

# Physical activity of working age Wroclaw residents with reference to their income

## Authors' Contribution:

- A Study Design
- B Data Collection
- C Statistical Analysis
- D Data Interpretation
- E Manuscript Preparation
- F Literature Search
- G Funds Collection

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## abstract

**Background:** The aim of the paper was to assess the relationship between physical activity and the material status in working age residents of Wrocław, Poland.

**Material and methods:** The research covered 3,495 people aged 18–65 years. The research tool was the short version of the IPAQ survey questionnaire. The following information was obtained: age, sex, height, weight, and gross monthly income per capita in the household. Basic statistical characteristics were calculated, as well as the Mann-Whitney test for samples with  $n > 20$  and the Kruskal-Wallis ANOVA test. Statistical significance was assumed for  $p < 0.05$ .

**Results:** In the weekly physical activity structure of the surveyed Wrocław residents, low-intensity activity was dominant. Usually, men were more engaged in physical activity of high intensity than women; women turned out more physically active than men within the range of low-intensity exercise. The gross monthly income per capita differentiated the categories of overall, moderate-intensity, and low-intensity physical activity in the surveyed women, and those of overall and low-intensity physical activity in the surveyed men. In both sexes, respondents with low income were characterised by the lowest physical activity. Women with medium income and men with high income were the most physically active.

**Conclusions:** It seems necessary to include the poorest working age people in public health programs aimed at increasing the level of physical activity.

**Key words:** health promotion, physical activity, economic status, income per capita, Poland.

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## INTRODUCTION

Civilisation changes, related primarily to the progress in science and technology, are the reason why the contemporary human engages less and less in physical activity. Increased automation and improved work organisation, modernised and more accessible means of transport, implementation of innovative technical solutions in the everyday life, and an extensive offer of services have considerably limited human physical activity in the professional setting, during transit, and within the household. Consequently, physical activity deficit is observed in many people, which results in deterioration of physical performance and fitness [1-5], as well as in an increased risk of such diseases as muscle atrophy, osteoporosis, type 2 diabetes, obesity, hypertension, coronary heart disease, and certain types of neoplasms [6-13]. In literature, negative effects of hypokinesia for mental health and mental performance are also pointed out, related to, among others, cognitive function disturbances, increased levels of anxiety and depression, worsened well-being, lowered self-esteem, decreased self-efficacy, increased stress, and lowered sleep quality [14-17].

Physical activity is of particular importance to working age people, as it allows them to maintain functional and intellectual performance at a level enabling efficient work. This is especially significant in the context of the frequently occurring, in highly developed countries, such socio-demographic phenomena as: lowered birth rates, prolonged education time, aging society (reduction of labour supply), extended life expectancy and related changes in pension legislation (raising the retirement age), or a burnout syndrome in a large percentage of workers [18, 19].

Hypokinesia in working-age people leads to many negative socio-economic consequences, including: lower employee productivity and business efficiency, burdens in public and private budgets related to high costs of managing chronic diseases, and, as a result, limiting the potential for economic development and for improving the quality of life [20, 21]. Therefore, in a growing number of countries, increasing the level of physical activity is considered a key element of national public health programs, as being one of the most effective and cheapest means of preventing civilisation diseases. Physical activity performed during leisure time is particularly susceptible to such action, although more demanding physical activity can be undertaken also in other areas of life. Actually, a number of measures are recommended, among others: limiting the use of motor vehicles and lifts, getting involved in household duties, and performing physical exercise during work breaks. The significant role of physical activity for the quality of professional work is also increasingly noticed by companies: active recreation of employees is more and more often favoured by including physical activity forms in work benefits and offering health advice, and leisure facilities are arranged at company premises.

The World Health Organisation also raises the need to increase physical activity, recommending 150 minutes of moderate intensity exercises or 75 minutes of high intensity exercises per week. Such activities should be arranged in at least 10-minute intervals [22]. However, results of empirical studies show that these recommendations are not commonly followed, especially in the Polish population. Gerovasili et al. [23] prove that Poles are among the least physically active European nations – as many as 44% of them remain completely physically inactive. Similar results are noted in works by Ignasiak et al. [24], and by Puciato et al. [18].

