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Adesão às Recomendações de Atividade Física: a Influência da
Participação em Atividades Desportivas Recreativas na Universidade de
Aveiro



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Dissertação apresentada à Universidade de Aveiro para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Fisioterapia, realizada sob a orientação científica do Doutor Fernando Ribeiro, Professor Coordenador com Agregação da Escola Superior de Saúde da Universidade de Aveiro.

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Palavras-chave

Contexto Universitário, Promoção, Atividade Física, Atividade Física de Lazer, Desporto Universitário.

Resumo

Introdução: A inatividade física é reconhecida como um dos principais fatores de risco de mortalidade e regista uma tendência crescente. As organizações de saúde há muito que salientam a urgência de implementar estratégias e planos de ação para mitigar este fenómeno e as suas implicações no estado de saúde, sociais e económicas. O objetivo deste estudo é avaliar os níveis de atividade física (AF) e o cumprimento dos critérios internacionais de AF em participantes de atividades física de tempos livres instituídas pela Universidade de Aveiro. Como objetivo secundário, pretende-se investigar o stress percebido, a auto-eficácia, as motivações para a prática de exercício físico e a adesão à dieta mediterrânica, comparando homens e mulheres, e testar a associação destas variáveis com os níveis de AF.

Métodos: Os dados para este estudo transversal foram recolhidos entre janeiro e abril de 2023 numa amostra de indivíduos com idades compreendidas entre os 18 e os 65 anos que tinham participado em Atividades Desportivas Recreativas (ADR) durante pelo menos 3 meses. As variáveis foram avaliadas por questionários: Questionário Internacional de Atividade Física – versão curta (IPAQ-SF) para a AF; níveis de stress pela Escala de Stress Percebido (PSS-10); autoeficácia pela Escala de Autoeficácia para o Exercício; motivações para o exercício pelo Inventário de Motivação para o Exercício (QMEr); adesão à dieta mediterrânica pelo Mediterranean Diet Adherence Screener (MEDAS).

Resultados: Participaram no estudo 73 indivíduos (60 mulheres e 13 homens). O IPAQ-SF classificou 42,5% dos participantes como "moderadamente ativos" e 37% como "muito ativos", em ambos os casos uma percentagem superior à da população em geral na mesma faixa etária; 60% da amostra refere passar ≥ 7 horas por dia sentado. Os homens apresentaram níveis significativamente mais elevados de AF total [2385,0 (1768,5) vs. 1514,0 (1180,5) MET-minutos/semana, $P=0,025$]. No geral, os participantes mostraram uma adesão moderada à dieta mediterrânica ($8,3 \pm 2,0$ pontos). 43,8 por cento da amostra referiu níveis de perceção de stress acima dos valores normativos. Foi observada uma correlação positiva entre a atividade física total (MET-minutos/semana) e a motivação para o exercício e a auto-eficácia.

Conclusões: A participação nas ADRs demonstrou ter um efeito positivo no cumprimento dos critérios de AF da OMS nesta população. Em particular, parece ser uma intervenção válida para, pelo menos, ajudar a cumprir as recomendações internacionais sobre os níveis de AF, mesmo em indivíduos que passam um elevado número de horas por dia em comportamentos sedentários.

Keywords

University Context, Promotion, Physical Activity, Leisure Time Physical Activity, University Sport.

Abstract

Background: Physical inactivity is recognised as a major risk factor for mortality and is on an increasing trend. Health organisations have long emphasised the urgency of implementing strategies and action plans to contrast this phenomenon and its health, social and economic implications. The objective of this study is to assess the levels of physical activity (PA) and the fulfilment of international PA criteria in participants of a leisure-time physical activity (LTPA) service instituted by the University of Aveiro. As a secondary aim, it is intended to investigate perceived stress, self-efficacy, motivations to exercise and adherence to the Mediterranean diet, comparing men and women, and test the associations of these variables with the PA levels.

Methods: Data for this cross-sectional study were collected between January and April 2023 on a sample of individuals aged 18-65 years who had participated in Recreational Sports Activities (RSA) for at least 3 months. The outcome measures were assessed by questionnaires: IPAQ-SF for physical activity; stress levels by the Perceived Stress Scale (PSS-10); self-efficacy by the Self-efficacy scale for Exercise; motivations to exercise by the Exercise Motivation Inventory (QMEr); adherence to the Mediterranean diet by the Mediterranean Diet Adherence Screener (MEDAS). The results were compared with those obtained from other recent studies representative of the Portuguese general population.

