ORIGINAL PAPER

International Journal of Occupational Medicine and Environmental Health 2014;27(3):487–497
http://dx.doi.org/10.2478/s13382-014-0282-8

PATTERNS AND CORRELATES OF PHYSICAL ACTIVITY AMONG MIDDLE-AGED EMPLOYEES: A POPULATION-BASED, CROSS-SECTIONAL STUDY

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Abstract
Objectives: The purpose of this study was to determine the level, pattern and correlates (socio-demographic, lifestyle and work-related) of physical activity among middle-aged employees in Croatia. **Material and Methods:** In this cross-sectional study the data were collected using a household interview on a random sample of 766 middle-aged employees (52% female) living in Croatia. The International Physical Activity Questionnaire (IPAQ-long) was used to assess physical activity. An additional questionnaire was used to collect data on socio-demographic, lifestyle and work-related correlates. **Results:** The median (95% CI) total physical activity for the whole sample was 78.7 (69.1–88.3) MET-hours/week. Most physical activity was accumulated in the domain of work (26.4 (20.3–32.5) MET-hours/week) or in domestic activities (19.2(17.8–20.7) MET-hours/week), whilst a significantly lower physical activity was found in the transport (3.3 (2.9–3.7) MET-hours/week) and leisure-time domains (6.5 (5.7–7.3) MET-hours/week). The multiple regression analysis showed an inverse relationship between educational level and the size of settlements with the domestic-related and total physical activity (β range: –0.11 to –0.22; $p < 0.01$). Among lifestyle correlates, only alcohol consumption was positively related to the total physical activity ($\beta = 0.12$; $p < 0.01$), while the perceived level of stress outside work was the only one, which was inversely associated with the work-related ($\beta = –0.09$; $p < 0.01$) and leisure-time physical activity ($\beta = –0.10$; $p < 0.01$). **Conclusions:** Middle-aged employees in Croatia accumulate most of their daily physical activity in the work and domestic domains. Analysis of the relationship between physical activity and potential socio-demographic, lifestyle, and work-related correlates indicated that physical activity promotional activities should be primarily focused on males, employees living in smaller settlements and those with higher educational levels. The correlates of physical activity among middle-aged employees seem to be domain-specific. Therefore, future studies in this area should consider assessing physical activity in each domain separately.

Key words:
Employment, Exercise, Lifestyle, Middle-aged, Motor activity, Socio-economic factors

INTRODUCTION

Studies have demonstrated that regular physical activity can be beneficial in preventing numerous major chronic diseases, thereby, in reducing the risk of all-cause mortality and improving mental health [1]. Importance of regular physical activity for public health is recognized not only by health professionals and health organisations but also by the general public [2]. However, all over the world there

Received: November 25, 2013. Accepted: April 14, 2014.
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is still a considerable portion of insufficiently physically active people [3,4]. Therefore, interventions for improving physical activity of different populations have been developed and implemented worldwide [5]. To establish effective evidence-based interventions, it is important to identify the level of physical activity, as well as its major determinants and correlates within a particular population. These factors are then targeted within physical activity promotion programmes. Studies on correlates of physical activity have been widely conducted in the past 2 decades and have encompassed many different populations and subpopulations [6–8]. Their results have made a great impact by improving the knowledge concerning factors that should be considered when developing physical activity interventions. However, 2 profound reviews indicated that the majority of previous studies focused on correlates of leisure-time physical activity and total physical activity, neglecting correlates of physical activity in other life domains, i.e. the domains of home, work and transport [9,10].

According to the World Health Organization [11], workplace has become one of the priority settings for health promotion. Workplace health programs have evolved in the last decade with the physical activity promotion being their essential part. Taking into account the large part of the day that most adults spend in their workplace, worksites offer unique opportunities to encourage employees and their families to engage in regular physical activity [12]. Interventions aiming at improving physical activity of employees should be evidence-based and should consider socio-economic, lifestyle, organisational and environmental factors [13]. No previous studies had assessed the pattern and correlates of domain-specific physical activity among middle-aged employees.

Hence, the main purpose of this study was to determine the levels of physical activity in 4 domains (work, transport, domestic and garden, and leisure-time) among middle-aged employees in Croatia. The 2nd aim was to determine the socio-demographic, lifestyle and work-related correlates of their physical activity.

