


Level and limitations of physical activity in patients with excess body weight or diabetes

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ABSTRACT

Physical activity (PA) is recommended to prevent or treat many diseases, but various factors may limit it. We analyse the level of PA and the barriers to undertaking it. Patients aged 18–64 with diabetes or at least overweight completed the following questionnaires: International Physical Activity Questionnaire (IPAQ) and Accompanying Survey (AS). For statistical analysis, non-parametric Mann-Whitney U, χ^2 —Pearson, correspondence analysis and meta-analysis (OR with $\pm 95\%$ CI) were used, and $\alpha=0.05$ was assumed. Of 191 sets of questionnaires were analysed (67% from women). The median (MD) age for the group was 50.5 years, MD for metabolic equivalents (METs): 2079 (MET-min/week); 16.23% of subjects scored insufficient, 46.07% sufficient and 37.7% high PA according to the IPAQ scale. A relationship between the IPAQ and PA level results from the AS was confirmed (χ^2 ; $p=0.00047$). The most common reasons indicated for not taking up PA were lack of time due to professional work (49%) and additional duties (32%) as well as fatigue from daily duties (44%). Participants <45 years were more likely to indicate additional duties ($p=0.013$), participants >45 years illnesses ($p=0.04$) and people with BMI (body mass index) ≥ 30 kg/m², ‘fatigue from daily duties’ ($p=0.019$) as an obstacle to undertaking PA. ‘Lack of suitable conditions to undertake PA’ was indicated more often by patients with primary education ($p<0.01$), diabetes ($p=0.037$), after myocardial infarction ($p=0.039$) and those under psychiatric treatment ($p=0.039$). Women more often declared a lack of motivation ($p=0.018$). Residents of big cities and those with BMI ≥ 30 were more likely to assess their PA as ‘insufficient’ ($p=0.0260$ and $p=0.0081$, respectively). The overwhelming number of respondents who were in the age of professional activity had a sufficient level of PA. The most common barriers to undertaking PA were lack of time and fatigue, related to both work and non-work activities, but specific barriers were also found for women and patients with various diseases.

INTRODUCTION

Physical activity (PA) is often associated with achieving ideal body weight. However, despite the undeniable role of PA, which is part of the so-called energy balance-related behaviours, research shows that even people who engage

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ People represent different levels of physical activity, one of the most important components of behavioural treatment. Various factors can limit the physical activity.

WHAT THIS STUDY ADDS

⇒ Most of the people with diabetes and those with excessive weight but without carbohydrate disturbances who are the age of professional activity represent a sufficient level of physical effort, which can be the effect of widespread education among this group. However, different limitations can be detected. The most important impediments to everyday physical activity are the barriers to leisure time and the tiredness of everyday duty.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The detected limitation can be of great importance in the context of the current discussion about a reduction in weekly working hours.

in PA as recommended generally do not achieve ideal body weight. After incorporating PA of 150–300/min per week,¹ weight loss amounts to 2–3 kg.^{2 3} The remaining ‘burden’ of effort lies in a suitably adapted diet, but even these combined measures do not ensure long-term success.¹

Such disappointing results discourage patients from undertaking behavioural challenges, especially PA, as it requires time and commitment disproportionate to the achieved, measurable results. Recent medical developments promoting fat reduction (incretins, bariatric surgery) seem much more within reach than painstaking behavioural measures. However, a change in body proportions, correction of cardiovascular risk factors, improved cardiovascular and respiratory function, and many other benefits from regular exercise are more important than burning calories.^{4 5} The lack of enforcement of clear and seemingly simple recommendations is discussed by Ekkekakis



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et al^b while calling for research to help understand the problem.