Results: A total of 73 subjects took part in the study (60 women, 13 men). The IPAQ-SF classified 42.5% of participants as "moderate active" and 37% as "high active," in both cases a higher percentage than the general population in the same age group; 60% of the sample report spending ≥ 7 hours a day sitting. Men showed significantly higher levels of total PA [2385.00 (1768.5) vs. 1514.0 (1180.5) MET-minutes/week, $P=0.025$]. Overall, the participants showed a moderate adherence to the Mediterranean diet (8.3 ± 2.0 points). 43.8% of the sample referred levels of perceived stress above normative values. A positive correlation was observed between total physical activity MET-minutes/week and motivations to exercise and self-efficacy. No correlation was found between PA levels and perceived stress and adherence to the Mediterranean diet.

Conclusion: The participation in the RSAs has shown to have a positive effect in achieving the WHO PA criteria in this population. In particular, it appears to be a valid strategy to, at least, help meet international recommendations on PA levels even in individuals spending a high number of hours per day in sedentary behaviours.

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**Abbreviations and/or
acronyms**

EMI-2 – Exercise Motivations Inventory-2

IPAQ-SF – International Physical Activity Questionnaire – Short Form

LTPA – Leisure Time Physical Activity

MEDAS – Mediterranean Diet Adherence Screener

MET – Metabolic Equivalent of Task

PA – Physical Activity

PSS-10 – Perceived Stress Scale

QMEr – Questionário de Motivação para o Exercício – Versão Reduzida

RGPD – Regulamento Geral de Proteção de Dados

RSA – Recreational Sports Activities

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Introduction

Physical inactivity is a global health pandemic, as it is now recognised as the fourth leading risk factor for worldwide mortality^[1-5]. The number of adults reporting insufficient physical activity (PA) increased by 5% in high-income countries between 2001 and 2016^[5]. The observed trend was partially attributed to reduced physical activity during leisure time, sedentary behaviors both at work and at home, and the growing reliance on 'passive' modes of transportation^[5-8]. At European level, this tendency was confirmed by the comparison between the 2009 Eurobarometer survey^[9] with the one of 2017^[10], in which the percentage of respondents who stated they never exercise or play sports had gained 6 points since 2009. The 2022 Eurobarometer survey^[11] showed a slight reversal of this trend, with an overall one percentage point decrease in physical inactivity when compared to the same survey carried out in 2017. Despite these overall results, Portugal showed a marked decrease in participation in PA, rising from 64% of respondents saying they never do exercise or sport in 2017 to 72% in 2022. That said, it is necessary to point out that, in this same survey, Portugal was found to be one of the European countries with the lowest rate of sedentary attitudes in relation to 'time spent sitting during the day', another of the parameters investigated to assess the general level of physical activity/inactivity. A result that is consistent with what emerged in 2017, although these results are in contrast to the data collected by the IAN-AF 2015-2016 national survey^[12]. Turning our attention to the results from the IAN-AF survey, where the IPAQ-SF data was examined, it was found that 43% of the Portuguese population aged 14 and above fell into the category of "sedentary," failing to meet any of the internationally recognized criteria for physical activity. Only 36% of young people (15-21 years), 27% of adults and 22% of the elderly (65-84 years) met the WHO recommendations^[13] and were therefore considered physically active. Increasing the PA levels is already a primary and common national and international goal^[1-4,7,14,15]. In pursuit of this objective, action plans and multiple strategies have been put forth, with due consideration for the specific target populations^[1,2,6,16-18]. When taking into account the population of university students, PA levels below recommendations can be observed in a substantial proportion of university students, as well as higher rates of time spent in sedentary behaviours than in the general population of young adults^[19-24]. At the current state of research, only few studies in Portugal have investigated this population's adherence to WHO PA guidelines^[25-27]; nevertheless, they seem to support this trend for Portugal as well. Considering the university a context in which good practices can and should be transmitted and encouraged, along with the fact that this population group is particularly susceptible to a drop in PA^[27,28], the present study aims to assess the levels of physical activity and the fulfilment of international PA criteria in students and employees of the University of Aveiro participating in informal sports practice, namely participation in Recreational Sports Activities (RSA). As a secondary goal, we intend to determine the levels of perceived stress, self-efficacy, motivation to exercise, and adhesion to the

Mediterranean diet comparing men and women; and assess whether physical activity is associated with perceived stress, self-efficacy, motivation to exercise, and adherence to the Mediterranean diet.

