Prevalence and correlates of physical inactivity in adults across 28 European countries

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Introduction

Physical activity is positively associated with health and quality of life. According to World Health Organization (WHO) recommendations (2020), healthy adults (18–64 years old) should undertake at least 150–300 min of aerobic physical activity in moderate-intensity or at least 75–150 min of vigorous-intensity aerobic physical activity every week. Notably, insufficient physical activity is one of the most important modifiable risk factors both for non-communicable diseases, including obesity, cardiovascular disease, diabetes, cancer, hypertension and osteoporosis/osteoarthritis. Physical inactivity is estimated to be responsible for ~1 million deaths and 8.3 million disability-adjusted life-years annually in the WHO European Region. Furthermore, physical inactivity imposes economic costs of €80.4 billion per year to the EU-28, adding a significant financial burden to healthcare systems and societies. On the contrary, engaging in physical activity has a beneficial impact on the health of individuals, the economy and society. Despite the above benefits, previous research has noted that ~23.4% (95% UI 20.9–28.0) of the central and eastern European population still does not meet the WHO recommendations for physical activity.

Many personal, social and environmental factors have been associated with physical activity/inactivity. However, in Europe, the majority of such studies focus on specific subpopulations, such as children, adolescents, older adults and minority groups or focus on certain types of physical activity. Moreover, most studies that estimate the prevalence of physical activity/inactivity and its associated factors are either country-specific or international without a specific European focus, with studies reporting for European countries limited in number. With the above in mind, this study aims to present the prevalence and correlates of physical inactivity in adults across 28 European countries in 2017.

Methods

Data source

De-identified publicly available data were obtained from the Special Eurobarometer 472 on sport and physical activity. The cross-sectional survey was conducted in December 2017 across 28 European countries at the request of the European Commission, Directorate-General for Education Youth, Sport and Culture. The data collection included the UK as part of the European Union (EU), as it was performed before Brexit, however, we refer to European Countries rather than EU member states (EU MS) in the current document. The Eurobarometer uses a multi-stage, random sampling design. For this, the number of sampling points is drawn with probability proportional to population size and population density, covering the whole territory of each country. In all countries, gender, age, region and size of the locality were introduced in the iteration procedure. A comparison was made between the sample composition and population distributions of each of the participating countries to adjust for non-response. Participants from different demographic groups were interviewed face-to-face at home in their first language. The data consisted of ~1000 respondents aged ≥15 years per country, leading to a pooled sample size of 28 031. The analysis of this study was restricted to adults aged 18–64 years (n = 19 645).
Measures

To maintain consistency with the previous secondary analysis on Eurobarometer data report by Gerovasili et al., we assessed the frequency and duration of three types of physical activity based on the definition of physical activity derived from the International Physical Activity Questionnaire (IPAQ): vigorous activity, moderate activity (excluding walking) and walking. The IPAQ classification has been validated in several settings. The frequency was assessed with the questions ‘In the last 7 days, how many days did you do vigorous physical activity like lifting heavy things, digging, aerobics or fast cycling?’, ‘In the last 7 days, on how many days did you do moderate physical activity like carrying light loads, cycling at a normal pace or doubles tennis?’ Please do not include walking, and ‘In the last 7 days, on how many days did you walk for at least 10 minutes at a time?’ Duration of physical activity was assessed with the following questions ‘In general, on days when you do [type of activity], how much time do you spend at it?’ Respondents reported duration in minutes or answered ‘never’ or ‘don’t know’. The response ‘never’ was treated as a numeric value of zero, and those who answered ‘don’t know’ to any of the relevant questions were excluded from the analysis (n = 261).

We also assessed metabolic equivalents of task (METs) to estimate total physical activity per week. Based on energy expenditure estimates used in the IPAQ, each type of activity was assigned a MET value as follows: 3.3 METs for walking, 4 METs for other moderate activity and 8.0 METs for vigorous activity. The total amount of MET-minutes (MET-min) per week was calculated for each respondent by multiplying the reported time spent doing each type of activity by corresponding MET.

