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Research Article

Sedentary Work and Anthropometric Assessment in Workers at a Polytechnic Higher Education Institution in Portugal

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Abstract

Introduction: In the last decades, with the introduction of changes in work processes and new technologies, there has been an increase in occupational sedentarism (worker in a sitting position for long periods).

Sedentary behavior is associated with an increased risk of developing chronic diseases such as obesity, type II diabetes, cardiovascular disease.

Objective: This study evaluates the relationship between sedentary work and anthropometric evaluation in Coimbra workers of polytechnic higher education institutions.

Materials and Methods: A questionnaire was applied, the Occupational Sitting and Physical Activity Questionnaire (OSPAQ). Data on age, sex, body fat percentage, waist circumference, skeletal muscle mass and body mass index were collected from a sample of 59 adult men and women between December 2017 and January 2018, working full time. For statistical treatment, the authors analyzed the information with SPSS Statistics.

Results: In the present study, 39 of the individuals were females and 19 males, aged between 31 and 62. Non-teachers showed a more significant sedentary lifestyle in their occupational activity, and teachers showed greater skeletal muscle mass and lower body fat percentage. Spearman's correlation revealed that there was no association between occupational sedentarism (sitting posture) and anthropometric parameters ($p > 0.05$).

Conclusion: Although there was no statistically significant association between sedentary work and anthropometric data, it was possible to observe a tendency for workers with a higher occupational sedentary lifestyle to show worse anthropometric parameters. Taking these data into account, it is urgent to adopt measures to create conditions for a healthy work environment.

Keywords: Health Promotion; Sedentary Behavior; Anthropometric Assessment; Workplace

Abbreviations:

OSPAQ: Occupational sitting and physical activity questionnaire

BMI: Body mass inde

Introduction

In recent decades, there have been substantial changes in technology (for example, computers), work organization, and the structure of industries and occupations, which has manifested itself in a service-oriented economy. Consequently, routine manual tasks at work have been replaced substantially over time by mechanized, automated or computerized systems. The number of jobs with more demanding physical load decreased, and sedentary work, in the sitting posture most of the time, increased significantly [1-4].

A study was carried out with almost 30,000 individuals in 32 European countries. The average time reported by participants in the sitting posture was 5 hours a day [5]. In another study that compared the reality of 20 countries (with almost 50,000 participants) using the same question, the average reported time in sitting posture was also 5 hours a day [6].

The 2003-2004 National Health and Nutrition Examination Survey (NHANES) study in the United States measured sedentary time by an accelerometer placed on the hip in 6 329 participants, with an average sedentary time of 7.7 hours per day - 54, 9% of the time agreed [7]. The Canadian Health Measures Survey (CHMS), with the participation of 2,832 Canadian adults, also collected data using an accelerometer placed on the hip (although not the same devices as the NHANES study) and found that the average daily sedentary time was 9.6 hours for men and 9.8 hours for women [8].

In previous studies, employees associated sedentary behavior (sitting posture for prolonged periods) in the workplace with little perception of health and expressed their more focused concerns about the pain associated with musculoskeletal injuries, fatigue and demotivation [9].

In Portugal, studies involving occupational inactivity that analyze the time spent in sitting posture have focused more in terms of musculoskeletal injuries related or linked to work, damages that result from the action of risk factors professionals such as repetition, overload and/or posture adopted during work [10,11].

However, occupational inactivity has been independently associated with comorbidities and mortality and is emerging as a severe public health problem [12].

The lifestyle of societies in European countries translates into increasingly less active behaviors, with the economy supported, with an increasing trend, in very sedentary professions/occupations, in which professionals such as managers, technicians, administrators and vendors [13].

One of the review studies on epidemiological studies regarding mortality, cardiovascular disease, diabetes and specific metabolic risk factors is suggestive that sitting for long periods and physical inactivity can cause serious health problems, and this cannot be simply explained by lack of exercise. This work highlights that the most direct evidence in the future for this crucial area may come from experience, by inducing more time in the sitting posture to determine the associated mechanisms directly and whether there are plausible cause-and-effect relationships between physical inactivity (sitting posture) and metabolic risk factors [14].

The current evidence links sedentary behavior to an increased risk of developing chronic non-communicable diseases such as diabetes mellitus type 2, cardiovascular diseases, cancers and these pathologies as the leading cause of mortality and morbidity in Portugal [15].