Meanwhile, a lack of adherence to the principles of healthy nutrition⁷ and maintenance of adequate levels of calorie-burning through tailored PA⁸ has a significant impact on epidemiology. In Poland, the percentage of adults at least overweight is almost 60%, while 21% of people are obese.⁹ Globally, 38% of the population is at least overweight.¹⁰ As a consequence of the aforementioned epidemiology, the incidence of type 2 diabetes mellitus is increasing rapidly¹¹—in Poland, the disease affects approximately 8%¹² and more than 10% of adults worldwide.¹³ These groups of patients are characterised by insufficient levels of PA (<150 min/week of exercise) but represent high cardiovascular risk and high prevalence of several other diseases that could be modified by respected behavioural recommendations.^{9 14–21}

As various factors influence the patient's decision in this activity,^{22 23} their identification is crucial from the point of view of education or the planning of follow-up advice. Additionally, looking for causes not directly related to the patient's limitations can be useful for public budget planning to target public finances according to the identification of the needs. A guideline for the implementation of PA is the 5 A's strategy (Ask, Assess, Advise, Agree and Assist),²⁴ which also suggests principles for identifying problems encountered by individuals.^{24–26}

Each patient should first know their PA level.²⁷ The previous study suggested that during self-assessment, individuals are prone to overestimate energy expenditure to their advantage.²⁸ An objective tool for such an assessment could be the short-form International Physical Activity Questionnaire (IPAQ), which covers all types of PA: daily life, work and leisure.²⁹

Given the particular role that PA plays in the prevention and treatment of people with excess body weight and patients with DM, our study aimed to assess these individuals' activity levels and analyse the barriers to undertaking PA.

METHODS

Patients were surveyed using two questionnaires, one assessing PA levels: the International Physical Activity Questionnaire (IPAQ)/Polish/Short Form (IPAQ/PL/SF)³⁰ and the Accompanying Survey (AS) (online supplemental file 1) with demographic and epidemiological questions, questions assessing the patient's limitations to undertaking regular PA, and a subjective assessment of its level. One month of community consultation preceded the selection of the limitations to create AS. As the AS was an author's questionnaire, patients were asked to complete it again within 7 days. The aim was to test the reliability of this tool to minimise the risk of randomisation of responses.

Information about the survey was given to patients at two centres (NZOZ Nowy Dwor Wroclaw and Diabetes Education Centre Wroclaw, Poland) between January and August 2023. The information was also provided once

during the 'Long-Term Care in Practice' conference held in Walbrzych, Poland, on 2 March 2023. After reading the 'Study Information', patients agreed to participate in the study and were given a set of questionnaires to complete if they met the following inclusion criteria: 18–64 years of age, any sex and race, prediabetic status or diabetes regardless of BMI (body mass index), or BMI ≥ 25 if there was no confirmation of the mentioned carbohydrate metabolism disorders. Exclusion criteria: pregnancy, inability to complete the IPAQ or AS questionnaire for any reason as assessed by the interviewer, and recent history of an acute medical condition that may interfere with the reliability of the IPAQ result.

The study was approved by the Bioethics Committee of the Wroclaw Medical University (approval No.:KB 8/2023).

Only data from patients who completed both questionnaires (IPAQ/PL/SF and AS) satisfactorily were analysed. This meant answering the questions according to the design of the IPAQ questionnaire. For the AS, fully completed questionnaires were considered for analysis, and those filled in incompletely were filled in, provided the number of unanswered questions was no more than 2. However, 'missing' responses in this questionnaire did not include situations where the patient did not provide age, place of residence, or HbA1c (glycated haemoglobin) value in the case of diabetes, as the authors considered information relating to barriers to undertaking PA to be of key importance.

Height and weight measurements were performed on various devices available at the above-mentioned centres. The patient entered their values into the questionnaire themselves, while the researchers calculated BMI after collecting the questionnaire from the patient.

To cope with the heterogeneity in AS questions, we dichotomised the variable into the categories: parts A, B and C (see online supplemental table 1).

In addition to the baseline characteristics of the group and the assessment of PA level according to the IPAQ and its subjective level (based on the AS), the contribution of the obstacles to undertaking PA and their relation to PA level were analysed.

Statistics

Basic descriptive statistics were calculated for continuous variables: count, mean, median and SD. The normality of the distribution was verified with the Shapiro-Wilk test, and the homogeneity of variance with the Levene and Brown-Forsyth tests. For nominal variables, including dichotomous variables, tables of counts with percentages were determined.