Based on the IPAQ criteria, respondents’ physical activity level was classified into the following three categories: high (vigorous activity on at least 3 days achieving ≥1500 MET-min/week OR ≥7 days of any combination of walking, moderate activity achieving ≥800 MET-min/week); moderate (≥3 days of vigorous activity and/or walking at least 20 min per day OR ≥5 days of moderate activity and/or walking at least 30 min per day OR ≥5 days of any combination of walking, moderate/vigorous activity achieving ≥600 MET-min/week; and low (not meeting high/moderate criteria).

Statistical analysis

Data were weighted to be nationally representative of each of the participating countries. Descriptive statistics were computed for the 28 countries overall and by country with 95% confidence intervals (95% CIs). Multivariable logistic regression analysis was used to examine associations between physical activity and the following sociodemographic factors: country, sex, age, education, difficulty paying bills, urbanization, region and life satisfaction. Education was assessed as respondents’ age at which they stopped full-time education with the question ‘How old were you when you stopped full-time education?’ Difficulty paying bills was assessed with the question ‘During the last twelve months, how often have you had difficulties in paying bills at the end of the month...?’, and was regarded as a proxy of socioeconomical status (SES). Urbanization was self-reported to the question ‘Would you say you live in a...?’ We confirmed that variance inflation factors for all independent variables in the model were below 2.0. All analyses were conducted with R version 3.6.2.

Results

Physical activity level across the 28 EU MS

Concerning overall physical activity levels across the 28 European countries, 36.2% (95% CI: 35.1–37.3) of adult residents were classified as physically inactive, and the highest proportions were noted in Southern Europe. As presented in table 1, Portugal was found to have the highest prevalence of physical inactivity, with the percentage of individuals (18–64 years old) not meeting the IPAQ cut-offs for moderate/high physical activity reaching 63.7% (95% CI: 60.2–67.2) of the population. Slightly lower, but still elevated were the levels of physical inactivity in Malta, Italy and Cyprus. Conversely, Sweden had the lowest rate of physically inactive adults (19.2%, 95% CI: 15.3–23.1) followed by Germany, the Netherlands and Estonia, in which 21.1% (95% CI: 18.2–24.1), 22.5% (95% CI: 19.2–25) and 23.7% (95% CI: 19.9–25.7) adults, respectively, reported inadequate levels of physical activity. The total proportions for moderate and high levels of physical activity across the 28 European countries were estimated at 40.8% (95% CI: 39.7–42) and 23% (95% CI: 21.9–24), respectively. Significant geographical variability was also noted, with the highest proportions of moderate physical activity in Northern and Southern Europe, namely in Sweden (51.3%, 95% CI: 46.2–56.3), Spain (49.3%, 95% CI: 45.5–53.1) and Denmark (47.9%, 43.4–52.5) and the highest rates of high physical activity in Western and Northern Europe, such as Germany (37.7%, 95% CI: 34.1–41.4), Luxembourg (34.9%, 95% CI: 29.1–40.6) and Estonia (34.8%, 95% CI: 30.6–39.1).

Across the 28 European countries, the mean total physical activity level per week was 1940 MET-min (95% CI: 1884–1996), from which 816 MET-min were attributed to vigorous physical activity, 488 MET-min (95% CI: 781–852) to moderate physical activity and 651 MET-min (95% CI: 634–668) to walking. Broad differences were noted across the included countries, with the mean weekly total physical activity levels ranging from 931 MET-min (95% CI: 842–1021) in Italy to 2861 MET-min (95% CI: 2656–3066) in Germany. Consistently with the previous findings, Northern and Western European countries, such as Latvia (1285 MET-min, 95% CI: 1125–1445), Estonia (1239 MET-min, 95% CI: 1077–1402) and Germany (1219 MET-min, 95% CI: 1088–1351) were found to be first in terms of vigorous physical activity level, while Southern European countries, namely in Malta (351 MET-min, 95% CI: 202–501), Italy (388 MET-min, 95% CI: 326–450) and Portugal (393 MET-min, 95% CI: 312–473) were holding the last places. Respondents from Germany with 844 MET-min (95% CI: 770–917), followed by Luxembourg with 776 MET-min (95% CI: 645–906) and the Netherlands with 735 MET-min (95% CI: 660–810) reported the most time in performing moderate physical activity, while the least was noted in Malta (173 MET-min, 95% CI: 113–233), Italy (188 MET-min, 95% CI: 161–215) and Portugal (259 MET-min, 95% CI: 215–303). Finally, adults in Estonia had the highest levels of walking (921 MET-min, 95% CI: 844–998) and those from Cyprus the lowest (351 MET-min, 95% CI: 289–413) (table 2).