A study carried out in Australia, with a sample of 1579 adult men and women, with full-time employment at the time of the research, revealed that, although additional studies are needed to clearly understand the association between the time spent in sitting posture during the work in the female elements, that the variable time in sitting posture during the workday was independently associated with overweight and obesity in male individuals who worked full time [16].

Also, in the United States, sedentary work, the low physical demands of the job or its combination increased the risk of total and central obesity in male workers, mainly when they worked more than 40 hours a week. In women, sedentary work marginally increased the risk of total and central obesity - abdominal and trunk [3].

One of the motivations that led to this study was this evidence of a worrying reality, from the point of view of public and occupational health, to assess the relationship between occupational inactivity and anthropometric data, intending to define strategies work that promotes healthy lifestyles, as there are countless health benefits related to physical activity, which include a lower risk of chronic diseases, such as diabetes, heart disease and stroke, some types of cancer and depression.

Materials and Methods

Data collection took place during December 2017 and January 2018 at the polytechnic higher education institution premises, and all participating individuals did so voluntarily by signing the informed consent and were previously informed about the results. Methodological objectives and procedures.

The study was of an observational analytical type, and concerning the design, this was transversal.

Study subjects

In the universe of 74 teaching and non-teaching professionals (who were eligible considering that they were full-time teaching workers on an exclusive basis and teaching workers with administrative functions), 59 ESTeSC workers (approximately 80%) were included in the sample. Of the remainder, four refused to participate in the study; two were not fit for clinical reasons and nine due to lack of availability.

Data collection

Anthropometric measurements

The anthropometric assessment allowed to assess the body composition of the individuals under study to identify/perceive health risks.

All individuals who constituted the sample were submitted to the anthropometric assessment protocol. The evaluation was always carried out by the same evaluator and lasted an average of 15 to 20 minutes per participant.

In the anthropometric assessment protocol, height and weight were estimated using a SECA 763 stadiometer; body mass index, body fat percentage and skeletal muscle mass were assessed with an Inbody230 bioimpedance scale, and waist circumference was measured.

Occupational sitting and physical activity questionnaire - OSPAQ

OSPAQ is a six-item questionnaire, developed by Chau and colleagues from the World Health Organization's MONICA Project, which requires participants to self-report as a percentage of the time they spend sitting, standing, walking, and perform heavy work/physically demanding tasks during a typical working day in the last seven days. Also, participants must provide data on the total effective working time in that same time interval - hours and days [17,18].

Considering that this study's primary focus is aimed at the institution workers (administrative workers and teachers), heavy work was omitted in this study. Only three non-teaching participants and one teacher indicated a value other than "0" for this category. Three of the responses received a value of "5%", and one received a value of "10%"; therefore, this category and the data of these four participants were excluded from further analysis.

The participants' activity data were calculated by multiplying the percentage of activity in each domain (sitting, standing, walking) of OSPAQ by the number of hours worked per day and the number of hours worked per week. In both cases, the results obtained were converted into minutes [17].

Statistical analysis

The statistical treatment was carried out by computer using the statistical treatment program Statistical Package for the Social Science (SPSS), in version 23 of 2016.

The statistical techniques applied were frequencies (absolute and relative), measures of central tendency (arithmetic mean, ordinal and median mean), measures of dispersion or variability (amplitude, interquartile range and standard deviation), coefficients (Alpha de Cronbach and Spearman) and statistical tests (Mann-Whitney U, the significance of the Spearman and Kolmogorov-Smirnov correlation coefficient, as a normality test). For all tests, 0.05 was set as a significance limit.

Results

Characteristics of the study sample

The study sample consisted of 59 individuals, aged between 31 and 62 years; most of the sample consisted of teachers (66.1%). We also found that most individuals were female (66.1%) and that 37.3% had a master's degree, and an equal percentage were PhDs.

Anthropometric assessment

Regarding the weight status, it was found that 42.4% of the subjects were overweight, followed by 44.1% who were of normal weight. For the BMI, values between 18.4 and 36.2 kg/m^2 were calculated, with the average value being 25.29 ± 4.18 kg/m^2. The parameters contained in World Health Organization were used [19].

As for skeletal muscle mass, it was found that 33.9% of individuals had values between 20.0 and 24.9 kg, followed by 15.2% who had less than 20.0 kg and an equal percentage that revealed values between 25.0 and 29.9 kg. Skeletal muscle mass varied between 17.3 and 46.8 kg, with an average weight of 27.50 ± 7.69 kg.