For the results obtained in the study from original questionnaires (AS), their statistical reliability and internal consistency were assessed by standardised Cronbach's alpha and a Guttman split-half reliability.

The non-parametric Mann-Whitney U test assessed the statistical relationship between dichotomous and continuous variables.

The non-parametric χ^2 —Pearson test and correspondence analysis assessed relationships between variables on nominal scales. In addition, by analysing correlations between dichotomous variables in bivariate tables (2×2), ORs were determined with 95% significance intervals. The results of the statistical analyses based on the constructed bivariate tables were visualised by creating a forest plot. For this purpose, a meta-analysis model was constructed using the OR and the $\pm 95\%$ CI as the test metric. Global statistical significance was calculated based on the variable effects model. For the meta-analysis, two continuous variables, age and BMI, were categorised into dichotomous variables by adopting cut-off points: median (MD) for age and BMI=30.

Based on the IPAQ, the average metabolic equivalents (METs) value for the test group was calculated as well as the absolute number and percentage of study participants in each of the three categories corresponding to the level of PA: insufficient (less than 600 MET-min/week), sufficient (600–1500 or 600–3000 MET-min/week—according to the instruction) or high (more than 1500 or 3000 MET-min/week—according to the instruction).

In all statistical analyses performed, a significance level of $\alpha=0.05$ was assumed. Statistical analysis was performed using Statistica 13.3 PL computer program from StatSoft.

RESULTS

Acceptance of the questionnaires

Two hundred and twenty-nine patients were issued questionnaires, while 191 questionnaires were analysed (67% women, 33% men, 128 and 63, respectively). If a participant completed the questionnaires two times, data from the set of questionnaires (AS and IPAQ) completed the first time by the participant were used for the analyses.

Data from 38 patients were removed as incomplete. Among the analysed questionnaires, there was no information on the age concerned five and on place of residence—9 patients.

The AS was completed two times by 39 people (internal consistency: Cronbach's $\alpha=0.73$; Guttman's split-half reliability=0.93).

Baseline characteristics (parts A and B in AS) and IPAQ results

The variables subjected to statistical analysis were on different measurement scales. Four of them—age, BMI, HbA1c and the combined total PA value of the IPAQ test were continuous and on a ratio scale. The remaining variables were nominal and dichotomous. The continuous variables discussed did not meet the assumptions of normality of distribution and homogeneity of variance. Therefore, the primary statistical tests used in the data analysis were non-parametric techniques.

All individuals who received an invitation to the study were adults under 65 years of age (age verification based on identity document). The MD of age was 50.5 years

(range: 20–64). There were 9.9% of retired people (only women, all declared that they were still professionally active despite retirement) and 2.6% of people on a disability pension.

The mean BMI of the participants was 29.71 kg/m² (SD: ± 5.19), and the mean HbA1c for patients with diabetes (n=74) was 7% (SD: ± 1.3)—available from 32 participants. The demographic and epidemiological characteristics are included in online supplemental table 1A). The most common diseases were hypertension (>47%), diabetes (>39%) and musculoskeletal diseases (>19%).

All respondents made a subjective assessment of their PA: a similar proportion rated it as insufficient or at least sufficient, less than 6% as high (online supplemental table 1B). Over 57% indicated PA outside the home as preferred (online supplemental table 1B).

IPAQ results

The MD for the combined total PA of the group was 2079; range: 16.5–30 240 (MET-min/week). The percentage of people who obtained insufficiency (n=31), sufficient (n=88) and high levels of PA (n=72) were, respectively: 16.23, 46.07 and 37.7%.

The limitations to undertaking PA (part C in AS)

The patients could choose one or more of the proposed options that limit their PA; 161 (84,3%) participants chose at least one obstacle from those proposed; 30 people did not answer this question. Almost 50% of patients indicated a lack of time due to work, and just over 32% indicated a lack of time due to additional duties as a reason for being restricted from undertaking PA. Despite having enough free time that could be spent on PA, more than 44% do not undertake it due to 'fatigue from everyday duties', and almost 25% admitted no motivation to exercise. More than 13% of patients found their 'chronic disease' as a limitation (online supplemental table 1C).