Physical activity level and sociodemographic factors

An adjusted logistic regression analysis identified that adequate (moderate and high) levels of physical activity were independently associated with sociodemographic factors (table 3). Women were less likely than men to be adequately or highly physically active (aOR: 0.86, 95% CI: 0.78–0.95). Similarly, adults between the age of 40–54 (aOR: 0.65, 95% CI: 0.52–0.81) and 55–64 (aOR: 0.61, 95% CI: 0.49–0.77) were less likely to have moderate or high levels of physical activity in comparison with respondents aged between 18–24 year of age. Moreover, residents in Eastern and Southern European countries had higher odds of being physically inactive compared to Northern European countries (aOR: 0.64, 95% CI: 0.55–0.74 and aOR: 0.61, 95% CI: 0.52–0.71), while, high SES was positively associated with physical activity (aOR: 1.4, 95% CI: 1.16–1.69).

Discussion

Our study, based on the updated data of Eurobarometer 2017, indicated that approximately one-third (36.2%) of the adult population under the age of 65 was physically inactive across 28 countries in
Europe. In 2013, Gerovalili et al. within a secondary data set analysis of the previous Eurobarometer noted a lower prevalence of physically inactive adults (28.6%), suggesting a potential increase in physical inactivity between 2013 and 2017 as indicated by our analyses. Likewise, we found a lower total MET-min per week in 2017, of 1940 MET-min, compared to the 2151 MET-min in 2013. However, it is important to note that different cut-off criteria with regard to physical activity levels were used between the two studies, and hence this should be taken into account when comparing data. Similarly, Mayo et al. also noted that the prevalence of physical inactivity in Central and Eastern Europe and high-income Western countries gradually increased during this timeframe.

With regard to physical activity levels, a substantial cross-country differences were noted, which were expected due to the variability of geographical, sociodemographic and cultural characteristics between the 28 European countries. Southern and Eastern European countries found to be more physically inactive in comparison with Northern and Western European ones. This could be partly explained by the positive association between country prevalence of sedentary behaviour and country gross domestic product per capita in adults, which has been elucidated within a previous European study, or potentially to other climate or lifestyle factors. The quality of the environment and the built environment itself are geographical, sociodemographic and cultural characteristics between the 28 European countries. Southern and Eastern Europe and high-income Western countries gradually increased during this timeframe.

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Another interesting finding of this study and consistent with the current literature is that gender and age are significantly associated with physical activity. Females and older adults had a higher likelihood of being physically inactive in comparison to males and younger adults, respectively. While a parallel study assessing the gender gap in physical inactivity in Europe using the 2013 and 2017 Eurobarometer datasets also noted a higher prevalence of PIA was observed in women for 2017, and for 2013. However, a cross-national European study focused on sex differences of leisure-time physical activity, concluded that in countries with a higher level of equal opportunities between women and men in many life...
Table 3 Association between sociodemographic factors and being adequately or highly active among individuals aged 18–64 in 28 European countries, 2017 (n=19 645)

