

# THE LEVELS OF PHYSICAL ACTIVITY AND FATIGUE AMONG TEACHERS IN POLAND AND THE UNITED KINGDOM IN THE FIRST YEAR AFTER THE COVID-19 PANDEMIC

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## ABSTRACT

**Background:** The COVID-19 disease has a negative impact on the psychophysiological health of populations worldwide, including a decrease in overall physical performance and an increase in fatigue. Fatigue was one of the main symptoms reported by patients and persisted for several weeks after infection with COVID-19. Although the phenomenon of fatigue is still poorly understood, physical activity can be a supportive factor in combating feelings of fatigue and lack of energy. The purpose of this research was to assess the physical activity (PA) and fatigue levels of teachers in Poland and the United Kingdom in the first year after the COVID-19 pandemic. **Material and Methods:** The online research was carried out among 410 teachers from Poland and the United Kingdom. The PA level was assessed using the *International Physical Activity Questionnaire* (IPAQ). The level of fatigue was measured using the *Modified Fatigue Impact Scale* (MFIS). **Results:** Polish teachers, regardless of sex, are more physically active (the differences relate mainly to walking and moderate activity). When assessing the level of fatigue, there is a significant difference between men and women – the former indicate a higher degree of fatigue, with the difference between the sexes being particularly large in the Polish community. Quite clearly, there is an association between less activity (except walking) and more fatigue. All models show a statistically significant effect of total fatigue on total effort. Physical activity is not very strongly correlated with age but the level of fatigue increases with age. **Conclusions:** The problem of teacher fatigue is unfortunately widespread. They should be encouraged to engage in as much PA as possible during the day. When planning and targeting fatigue reduction campaigns, PA should be encouraged and variables such as age, sex should be taken into account. *Med Pr Work Health Saf.* 2024;75(2)

## Key words:

Poland, fatigue, exercise, public health, physical exertion, United Kingdom

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## INTRODUCTION

Physical activity is defined by the World Health Organization as any movement that is generated by skeletal muscles and requires energy expenditure. It is therefore any movement, even during leisure time, including movement to and from a place or as part of work. Both moderate and high-intensity activity improves health [1]. Systematic physical activity is associated with many physical and mental health benefits, including maintaining a healthy body weight, reducing anxiety and depression, improving overall well-being, and benefits to the heart, body and mind. Numerous studies show that regular physical activity at an appropriate level helps prevent and treat non-communicable diseases such as heart disease, stroke, diabetes and some cancers [2–9]. There are also studies that show that reduced physical activity contributes to a faster onset of

some diseases of civilization such as diabetes, high blood pressure, obesity and musculoskeletal pain [10,11]. At the same time, there is also evidence that occupational physical activity may be associated with an increased risk of health deterioration [12].

Approximately 20% of the world's population complains of fatigue for various reasons. It is considered a rather unpleasant symptom, described as a feeling of mental or physical weakness that does not necessarily indicate illness, but can interfere with daily functioning. Factors that may indicate the causes of fatigue are individual characteristics or additional stresses, such as general or occupational stress [13,14]. However, fatigue that persists over a longer period of time (>6 months) without any recognizable cause is referred to in medicine as chronic fatigue syndrome. It usually leads to a decrease in physical activity and performance. In professionally

active people, it is also often associated with professional burnout [15–18].

Teaching is one of the oldest professions in the world. It is a difficult and responsible profession in which the phenomenon of professional burnout is quite common due to the workload and the nature of the work. It is characterized by a loss of motivation to work, physical fatigue or emotional exhaustion. This can have a negative impact on physical and mental health and lead to chronic fatigue or a lack of resilience [19–22].

There are studies in the literature that show that COVID-19 disease has a negative impact on the psychophysiological health of populations worldwide, including a decrease in overall physical performance and an increase in fatigue. Fatigue was one of the main symptoms reported by patients and persisted for several weeks after infection with COVID-19 [23–26]. And although the phenomenon of fatigue is still poorly understood, physical activity can be a supportive factor in combating feelings of fatigue and lack of energy.