In addition, in part C questions assessing patients' knowledge about the disease as a limitation, more than 17% felt that illness or symptoms could be a barrier to undertaking additional PA. Most people indicated that this was a concern for bone and joint diseases (10.5%). Second, excessive body weight and diabetes were marked as obstacles that, in the patient's opinion, may limit PA (both reasons were indicated by 4.7% of respondents). Heart diseases, nervous system diseases or symptoms such as dyspnoea and dizziness were indicated by <4% of respondents. None of the respondents indicated 'leg wounds' as an obstacle to PA!

The detailed breakdown of responses is included in online supplemental table 1C.

Relationships between barriers to undertaking PA and other variables (χ^2)

For the most frequently indicated reason for insufficient activity (lack of time due to work), no relationship was

Correspondence Analysis - CA

1D Plot of Row and Column Coordinates for Dimension: 1; (Standardization: Row and column profiles)

Eigenvalue = 0.06859 (100.00% of Inertia); Contribution to Chi-square = 10.768

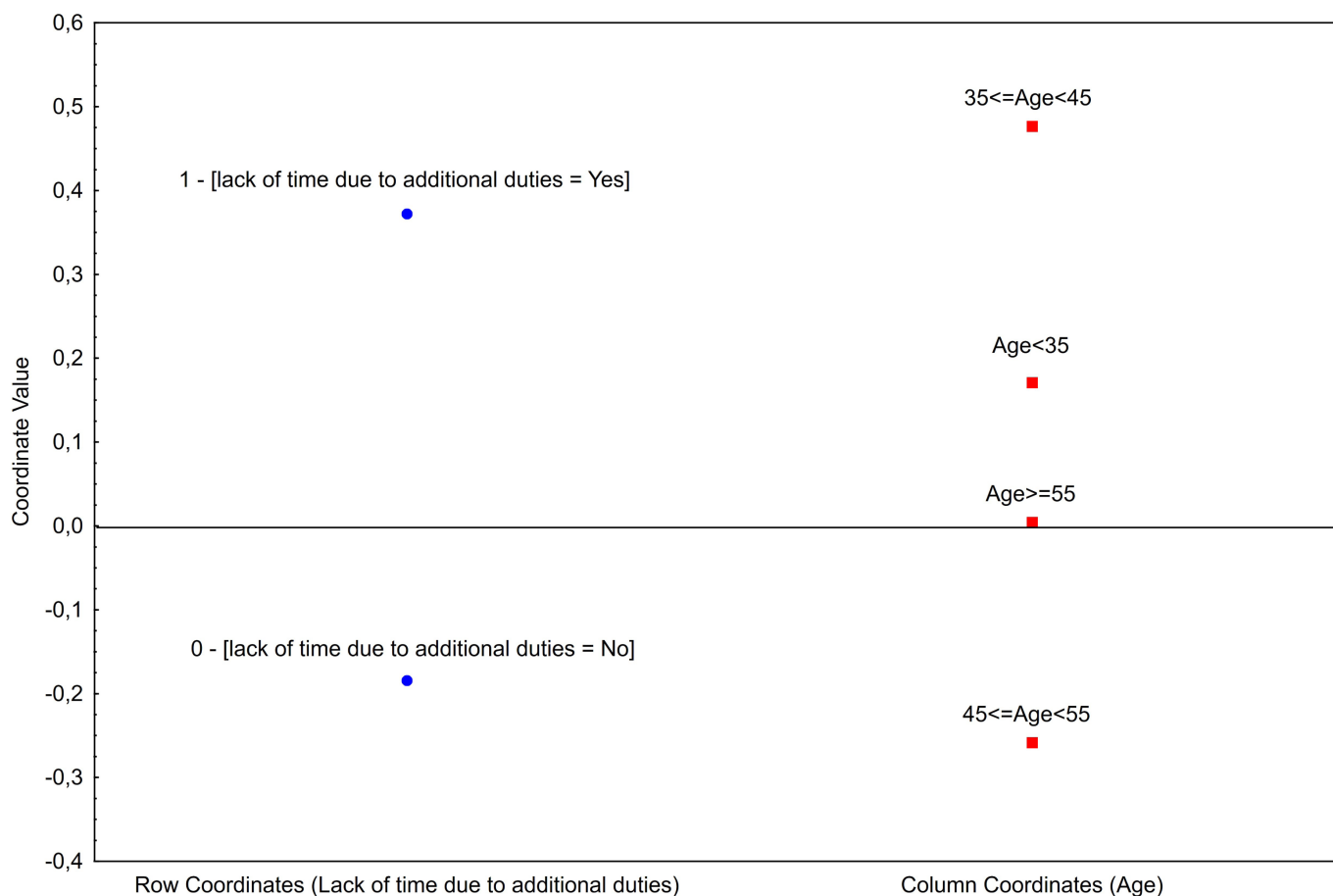


Figure 1 Relationship between barriers to undertaking physical activity and age.

found between demographic or epidemiological factors. For the second most frequent answer (lack of time due to additional duties), there was a relationship with age: persons <45 years of age more often chose the affirmative answer, participants aged 45–55 chose a negative answer to this question, while in the group of people >55 years of age, the affirmative answer to this question and the negative answer were equally distributed (χ^2 , $p=0.013$) (figure 1). Respondents who indicated 'fatigue from everyday duties' as the reason for low PA were more likely to have a BMI ≥ 30 kg/m² ($p=0.019$, OR: 0.47) and were more likely to assess their level of PA as 'insufficient' ($p=0.007$) and declared they would choose any place when undertaking PA ($p=0.014$). Among the respondents who declared that the reason for insufficient PA was 'lack