Physical activity, apart from being a biological phenomenon, is also a socio-cultural issue, related to the lifestyle of contemporary people. As such, it can be indirectly modified by the following factors: age, sex, place of residence, marital status, education, as well as occupational and material status. With regard to economic factors, critical from the perspective of the article, monthly gross income per capita seems to be a useful measure. Contrary to total monthly gross income, it takes into account the size of the household and its actual purchasing power.

The relationships between physical activity and social factors are fairly well documented in literature [23–31]. However, the directions of impact of the financial status on physical activity are not fully recognised. On the one hand, people of lower economic status often perform manual labour, but on the other hand, people better off materially are generally better educated, and therefore more conscious of the importance of lifestyle, including physical activity, for health [30–33]. In addition, recreational services are now becoming commercial and chargeable, which puts materially affluent people in a better position. Not only tickets, passes or vouchers for sports activities are paid for, but also means of transport, insurance, recreational equipment, clothing, food, or supplements. The results of the empirical studies carried out so far to analyse the relationship between physical activity and material status are inconclusive. The works by Biernat [34] and Choi et al. [32] pointed at an increase in physical activity along with economic status improvement, but Chen et al. [35], Da Silva et al. [36], and Puciato [29] observed multidirectional correlations of physical activity and economic status.

In past studies, socio-economic conditions of physical activity of working age people were rarely analysed, as the authors usually concentrated on the whole population or studied the issue in relation to specific social or professional groups. Eliminating these research gaps is the most important goal of this paper, which aims at assessing the relationship between physical activity and monthly gross income per capita in residents of Wrocław, Poland, aged 18–65 years.

## **MATERIAL AND METHODS**

The study material included 3,495 people (1,894 women and 1,601 men) aged 18–65 years, which constituted about 1% of Wrocław inhabitants of this age. The mean value of age equalled  $40.4 \pm 4.3$  years for women and  $40.9 \pm 5.1$  years for men.

The study was carried out in the period from March 2012 to November 2013.

No statistically significant differences were observed between the age of the studied men and women in the groups of varied levels of income. Quota sample selection was applied, where: (1) control characteristics of the population were defined – sex and age – as well as groups (quotas) of population elements corresponding to the structure of the Wrocław population; (2) the defined quotas were divided among interviewers (students trained to carry out questionnaire surveys). Each poll taker was assigned one of the Wrocław districts appointed with the use of random number tables.

The number of respondents from particular districts was proportional to the number of inhabitants. All the respondents were advised about the aim and course of the study and they expressed their consent to participate.

The study design was approved by the Research Ethics Committee of the University School of Physical Education in Wrocław, Poland

The detailed characteristics of the respondents depending on the gross income per capita in the household are shown in Table 1.

Table 1. The number of men and women in the groups designated depending on the monthly income per capita in the household

Sex	Monthly income per capita			Total
	<1000 PLN (low)	1000-2000 PLN (medium)	>2000 PLN (high)	
Women	718	879	297	1894
Men	437	690	474	1601
Total	1155	1569	771	3495

To assess the habitual physical activity, the diagnostic survey method – auditorium surveying technique – was applied. As the survey tool, the short version of the IPAQ survey questionnaire was used, consisting of six queries related to the respondents' physical activity in a typical week of their lives [37]. The activity taken into account in the research covered physical activity undertaken as part of professional work activities, at home and in its close vicinity, when moving from one place to another, and during leisure time. The authors thoroughly analysed the responses pertaining the assessment of physical activity frequency and duration in three intensity categories: high, moderate, and low. The intensity of exercise was determined with the use of the metabolic equivalent (MET; 1 MET is equivalent to oxygen [O<sub>2</sub>] consumption at rest, and equals 3.5 ml O<sub>2</sub>/kg body weight/min), assuming 3.3 MET for low intensity exercise, 4 MET for moderate exercise, and 8 MET for high intensity exercise. The calculation algorithm constituted in multiplying the number of days, the duration, and the mentioned MET values separately for each intensity category.

