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Brief Report

Sedentary Risk Factors across Genders and Job Roles within a University Campus Workplace: Preliminary Study

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Abstract: Sedentary Risk Factors across Genders and Job Roles within a University Campus Workplace: Preliminary Study: Ahmad ALKHATIB. Department of Life and Sport Science, School of Science, University of Greenwich, UK—Background: University campus administrators, predominantly females, are considered more sedentary than academics, which may lead to higher prevalence of associated health risks. **Objectives:** The aim of this study was to investigate whether sedentary job role and gender are reflected by sedentary risk factors within a university campus. **Methods:** Following institutional ethical approval, 80 UK university campus employees were recruited, and 34 of them (age 47.8 ± 11.9 years, height 169 ± 1.0 cm, body mass 72.0 ± 14.1 kg) were measured for their systolic (SBP) and diastolic blood pressure (DBP), blood glucose (Glu), total serum blood cholesterol (Cho), dominant (DHG) and nondominant handgrip strength (NHG), body fat percentage (Fat%), trunk flexibility (Flex), peak cardiorespiratory capacity ($\dot{V}O_{2max}$), and answered a physical activity questionnaire (IPAQ). The data were analyzed using two-way ANOVA with job role and gender as independent factors, and each measured risk as a dependent factor. **Results:** Gender had significant effects (p<0.05), and males demonstrated higher Glu, SBP, DBP and BMI than females (p<0.05). Females had higher Flex and Fat%, and lower DHG and NHG (p<0.05). Job role neither affected measured risk factors nor interacted with gender. However, both groups demonstrated high BMI, Fat% and Glu values, with these risk factors being above the recommended healthy thresholds. IPAQ hours correlated positively with Glu (p<0.05) but with none of the remaining tests. **Conclusions:** Sedentary risk factors are prevalent within university employees irrespective of job role but not irrespective of gender. The results may provide a baseline for initiating tailored organizational targeted policies aimed at reducing sedentary risk factors associated with the university workplace.
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Key words: Cardiorespiratory capacity, Health risk factors, Sedentary lifestyle, University campus workplace

Workplace health promotion is known to influence employees' healthy behavior, nutrition and physical activity (PA)[1]. Effective health screening increases the awareness of existing sedentary lifestyle risks, leading to reductions in cardiovascular risks[2]. Regular health and physical activity (PA) screening within the workplace is beneficial in identifying, preventing and treating sedentary lifestyle risk factors[3, 4], which further encourages healthier lifestyle changes[5]. It also has cost reduction benefits for workplaces[3]. The cost of screening and evaluation has been suggested to account for at least 10–20% of any health intervention budget[6].

While the benefits of workplace PA intervention programs are evident, tailored evaluation of employees' health and fitness based on their gender and job role has not been fully explored. Generally, females and older adults have a higher prevalence of physical inactivity[7], and females have been found to be at high to very high risk of diseases associated with physical inactivity and associated obesity[8]. However, whether this gender-dependent trend is also prevalent within the same workplace, such as a university campus, is unknown.

The university campus workplace serves as a unique and ideal setting for health promotion[9]. Significant numbers of young adults attending university courses, and university employees may act as role models in incorporating healthy behaviors into their own lives, especially staff whose role is directly linked to health promotion[10]. The majority of university employees are white-collar, with varied office-based responsibilities for administrators (Adm), or teaching and research for academics (Acd). However, administrators tend to be mainly females and have been reported to sit

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for longer durations than academics, which may lead to higher risks of cardiovascular disease[11]. Whether campus administrators' overall health and fitness reflect increased health risks of reduced cardiorespiratory capacity, excess body fat, hyperglycemia, hypercholesterolemia and hypertension, compared with their academic counterparts is unknown. Only one study[12], which screened students, investigated some of those risk factors within a university campus community, but only a small sample of their results was presented due to the pedagogical context of their study. The advantages of identifying workplace employees' fitness and health through multiple health and PA measurements are well documented[13]. However, differences within the campus workplace specific to job role and gender have not yet been investigated.

The aim of this study was to assess the prevalence of lifestyle diseases risk factors associated with gender and job role within a university campus workplace. It was hypothesised that sedentary risk factors are associated with job role and gender within a university campus workplace.

Methods

Participants and design

In this cross-sectional study, all the participants were employees within a typical UK university campus based in Suffolk, UK. After obtaining institutional ethical approval, an email was sent to all enrolled staff of this campus, reaching the sample of approximately 180 employees (approximately 60% Adm and 40% Acd) with information about this study through the university campus email system. All employed staff have access to this mailing system as provided by the university. Around 80 employees from the same campus expressed interest and were all sent further email with specific information about the study's involvement, benefits and risks, and their correspondence was used to ensure that all sections of the campus sample were represented using convenient sampling. This number of respondents provided a power of approximately 70% for the intended comparisons for a significant level of 5%, which also considers the number of intensive physiological measurements performed per participant[14, 15]. A telephone interview was then performed to determine participant eligibility based on ACSM risk stratifications[16] and the results of a completed Physical Activity Participation Questionnaire (PAR-Q). The eligibility criteria used included 1) no previous diagnosed health or current medication and 2) ability to attend the whole duration of the assessment during their normal working hours, which in some cases required managerial consent.