of idea what I could do', people with disabilities dominated ($p=0.001$, OR: 14.1). People with primary education were more likely to indicate 'lack of suitable conditions' ($p=0.0098$) as a reason for not undertaking PA. A similar problem was indicated by those with diabetes ($p=0.037$, OR: 7.34), after myocardial infarction (MI) ($p=0.039$, OR: 8.4) and those under psychiatric treatment ($p=0.039$, OR: 8.4). Patients over 45 years of

age were more likely to believe that the chronic diseases they faced limited their PA ($p=0.04$), and the diseases that generally limited patients the most were hypertension ($p=0.016$, OR: 3.3) and musculoskeletal diseases ($p<0.001$, OR: 11.7).

Poststroke patients and those undergoing psychiatric treatment more often indicated that they do not like being physically active ($p=0.018$; $p=0.0047$, OR: 9.5, respectively). At the same time, people who chose the reason 'I do not like to be physically active' critically assessed their level of activity according to self-assessment (based on the AS), indicating that it was insufficient ($p=0.004$). 'Lack of motivation' to engage in PA was more frequently declared by women ($p=0.019$, OR: 2.7). This reason was also related to the low level of PA in the self-assessment ($p=0.0012$). Respondents with lower education were more likely to choose 'I don't have anyone to exercise with' as a reason, which ultimately influences the abandonment of PA ($p=0.014$). Lack of the necessary (in the opinion of the respondent) financial resources to undertake a sufficiently high level of PA was declared by single people ($p<0.001$, OR: 0.048), people with disabilities ($p=0.006$, OR: 6.9), with DM ($p=0.017$, OR: 8.96), who

have cancer ($p=0.0011$, OR: 27.4), skin diseases ($p=0.005$, OR: 9.36) or mental illness ($p<0.001$, OR: 22.5).

There were no other correlations (χ^2) between barriers to undertaking PA and the available variables assessed in the study.

There was no association between patients' age and any variable describing obstacles to undertaking PA (Mann-Whitney U test).