Therefore, the authors decided to conduct a study to assess the physical activity and fatigue levels of teachers in Poland and the United Kingdom (UK) in the first year after the COVID-19 pandemic. The authors additionally posed the research question: Is there a relationship among physical activity, age, sex, fatigue and country of residence in the study group?

## MATERIAL AND METHODS

### Participants and procedure

The authors conducted a cross-sectional online survey in September 2023. The study group consisted of teachers from Poland and the UK. The authors posted hyperlinks to a Google Forms form on their social media as well as in Facebook groups for teachers of different educational levels, which included questions on fatigue (*Modified Fatigue Impact Scale* – MFIS) and physical activity (*International Physical Activity Questionnaire* – IPAQ) as well as information about the study, its anonymity, and consent to participate. Every question in the survey had to be answered. Without ticking an answer, it was not possible to move on to the next question or submit the form. The questionnaire was prepared in 2 languages: Polish and English. The researchers received a total of 410 questionnaires (207 Polish and 203 British). The inclusion criteria set by the authors of the study were: active work as a teacher, infection with COVID-19 during the pandemic, residence in Poland or the United Kingdom. Exclusion criteria were:

musculoskeletal disease, trauma, chronic cardiovascular disease unrelated to COVID-19, history of chronic respiratory disease unrelated to COVID-19.

The research was conducted in accordance with the principles of the Declaration of Helsinki and received approval by the Senate Committee on Research Ethics of the School of Medical Science in Białystok with the number KB/18/2020.2021. The article is the result of a joint project and a research internship completed by the authors in London.

### Methods of assessing the level of physical activity, and fatigue

#### *International Physical Activity Questionnaire*

In this study, the authors used a shortened version of the IPAQ to assess the level of physical activity. The questionnaire contains questions on all forms of daily activities and is designed for people aged 15–69 years [27]. The questionnaire allows for the assessment of all activities performed at home, at work and during leisure time. The questions refer to activities that last continuously for at least 10 min and belong to the moderate and vigorous activities. These activities are assessed in units of MET-min/week (the product of the factor associated with the activity and the number of days per week that the activity is performed per unit of time, expressed in minutes) [28]. Cronbach's alpha values for the IPAQ reported in the literature are  $>0.7$  [29–32].

#### *Modified Fatigue Impact Scale*

To assess the level of fatigue, the authors used the MFIS in their study, which consists of 3 parts – physical functioning (F-1), cognitive functioning (F-2) and psychosocial functioning (F-3), assessed over the last 4 weeks. Depending on the answers ticked in each part of the questionnaire, the respondent may receive a score between 21–105, where a higher score indicates greater fatigue affecting poorer functioning [33]. The Cronbach's alpha value reported in the publications is  $>0.7$  [34].

### Statistical methods

Statistica v. 13 software (TIBCO Software Inc., Palo Alto, CA, USA, 2017) was used for the statistical analysis. The following descriptive statistics were used: mean with 95% confidence interval, median, standard deviation and skewness coefficient.

Due to the strong skewness of the distribution of the physical activity measures, the significance of the differences between the groups was assessed using the non-parametric Mann-Whitney test. Associations between IPAQ

and MFIS measures, as well as between age and these measures, were analyzed using Spearman's correlation coefficient. To examine the possible influence of age on the occurrence of correlations between the IPAQ and the MFIS, a regression analysis was performed with total activity as the dependent variable and total fatigue and age as independent variables. The analysis was performed by sex and country of residence. Prior to the regression analysis, the IPAQ and MFIS values were subjected to a Box-Cox transformation to eliminate significant skewness that could affect the reliability of the results.

## RESULTS

### Characteristics of the sample population

A total of 410 teachers took part in the study, including 207 from Poland and 203 from the UK aged 24–59 years. The age of teachers from Poland was in the range of 24–59 years ( $M=38.8$  years), and from Great Britain in the range of 24–56 years ( $M=38.3$  years). The proportion of women in both communities is almost identical at 71.0% and 71.9%. The high proportion of women is due to the special nature of the teaching profession, which is strongly female-dominated. There are some differences in the structure of the surveyed community in the workplace structure – in particular, more people in the Polish community worked in primary school and less in secondary school and university (Table 1).

