Interquartile range (IQR) in MET-hours/week calculated according to IPAQ scoring protocol (25).
§Kruskal-Wallis ANOVA.

**TABLE 5. Results of multiple regression analysis between socio-demographic characteristics and self-rated health (independent variables) and physical activity (PA, dependent variables) – standardized regression coefficients and multiple determination coefficients**

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Work PA</th>
<th>Transport PA</th>
<th>Domestic and garden PA</th>
<th>Leisure PA</th>
<th>Total PA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of settlements</td>
<td>-0.12 (0.001)</td>
<td>0.01 (0.871)</td>
<td>-0.21 (&lt;0.001)</td>
<td>0.10 (0.004)</td>
<td>-0.19 (&lt;0.001)</td>
</tr>
<tr>
<td>Household income</td>
<td>0.04 (0.256)</td>
<td>-0.13 (0.001)</td>
<td>0.06 (0.094)</td>
<td>0.10 (0.010)</td>
<td>-0.03 (0.375)</td>
</tr>
<tr>
<td>Educational level</td>
<td>-0.07 (0.070)</td>
<td>0.01 (0.707)</td>
<td>-0.09 (0.007)</td>
<td>0.06 (0.097)</td>
<td>-0.08 (0.022)</td>
</tr>
<tr>
<td>Age</td>
<td>0.02 (0.730)</td>
<td>-0.04 (0.433)</td>
<td>0.34 (&lt;0.001)</td>
<td>0.00 (&gt;0.950)</td>
<td>0.12 (0.009)</td>
</tr>
<tr>
<td>Body mass index*</td>
<td>0.06 (0.124)</td>
<td>-0.10 (0.016)</td>
<td>-0.06 (0.117)</td>
<td>-10 (&lt;0.013)</td>
<td>0.00 (&gt;0.950)</td>
</tr>
<tr>
<td>Self-rated physical health*</td>
<td>-0.02 (0.704)</td>
<td>-0.09 (0.028)</td>
<td>-0.05 (0.161)</td>
<td>0.08 (0.038)</td>
<td>-0.07 (0.054)</td>
</tr>
<tr>
<td>Self-rated mental health†</td>
<td>0.06 (0.131)</td>
<td>0.07 (0.061)</td>
<td>-0.02 (0.510)</td>
<td>0.16 (&lt;0.001)</td>
<td>0.08 (0.026)</td>
</tr>
<tr>
<td>Multiple determination (R^2, P)</td>
<td>0.03 (&lt;0.001)</td>
<td>0.03 (&lt;0.001)</td>
<td>0.19 (&lt;0.001)</td>
<td>0.10 (&lt;0.001)</td>
<td>0.08 (&lt;0.001)</td>
</tr>
</tbody>
</table>

*Standardized regression coefficient (\(\beta^*\)).
†Body mass index was calculated using self-reported weight and height.
‡Summary measures of self-rated physical and mental health calculated according to Ware et al (26).
§Coefficient of multiple determination.
activity estimated using the long version of IPAQ may be
higher because the short version systematically underes-
timates physical activity level (31), since it consists of few-
er questions (7 questions in the short version compared
with 27 questions in the long version). European Activ-
ity Surveillance System (EUPASS) project encompassed
physical activity research in 8 countries of the European
Union, with the following median physical activity scores:
Belgium – 67.0 MET-hour/week, Finland – 70.2 MET-hour/
week, France – 63.8 MET-hour/week, Germany – 84.5 MET-
hour/week, Italy – 19.6 MET-hour/week, the Netherlands
– 56.4 MET-hour/week, Spain – 39.3 MET-hour/week, and
the Great Britain – 27.6 MET-hour/week (29). Median physi-
cal activity score for all the countries together was 49.5
MET-hour/week (29), which is 8.7 MET-hour/week lower
than the median physical activity score in Croatia. This in-
dicates that the physical activity level in Croatia does not
differ considerably from average physical activity in the Eu-
ropean Union countries.

Total physical activity scores alone do not give us a com-
plete understanding of the physical activity pattern in the
Croatian population. Although total physical activity in
Croatia did not differ from the total physical activity in the
countries of the European Union, we assume that the pat-
tern of physical activity would differ because it has been
shown that living conditions and life-style, especially in
the work domain, depend on the standard of living (32). It
is therefore important to identify the contribution of each
physical activity domain to the total physical activity. For
example, health studies that determine the level of physical
activity only in the domain of leisure, while ignoring
the domain of work, could possibly lead to flawed conclu-
sions. This is supported by the studies that found a cor-
relation of physical activity at work to specific aspects of
health. For example, Norfolk prospective population study
showed a significantly decreased risk of death and cardio-
vascular diseases in persons who were physically active at
work (33) and other studies showed an inverse correlation
between work-related physical activity and cardiovascular
mortality (34,35). Studies that determine only total physi-
cal activity and do not examine physical activity through-
out domains neglect the fact that physical activity in the
domain of leisure and in the domain of work has differ-
ent influence on certain aspects of health. Gutierrez-Fisac
et al (36) found that physical activity at work was not rel-
ated to obesity, while Fung et al (37) found that there
was a relation between physical activity in leisure time
and obesity. Furthermore, Ruzic et al (38) found that
an increased physical activity at work was not relat-
ed to the improvement in physical fitness because it does
not have adequate intensity and duration to affect posi-
tive changes. On the other hand, Tuero et al (39) showed
a positive correlation between physical activity in leisure
time and physical fitness. This was the reason why we ana-
alyzed physical activity of Croatian population in different
life domains.