Relationships between PA level according to self-assessment (AS) and other variables (χ^2)

People living in a provincial city more often described their PA as insufficient. People from smaller cities and rural areas more often believed that their PA was at least sufficient ($p=0.044$). Those with a BMI ≥ 30 were more likely to rate their PA level as insufficient ($p=0.026$), while those with a BMI < 30 were more likely to rate their BMI as at least sufficient. Also, those who rated their PA level as at least sufficient were more likely to indicate that they did not need to increase it ($p=0.01$).

There was no correlation between other variables and the level of PA indicated by respondents in the self-assessment.

Relationships between PA level according to the IPAQ and self-assessment or other variables (χ^2)

The relationship between the IPAQ scale and PA level scores from the self-assessment (AS) was confirmed—those who scored 'insufficient' on the IPAQ indicated similarly on the self-assessment. Those respondents who had activity levels of at least 'sufficient' or 'high' rated themselves similarly in the questions included in the AS ($p<0.001$), which were devoted to self-assessment. Additionally, the correspondence analysis showed that choosing 'insufficient' PA in self-assessment was associated with 'insufficient' or 'sufficient' score in the IPAQ, and assessing one's PA level as 'sufficient' and 'high' was associated with 'high' level of PA according to the IPAQ (patients tended to underestimate their level of activity when they assessed themselves subjectively). Extreme responses corresponded most closely. More people with 0 (insufficient PA level) on one scale also scored 0 on the other scale, similar to 2 (high PA level). The PA level represented by 1 (sufficient PA) differentiated the group the least (figure 2).

Correspondence Analysis - CA

2D Plot of Row and Column Coordinates; Dimension: 1 x 2 (Standardization: Row and column profiles)