For the percentage of body fat, after classification [20,21], we found that most of the sample elements, precisely 67.8%, belonged to the class referred to as not diagnosed with obesity. Values between 13.2% and 47.7% were observed, with an average of 29.05 ± 8.07%.

It was found that, based on the waist circumference values, 64.4% of the individuals were classified as having a low risk. The values varied between 59.9 cm and 109.4 cm, with an average of 81.95 ± 13.15 cm. To assess the risk of metabolic complications were used the parameters of World Health Organization [22].

Occupational sitting and physical activity questionnaire - OSPAQ

Applying the OSPAQ instrument, we were able to assess the sedentary lifestyle in the study participants' workplace and obtain the results shown in table 2.

For working time/week, expressed in hours, we observed values between 14.0 hours and 84.0 hours, with an average of 43.20 ± 13.96 hours. Half of the sample elements reported weekly working times of less than 40.00 hours, with half of the subjects working up to 5.00 days/week.

As for the sitting time per week, expressed in minutes, we found results between 360.0 and 3780.0 minutes, with an average value of 1721.80 ± 746.14 minutes. Half of the sample members worked seated for more than 1680.00 minutes/week, and the interquartile range varied between 1176.0 and 2160.0 minutes/week. For the analysis taking the working day as a reference, sitting times between 69.0 and 588.0 minutes were observed, with an average of 335.19 ± 116.07 minutes.

Regarding the weekly standing time, values between 0.0 and 1470.0 minutes were observed, with an average value of 628.86 ± 359.05 minutes. Fifty per cent of the individuals worked, standing up to a maximum of 630.00 minutes/week. We found that standing time between 0.0 and 367.0 minutes was recorded concerning the daily work period, with an average value of 101.28 ± 84.63 minutes.

The weekly working time to walk was between 0.0 and 1260.0 minutes, with an average value of 321.91 ± 284.29 minutes. Half of the sample elements walked during work, at most, 252.00 minutes/week. Taking the day as a standard, we found work values

Variable	n	%
BMI (kg/m²)		
Underweight < 18.5	1	1.7
Normal (18.5 - 24,9)	26	44.1
Overweight (25.0 - 29.9)	25	42.4
Obesity class I (30.0 - 34.9)	5	8.5
Obesity class II (35.0 - 39.9)	2	3.4
Obesity class III (≥ 40)	0	0.0
A = [18.4 - 36.2]; = 25.29; Md = 25.20; s = 4.18; AI = [21.9 - 28.1]; p = 0.200		
Skeletal Muscle Mass (kg)		
< 20.0	9	15.2
20.0 - 24.9	20	33.9
25.0 - 29.9	9	15.2
30.0 - 34.9	8	13.6
35.0 - 39.9	8	13.6
≥ 40.0	5	8.5
A = [17.3 - 46.8]; = 27.50; Md = 25.30; s = 7.69; AI = [21.3 - 33.5]; p = 0.001		
Body fat percentage		
Without diagnosis of obesity	40	67.8
Diagnosed with obesity	19	32.2
A = [13.2 - 47.7]; = 29.05; Md = 27.40; s = 8.07; AI = [23.9 - 34.5]; p = 0.039		
Waist circumference (grouped)		
Low risk	38	64.4
Increased risk	15	25.4
Greatly increased risk	6	10.2
A = [59.9 - 109.4]; = 81.95; Md = 81.50; s = 13.15; AI = [69.9 - 91.0]; p = 0.200		

Table 1: Anthropometric characteristics.

Sedentary lifestyle in the workplace (OSPAQ)	A		Md	s	AI	p
Working time/week (hours)	[14.0 - 84.0]	43.20	40.00	13.96	[35.0 - 50.0]	< 0.001
Working time/week (days)	[2.0 - 7.0]	5.14	5.00	1.09	[5.0 - 6.0]	< 0.001
Sitting time per week *	[360.0 - 3780.0]	1721.80	1680.00	746.14	[1176.0 - 2160.0]	0.200
Sitting time per day *	[69.0 - 588.0]	335.19	336.00	116.07	[270.0 - 405.0]	0.200
Standing work time per week*	[0.0 - 1470.0]	628.86	630.00	359.05	[420.0 - 840.0]	0.039
Standing work time per day*	[0.0 - 367.0]	101.28	72.00	84.63	[42.0 - 147.0]	0.004
Walking work time per week *	[0.0 - 1260.0]	321.91	252.00	284.29	[105.0 - 420.0]	0.016
Walking work time per day *	[0.0 - 252.0]	62.87	51.40	55.06	[21.0 - 100.0]	0.013
Obs.: * evaluation in minutes						

Table 2: Sedentary characteristics in the workplace.

walking between 0.0 and 252.0 minutes, with an average value of 62.87 ± 55.06 minutes.