### Physical activity

Information on the physical activity of teachers from Poland and the UK is presented in Table 2. The

differentiating factor for physical activity is sex, therefore the analysis was conducted with a distinction between men and women. The results show that Polish teachers, regardless of sex, are more physically active. However, the differences relate mainly to walking and moderate activity. There are no significant differences in the level of high-intensity physical activity.

### Fatigue level (MFIS)

When assessing the level of fatigue, there is a significant difference between men and women – the former indicate a higher degree of fatigue, with the difference between the sexes being particularly large in the Polish community (Table 3). The difference between the Polish and British populations is only evident among women – it is Polish female teachers who report a significantly higher level of fatigue.

### Physical activity and fatigue

Quite clearly, there is an association between less activity (except walking) and more fatigue. The correlations are at a fairly similar level, regardless of the country of the teachers surveyed and their sex (Table 4).

To examine the possible influence of age on the occurrence of correlations between the IPAQ and the MFIS, a regression analysis was carried out (Table 5). All models show a statistically significant (almost significant only for the Polish male population:  $p = 0.0842$ ) effect of total fatigue on total effort. This correlation is also present when the age of the teachers is included in the models, so it is not an obvious correlation. It is noteworthy that, in contrast to the Polish teachers, the

**Table 1.** Workplace distribution among women and men in Poland and the United Kingdom in 2023

| Workplace         | Participants<br>(N = 410)<br>[n (%)] |                 |                                 |                 |
|-------------------|--------------------------------------|-----------------|---------------------------------|-----------------|
|                   | Poland<br>(N = 207)                  |                 | The United Kingdom<br>(N = 203) |                 |
|                   | women<br>(N = 147)                   | men<br>(N = 60) | women<br>(N = 146)              | men<br>(N = 57) |
| Kindergarten      | 25 (17.0)                            | 0 (0.0)         | 28 (19.2)                       | 1 (1.8)         |
| Primary school    | 57 (38.8)                            | 14 (23.3)       | 26 (17.8)                       | 2 (3.5)         |
| Special school    | 26 (17.7)                            | 3 (5.0)         | 23 (15.8)                       | 1 (1.8)         |
| Vocational school | 4 (2.7)                              | 9 (15.0)        | 11 (7.5)                        | 2 (3.5)         |
| Technical college | 1 (0.7)                              | 19 (31.7)       | 2 (1.4)                         | 24 (42.1)       |
| High school       | 23 (15.6)                            | 7 (11.7)        | 37 (25.3)                       | 12 (21.1)       |
| College           | 11 (7.5)                             | 8 (13.3)        | 19 (13.0)                       | 15 (26.3)       |

**Table 2.** Physical activity of teachers from Poland and the United Kingdom in 2023

| Effort (IPAQ)                      | Physical activity [METs] |      |      |                    |      |     | P                |
|------------------------------------|--------------------------|------|------|--------------------|------|-----|------------------|
|                                    | Poland                   |      |      | The United Kingdom |      |     |                  |
|                                    | M                        | Me   | IQR  | M                  | Me   | IQR |                  |
| Women (Poland N = 147, UK N = 106) |                          |      |      |                    |      |     |                  |
| intense effort                     | 484                      | 480  | 720  | 461                | 480  | 720 | 0.785            |
| moderate effort                    | 428                      | 360  | 240  | 325                | 360  | 240 | <b>0.046</b>     |
| walking                            | 592                      | 495  | 396  | 378                | 297  | 297 | <b>&lt;0.001</b> |
| total effort                       | 1505                     | 1417 | 954  | 1165               | 1174 | 725 | <b>0.001</b>     |
| Men (Poland N = 60, UK N = 50)     |                          |      |      |                    |      |     |                  |
| intense effort                     | 843                      | 800  | 600  | 667                | 720  | 640 | 0.086            |
| moderate effort                    | 515                      | 480  | 280  | 405                | 360  | 240 | <b>0.010</b>     |
| walking                            | 593                      | 512  | 363  | 303                | 264  | 99  | <b>&lt;0.001</b> |
| total effort                       | 1951                     | 1855 | 1018 | 1374               | 1392 | 720 | <b>&lt;0.001</b> |

IPAQ – International Physical Activity Questionnaire.

p value was calculated using Mann-Whitney test.