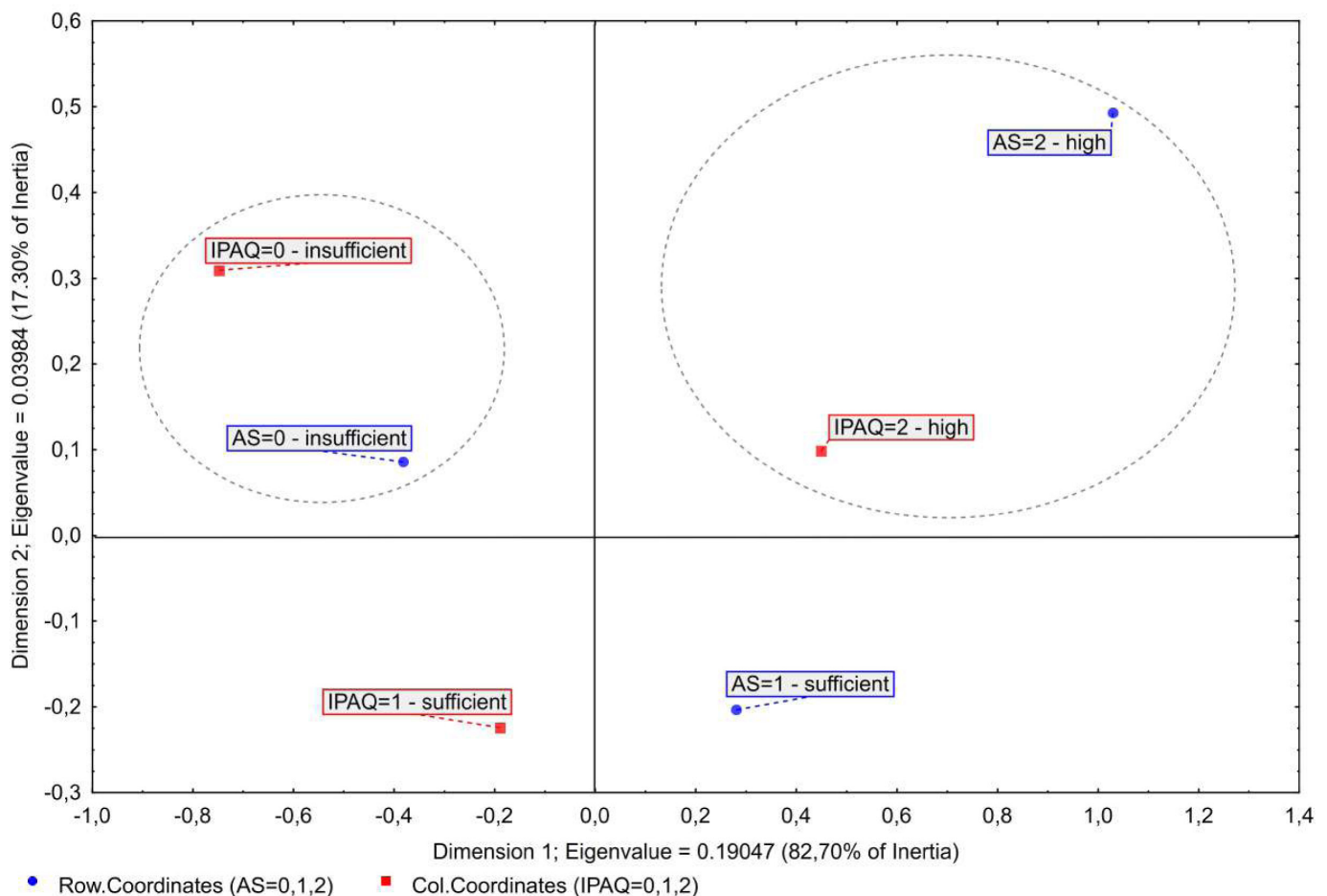


Figure 2 Analysis of the relationship between physical activity level by the IPAQ and the patient's self-assessment. AS, Accompanying Survey; IPAQ, International Physical Activity Questionnaire.

data about the patterns of socio-economic inequalities in LTPA in the different member states of the European Union was published.³⁵ Unfortunately, Poland did not participate in the project. In our analysis, the education level was not connected with the level of PA measured by IPAQ or by questions from AS. It should be realised that in the IPAQ, LTPA and general PA are assessed, which can modify the results from previous data. However, the physical effort is important not only if additional action is applied. People with elementary education can represent a higher level of PA during their duty at work and finally represent quite high total PA.³⁷ Thus, the use of IPAQ equalises the chance between physically active groups at work and those active after their duties.

Demographic factors such as sex and age are also indicated as moderators of PA in numerous summaries.^{27 35 38} In our study, neither sex nor age was associated with the level of PA measured by IPAQ or indicated in AS. However, twice as many women as men took part in the questionnaire, so it cannot be ruled out that this disparity may have translated into a failure to show a relationship between sex and the level of PA. The choice of the age limit of the participants (< 65 years of age) may also have resulted in the fact that, given the similar duties (professional work) of women and men, the main declared reason that was an obstacle to undertaking PA had the most significant impact on its level, eliminating differences that may have resulted from gender. Nevertheless, women were much more often emphasised the problem of “lack of motivation”. Due to the lack of evidence of a relationship between sex and other obstacles declared by patients, the role of undiagnosed depression, which more often affects women,^{39 40} is associated with excessive body weight,⁴¹ and for which lack of motivation is a common feature,⁴² cannot be underestimated.

The main obstacle mentioned (lack of time due to professional work) did not show a relationship with age, which underlines its power to affect those in the so-called “productive age”. However, people aged 45 and below were likelier to indicate a lack of time due to additional duties. In contrast, those over 45 indicated more often that the illnesses they were being treated for, mainly hypertension and musculoskeletal disorders, limited their activity. This distribution of responses seems understandable given the natural order of things, such as, for example, the need to look after children by younger people (<45 years of age) and the increasing chance of developing a chronic disease with age (>45 years of age).