Methods

Study design

The present study is an observational descriptive cross-sectional study. The study was intended to be representative of the population participating in the Recreational Sports Activities (RSAs) provided by the University of Aveiro within the campus structure in the period between January and April 2023. The minimum sample size target was set at 30% of this population (approximately 400). The study design was approved by Regulamento Geral de Proteção de Dados (RGPD) and Ethics Committee of Aveiro University. All participants signed electronically an informed consent form. All data were collected in forms.ua.pt and then downloaded in an Excel file that was stored in the Aveiro University "ARCA" storage space. These were processed, codified and anonymised, through the pseudonymisation technique, in order to guarantee the protection of the legitimate rights of the holders, in conformity with the rules for privacy data protection established by the RGPD.

RSAs description

The RSAs services provided by the University of Aveiro to promote sport and physical activity within the university community consist of: gym group classes; weight room; individual and collective sports. With regard to gym group classes, the proposals are currently in the area of body&mind, cardio and strength training, namely: spinning; functional training; pilates; circuit training; recharge; localised; Jazz fit; Yourfit Pump; Yourfit fight; GAP; yoga. The weight room is equipped with machines and free weights, and an exercise technician is always present during operating hours. All users, after registration, have the right to an evaluation following which a training program is provided. In terms of sports activities, the proposals are: badminton; basketball; women's futsal; football 7; jiu-jitsu; ultimate frisbee; volleyball; taekwondo; padel. The premises designated for these uses are located within the campus structure. All information on these programmes is available on the University of Aveiro's website and additionally communicated via the institutional email.

Participants and sample recruitment procedures

The RSAs programme subscribers were contacted and invited to participate in the study by e-mail directly from the RSAs university promoter. The e-mail contained the link to the Limesurvey Internet platform of the University of Aveiro (<https://forms.ua.pt>), with the informed consent form to assign for participating and the questionnaire. The inclusion criteria were: age between 18 and 65 years; enrolled for at least 3 months in RSAs at the University of Aveiro. While the exclusion criteria were: any limitation or contraindication to performing physical exercise or PA of moderate to vigorous intensity.

Sample characterisation data and outcome measures

Alongside questions to characterise socio-demographic, academic/occupational, health and sports and physical activity profiles, the following questionnaires, all in their Portuguese validated versions, were submitted to the participants: IPAQ-SF to assess daily physical activity; Perceived Stress Scale (PSS-10) to assess perceived stress; Self-efficacy scale for Exercise for assessing self-efficacy; the Exercise Motivation Inventory (QMEr) to assess motivations to exercise; Mediterranean Diet Adherence Screener (MEDAS) to assess adherence to the Mediterranean diet.

For the assessment of the daily levels of physical activity, the IPAQ-SF, was used^[29,30]. It proposes questions concerning the average daily amounts of walking, moderate and vigorous activity as well as time spent sitting in the previous 7 days; from these data, an estimate of the weekly METs is obtained, and participants are classified into one of 3 levels of PA: 'high', i.e. people reporting to do vigorous-intensity activity on at least 3 days and accumulating at least 1500 MET-minutes/week, or 7 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 3000 MET-minutes/week; 'moderate', corresponding to 3 or more days of vigorous activity of at least 20 minutes per day, or 5 or more days of moderate-intensity activity or walking of at least 30 minutes per day, or 5 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 600 MET-min/week; 'low' or 'inactive', for those individuals not fulfilling any of the above criteria^[30].

Knowing that stress is a major contributor to the development and progression of cardiovascular disease^[31], and that PA has a beneficial effect both on psychological health and in attenuating cardiological responses to stress^[32,33], we decided to assess it with the PSS-10^[34,35]. This 10 items self-report questionnaire is designed to detect how stressful respondents felt in the previous month as a result of unpredictable, uncontrollable and overloaded situations.