| N | % (95% CI) | AOR |
|---|------------|-----|
| Overall | 19 645 | 63.8 (62.7–64.9) | – |
| Gender | | | |
| Man | 8938 | 65.8 (64.2–67.4) | ref. |
| Woman | 10 807 | 61.8 (60.3–63.3) | 0.86 (0.78–0.95)* |
| Age | | | |
| 18–24 | 1862 | 73.2 (70.2–76.3) | ref. |
| 25–39 | 5792 | 67.4 (65.5–69.2) | 0.85 (0.68–1.05)* |
| 40–54 | 6935 | 60.1 (58.2–62.1) | 0.65 (0.52–0.81)* |
| 55–64 | 5056 | 57.9 (55.6–60.1) | 0.61 (0.49–0.77)* |
| Education | | | |
| 15 years | 1731 | 53.2 (49.6–56.8) | ref. |
| 16–19 years | 9305 | 60.7 (59.2–62.3) | 1.09 (0.92–1.29) |
| 20+ years | 7156 | 69.1 (67.3–70.8)* | 1.36 (1.13–1.62)* |
| Still studying | 1129 | 75.4 (71.5–79.2) | 1.53 (1.22–1.92)* |
| Difficulties paying bills | | | |
| Most of the time | 1892 | 52.2 (48.5–56) | ref. |
| From time to time | 5559 | 58.2 (56.1–60.3) | 1.2 (0.99–1.45) |
| Almost never | 11 848 | 67.8 (66.4–69.1) | 1.4 (1.16–1.69) |
| Perceived urbanization | | | |
| Rural village | 5502 | 64.8 (62.7–66.8) | ref. |
| Small/mid-size town | 8436 | 62.6 (60.9–64.3) | 0.9 (0.79–1.01) |
| Large town | 5696 | 64.7 (62.7–66.7) | 0.97 (0.85–1.11) |
| EU region | | | |
| Northern | 5293 | 70.5 (68.1–72.9) | ref. |
| Western | 4335 | 70.9 (69.7–72.9) | 1.11 (0.95–1.29) |
| Eastern | 4757 | 56.9 (54.9–58.9) | 0.64 (0.55–0.74)* |
| Southern | 5260 | 54.3 (52.2–56.3) | 0.61 (0.52–0.71)* |
| Life satisfaction | | | |
| Very satisfied | 4411 | 74.3 (71.2–77.4) | ref. |
| Fairly satisfied | 11 915 | 62.8 (61.5–64.2) | 0.74 (0.64–0.84)* |
| Not very satisfied | 2677 | 52.9 (49.9–56) | 0.6 (0.5–0.73)* |
| Not at all satisfied | 486 | 49.6 (46.2–53.5) | 0.53 (0.38–0.73)* |

AOR, adjusted odds ratios controlling for all factors in the table. 
*: Statistically significant results (P<0.005).
aspects, sex was not correlated with leisure-time physical activity.29,30 These results may show that sex-based inequality could be a possible explanation from a societal perspective. Moreover, in many countries, the women’s social role includes responsibilities including childcare and household managing, limiting the possibility of leisure-time physical activity, while it is more likely for men to participate in associations and groups where physical activity is promoted.31 With regard to age and physical activity, numerous studies have been conducted in order to detect the barriers and motivators for physical activity in older adults, with the most dominant ones referring to perceived physical and mental health.32

Finally, a strong correlation was found in this study between life satisfaction and physical activity, where adults with a high self-reported life satisfaction were more likely to be adequately or highly active. Although the majority of scientific evidence shows the positive impact of physical activity on life satisfaction, a reversed relationship between those two variables is also possible. A study by Schnohr et al.33 found increased life satisfaction in joggers with increased physical activity intensity. Additionally, Valois et al.34 found inadequate physical activity levels to be associated with low life satisfaction.

The strengths of this study include the representativeness of the sample in each of the 28 European countries as occurs from the Eurobarometer sampling methodology1 and the use of the same questionnaire, which allowed us to make cross-country comparisons. On the contrary, our study has several limitations, which should be taken into account prior to the interpretation of the results. First, this study is questionnaire based and there is a potential for information bias to occur (e.g. recall and social desirability bias). Second, we employed a cross-sectional, descriptive design and the implications for information bias to occur (e.g. recall and social desirability bias). Finally, a strong correlation was found in this study between life satisfaction and physical activity, where adults with a high self-reported life satisfaction were more likely to be adequately or highly active. Although the majority of scientific evidence shows the positive impact of physical activity on life satisfaction, a reversed relationship between those two variables is also possible. A study by Schnohr et al.33 found increased life satisfaction in joggers with increased physical activity intensity. Additionally, Valois et al.34 found inadequate physical activity levels to be associated with low life satisfaction.