In the course of the research, the following information concerning the respondents was also obtained: age, sex, height, body weight (which were the basis for calculating the body mass index, BMI), and gross monthly income per capita in the household. Three income ranges were assumed: up to 1000 PLN (low income), 1000-2000 PLN (medium income), and over 2000 PLN (high income).

Basic statistical characteristics were calculated: arithmetic means, standard deviations, variation coefficients, and extreme (minimum and maximum) values. Because of the lack of compliance of the analysed variables with normal distribution, the following nonparametric tests were calculated: the Mann-Whitney test for samples with  $n > 20$ , and the Kruskal-Wallis ANOVA test. Statistical reasoning was carried out for  $p < 0.05$ . Calculations were performed with the usage of the IBM SPSS Statistics 20 application.

## RESULTS

The mean values of body height, body weight, and BMI were statistically significantly higher in the studied men than in women ( $p < 0.05$ ). In the case of men, the average BMI value increased with the increase in income, and indicated slight overweight, regardless of the income.

The average duration of weekly physical activity in the studied group of Wrocław residents decreased with the increase of physical activity intensity. The respondents declared that they spent the most time performing physical activities of low intensity, and the least time performing physical activities of high intensity. Among the respondents of both sexes with the lowest income, statistically significant differences in the mean weekly duration of physical activity were observed for the activities of high (in favour of men) and low (in favour of women) intensity. In the group of respondents with medium income, the mean duration of physical activity overall and of that of low and moderate intensity was statistically significantly higher in men than in women. Among the respondents with the highest income, statistically significant differences were observed for physical activity of high and moderate intensity. The male respondents were more eagerly involved in physical activity of high intensity, and the female respondents – in physical activity of moderate intensity (Table 2).

Table 2. Differentiation of variables for respondents with various levels of monthly income per capita in the household according to sex

Variable	Sex	<1000 PLN (low)				1000–2000 PLN (medium)				>2000 PLN (high)			
		$\bar{x}$	SD	Z	p	$\bar{x}$	SD	Z	p	$\bar{x}$	SD	Z	p
Age [years]	F	38.9	13.5	-0.58	0.564	41.7	14.4	2.30	<b>0.022</b>	42.4	12.8	1.61	0.107
	M	39.8	15.3			39.9	13.6			40.9	12.6		
Height [cm]	F	166.4	6.3	-22.59	<b>0.000</b>	166.0	8.0	-25.72	<b>0.000</b>	165.8	5.6	-19.69	<b>0.000</b>
	M	178.6	7.4			178.4	7.0			179.3	7.6		
Weight [kg]	F	64.1	10.2	-20.70	<b>0.000</b>	64.9	10.4	-23.13	<b>0.000</b>	63.3	9.6	-18.34	<b>0.000</b>
	M	79.8	10.5			80.3	12.0			84.4	13.4		
BMI [kg/m <sup>2</sup> ]	F	23.2	3.5	-9.64	<b>0.000</b>	23.6	4.0	-9.92	<b>0.000</b>	23.0	2.9	-12.49	<b>0.000</b>
	M	25.1	3.5			25.2	3.2			26.2	3.5		
DVPA [min/week]	F	180.9	114.3	-1.73	<b>0.084</b>	175.9	105.2	-3.14	<b>0.002</b>	182.0	139.2	-2.68	<b>0.007</b>
	M	190.6	105.7			204.9	126.7			210.1	132.5		
EEVPA [MET min/week]	F	1447.2	914.1	-1.73	<b>0.084</b>	1407.6	841.7	-3.14	<b>0.002</b>	1455.7	1113.6	-2.68	<b>0.007</b>
	M	1524.7	845.8			1639.6	1013.4			1710.7	1128.5		
DMPA [min/week]	F	216.7	135.3	-0.01	0.995	203.2	139.9	-2.29	<b>0.022</b>	245.4	182.9	1.73	<b>0.083</b>
	M	215.4	130.5			220.0	137.4			213.8	141.1		
EEMPA [MET min/week]	F	866.9	541.3	-0.01	0.995	812.8	559.4	-2.29	<b>0.022</b>	981.6	731.4	1.73	<b>0.083</b>
	M	861.6	522.0			880.0	549.5			840.3	530.1		
DLPA [min/week]	F	272.0	125.8	2.71	0.007	273.6	171.1	-1.59	0.111	251.0	182.2	-0.55	0.580
	M	250.4	125.7			285.4	167.6			255.6	175.5		
EELPA [MET min/week]	F	897.7	415.0	2.71	0.007	903.0	564.7	-1.59	0.111	828.4	601.3	-0.55	0.580
	M	826.2	414.7			941.7	553.2			843.4	579.2		
DTPA [min/week]	F	540.4	294.0	-0.43	0.664	513.5	312.9	-3.49	<b>0.000</b>	564.3	390.6	1.13	0.260
	M	544.7	272.8			571.5	339.0			509.9	333.0		
EETPA [MET min/week]	F	2458.1	1448.4	-0.60	0.550	2276.6	1537.4	-3.67	<b>0.000</b>	2602.7	1878.0	1.16	0.246
	M	2524.5	1516.7			2632.1	1736.6			2419.2	1742.1		