Bolded are the significance results for  $p < 0.05$ .

**Table 3.** Level of fatigue in the study group of teachers in Poland and the United Kingdom in 2023

| Functioning (MFIS)                 | Fatigue |     |      |                    |    |      | p                |
|------------------------------------|---------|-----|------|--------------------|----|------|------------------|
|                                    | Poland  |     |      | The United Kingdom |    |      |                  |
|                                    | M       | Me  | IQR  | M                  | Me | IQR  |                  |
| Women (Poland N = 147, UK N = 106) |         |     |      |                    |    |      |                  |
| physical (F-1)                     | 9.1     | 9   | 13.0 | 6.8                | 5  | 12.0 | <b>0.013</b>     |
| cognitive (F-2)                    | 11.9    | 10  | 16.0 | 7.8                | 6  | 14.0 | <b>&lt;0.001</b> |
| psychosocial (F-3)                 | 2.0     | 2   | 3.0  | 1.5                | 1  | 2.0  | <b>0.016</b>     |
| total                              | 23.0    | 21  | 32.0 | 16.2               | 11 | 29.0 | <b>0.001</b>     |
| Men (Poland N = 60, UK N = 50)     |         |     |      |                    |    |      |                  |
| physical (F-1)                     | 4.8     | 3   | 9.0  | 5.7                | 3  | 9.0  | 0.545            |
| cognitive (F-2)                    | 6.6     | 5   | 13.0 | 7.0                | 4  | 10.0 | 0.767            |
| psychosocial (F-3)                 | 1.1     | 0   | 2.0  | 1.4                | 1  | 2.0  | 0.234            |
| total                              | 12.4    | 8.5 | 23.5 | 14.1               | 9  | 21.0 | 0.619            |

MFIS – Modified Fatigue Impact Scale.

p value was calculated using Mann-Whitney test.

Bolded are the significance results for  $p < 0.05$ .

age of the British teachers has no significant influence on the reduction in total exertion.

### Age and physical activity and fatigue

Physical activity is not very strongly correlated with age – not at all in the British collective (Table 6). In the Polish population, especially among men, physical activity decreases with age. The level of fatigue increases with age. This poses a certain problem, as the

correlations between these measures may be partial or even completely obvious, i.e., people who are relatively older are more likely to experience both types of these ailments.

## DISCUSSION

Low levels of physical activity are one of the main factors in the development of obesity, heart disease, cancer