MATERIAL AND METHODS

Sample design

The survey was conducted in November 2007 on a random, stratified sample of 834 middle-aged employees. According to Erikson [14], the category of "middle-aged" includes people aged 40 to 65 years. The stratification was performed by geographical regions (6 regions in Croatia) and settlement sizes (4 sizes of settlement: a) < 2000; b) 2001–10 000; c) 10 001–100 000; and d) > 100 000 inhabitants). The household interviews took place in the afternoon or on weekends, when the selected participants were most likely to be at home.

All the participants gave their written consent before the interview. According to the data cleaning rules [15], due to the incompleteness of their data, 86 participants were excluded from the analyses. The final sample consisted of 766 participants (females – 52%). Descriptive data on socio-demographic, lifestyle and workplace characteristics of the sample are presented in Table 1. The Scientific and Ethics Committee of Faculty of Kinesiology, University of Zagreb, approved the study protocol.

Table 1. Socio-demographic, lifestyle and work characteristics of the study sample

Variable	Data (%, M±SD)[a]
Women	52.17
Age (years)	48.04±6.25
Educational level	
elementary school	9.35
high school	59.29
college degree	13.18
university degree	16.73
doctoral degree	1.45
personal income (euros per month)[b]	562.11±326.66
Children (n)	
0	15.84
1	24.35

Table 1. Socio-demographic, lifestyle and work characteristics of the study sample – cont.

Variable	Data (%, M±SD)[a]
Children (n) – cont.	
2	49.35
3	7.33
≥ 4	3.14
Size of settlements (inhabitants, n)	
< 2000	37.17
2001–10 000	15.97
10 001–100 000	20.81
> 100 000	26.05
Cigarette consumption (n/day)	
> 20	40.00
10–20	18.01
< 10	9.14
former smoker	21.59
never smoked	11.26
Alcohol consumption	
several times per day	46.37
once per day	32.23
several times per week	10.57
several times per month	5.94
never	4.89
Perceived level of stress outside work[b]	2.23±0.98
Body mass index	26.04±3.53
Perceived physical work demand[c]	3.06±1.29
Perceived mental work demand[c]	3.61±1.05
Perceived level of stress within work[b]	2.78±1.04
Work satisfaction[d]	3.60±0.94

[a] Data for quantitative variables presented as mean (M) and standard deviation (SD) and for categorical variables as percentage (%) of participants in different categories.
[b] Croatian Kuna was converted to Euro according to current exchange rates (1 Euro = 7.65 Croatian Kunas).
[c] Self-evaluated on a scale from 1 (no stress) to 5 (excessive stress).
[d] Self-evaluated on a scale from 1 (not physical or mentally demanding work) to 5 (extremely physically or mentally demanding work).
[e] Self-evaluated on a scale from 1 (extreme dissatisfaction with work) to 5 (extreme satisfaction with work).

Physical activity assessment

The long version of the International Physical Activity Questionnaire (IPAQ-long) in the Croatian language was used to estimate the level of physical activity. The questionnaire was designed to cover 4 domains of physical activity, i.e., the work, transport, domestic and leisure-time physical activity. The items were structured to provide domain-specific scores for walking, moderate-intensity and vigorous-intensity activities. All questions referred to the previous 7 days. The results were presented as the estimated energy expenditure in metabolic equivalent-hours per week (MET-hours/week). We used algorithms for the continuous physical activity scores [15] and presented scores for each of the 4 domains of physical activity separately. The Croatian version of IPAQ-long has previously shown satisfactory reliability [16].

Socio-demographic, lifestyle and work-related characteristics

Socio-demographic and lifestyle data were collected using a separate questionnaire. The participants' age was recorded as a continuous variable, expressed in years. The level of education was categorized as: elementary school, high school, college degree, university degree and doctoral degree. Croatian Kuna was used to express personal income, which was recorded as continuous variable. Based on the participants' smoking habits, the study group was divided into 5 categories: those smoking more than 20 cigarettes per day, those smoking 10–20 cigarettes per day, those who smoke fewer than 10 cigarettes per day, who quit smoking, and those who have never smoked. As for alcohol intake, the participants were categorized based on the frequency of its consumption: more than once per day, once per day, several times per week, several times per month and never. According to the number of children, the households were divided into 5 categories, from no children to 4 or more children.