As it was verified, through the Kolmogorov-Smirnov test application, only the parameters referring to the sitting time per week and per day showed frequency distributions close to the normal distribution (p = 0.200).

Sedentary lifestyle in the workplace, according to the professional group

Applying the Mann-Whitney U test, statistically, significant differences were detected in terms of standing time per week and per day and walking time, also per week and day. The results obtained for central tendency measures (ordinal average, mean and median), it was found that teachers tend to show higher standing and walking times than non-teachers. As the differences in seated work are not significant, we can conclude that teachers show a less sedentary lifestyle in the workplace than non-teachers.

Anthropometric data according to the professional group

The results obtained (Table 4) show statistically significant differences in skeletal muscle mass and the percentage of body fat (p < 0,05). By comparatively analyzing the results obtained for central tendency measures, we can say that the teachers revealed to have greater skeletal muscle mass and a lower percentage of body fat than the elements of the group of non-teachers.

Relationship between physical inactivity at work and anthropometric data

Through Spearman's correlation coefficient and the respective significance test, we proceeded to study the relationship between

Sedentary lifestyle in the workplace (OSPAQ) Professional group	n	$\bar{x}_{ord}$		Md	p
Sitting time per week					
Teachers	39	30.42	1755.23	1680.00	0.791
Non-Teachers	20	29.18	1656.60	1732.50	
Sitting time per day					
Teachers	39	28.95	329.11	336.00	0.511
Non-Teachers	20	32.05	347.07	371.70	
Standing work time per week					
Teachers	39	36.76	767.69	750.00	< 0.001
Non-Teachers	20	16.83	358.14	420.00	
Standing work time per day					
Teachers	39	37.23	131.49	125.00	< 0.001
Non-Teachers	20	15.90	42.39	42.00	
Walking work time per week					
Teachers	39	33.60	380.89	360.00	0.024
Non-Teachers	20	22.98	206.91	159.60	
Walking work time per day					
Teachers	39	33.22	73.02	62.80	0.044
Non-Teachers	20	23.73	43.08	39.90	

Table 3: Comparison of sedentary lifestyle in the workplace according to the professional group.

the results obtained for a sedentary lifestyle at work (OSPAQ) and the values observed for anthropometric variables.

Based on the results presented in table 5, only statistically significant relationships between working time per week and the percentage of body fat were identified, as shown in a negative correlation ($p < 0,05$). Thus, we can say that individuals for whom the weekly standing time is higher tend to offer a lower percentage of body fat.

Anthropometric data Professional group	n	$\bar{x}_{ord}$		Md	p
BMI (kg/m²)					
Teachers	39	29.72	25.10	25.10	0.860
Non-Teachers	20	30.55	25.65	25.55	
Skeletal Muscle Mass (kg)					
Teachers	39	33.26	28.96	26.90	0.042
Non-Teachers	20	23.65	24.64	22.30	
Body fat percentage (%)					
Teachers	39	26.71	27.45	25.90	0.040
Non-Teachers	20	36.43	32.18	32.00	
Waist circumference (cm)					
Teachers	39	30.59	82.25	83.30	0.713
Non-Teachers	20	28.86	81.36	79.05	

Table 4: Comparison of anthropometric data according to the professional group.

Discussion

Concerning sedentary characteristics in the work practice of teaching and non-teaching workers, carried out through OSPAQ, the results obtained were in line with expectations, with non-teaching workers showing greater inactivity in the workplace compared to teachers, since who perform administrative functions (which was one of the inclusion criteria in the study), spending more time in sitting posture and less time in standing and/or walking. These results are in line with some investigations carried out among office workers: Jancey and colleagues reported that, on average, the participants in their study sat in excess, about 1900 minutes for five consecutive days (in our research, the non-teachers pass on average 1755.23 minutes), or almost 6.4 hours per day of work - the results of non-teachers reveal about 5.8 hours per day of work [18].

Another study that supports the results obtained in this study and that was also carried out with workers in the same area where it was clarified that office workers could be sedentary for a very high proportion of their working hours, this study has found that sedentary during working hours was responsible for almost half (48.5%) of all of her sedentary time at weekly level [23]. A study was carried out with University of Minnesota Duluth staff, in which, except for facility maintenance staff, university staff spent nearly 75% of their working day sitting [24]. In the non-teaching team, who participated in our study, it was possible to observe that about 73% of their working hours are spent in a sitting posture.