In order to better understand the factors influencing the physical activity behaviours of the study respondents, self-efficacy for exercise and motivation for participation were investigated using, respectively, the Physical Exercise Self-Efficacy Scale and the Exercise Motivation Inventory (QMEr). The Physical Exercise Self-Efficacy Scale consists of a 5-item questionnaire, for a total maximum score of 20, analysing the confidence an individual has in performing an exercise according to different emotional states^[36]; the QMEr is a 14-item questionnaire divided into 3 dimensions (physical and psychological well-being; social motivations; health motivations) developed from the Exercise Motivations Inventory-2 (EMI-2)^[37,38].

As the protective impact of adherence to the Mediterranean diet on overall mortality and cardiovascular diseases, inter alia, is well established^[39], we decided to investigate it amongst participants. The questionnaire used for this purpose to assess dietary intake, MEDAS, consists of 14 items asking about the portions or times per week an individual consumes certain aliments or food groups as part of the Mediterranean diet. The total score of the MEDAS is obtained by summing

the score (0 or 1) assigned to each question (0-14); based on this score, participants are divided into 3 categories: poor (≤ 5 points), moderate (6-9 points), or good (≥ 10 points) adherence to the Mediterranean diet^[40-42].

Data analysis

Exploratory data analysis and Shapiro-Wilk tests were performed to determine the normality of the data distribution. Each variable in the study was presented as mean and standard deviation, when they respect a normal distribution, otherwise as median and interquartile range. Differences between men and women were tested with unpaired t tests (variables with normal distribution), Mann-Whitney U test (variables without normal distribution), or the χ^2 test (categorical variables). Pearson and Spearman's bivariate correlation were conducted to analyse the correlation between variables. Statistical significance was set at $p < 0.05$ for all tests. All analyses were conducted with the statistics software SPSS, version 29.0.

These data, within the limit of the possible overlap of outcome measures, were finally compared with data from the 2017 IAN-AF study and Eurobarometer 2022, as these were representative of the PA levels of the Portuguese population.

Results

A total the 73 adults met the enrollment criteria and completed the online questionnaires. Of these, 60 (82.2%) were women and 13 were men (17.8%). The age of participants ranges from 18 to 66; mean (SD) age was 39.4 (12.7) years. The characteristics of participants, in general as well as according to gender, are presented in Table 1.

Table 1. Participant characteristics and a comparison between women and men.

	All participants (n = 73)	Women (n = 60) (82.2%)	Men (n = 13) (17.8%)	P-value (women vs. men)
Age (years)	39.4 (12.7)	39.4 (12.2)	39.7 (15.3)	0.934
Weight (kg)	64.8 (11.9)	62.1 (10.4)	77.2 (10.5)	<0.001
Height (meters)	1.66 (0.08)	1.64 (.06)	1.77 (.07)	<0.001
BMI (kg/m ²)	23.42 (3.15)	23.2 (3.2)	24.6 (2.6)	0.143
Dominant member (upper limbs) [%]				
Right	89.0	88.3	92.7	0.255
Left	2.7	1.7	7.7	
Both	8.2	8.2	0.0	
Dominant member (lower limbs) [%]				
Right	82.2	83.3	76.9	<0.001
Left	4.1	0.0	23.1	
Both	13.7	13.7	0.0	
CV risk factors [%]				
Hypertension [%]	8.2	10.0	0.0	0.234
Dyslipidaemia [%]	19.2	21.7	7.7	0.246
Stress [%]	20.5	23.3	7.7	0.206
Family history of CVD [%]	12.3	13.3	7.7	0.575
Regular medications [%]				
Anti-hypertensive	8.2	10.0	0.0	0.234
HMG-CoA reductase inhibitors (Statins)	2.7	1.7	7.7	0.228
Other	11.0	11.7	7.7	0.677
Nationality [%]				
Portuguese	90.4	90.0	92.3	0.798
Other	9.6	10.0	7.7	
Marital status [%]				
Married / de facto union	60.3	61.7	53.8	0.601
Academic qualifications [%]				
2nd cycle of basic education	1.4	1.7	0.0	0.894
Secondary school	15.1	13.3	23.1	
Graduation	28.8	30.0	23.1	
Master's degree	21.9	21.7	23.1	
PhD	32.9	33.3	30.8	