BMI was calculated as weight (kg) / height^2 (m^2), using the self-reported data.

Work characteristics were described through physical demands, mental demands, stress at and outside work, and work satisfaction. The participants self-evaluated their physical and mental work demands on a scale from 1 to 5, where 1 represented "not physical/mentally demanding work" and 5 represented "extremely physically/mentally demanding work". The level of stress, both at and outside the workplace, was also self-evaluated on a scale from 1 to 5, where 1 represented "no stress" and 5 represented "excessive stress". Similarly, work satisfaction was self-evaluated on a 5-point response scale, where 1 represented "extreme dissatisfaction with work" and 5 represented "extreme satisfaction with work".

Data analysis

Medians in MET-hours/week, 95% confidence interval (CI) for medians, and interquartile ranges were calculated for each domain of physical activity, according to the IPAQ-long scoring protocol [15]. The 95% confidence interval (CI) limits for medians were calculated based on the method proposed by Bonett and Price [17]. The analyses were performed on the total sample and separately for males and females. The differences between the sexes were tested using the Mann-Whitney U test.

In order to assess the relationship between physical activity and hypothesized correlates, a series of multiple regression analyses were performed. Prior to the regression analyses, the tolerance for all independent variables was calculated to test the models for multicollinearity. In the regression analyses, the total physical activity and the physical activity levels in the 4 life domains were used as the dependent variables (work, transport, domestic and garden, and leisure-time). The dependent variables were log-transformed to improve the normality.

In the regression models 3 groups of independent variables (socio-demographic, lifestyle and work-related characteristics) were analyzed. The socio-demographic variable group consisted of the following: gender, age, educational level, personal income, number of children and size of settlement. The lifestyle variable group included: cigarette consumption, alcohol consumption, perceived level of stress outside work and body mass index. The work-related variable group was comprised of: perceived physical work demand, perceived mental work demand, perceived level of stress at work and work satisfaction. As a result of the performed regression analyses, standardised regression coefficients and multiple correlation coefficients were presented.

All statistical analyses were performed using Statistica software (StatSoft, Inc., version 8.0.), with the level of significance set at $p < 0.01$ and $p < 0.0006$ ($p < 0.05$ adjusted for multiple testing using the Bonferroni correction).

RESULTS

The final sample of middle-aged employees consisted of 766 participants (52% – women and 48% – men), whose self-reported data were included in the data processing. The median (95% CI) total physical activity for the whole sample was 78.7 (69.1–88.3) MET-hours/week (Table 2). Most physical activity was accumulated in the domain of work (26.4 (20.3–32.5) MET-hours/week) or in domestic activities (19.2 (17.8–20.7) MET-hours/week), whilst a significantly lower physical activity was found in the transport (3.3 (2.9–3.7) MET-hours/week) and leisure-time domains (6.5 (5.7–7.3) MET-hours/week).

Men had a significantly higher energy expenditure than women (99.4 (81.7–117.1) vs. 67.4 (58.7–76.0) MET-hours/week; $p < 0.001$). There were also significant gender differences concerning the work, transport and domestic physical activity. Women had a significantly higher level of physical activity in the transport ($p = 0.009$) and domestic ($p < 0.001$) domains, whilst men were significantly more active at work ($p < 0.001$).

Table 2. Physical activity (PA) of middle-aged employees in metabolic equivalents-hours per week (MET-hours/week) and tests of differences between genders

PA domain	Physical activity [Me (95% CI); IQR]			p
	women	men	overall	
Work	16.5 (11.6–21.4); 85.2	52.5 (32.9–72.1); 152.9	26.4 (20.3–32.5); 118.4	< 0.001
Transport	4.1 (3.0–5.2); 11.6	2.5 (1.1–3.8); 10.8	3.3 (2.9–3.7); 11.6	0.009
Domestic	21.0 (18.7–23.3); 32.0	16.0 (12.1–19.9); 36.5	19.2 (17.8–20.7); 35.0	< 0.001
Leisure	6.6 (5.3–7.9); 16.0	5.0 (3.3–6.6); 16.0	6.5 (5.7–7.3); 16.0	0.239
Total PA	67.4 (58.7–76.0); 121.2	99.4 (81.7–117.1); 182.9	78.7 (69.1–88.3); 150.7	< 0.001

Me – median in MET-hours/week; (95% CI – 95% confidence interval for median calculated based on the method proposed by Bonett and Price [17]; IQR – interquartile range; p – Mann-Whitney U-test.