Conclusions

Conclusively, our results noted that approximately one in three adults under 65 across the 28 European countries was physically inactive. Furthermore, we identified several individual/demographic (sex, age group, education) and macro-environment (economic difficulties, geographic setting) risk factors for physical inactivity. In particular, in terms of geographical factors, we report a considerable difference, with North/South East Europe divide in physical exercise outcomes. Moreover, as region/country specific differences were noted across the 28 European Countries, further research is needed to elucidate the factors behind these differences and to identify potential policy actions that may support the adoption of a physically active lifestyle across Europe.

Conflicts of interest: None declared.

Key points

- More than one in three of adults in 28 European countries were classified as physically inactive.
- Women were less likely than men to be adequately or highly physically active.
- Adults at the age of 40–54 and 55–64 were less likely to have moderate or high physical activity.
- High SES was positively associated with physical activity.

References

1 EU Working Group “Sport & Health”. Recommended Policy Actions In Support of Health-Enhancing Physical Activity. 2008. Available at: https://ec.europa.eu/assets/eca/sport/library/policy_documents/eu-physical-activity-guidelines-2008_en.pdf (8 September 2020, date last accessed).

2 World Health Organization. WHO Guidelines on Physical Activity and Sedentary Behaviour. 2020. Available at: file:///C/Users/user/Downloads/9789240015128-eng.pdf (9 March 2021, date last accessed).

3 World Health Organization. 2018. Physical Activity Factsheets for the 28 European Union Member States of the WHO European Region. Available at: https://www.euro.who.int/__data/assets/pdf_file/0005/382334/28fs-physical-activity-euro-rep-eng.pdf?ua=1 (8 September 2020, date last accessed).

4 Gutthold R, Stevens GA, Riley LM, Bull FC. Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1.9 million participants. Lancet Glob Health 2018;6:e1077–86.

5 Sheldrick MP, Tyler R, Mackintosh KA, Stratton G. Relationship between sedentary time, physical activity and multiple lifestyle factors in children. J Funct Morphol Kinesiol 2018;3:15.

6 Zagout M, Vyncke K, Moreno LA, et al. Determinant factors of physical fitness in European children. Int J Public Health 2016;61:573–82.

7 De Cocker K, Artero EG, De Henauw S, et al. Can differences in physical activity by socio-economic status in European adolescents be explained by differences in psychosocial correlates? A mediation analysis within the HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) study. Public Health Nutr 2012;15:2100–9.

8 De Cocker K, Ottevaere C, Sjostrom M, et al. Self-reported physical activity in European adolescents: results from the HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) study. Public Health Nutr 2011;14:246–54.

9 Lubis I, Peljes I, Drell C, Bammann K. Cross-sectional and longitudinal factors influencing physical activity of 65 to 75-year-olds: a pan European cohort study based on the survey of health, ageing and retirement in Europe (SHARE). BMC Geriatr 2018;18:94.

10 Langsjoen LJ, Terragni L, Rugser G, et al.; on behalf of the DEDIPAC Consortium. Systematic mapping review of the factors influencing physical activity and sedentary behaviour in ethnic minority groups in Europe: a DEDIPAC study. Int J Behav Nutr Phys Act 2017;14:99.

11 Makinen TE, Sippola R, Borodulin K, et al. Explaining educational differences in leisure-time physical activity in Europe: the contribution of work-related factors. Scand J Med Sci Sports 2012;22:439–47.

12 Mita J, Cerin E, Reis RS, et al. Do associations of sex, age and education with transport and leisure-time physical activity differ across 17 cities in 12 countries? Int J Behav Nutr Phys Act 2019;16:121.

13 Alkerwi AA, Schuh B, Sauvageot N, et al. Adherence to physical activity recommendations and its associated factors: an interregional population-based study. J Public Health Res 2015;4:406.

14 Belanger M, Townsend N, Foster C. Age-related differences in physical activity profiles of English adults. Prev Med 2011;52:247–9.