DVPA – duration of vigorous physical activity, EEVPA – energy expenditure of vigorous physical activity; DMPA – duration of moderate physical activity, EEMPA – energy expenditure of moderate physical activity; DLPA – duration of low physical activity, EELPA – energy expenditure of low physical activity; DTPA – duration of total physical activity, EETPA – energy expenditure of total physical activity.

Table 3. Differentiation of variables for respondents with various levels of monthly income per capita in the household

Variable	Monthly income per capita [PLN]	Women				Men			
		$\bar{x}$	SD	H	p	$\bar{x}$	SD	H	p
Age [years]	<1000	38.9	13.5			39.8	15.3		
	1000-2000	41.7	14.4	21.23	<b>0.000</b>	39.9	13.6	5.39	0.068
	>2000	42.4	12.8			40.9	12.6		
Height [cm]	<1000	166.4	6.3			178.6	7.4		
	1000-2000	166.0	8.0	1.85	0.397	178.4	7.0	6.62	<b>0.037</b>
	>2000	165.8	5.6			179.3	7.6		
Weight [kg]	<1000	64.1	10.2			79.8	10.5		
	1000-2000	64.9	10.4	6.63	<b>0.036</b>	80.3	12.0	58.69	<b>0.000</b>
	>2000	63.3	9.6			84.4	13.4		
BMI [kg/m <sup>2</sup> ]	<1000	23.2	3.5			25.1	3.5		
	1000-2000	23.6	4.0	4.38	0.112	25.2	3.2	51.98	<b>0.000</b>
	>2000	23.0	2.9			26.2	3.5		
DVPA [min/ week]	<1000	175.9	105.2			190.6	105.7		
	1000-2000	180.9	114.3	0.84	0.658	204.9	126.7	1.39	0.500
	>2000	182.0	139.2			213.8	141.1		
EEVPA [MET min/ week]	<1000	1407.6	841.7			1524.7	845.8		
	1000-2000	1447.2	914.1	0.84	0.658	1639.6	1013.4	1.39	0.500
	>2000	1455.7	1113.6			1710.7	1128.5		
DMPA [min/ week]	<1000	203.2	139.9			210.1	132.5		
	1000-2000	245.4	182.9	9.22	0.010	215.4	130.5	0.72	0.699
	>2000	216.7	135.3			220.0	137.4		
EEMPA [MET min/ week]	<1000	812.8	559.4			840.3	530.1		
	1000-2000	981.6	731.4	9.22	0.010	861.6	522.0	0.72	0.699
	>2000	866.9	541.3			880.0	549.5		
DLPA [min/ week]	<1000	251.0	182.2			250.4	125.7		
	1000-2000	273.6	171.1	17.32	0.000	255.6	175.5	12.51	<b>0.002</b>
	>2000	272.0	125.8			285.4	167.6		
EELPA [MET min/ week]	<1000	828.4	601.3			826.2	414.7		
	1000-2000	903.0	564.7	17.32	0.000	843.4	579.2	12.51	<b>0.002</b>
	>2000	897.7	415.0			941.7	553.2		
DTPA [min/ week]	<1000	513.5	312.9			509.9	333.0		
	1000-2000	564.3	390.6	11.14	<b>0.004</b>	540.4	294.0	9.03	<b>0.011</b>
	>2000	544.7	272.8			571.5	339.0		
EETPA [MET min/ week]	<1000	2276.6	1537.4			2419.2	1742.1		
	1000-2000	2602.7	1878.0	11.56	<b>0.003</b>	2524.5	1516.7	6.02	<b>0.049</b>
	>2000	2458.1	1448.4			2632.1	1736.6		