**Table 4.** Correlations between physical activity and fatigue of teachers in Poland and the United Kingdom in 2023

| Effort (IPAQ)      | Functioning (MFIS) |                  |                 |                  |                    |                  |       |                  |
|--------------------|--------------------|------------------|-----------------|------------------|--------------------|------------------|-------|------------------|
|                    | physical (F-1)     |                  | cognitive (F-2) |                  | psychosocial (F-3) |                  | total |                  |
|                    | r                  | p                | r               | p                | r                  | p                | r     | p                |
| Poland             |                    |                  |                 |                  |                    |                  |       |                  |
| women              |                    |                  |                 |                  |                    |                  |       |                  |
| intense effort     | -0.46              | <b>&lt;0.001</b> | -0.51           | <b>&lt;0.001</b> | -0.45              | <b>&lt;0.001</b> | -0.50 | <b>&lt;0.001</b> |
| moderate effort    | -0.33              | <b>&lt;0.001</b> | -0.37           | <b>&lt;0.001</b> | -0.33              | <b>&lt;0.001</b> | -0.36 | <b>&lt;0.001</b> |
| walking            | -0.09              | 0.269            | -0.11           | 0.192            | -0.15              | 0.064            | -0.11 | 0.174            |
| total effort       | -0.37              | <b>&lt;0.001</b> | -0.40           | <b>&lt;0.001</b> | -0.42              | <b>&lt;0.001</b> | -0.40 | <b>&lt;0.001</b> |
| men                |                    |                  |                 |                  |                    |                  |       |                  |
| intense effort     | -0.38              | <b>0.003</b>     | -0.35           | <b>0.006</b>     | -0.34              | <b>0.008</b>     | -0.36 | <b>0.005</b>     |
| moderate effort    | -0.33              | <b>0.011</b>     | -0.28           | <b>0.028</b>     | -0.31              | <b>0.016</b>     | -0.31 | <b>0.016</b>     |
| walking            | -0.19              | 0.151            | -0.15           | 0.256            | -0.27              | <b>0.037</b>     | -0.20 | 0.127            |
| total effort       | -0.35              | <b>0.006</b>     | -0.30           | <b>0.018</b>     | -0.37              | <b>0.004</b>     | -0.33 | <b>0.009</b>     |
| The United Kingdom |                    |                  |                 |                  |                    |                  |       |                  |
| women              |                    |                  |                 |                  |                    |                  |       |                  |
| intense effort     | -0.34              | <b>&lt;0.001</b> | -0.35           | <b>&lt;0.001</b> | -0.20              | <b>0.016</b>     | -0.33 | <b>&lt;0.001</b> |
| moderate effort    | -0.25              | <b>0.002</b>     | -0.23           | <b>0.005</b>     | -0.24              | <b>0.003</b>     | -0.24 | <b>0.004</b>     |
| walking            | 0.07               | 0.385            | 0.08            | 0.335            | 0.02               | 0.799            | 0.07  | 0.370            |
| total effort       | -0.33              | <b>&lt;0.001</b> | -0.33           | <b>&lt;0.001</b> | -0.27              | <b>&lt;0.001</b> | -0.32 | <b>&lt;0.001</b> |
| men                |                    |                  |                 |                  |                    |                  |       |                  |
| intense effort     | -0.36              | <b>0.005</b>     | -0.41           | <b>0.001</b>     | -0.17              | 0.209            | -0.38 | <b>0.004</b>     |
| moderate effort    | -0.29              | <b>0.027</b>     | -0.27           | <b>0.043</b>     | -0.23              | 0.081            | -0.27 | <b>0.041</b>     |
| walking            | -0.07              | 0.623            | 0.02            | 0.880            | -0.07              | 0.626            | -0.02 | 0.906            |
| total effort       | -0.39              | <b>0.003</b>     | -0.40           | <b>0.002</b>     | -0.21              | 0.113            | -0.38 | <b>0.003</b>     |

IPAQ – *International Physical Activity Questionnaire*, MFIS – *Modified Fatigue Impact Scale*.

Bolded are the significance results for  $p < 0.05$ .

and diabetes [33]. During the COVID-19 pandemic, the proportion of physical activity in the population worldwide [34] and also among teachers [35] decreased significantly. Many schools at different levels of education are participating in special programmes to promote physical activity among pupils or students after the pandemic. However, the promotion of physical activity among teachers in these schools remains low. As research shows, a teacher's personal commitment to physical activity can also have a positive influence on students' physical activity behavior [36–38].

Teachers also represent an occupational group in which a high level of fatigue can be observed due to the nature of the job and the specific workload [22]. It can be correlated with various factors, e.g. emotional exhaustion [39], the quality of communication with colleagues or quantitative indicators of workload [40].