Table 2 shows the RSAs and the LTPAs undertaken besides the university-promoted RSAs in terms of participation in at least one activity per category and absolute participation per type of RSA/LTPA. Participants attend an average of 1.8 ± 0.8 sessions per week of the RSAs promoted by the university programme with a mean duration of 59.2 ± 24.2 minutes per session. Men participated more in sport-like activities than women (46.2% vs. 6.7%, $P \leq 0.001$), while women attended significantly more group classes (e.g., functional training, localised training, Pilates) (81.7% vs 38.5%, $P=0.001$). The relative percentage of males involved in a second university RSA is lower than that of females; 39 participants (60.0% women vs. 23.1% men, $P=0.016$) were enrolled in two activities and 18 (26.7% women vs. 15.4% men, $P=0.392$) in three activities. On the other hand, 46.2% of male subjects undertake LTPA outside the university network in comparison to 30% of women ($P=0.261$). Overall, about one third of the participants engage in additional extra-university LTPA.

The levels of daily physical activity, motivations to exercise, self-efficacy, perceived stress and adherence to the Mediterranean diet of the total sample and compared by sex are presented in table 3. Overall, men reported a significantly higher levels of total PA, in terms of MET-minutes/week, mainly due to high amount of moderate activity (Table 3). Among them, the absolute percentage of individuals achieving high PA levels in the IPAQ-SF is almost double compared to the rest of the sample.

Motivations to exercise, self-efficacy, perceived stress, and adherence to the Mediterranean diet was similar between men and women (Table 3). Overall, the participants showed a moderate level of adherence to the Mediterranean diet. However, it's worth noting that 30.1% of the respondents exhibited a high degree of adherence, as indicated by a MEDAS score equal to or exceeding 10. In terms of the PSS-10 scores, 56.2% of the sample fell below the cutoff values of 20 for men and 22 for women, as compared to normative values for the Portuguese population. The women in our study averaged at the 70th percentile, while the men averaged at the 80th percentile. This suggests that, on average, men in the study experienced higher stress levels compared to both the general population and the women in the study. When considering motivations for participating in physical activity, the highest mean score was observed in the category related to health-related motivations, followed by psycho-physical well-being, and finally social motivations. In both genders, the mean scores on the self-efficacy scale were high, although it's important to note that there are no established reference values for comparison in existing literature.

Table 2. RDAs and beside-RDAs LTPAs in the total sample and a comparison between women and men.

	All participants (<i>n</i> = 73)	Women (<i>n</i> = 60) (82.2%)	Men (<i>n</i> = 13) (17.8%)	P-value (women vs. men)
Sport type RSA (total number)	10 (13.7%)	4 (6.7%)	6 (46.2%)	<0.001
Ultimate frisbee	2	1	1	
Volleyball	5	2	3	
Futsal	3	1	2	
Badminton	1		1	
Jiu-Jitsu	1		1	
Gym group classes type RSA (total number)	54 (74.0%)	49 (81.7%)	5 (38.5%)	0.001
Functional training	26	25	1	
JazzFit	7	7	0	
Yoga	2	2	0	
Spinning	10	8	2	
Localized training	13	13	0	
Pilates	23	21	2	
Circuit Training	14	12	2	
Fitness	5	4	1	
Recharge	2	2	0	
GAP	4	4	0	
Cardio	1	1	0	
Fight training	1	1	0	
Resistance training type RDA (total number)	10 (13.7%)	8 (13.3%)	2 (15.4%)	0.845
Other sports activities besides RSAs (total number)	19 (26.0%)	15 (25.0%)	4 (30.8%)	0.677
Futsal	2	2	0	
Ultimate Frisbee	1	1	0	
Sailing	1	0	1	
Rowing	1	0	1	
Running	6	6	0	
Gymnastics	1	1	0	
Swimming	4	4	0	
Skating	1	0	1	
Argentine tango	2	2	0	
Walking	2	2	0	
Jiu Jitsu	1	1	0	
Arbitrage	1	0	1	
Other resistance training activities beside RDAs (total number)	5 (6.8%)	2 (3.3%)	3 (23.3%)	0.011
Calisthenics	1	0	1	
Resistance training	4	2	2	

Table 3. Levels of daily physical activity, motivations to exercise, self-efficacy, perceived stress and adherence to the Mediterranean diet.