DVPA – duration of vigorous physical activity, EEVPA – energy expenditure of vigorous physical activity; DMPA – duration of moderate physical activity, EEMPA – energy expenditure of moderate physical activity; DLPA – duration of low physical activity, EELPA – energy expenditure of low physical activity; DTPA – duration of total physical activity, EETPA – energy expenditure of total physical activity.

With regard to somatic parameters, the size of the gross monthly income per capita in the household statistically significantly differentiated the following characteristics: body weight in both sexes, and height and BMI in male Wrocław residents. In women, the mean body weight was the lowest in those with high income, and the highest in those with medium income. In men, the mean body weight increased together with income. In the group of men, similar relationships with income were noted for BMI; with regard to body height, men with medium income turned out the shortest on average, and men with high income were the tallest.

Among the surveyed women from Wrocław, statistically significant differences between the groups selected by monthly gross income per capita in the household were observed for the overall physical activity and for the physical activity of moderate and low intensity. For both analysed physical activity parameters, i.e. weekly duration and energy expenditure, women with lowest income featured the lowest average parameter values, and women with medium income featured the highest average parameter values. It should be emphasised that the mean differences between the average physical activity parameter values in groups of women with medium and low income were bigger than among those with medium and high income.

In the case of the surveyed working age men, significant differences between the groups selected by monthly gross income were observed for the overall weekly physical activity and for low-intensity physical activity. Mean physical activity parameter values increased together with the monthly gross income per capita in the household (Table 3).

## **DISCUSSION**

In the structure of the respondents' weekly physical activity, low-intensity activity was dominant. Similar observations were made by other researchers [11, 30, 34]. However, in the case of the surveyed Wrocław residents, this is not necessarily a negative phenomenon, owing to a relatively long average duration of higher intensity activity. Actually, the mean duration of physical activity of moderate and high intensity indicates that the study subjects meet the standards formulated by the World Health Organisation [22].

The sex-related differences among the respondents with respect to their physical activity turn out to be quite interesting. Earlier papers clearly indicated that men were more physically active than women [10, 19, 23, 24, 29]. However, the analysis of the particular levels of physical activity intensity points at multidirectional relationships between physical activity and sex in the surveyed population. In the group of respondents with the lowest income, men were characterised by higher physical activity of high intensity, and women - by higher physical activity of low intensity. Among residents with medium income, men were more physically active than women with respect to overall, high, and moderate range of intensity. Last but not least, in the group of respondents with the highest income, men were more inclined to engage in physical activity of high intensity, and women - in that of moderate intensity.

The outcomes noted in the paper can be caused by the fact that people with the lowest income are often employed as physical workers. This type of work is usually more physically intensive for men than for women, due to physiological, cultural, and legal reasons. Moreover, in the Polish family model, despite the increasing equality of sexes, the majority of household duties are still carried out by women. The intensity of this type of physical activity is usually low. In the group of people with the highest income, physical activity performed during leisure time was probably dominant. The most popular forms of physical activity in free time for men (such as team games, strength workout, or martial arts) are usually also characterised by more intensity than the physical activities preferred by women (such as fitness workout, dancing or jogging). Thus, generalizing the obtained study results, one can conclude that the surveyed men were engaged in physical activity of high intensity for a longer time, and in the case of the surveyed women, physical activity of low intensity was dominant. This observation is consistent with the results of some previous empirical research [12, 30, 32].