The distribution of physical activity throughout domains
indicated considerably lower physical activity of Croatian
participants in the domains of leisure-time and transport
than in the domains of work and domestic and garden.
When compared with the domains of work and domes-
tic and garden, the domains of leisure-time and transport
have been more often discussed in studies showing posi-
tive relation between physical activity and health (40,41).
Therefore, the distribution of physical activity throughout
domains in Croatia indicates the importance of creating
physical activity interventions with the emphasis on leisure
time and transportation domain. Our finding that physical
activity scores increase with advancing age are contrary to
our expectations and the results of other studies (42,43).
The highest physical activity was reported by participants
aged 55 to 64 and this was mainly due to high physical
activity in the domains of work and domestic and garden.
This corroborates the assumption that in transition coun-
tries, men of that age still perform physically demanding
work (different kinds of manual labor), while women of
that age traditionally work a lot in the house and in the
garden. On the other hand, young participants (15 to 24
years) reported the lowest physical activity, mainly due to
a very low level of physical activity in the domestic and gar-
den domain. Decreased physical activity in young people
in Croatia was an expected finding, since their workplace
lifestyle is becoming more and more sedentary, which is
similar to the recent trends in the developed countries
(32). Although participants aged 15 to 24 reported the
highest physical activity score in the leisure-time domain,
this was obviously insufficient to increase their total physi-
cal activity scores.

Comparison of physical activity by sex revealed that Croa-
tian men were physically more active than women, which
was in accordance with previous studies (43,44). Addition-
ally, it is important to notice that patterns of physical ac-
tivity were also considerably different for men and wom-
en. Namely, men reported more physical activity at work,
while women reported more physical activity in the dom-
estic and garden domain. These results suggest that it is
necessary to examine both work and domestic and garden
domains if sex differences in the patterns of physical activity are to be discussed.

We found that total physical activity score and physical activity in work domain were inversely associated with the size of settlements, which implies that people who live in smaller settlements are more likely to be physically active. This was mainly due the fact that Croatian people in smaller settlements more often perform physically demanding work as opposed to bigger towns where there are more sedentary jobs. This is in accordance with the study by Sjöström et al (30), who found that people living in large towns were less likely to be sufficiently active than those living in small towns.

Educational level showed the expected inverse associations with the total score of physical activity and positive associations with physical activity in leisure-time domain. People with lower educational level and lower income often perform more physically demanding work and probably do not have enough time and financial resources for leisure-time physical activity. On the other hand, people with higher educational level have more sedentary jobs and tend to be more physically active in leisure-time probably due to greater need for physical activity and greater knowledge about its health benefits. Positive relation of educational level and leisure-time physical activity has also been shown in other studies (30,45). Physical activity in leisure-time domain was also associated with self-rated mental health. These findings are in accordance with the findings of other studies, which suggest that physical activity can be useful in treating and avoiding depressive illnesses, and can be used as a means of reducing stress and anxiety on a daily basis (46).

Regression analysis showed that socio-demographic and health-related characteristics were significantly related to physical activity in different domains, although this relationship was not very strong. These variables explained only from 2% to 8% of the variance in physical activity at different domains. Thus, more parameters, like enjoyment in activities, knowledge of exercise health benefits, barriers to physical activity, social support, and access to sport facilities, should be included in future analyses in order to more comprehensively determine physical activity correlates in Croatia.

The major advantages of this study are the methods used. First, IPAQ is designed in order to standardize measurement of physical activity in different independent studies, so our results are comparable with other physical activity studies based on this widely used questionnaire. Second, the long version of IPAQ allowed us to determine the level of physical activity in each of 4 physical activity domains, which is very important in order to get a complete insight into the pattern of physical activity in transitional countries.

Our study also has several limitations. One of them is the fact that complex nature of physical activity was investigated with the use of self-report questionnaire, which may have led to overreporting of physical activity by participants with low capacity for physical activity, such as the elderly. Although, there are more precise physical activity measures as activity monitors, questionnaires are most often used in population based studies of physical activity. Another limitation of our study is the validity of IPAQ in the elderly (age 65 and older), which has not yet been determined. Therefore, the results for participants in this age group could have differed from the actual results. Our survey was conducted in November, so another possible limitation arises from the assumption that the level of physical activity can vary throughout different seasons. Although Croatia is a typical example of a post-communist country in social and economic transition, generalization of our results on other transitional countries is not completely accurate. Further studies of physical activity in Croatia should investigate differences according to education, personal and household income, size of settlements, and other socio-economic characteristics in order to develop more adequate physical activity promoting strategies.

Based on the comparison with similar data, we may conclude that physical activity in Croatia does not differ considerably from average physical activity in the European Union countries. However, it is necessary to mention that the domains that contributed most to the total physical activity among Croatians were work and domestic and garden. Therefore, studies of physical activity in transition countries should include the domains of work and domestic and garden, because if only leisure-time domain is examined, physical activity level could be notably underestimated. Moreover, for a more complete insight into the pattern of physical activity, studies in transition countries should separately analyze each physical activity domain. It is important to emphasize that the lowest level of physical activity was reported by participants aged 15 to 24 years. Therefore, strategies for increasing physical activity in Croatia should mostly be aimed at the population of adolescents and young adults.
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