Regarding the comparison of anthropometric variables according to the professional group, the results obtained show that teachers have greater skeletal muscle mass (Md = 26.90 kg) and a lower percentage of body fat (Md = 25.90%). If we check the previous point, this professional group tends to show higher working time while standing and walking, either per day (standing presents Md = 125 minutes; walking Md is equal to 62.80 minutes) or for a week (standing shows Md = 750 minutes; walking to Md is similar to 360 minutes), thus assuming that they have more significant physical activity at their workplace, daily and weekly, associated, in most cases, with the time they are to teach. Like this result, in the correlation between physical inactivity at work and anthropometric variables, individuals for whom the weekly working time is higher tend to show a lower body fat percentage. Some published studies maintain that individuals who are more active tend to have a lower body fat percentage [25,26].

Although our sample under study is not within this age group, published research carried out in Japan, with a sample of 272 women aged 65 and over, concludes that physical activity in middle age may be associated with a greater muscle mass in old age [27].

Contrary to other investigations carried out by Mummery and also by Lin in which there was an association between occupational inactivity and BMI ≥ 25 kg/m² [16,28]. Although our study correlates inactivity at work (in terms of time spent in sitting pos-

ture) with anthropometric variables, the reality is that we are facing a sample that shows occupational inactivity, in which half of the sample elements worked seated for more than 1680 minutes/week, and 336 minutes per day [18,23,24]. If we analyze table 2, in terms of the body mass index, 54.3% of the participants were ≥ 25 kg/m^2; concerning the body fat percentage, 32.2% of the participants present values that are in line with a diagnosis of obesity [20,21]. As for the waist circumference, 25.4% of our participants are at increased risk, and 10.2% significantly increased risk of metabolic complications, with the excessive accumulation of visceral fat in the abdominal region being associated with a higher risk of diseases cardiovascular diseases, type 2 diabetes, high blood pressure, as well as metabolic syndrome [29].

Conclusion

Against the objectives proposed in this study, concerning sedentary characteristics in the work practice of teaching and non-teaching workers, carried out through OSPAQ, the results obtained were in line with expectations, with non-teaching workers being the most sedentary in the area compared to teachers since they perform administrative functions.

Regarding the comparison of anthropometric variables according to the professional group, the results obtained show that teachers have greater skeletal muscle mass and a lower percentage of body fat, which are the ones that show less sedentary behavior at the occupational level, manifesting in their daily work some physical activity, such as standing and walking, associated with tasks related to the teaching of classes.

Based on the results presented in table 5, the study has no statistically significant relationship between sitting time (occupational inactivity) per week and per day with the percentage of body fat, body mass index and waist circumference. There may have been factors that we did not take into account in our study (such as the homogeneity of the sample in terms of years of service at the institution), and that may have influenced the same.

Regarding the data that characterize our sample, in terms of anthropometric parameters such as physical inactivity in the workplace, they constitute an alarm signal, consisting of risk factors in the development of chronic non-communicable diseases mentioned earlier in this work; so it is imperative to take these results into account and take steps to prevent this scenario from getting worse, taking into account one of the general principles of professional risk prevention, which translates into the elimination or minimization of risk. Due to the characteristics associated with the tasks inherent to the professional groups under study, the elimination of risk will be more complicated to manage. Still, from the point of view of minimizing exposure to it, some measures can be adopted to create work environments that promote styles of work healthy living. In this particular case, being a higher education institution in the health area, it has the human resources necessary to carry out this work, involving areas such as Environmental Health, Dietetics and Nutrition and Physiotherapy that can constitute a multidisciplinary team, in order to move from theory to practice in health promotion, which should be further encouraged in the workplace, through the organization of work, such as, for example, the rotation between tasks in sitting and standing or walking posture, acquisition of a secretary with hydraulic system for raising them; through the physical activity of workers with actions to raise awareness about the importance of it and its benefits for health and planning/executing programs to increase physical activity in the workplace; and the adoption of healthy eating habits with nutrition consultations, awareness-raising actions/workshops for healthy eating and intervention in the food offer made available in the canteen, bars and vending machines. Outside this context of an educational institution in the health area, the current evidence justifies hiring by companies/institutions of health professionals from the different areas mentioned above, integrating an Occupational Health Service so that workers' health conditions are guaranteed.

Conflict of Interest

The authors declare that they have no competing interest.

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