No significant gender differences were found with regard to the leisure-time physical activity (Table 2).

Socio-demographic characteristics (independent variables) showed significant relationships with the work-related, transport-related, domestic and total physical activity ($p < 0.01$ for all) (Table 3). Multiple correlation coefficients varied between 0.20 for the transport-related physical activity and 0.26 for the domestic physical activity. The set of independent variables accounted for from 4% to 6.8% of the physical activity variance. Educational level was inversely related to the work, domestic and total physical activity. The size of settlements was positively related to the transport physical activity and inversely related to the domestic and total physical activity.

Lifestyle characteristics (independent variables) showed significant relationships with the leisure-time and total physical activity (Table 4). The set of independent variables accounted for 1.7% of the variance of physical activity in the leisure-time domain and 2.6% of the total physical activity variance ($p < 0.01$ for both). Alcohol consumption was positively related to the total physical activity. The perceived level of stress outside the workplace was inversely related to the work and leisure-time physical activity.

Table 3. Results of a series of multiple regression analyses between socio-demographic characteristics (independent variables) and physical activity (PA, dependent variables) – standardized regression coefficients and multiple correlation coefficients

Independent variable	Dependent variable, β				
	work PA	transport PA	domestic PA	leisure PA	total PA
Gender	0.08	0.07	–0.01	0.02	0.01
Age	–0.02	0.01	–0.03	0.02	0.01
Educational level	–0.17**	–0.08	–0.11*	0.09	–0.16**
Personal income	0.01	–0.06	0.04	0.03	–0.02
Number of children	0.04	0.04	–0.01	0.00	0.02
Size of settlements	–0.08	0.17**	–0.22**	0.07	–0.11*
Multiple correlation coefficient	0.22**	0.20**	0.26**	0.14	0.22**

β – standardized regression coefficient.
* $p < 0.01$.
** $p < 0.0006$ (critical $p < 0.05$ adjusted for multiple testing using the Bonferroni correction).

Table 4. Results of a series of multiple regression analyses between lifestyle characteristics (independent variables) and physical activity (PA, dependent variables) – standardized regression coefficients and multiple correlation coefficients

Independent variable	Dependent variable, β				
	work PA	transport PA	domestic PA	leisure PA	total PA
Cigarette consumption	–0.05	0.03	–0.02	0.02	–0.05
Alcohol consumption	0.09	–0.02	0.03	–0.05	0.12*
Perceived level of stress outside work	–0.09*	–0.06	0.02	–0.10*	–0.05
Body mass index	0.03	–0.01	–0.04	–0.07	–0.09
Multiple correlation coefficient	0.13	0.07	0.05	0.13*	0.16*

Abbreviations as in Table 3.

Table 5. Results of a series of multiple regression analyses between work characteristics (independent variables) and physical activity (PA, dependent variables) – standardized regression coefficients and multiple correlation coefficients

Independent variable	Dependent variable, β				
	work PA	transport PA	domestic PA	leisure PA	total PA
Perceived physical work demand	0.32**	0.09	0.02	–0.03	0.30**
Perceived mental work demand	–0.10*	0.04	0.01	0.04	–0.01
Perceived level of stress within work	–0.01	–0.04	–0.03	0.00	–0.06
Work satisfaction	–0.05	0.05	0.04	0.01	–0.03
Multiple correlation coefficient	0.34**	0.12	0.06	0.05	0.30**

Abbreviations as in Table 3.

Significant relationships were found between the set of work characteristics and work, and the total physical activity (Table 5). The set of independent variables explained 11.6% of the work-related physical activity and 9.0% of the total physical activity ($p < 0.001$ for both). The perceived physical work demands were positively related to work and total physical activity, whilst the perceived mental work demands were inversely related to physical activity at work.