The present study provides recent data on the physical activity and fatigue levels of teachers from Poland and the UK in the first year after the COVID-19 pandemic. No other studies comparing the 2 groups were found, so this is an original study. The results of this study show that Polish teachers are more physically active regardless of sex. However, the differences are mainly in walking and moderate activity. There are no significant differences in terms of intensity of physical activity among teachers in the 2 countries. It is possible that some of the differences between the levels of physical activity in the 2 countries are due to the prevalence of different workplaces among respondents – more respondents from Poland worked in elementary school where teachers are more likely to go for a walk or engage in moderate physical activity during their daily work with pupils.

**Table 5.** Influence of age on the occurrence of correlations between *International Physical Activity Questionnaire* (IPAQ) and *Modified Fatigue Impact Scale* (MFIS) – results of regression models in 2023 in Poland and the United Kingdom

| Independent factor                                  | Total effort (IPAQ)      |                  |         |
|---|--------------------------|------------------|---------|
|   | B (95% CI)               | p                | $\beta$ |
| Poland  |                          |                  |         |
| women ( $R^2 = 14.0\%$ , $F = 11.7$ , $p < 0.001$ ) |                          |                  |         |
| age (years)   | -0.235 (-0.417-(-0.053)) | <b>0.012</b>     | -0.20   |
| MFIS (total functioning)                            | -0.810 (-1.301-(-0.320)) | <b>0.001</b>     | -0.26   |
| men ( $R^2 = 13.7\%$ , $F = 4.5$ , $p = 0.015$ )    |                          |                  |         |
| age (years)   | -0.237 (-0.501-0.028)    | 0.078            | -0.23   |
| MFIS (total functioning)                            | -0.588 (-1.259-0.082)    | 0.084            | -0.23   |
| The United Kingdom                                  |                          |                  |         |
| women ( $R^2 = 13.7\%$ , $F = 11.4$ , $p < 0.001$ ) |                          |                  |         |
| age (years)   | -0.056 (-0.217-0.105)    | 0.494            | -0.06   |
| MFIS (total functioning)                            | -0.825 (-1.212-(-0.438)) | <b>&lt;0.001</b> | -0.35   |
| men ( $R^2 = 15.4\%$ , $F = 4.9$ , $p = 0.011$ )    |                          |                  |         |
| age (years)   | -0.043 (-0.263-0.177)    | 0.696            | -0.05   |
| MFIS (total functioning)                            | -0.873 (-1.451-(-0.296)) | <b>0.004</b>     | -0.38   |

B – regression coefficient,  $\beta$  – standardize regression coefficient, F – test statistic and p value for significance of whole model,  $R^2$  – coefficient of determination. p value for significance of each regression coefficient. Bolded are the significance results for  $p < 0.05$ .

**Table 6.** Correlations between age and physical activity or fatigue of teachers in Poland and the United Kingdom in 2023

| Variable           | Correlation – age |                  |       |              |                    |                  |       |              |
|--------------------|-------------------|------------------|-------|--------------|--------------------|------------------|-------|--------------|
|                    | Poland            |                  |       |              | The United Kingdom |                  |       |              |
|                    | women             |                  | men   |              | women              |                  | men   |              |
| r                  | p                 | r                | p     | r            | p                  | r                | p     |              |
| Physical activity  |                   |                  |       |              |                    |                  |       |              |
| intense effort     | -0.04             | 0.618            | -0.07 | 0.586        | 0.02               | 0.786            | -0.07 | 0.585        |
| moderate effort    | -0.18             | <b>0.027</b>     | -0.35 | <b>0.006</b> | -0.10              | 0.222            | -0.24 | 0.078        |
| walking            | -0.21             | <b>0.012</b>     | -0.26 | <b>0.045</b> | -0.20              | <b>0.017</b>     | -0.03 | 0.816        |
| total              | -0.20             | <b>0.013</b>     | -0.28 | <b>0.027</b> | -0.14              | 0.089            | -0.09 | 0.528        |
| Functioning        |                   |                  |       |              |                    |                  |       |              |
| physical (F-1)     | 0.35              | <b>&lt;0.001</b> | 0.33  | <b>0.009</b> | 0.39               | <b>&lt;0.001</b> | 0.12  | 0.355        |
| cognitive (F-2)    | 0.24              | <b>0.004</b>     | 0.28  | <b>0.029</b> | 0.36               | <b>&lt;0.001</b> | 0.26  | 0.053        |
| psychosocial (F-3) | 0.36              | <b>&lt;0.001</b> | 0.31  | <b>0.017</b> | 0.45               | <b>&lt;0.001</b> | 0.28  | <b>0.037</b> |
| total              | 0.30              | <b>&lt;0.001</b> | 0.30  | 0.022        | 0.38               | <b>&lt;0.001</b> | 0.23  | 0.085        |