The gross monthly income per capita differentiated the categories of overall, moderate-intensity, and low-intensity physical activity in the surveyed women, and those of overall and low-intensity physical activity in the surveyed men. In both sexes, respondents with low income were characterised by the lowest physical activity. Women with medium income and men with high income were the most physically active. The obtained results prove that in the poorest social groups, the conditions for undertaking physical activity are particularly unfavourable. It should be remembered that the lowest income category defined in the research (<1000 PLN) is more or less equivalent to the minimum subsistence level in Poland. Thus, this group included people with income slightly above the subsistence level and those living at or below the subsistence level, in some cases even at the living wage level (approximately 500 PLN). Income of this height allows meeting only the basic existence and consumer needs at a very low level, which seems extremely unfavourable in the context of the feasibility to engage in physical activity. Usually, people with such low income are also not very well educated, and therefore, apart from being unable to cover expenses related to physical activity, they may remain unaware of the significance of lifestyle for good health and quality of life. Some interesting dependencies were also observed among people with high income. For women, medium levels of income proved sufficient to engage in physical activity, as this income group included the most physically active respondents. Among men, those with the highest income were the most physically active. Similar regularities were noted in some earlier works, which also reported that the medium socio-economic status was sufficient to ensure appropriate conditions to adopt healthy behaviours [18, 32, 35].

In the context of the assumptions made, one should remember, however, that the average income in Poland is still among the lowest in the European Union, and that it often turns out insufficient to satisfy the basic needs. This is particularly important in the case of men, who, despite the decreasing differences, still earn more on average than women, and bear the primary responsibility for the well-being of their families. Therefore, they probably sometimes give up some part of their free time resources to take an additional professional activity. This is consistent with the economic theory phenomenon known as the substitution effect of a wage increase. In the group of the surveyed men with the highest income, an opposite phenomenon could have taken place (the income effect of a wage increase), consisting in full utilization of free time resources or even increasing them by giving up a portion of work time. This allowed them to increase the physical activity level in their free time, which was supported by the ability to purchase paid recreational services. In the case of men with the highest income, who are usually well educated, the reasons to engage in physical activity could have included the awareness of desired healthy behaviours and the peculiar fashion for active lifestyle, observed among urban middle class representatives at present. People with high income can also afford to purchase household maintenance services, which may additionally increase the amount of their free time. One of the facts confirming the occurrence of regularities resulting from the marginal rate of substituting recreation for leisure in Wrocław residents can be the empirically proven domination of the income effect over the substitution effect in men. It should also be stressed that the differences concerning physical activity between the respondents with high and with medium income were definitely lower than the differences between Wrocław residents with high or medium income together as compared to those with low income. This proves the particularly unfavourable effects of such negative socio-economic phenomena as poverty on human physical activity and health. This observation is partially consistent with the results obtained by Gerovasili et al. [23], who points out that inhabitants of richer European Union countries are usually more physically active than those coming from less developed countries.

## CONCLUSIONS

The study reports significant relationships between physical activity and monthly gross income per capita in the household. The lowest income levels proved particularly disadvantageous for the Wrocław residents in the context of implementing physical activity. Therefore, it seems necessary to include working age people, especially the poorest ones, in public health programs aimed at increasing the level of physical activity.

The analysis of the research results allows indicating both the strengths and weaknesses of the article. Among the strengths, one should mention the study group, as determinants of physical activity in working age people were rarely analysed in previous studies. The subject of assessing the relationship between physical activity and monthly income per capita is also an advantage. On the one hand, empirical studies rarely consider economic factors, focusing primarily on the social ones. On the other hand, monthly income per capita seems to be an efficient indicator of the economic situation. Therefore, it can be recommended for use in subsequent studies.

The article weaknesses certainly include the study subject limitation to the inhabitants of Wrocław, and the application of a research tool in the form of the short version of the IPAQ survey questionnaire. Actually, it allows evaluating overall physical activity only, without a separate analysis of physical activity at work, at home, in free time, and when moving from one place to another. Therefore, in future studies, the research population should be extended to the whole area of Poland and other countries in East-Central Europe, and different research tools should be applied, e.g. the long version of the IPAQ survey questionnaire. Differences between the particular types of physical activity may turn out crucial for explaining the relationships between physical activity and socio-economic factors, including material status.

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