DISCUSSION

Patterns of physical activity

The study provided some insight into the pattern and correlates of physical activity among middle-aged employees in Croatia. A variety of socio-demographic, lifestyle and work characteristics were significantly related to physical activity in 4 domains of life (work, transport, domestic and garden, and leisure-time). The study contributed to the limited body of evidence on the factors that influence physical activity in different domains among middle-aged employees. Overall, our findings support the hypotheses that physical activity is a complex behaviour [18] and that it should be researched in each domain of life separately.

The total physical activity among middle-aged employees in Croatia was 78.7 MET-hours/week, which is equivalent to approximately 2.8 h of moderate-intensity physical activity per day. This is a considerably higher level than in the general Croatian population, where the median for the total physical activity was found to be 58.2 MET-hours/week [7]. The middle-aged employees reported somewhat higher physical activity in the work domain compared to the general population (26.4 vs. 16.5 MET-hours/week),

whilst other domains were rather similar. There are 2 possible explanations for this finding: either there is a higher percentage of middle-aged employees in blue-collar jobs than in the general population, or middle-aged employees perceived their work to be more physically demanding (i.e., of a higher intensity) than the employees from the general population. However, it should be noted that physically demanding occupations may increase the risk of disease and disability [19] possibly making middle-aged employees target population for specific health promotion strategies.

Comparisons of physical activity by gender revealed significant differences between men and women. In total, in accordance with previous findings [20,21], men were significantly more active than women (99.4 vs. 67.4 MET-hours/week). To corroborate the need to assess domain-specific physical activity in future population-based studies, we shall attempt to illustrate how interpreting this finding for the total physical activity can be misleading. Based solely on the total physical activity data, we may wrongly suggest that physical activity interventions should primarily focus on middle-aged employed women. However, insights into the domain-specific physical activity levels showed that women are in fact more active in the transport (4.1 vs. 2.5 MET-hours/week) and domestic domains (21 vs. 16 MET-hours/week) than men, whilst there is no significant difference in their leisure-time physical activity. The current physical activity recommendations for health [22] highly value aerobic physical activities that could be performed in the transport, domestic, and leisure-time domains (e.g., walking, water aerobics, riding a bike, pushing a lawn mower and gardening). By contrast, it has been suggested that excessive work-related physical activity, which in our sample, was likely more prevalent among men, can have negative effects on different aspects of health [23]. Therefore, after taking into account the domain-specific physical activity levels, it seems to be more justified to conclude that physical activity promotion programs in Croatia should be primarily focused on middle-aged employed men.

Correlates of physical activity

Multiple regression analyses showed that socio-demographic characteristics (gender, age, education, personal income, number of children and size of settlements) account for 4.8%, 4%, and 6.8% of the variance of physical activity in the work, transport and domestic domains, respectively. The size of settlements was the only significant predictor of the transport-related physical activity, indicating that people who live in larger communities tend to be more active in transport. This association may be explained by the lack of infrastructure for active commuting in smaller settlements, which is known to be one of the major barriers in the case of the transport-related physical activity [24]. Moreover, it has been proven that existence of walking and biking lanes promotes active commuting [25]. Therefore, strategic planning of the physical environment may be of great importance in the case of promotion of active commuting among middle-aged employees in smaller settlements.

Our results indicated that employees with higher educational levels tend to have more sedentary occupations, which is in accordance with the studies conducted on different populations [26,27]. In contrast, there was no significant relationship between educational level and the leisure-time or transport-related physical activity, although such relationships were previously determined in different populations [28]. Additionally, educational level was inversely related to the total and domestic physical activity, suggesting that the middle-aged employees with higher educational levels may be one of the priority target populations for physical activity promotion programs.