	All participants	Women	Men	P-value (women vs. men)
Physical activity*				
METs vigorous activity minutes per week (minutes)[median + IQR]	800.0 (1200.0)	760.0 (1200.0)	1144.6 (1440.0)	0.226
METs moderate activity minutes per week (minutes)[median + IQR]	240.0 (480.0)	160.0 (360.0)	720.0 (780.0)	<0.001
METs walking minutes per week (minutes)[median + IQR]	396.0 (651.8)	396.0 (721.9)	396.0 (643.5)	0.868
Sitting hours per day [median + IQR]	8.0 (3.5)	8.0 (3.0)	7.0 (4.5)	0.404
Total METs minutes per week (minutes) [median + IQR]	1680.0 (1416.0)	1514.0 (1180.5)	2385.00 (1768.5)	0.025
IPAQ-SF PA levels (%)				0.113
Low	20.5	22.3	7.7	
Moderate	42.5	45.0	30.8	
High	37.0	31.7	61.5	
Motivations to exercise				
Physical and Psychological Well-Being area	3.0 (0.8)	3.0 (0.8)	2.8 (0.8)	0.332
Motivation Associated with Social Interest area	2.2 (0.9)	2.2 (0.9)	2.6 (1.2)	0.106
Motivation associated with health area	3.6 (0.6)	3.6 (0.5)	3.8 (0.8)	0.302
Self-efficacy				
Self-efficacy for exercise scale score	16.6 (2.8)	16.6 (2.8)	16.8 (2.9)	0.846
Perceived Stress				
PSS-10 score	19.9 (7.8)	19.7 (7.7)	20.5 (8.2)	0.726
Mediterranean diet adherence				
MEDAS score	8.3 (2.0)	8.5 (2.0)	7.7 (0.6)	0.173

* two missings in the women' group (n=58)

A positive correlation was observed between total physical activity (MET-minutes/week) and motivations to exercise (Physical and Psychological Well-Being area: $r=0.250$, $P=0.015$; Motivation Associated with Social Interest area: $r=0.288$, $P=0.001$; Motivation associated with health area: $r=0.382$, $P=0.001$) and self-efficacy ($r=0.274$, $P=0.021$). Physical activity was not associated with perceived stress and adherence to the Mediterranean diet.

Discussion

This study aimed to investigate the main lifestyle factors influencing the risk of developing chronic, non-communicable diseases such as cardiovascular disease^[32]. Primarily, the levels of PA, with the main objective of assessing the effect of the LTPA available at the Aveiro University; followed by adherence to the Mediterranean diet, and the level of perceived stress. By 2020, the Aveiro University census counted approximately 18,000 students, professors, investigators and technical staff. At the time the questionnaires were submitted, there were approximately 400 professors, students, investigators and technical staff enrolled in the RSA programme. In this well-educated and health-conscious population almost 80% of the responders were found to be within the recommended minimum levels of PA. From the comparison of the results obtained by this sample at IPAQ-SF with those of the Portuguese general population reported in the 2015-2016 IAN-AF survey^[12] (57.4% moderately active to active), it is possible to observe that this specific PA promotion measure has a positive impact in favouring the achievement of the WHO recommendations. Regarding the PSS-10 score, 56.2% of the sample was below the cutoff of 20, for men, and 22, for women, relative to the normative values for the Portuguese population. These cut-offs refer to the 80th percentile of the scores obtained in the Trigo et al. study^[34], in which samples from the general population and samples with anxiety perturbation or diagnosed physical illness were examined. The women's average in our study was at the 70th percentile while the men's average was at the 80th percentile. The fact that almost half of the subjects exceed this threshold, above which a pathological component is considered to be present, can be partly explained by what the same study highlighted about higher average stress levels in university graduates and students. Nevertheless, these scores, although not compared with the counterpart population of students, employee and academics who do not engage in LTPA, do not cease to appear surprising, especially considering the well documented stress-reducing effect of physical activity^[32,33,43]. With regard to adherence to the Mediterranean diet, 30.1% of the responders was found to have high adherence based on the MEDAS score (cutoff ≥ 10); the same percentage corresponds to individuals with low adherence to this model (cutoff ≤ 7). These results are substantially overlapping with what was found in the IAN-AF survey through the Mediterranean Diet Score, except for the higher adherence of male individuals who in our study instead report a lower average score. In relation to the report about the predominant motivations to engage in physical activity, the field with the highest mean score is that of motivations associated with health, followed by that associated with psycho-physical well-being and lastly by the field of social motivations. The mean scores obtained on the self-efficacy scale were high in both sexes, although there are no cuts-off reference values in literature.