In general, for a more objective assessment of the level of PA provided by IPAQ, it was impossible to demonstrate a relationship with any of the analysed demographic and epidemiological variables. People who assessed their level of PA as “sufficient” were often wrong when their self-reported score was compared with that of the IPAQ. This indicates that this group is a potential candidate for independent assessment, using more objective scales to obtain a correct picture of their PA in daily practice. Notwithstanding the mean METs obtained and the relatively high

percentage of people who obtained at least sufficient activity levels on the IPAQ (almost 84% of respondents), one might be tempted to comment that, for adults of the most active age group (18–64 years), PA levels are either modified by work/education (for physically working people, professional work increases METs and for white-collar workers it decreases METs) or by undertaking LTPA (physically working people are less likely to undertake extra effort in their leisure time and white-collar workers are more likely to do so). These inverse relationships (the more occupation-related physical work, the less LTPA and vice versa) are understandable and justified.⁴³ People with lower education perceive their work as PA (in the self-assessment based on AS, they were more likely to rate their level of PA as high), which was not reflected in the more objective tool as IPAQ. Lower education and physical work are more often associated with choosing unhealthy food and nicotine addiction^{43 44} also, which may eliminate the benefits associated with regular muscle work. In our opinion, the lack of concordance between the IPAQ and self-assessment in this group may indicate ineffective education regarding “healthy” PA.

In an analysis by the Gallup Institute,⁴³ the following were among the variables identified as leading ultimately to obesity as they affect dietary choices and PA taking: lack of enough money, lack of a quiet place to exercise and depression. Our respondents also indicated such obstacles. The respondents included people with disability (n=18) and patients undergoing psychiatric treatment (n=5). Although the total number of respondents limited us from obtaining a larger number of these individuals, it is worth noting that people with disabilities indicated mainly two problems: lack of financial resources and lack of idea what they could do. Due to the limited opportunities for these people to perform any activity, special attention should be paid to them when providing recommendations. Research shows that the activation of people with disabilities is associated with large savings for the budget in the long term.⁴⁵ Disability should, therefore, not limit overall PA but only modify it. The need to counteract a sedentary lifestyle among people with disabilities was highlighted 2 years ago when recommendations emphasising the benefits and safety of PA among people with disabilities were published for the first time in 2021.⁴⁶ People undergoing psychiatric treatment saw more obstacles than others. Apart from the lack of resources, they also indicated no appropriate conditions for the activity and disliking. Given the nature of the diseases, it seems that greater involvement of psychiatrists in non-pharmacological therapies should be an important part of care.^{47 48} The prevalence of obesity, diabetes, and other consequences of metabolic disorders in this group is particularly high,⁴⁹ their relationship is bidirectional,⁵⁰ and coping with low levels of PA seems to require more complex interventions.

The authors of the study were particularly concerned about the lack of indication of leg wounds as an obstacle to physical exercise, even though almost 40% of

respondents suffered from DM. These people should be particularly alert to the possibility of a complication such as diabetic foot. Lack of resources and conditions for PA was also chosen more often by people with diabetes. Since a large budget or special conditions are not required to undertake simple activities, one may have the impression that declaring such problems is also the result of insufficient education because regular, long enough walks augmented with simple resistance exercises are sufficient to achieve clinically relevant levels of PA.^{25 26 51 52}

People with obesity disease were more self-critical and assessed their level of PA as lower (similar to people living in a provincial city), which was not confirmed by the objective IPAQ scale, while at the same time declaring their willingness to increase it regardless of the place where the activity would take place. This is an encouraging fact that proves the growing awareness of the role that exercise plays in every person's life, especially if they struggle with the problem of excess weight.

Nevertheless, according to available data, 23% of adults still do not meet the WHO global recommendations on PA.⁵³

Clinical implications

This is the first study in Poland dedicated to this topic because our country did not participate in the study of 15 countries from Europe, which was published in 2014.³⁵ We hope that our study will allow more efficient action on the challenge of the “Global Action Plan on Physical Activity 2018–2030: More Active People for a Healthier World”⁵⁴ and will be helpful in the context of the current discussion about a reduction in weekly working hours. The study may also draw attention to particular groups of problems that characterise individuals affected by excessive body weight or its consequences, like diabetes.

Limitation

The IPAQ is a semi-objective scale and thus can be influenced by undetectable factors like patient overestimation.

The extra analysis, dedicated to the narrow groups of individuals like patients with different diseases, was based on a small number of participants and thus should be interpreted cautiously and confirmed in a bigger, representative study.

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