Bolded are the significance results for  $p < 0.05$ .

However, this study shows a large difference between women and men, with the former reporting a higher level of fatigue, and a particularly large difference between the sexes in the Polish population. The discovered

differences between women and men confirm reports from the literature [22,41,42].

Increased fatigue in women is a phenomenon that has been known for a long time. It is thought to

occur up to 3 times more frequently than in men [43]. Differences in fatigue between the Polish and British populations can only be seen in women – Polish female teachers report significantly higher fatigue levels. The authors hypothesize that, as with physical activity, some differences between the fatigue levels of men and women in the 2 countries could be due to the fact that they have different jobs. The male respondents mainly work at a higher level of education, which could affect the comparability of the results for both sexes.

Differences in the level of fatigue and physical activity in both populations may be influenced by the teachers' place of employment (different types of schools). In Poland, a larger percentage of examined people worked in primary schools and in England in high schools. As research shows, physical strain increases the level of fatigue. It turns out that up to 60% of primary school teachers do not have the opportunity to take regular breaks at work, which may contribute to the occurrence of prolonged fatigue [44].

There is a clear correlation between lower levels of physical activity (other than walking) and higher levels of fatigue among the teachers surveyed. Similar correlations have been observed in patients with chronic fatigue syndrome [45], people with HIV/AIDS [46] and multiple sclerosis [47]. These correlations may be partly due to the fact that physical activity decreases with age and the feeling of fatigue increases. However, in the study presented here, the correlations of the IPAQ and MFIS with age were quite weak, and this does not appear to be a determining factor for the correlations that occurred. When interpreting the results of the cross-sectional study conducted, it is unclear what is the cause and what is the effect – whether it is the feeling of fatigue that discourages activity or whether inactivity increases the feeling of fatigue. In studies conducted with rheumatoid arthritis (RA) patients and mentally fatigued individuals, an increase in physical activity levels clearly led to a reduction in fatigue levels [48,49].

In this study, all models show a statistically significant (only for the Polish male population close to significant:  $p = 0.0842$ ) effect of total fatigue on total effort. This relationship is also present when the age of the teachers is included in the models, so it is an obvious relationship. It is worth noting that age has no significant effect on the reduction in total effort for UK teachers, in contrast to Polish teachers. There is evidence in the literature of a correlation between a lower level of physical activity and age [33]. In addition,

fatigue increases with age in the study group, which is confirmed in the literature [50,51]. This poses a problem as the correlations between these measures may be partial or even completely obvious, i.e., relatively older people are more likely to suffer from both types of these complaints.

The survey presented by the authors has a number of strengths, including the use of standardized survey instruments, the ease of reaching the sample group and the low cost of conducting the survey. The authors are also aware of the limitations, which include the cross-sectional nature, which makes it impossible to draw causal conclusions, the collection of data in an online environment and the self-report nature of the survey, which may result in participants giving a socially desirable response and the presence of confounding factors. Additionally, when collecting data, the authors did not collect information on non-occupational activities of the teachers or on the nature of work in schools with different levels of education.

## CONCLUSIONS

The problem of teacher fatigue is unfortunately widespread. They should be encouraged to engage in as much physical activity as possible during the day, which could have a positive impact on their health and productivity at work. The research presented here could provide the impetus for the development of systems to deal with fatigue among teachers in Poland and the UK. When planning and targeting fatigue reduction campaigns, physical activity should be encouraged and variables such as age, sex should be taken into account.

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