With 19% of regular participants in physical activities who nevertheless do not reach the minimum cut-off point for being considered physically active^[13], it is clear that the measure implemented is not sufficient by itself to achieve the aim. All the more so when considering that, due to the IPAQ's tendential overestimation bias, it is commonly assumed that only those in the 'high PA levels' group

are most likely to meet the current WHO recommendations^[44], thus reducing the number of responders meeting these criteria to only 38% (27.3% reported in the 2015-2016 IAN-AF survey in the general Portuguese population aged 22-65). This circumstance likely warrants further investigation, focusing on the influence of sedentary behavior on the attainment of the recommended full-day energy expenditure associated with physical activity^[45,46]. Bauman et al. using the IPAQ-SF confirmed how a sedentary lifestyle, here examined in terms of hours spent sitting during a normal working weekday, although this item is not directly included in the calculation of the instrument's final score, can be a factor highly associated with the actual fitness status even in those individuals who, as in this case, regularly perform PA^[47]. In this study, it is noteworthy that almost all participants reported spending significantly more time sitting than the corresponding segments of the general Portuguese population^[10,47-49]. A fact that could be partially justified by the international trend of increasing sedentary behaviour during study and work among students and academics^[50,51], with values consistent with those of Castro et al.'s review, in 2020^[22], but significantly higher when compared with those emerged from Vasconcelos et al.'s study, 2020, on a sample of Portuguese university students^[26], with 60% of responders exceeding both the 4.30 hour cut-off threshold to be considered already sedentary and the 7 diary hour cut-off that defines high risk^[52,53]. The other item that indirectly investigates sedentary habits, or rather is directly influenced by time spent in sedentary behaviors, and which is instead counted in the score calculation, is the weekly total time spent walking^[45,54,55] considering only walks of at least 10 minutes uninterrupted^[30]. Here again, the average MET-min per week was clearly lower than that of the general Portuguese population aged 18-64 years reported by the 2013 Eurobarometer^[8,56], also using the IPAQ-SF as assessment tool (396 vs. 625).

Considering this data, what is therefore most interesting is how, despite a pronounced sedentarism and the consequent reduced daily engaging in light PA^[45], the university's promotion measure proves to have an excellent impact in facilitating the attainment of the WHO criteria^[57]. That said, the risk that seems to be lurking behind this type of intervention, when not supported by a structured policy and appropriate strategies to enhance the reduction of sedentary behaviours, lies in the phenomenon of "active couch potatoes"^[58]. In fact, it has already been proven that a sedentary lifestyle, independently of PA (even if it still maintains its protective effect), is associated with an increased risk of mortality, cardiovascular disease, particular types of cancer and type 2 diabetes^[59-60]. As PA interventions might not necessarily lead to a reduction in sedentary behaviour^[58,61], it seems necessary to combine them with interventions aimed at informing and educating about the necessity and the reasons of reducing sedentary time and the strategies for doing so, applying them directly when possible as in the case of active breaks^[61,62]. According to this study's findings, particular emphasis should be placed on beneficial effects on health, as it was the main motivation for engaging in PA, and on psychological well-being, as stress was shown to be an important issue to consider

given the PSS-10 results. The university, and in a wider sense any school environment, is called upon to play a broader educational role, as the diffusion of these evidences and their application, whenever possible, would not seem to fit a better place or address a population more specifically susceptible to the risk of sedentariness and reduction of PA^[63].

Limitations and future research

Response rate and representativeness are the main concerns of this study. The low adherence resulted in a smaller sample size than expected with a consequently low power of statistical analysis. In addition, there is a clear disproportion within the sample between men and women. Another limitation is the proven inaccuracy of the questionnaire in estimating the real level of PA and sedentary lifestyle; in this sense, further studies should consider the additional use of more objective outcome measures to track these parameters, such as accelerometers or smartphone APPs. Future research should include the university population that does not participate in RSAs for making a comparison also on cardiorespiratory fitness and cardiovascular health.

Conclusions

The activities and facilities provided by the University of Aveiro to promote PA on campus have been shown to have a positive impact in meeting the WHO recommendations on PA in this population. In particular, the results seem to suggest that the RSAs can be a valuable resource to help achieve adequate levels of PA even in individuals who spend a high number of hours per day in sedentary behaviour.

A fact that, nevertheless, does not mitigate the need to complement this type of intervention with extended communication and education strategies aimed at reducing sedentary habits.

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