15 Marques A, Martins J, Diniz J, et al. The correlates of meeting physical activity recommendations: a population-based cross-sectional study. Eur J Sport Sci 2014;14:5462–70.

16 Murtagh EM, Murphy MH, Murphy NM, et al. Prevalence and correlates of physical inactivity in community-dwelling older adults in Ireland. PLoS One 2015;10:e0118293.

17 Marques A, Sarmento H, Martins J, Nunes LS. Prevalence of physical activity in European adults—compliance with the World Health Organization’s physical activity guidelines. Prev Med 2015;81:333–8.

18 Marques A, Martins J, Peralta M, et al. European adults’ physical activity socio-demographic correlates: a cross-sectional study from the European Social Survey. PeerJ 2016;4:e2066.

19 Gerovasili V, Agaku IT, Vardavas CI, Filippidis FT. Levels of physical activity among adults 18–64 years old in 28 European countries. Prev Med 2015;81:87–91.

20 International Physical Activity Questionnaire. 2002. Available at: http://www.sdp.uni-fvg.it/sites/default/files/IPAQ_English_self-admin_long.pdf (10 May 2021, date last accessed).
21 Lee PH, Macfarlane DJ, Lam TH, Stewart SM. Validity of the international physical activity questionnaire short form (IPAQ-SF): a systematic review. *Int J Behav Nutr Phys Act* 2011;8:115.
22 Mayo, X., Liguori, G., Iglesias-Soler, E. et al. The active living gender’s gap challenge: 2013–2017 Eurobarometers physical inactivity data show constant higher prevalence in women with no progress towards global reduction goals. *BMC Public Health* 2019;19:1677.
23 Guthold R, Stevens GA, Riley LM, Bull FC. Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1·9 million participants. *Lancet Glob Health* 2018;6:e1077–86.
24 Cameron AJ, Van Stralen MM, Kunst AE, et al. Macroenvironmental factors including GDP per capita and physical activity in Europe. *Med Sci Sports Exerc* 2013;45:278–85.
25 Van Holle V, Deforche B, Van Cauwenberg J, et al. Relationship between the physical environment and different domains of physical activity in European adults: a systematic review. *BMC Public Health* 2012;12:807.
26 Ståhl T, Rütten A, Nutbeam D, Kannas L. The importance of policy orientation and environment on physical activity participation—a comparative analysis between Eastern Germany, Western Germany and Finland. *Health Promot Int* 2002;17:235–46.
27 WHO. International Inventory of National Policies and Documents for Promotion of Physical Activity. Available at: https://www.euro.who.int/en/health-topics/dis ease-prevention/physical-activity/activities/international-inventory-of-national-policies-and-documents-for-promotion-of-physical-activity/inventory-overview (9 March 2021, date last accessed).
28 Kari JT, Pehkonen J, Hirvensalo M, et al. Income and physical activity among adults: evidence from self-reported and pedometer-based physical activity measurements. *PLoS One* 2015;10:e0135651.
29 Stalsberg R, Pedersen AV. Are differences in physical activity across socioeconomic groups associated with choice of physical activity variables to report? *Int J Environ Res Public Health* 2018;15:922.
30 Azevedo MR, Araújo CL, Reichert FF, et al. Gender differences in leisure-time physical activity. *Int J Public Health* 2007;52:8–15.
31 Verhoef M, Love EJ, Rose SA. Women’s social roles and their exercise participation. *Women Health* 1993;19:15–29.
32 Mudrák J, Slepíčka P, Slepíčková I. Perceived health and motivation to physical activity in seniors. *Kontakt* 2014;16:e44–50.
33 Schnohr P, Kristensen TS, Prescott E, Scharling H. Stress and life dissatisfaction are inversely associated with jogging and other types of physical activity in leisure time - The Copenhagen City Heart Study. *Scand J Med Sci Sports* 2005;15:107–12.
34 Valois R, Zullig K, Huehner E, Drane J. Physical activity behaviors and perceived life satisfaction among public high school adolescents. *J Sch Health* 2004;74:59–65.