Multiple regression analyses showed that lifestyle characteristics (cigarette consumption, alcohol consumption, perceived level of stress outside work, and body mass

index) account for 1.7% of the variance of the leisure-time physical activity and 2.6% of the variance of the total physical activity. The perceived level of stress outside work was the only significant predictor of the leisure-time physical activity, indicating that people with lower levels of stress tend to be more physically active. This finding is in accordance with previous data [29]. It has been suggested that more active people perceive less psychological stress and cope with daily stressors better [30]. However, due to the cross-sectional design of our study we cannot conclude that physical activity decreases the stress levels outside work. It is possible that high levels of stress outside work could act as a barrier against the leisure-time physical activity. Regardless of the direction of causality, our data showed that there is an inverse relationship between the leisure-time physical activity and perceived stress outside the workplace among the middle-aged employees. Future studies are needed to understand the directionality and mechanisms underlying this relationship better.

Among lifestyle variables only alcohol consumption was significantly related to the total physical activity, indicating that employees who consumed alcoholic beverages more frequently, tended to be more active. Although this result may seem unexpected, a positive relationship between alcohol consumption and physical activity has been confirmed in numerous previous studies [31]. A recent US national study has shown that heavy consumers of alcohol exercise approximately 10 min and 20 min per week more than the moderate consumers and abstainers, respectively [32]. More studies are needed to identify the mechanisms behind this relationship, but, from the public health perspective, it might be useful to accompany the promotion of physical activity among middle-aged employees with concomitant education about the risks of alcohol consumption.

Work characteristics (the perceived physical work demands, perceived mental work demands, perceived stress at work and work satisfaction) accounted for 11.6% of the work-related physical activity variance and 9.0% of the total physical activity variance. As expected, the perceived physical work demand was positively, and the perceived mental work demand negatively related to physical activity in the work domain, whilst the perceived work demand was the only significant predictor of the total physical activity. Leisure-time physical activity was not related to work characteristics, although previous studies have shown that stressful work accompanied with high psychological demands increases the likelihood of physical inactivity in the leisure-time [33,34]. It has even been suggested that the leisure-time physical activity may serve as a protective factor against work strain and work demands among young adults [35]. More thorough studies among middle-aged employees are needed before final conclusions about the relationship between work characteristics and the leisure-time physical activity are drawn.

As shown above, 4.8%, 2.6%, and 9% of the total physical activity variance was accounted for by socio-demographic, lifestyle and workplace characteristics, respectively. At first glance these proportions may look small. However, when interpreting these effect sizes it has to be taken into account that physical activity is a complex behaviour related to other numerous health-related, psychological, behavioural, social, cultural and environmental factors [10,36,37]. Moreover, in a recent study, up to one half of the physical activity variance was attributed to genetic factors [38]. Therefore, it would be unreasonable to expect that the set of independent variables used in our study could account for a much higher amount of the total physical activity variance. An inclusion of more potential correlates in future studies among middle-aged employees might contribute to better understanding of physical activity behaviour in this population.

Limitations and strengths of the study

There are several limitations of our study that should be taken into consideration before final conclusions are drawn. Firstly, the cross-sectional design of the

study precluded establishing any causal relationships among the observed variables. Secondly, all data were assessed using self-reports, subjected to different biases. Although we used measures with fair reliability, it is possible that the random error in self-reported data reduced effect sizes. In line with this consideration, we interpreted all associations that reached the significance level of $p < 0.01$, and not only those that reached significance level of $p < 0.006$ (after Bonferroni correction). This approach may have raised the probability of type I error.

A major strength of the study is the relatively large random sample of middle-aged employees in Croatia that allowed us to make reliable generalizations. Furthermore, we used the IPAQ-long, which allowed us to present the data on physical activity in each of the 4 domains separately.

CONCLUSION

Our study provided some insight into the pattern and correlates of physical activity among middle-aged employees in Croatia. The middle-aged employees in Croatia accumulate most of their daily physical activity in the work and domestic domains. Promotion of physical activity in this population should target the transport and leisure-time domains as previous studies have demonstrated that they have an important role in preventing chronic illnesses and enhancing health. Our findings also indicated that physical activity promotional activities should be primarily focused on males, employees living in smaller settlements as well as those with higher educational levels. Furthermore, presumably it might be useful to supplement physical activity promotion programs with parallel education about the misuse of alcohol. Finally, the correlates of physical activity among middle-aged employees seem to be domain-specific. Future studies in this area should, therefore, consider assessing physical activity in each domain separately.

ACKNOWLEDGEMENTS

The authors are very grateful to Zrinka Greblo, PhD, for her great support during work on this project.

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