Following applications of the latter exclusion criteria and voluntary withdrawals, approximately ten participants reported in their PAR-Q that they were on medication or had a previous medical history relating to hypertension, hyperglycemia or hypercholesterolemia. Another ten withdrew due to their inability to attend the testing schedule (time commitment), which sometimes required their manager's consent. Approximately ten others did not attend the testing day without providing a reason. Some (approximately ten) reported that they would feel back pain, chest pain, or dizziness if they performed some of the physical tests or that they did not wish to engage in the assessment fully (two of them due to hemophobia), so they were excluded following a telephone interview that confirmed this. Approximately six participants were excluded due to the fact that they were not regular employees (hourly paid staff).

Therefore, out of 80, there was 34 employees with the following characteristics: age (mean ± SD) =47.8 ± 11.9 years, height=1.69 ± 0.08 m, body mass= 72.0 ± 14.1 kg) who were then randomly tested and subsequently divided into groups based on gender as males and females (44% males, 56% females) and based on job role as academics and administrators (approximately 56% Adm to 44% Acd), which represented a distribution similar to that of the whole campus. The job roles represented approximately 10 different job titles with varied administrative and academics job roles from different departments within the same campus. The administrative roles were primarily office based, whereas the academic roles involved a combination of office and class-based duties involving teaching and research, which are similar to many other UK universities.

Testing procedures

The testing adhered to the Helsinki declaration for the use of human subjects. All participants gave written consent, took part in the full assessment and were individually interviewed and assisted in filling in the IPAQ questions related to PA for weekdays, weekends and work. The PA levels were then categorized into light, moderate and heavy activity levels according to the number of hours reported. Prior to the assessments, all equipment was fully calibrated. Coefficient of variability tests (approximately 3%) were performed for blood sampling, according to the manufacturers' recommended reliability for analyzers, blood collection and relevant biometric data. Participants were advised not to consume any food for at least 8 hours before the assessment and arrived in a fully hydrated state, with no heavy exercise or alcohol in the 24 hours before the assessment. Body mass was assessed to the nearest 0.1 kg, and height was assessed to the nearest 0.5 cm (Seca, Hamburg, Germany), with the shoes removed. Systolic and diastolic blood pressure were assessed after resting for 5 minutes using a digital monitor (M6, Omron, Bucks, UK) and recorded at least twice with a 1-minute break in between. Body composition was assessed for body fat mass and percentage[17] using a single- frequency bioelectrical impedance (BIA) analyzer at 50 kHz (Bodystat Ltd., Isle of Man, British Isles, UK).

Handgrip strength was measured for the dominant and nondominant arm using a handgrip dynamometer (Grip-D, Takei Scientific Instruments, Niigata, Japan). Maximal grip strength was determined as the highest score of three trials[16] and recorded to the nearest 0.1 kg. A trunk lift flexibility test was performed[18] three times with the maximum score recorded in centimeters using a flexometer (Takei, Takei Scientific Instruments, Niigata, Japan).

Blood samples were collected after a minimum of 5 minutes of rest in a supine position. A pin prick was applied to the finger tip, and approximately 10 μl of blood was collected on a test strip and analyzed using a portable analyzer for total serum cholesterol (Accutrend Plus, Roche, Mannheim, Germany) and for glucose (Accu-Chek, Roche, Mannheim, Germany).

Aerobic capacity was assessed with Astrand's submaximal exercise test[19], using a mechanically braked ergometer (Monark 824E, Monark Exercise, Varberg, Sweden). After a warm up of unloaded cycling for two minutes, the test was initiated with and increased by 1 kg for males and 0.5 kg for females every two minutes stage. The pedalling rate was maintained at 50 revolutions per minute. Heart Rate (HR) was continuously measured throughout the test using a HR monitor (RS400, Polar Electro, Kempele, Finland). The test was terminated during the last 10 seconds of the 6th minutes when participant's HR reached 120 BPM or higher. An additional stage was introduced if the HR failed to reach 120 BPM at the last stage. $\dot{V}O_2$ was estimated from the HR at the final stage using Astrand's monogram[19].

The employees filled in a survey about their perception of the assessment benefits they received. The survey consisted of seven open-ended questions about the employees intention to start, maintain or increase their PA following the study, the quality of the service they received, willingness to pay for such a service if provided on regular bases and whether they think the treatment should be provided for free and integrated within the campus workplace.

An individualized report was sent to each participant summarizing the results of each test conducted, presenting individualized tables of data, highlighting specific health benefits, risks and relevance for the employee and suggesting tailored recommendations for follow-up physical activity participation based on the employees' test results.

Data analyses and statistics

All of measured sedentary risks were analyzed for job role and gender using a two-way ANOVA with job role and gender as independent factors and each measured risk as a dependent factor. IPAQ results were analyzed similarly using a two-way Kruskal-Wallis nonparametric test. The results of each risk factor were compared against the recommended average (50th percentile) for age- and gender-matched healthy thresholds based on ACSM's guidelines[16]. Potential relationships between the measured risk factors across genders and job roles were analyzed using Pearson's correlation coefficient and when appropriate using Spearman's correlation.

The end of assessment survey questions were analyzed by coding for a) positive encouragement to engage in or increase PA following the study, b) intention to do exercise based on the test results received and c) integration of this assessment regularly in the workplace. The replies were then described as a percentage of the total number for each of these three codes. All data were analyzed using SPSS v.19, and significance levels were set at $p<0.05$. Data are expressed as means ± SD unless otherwise stated.

Results

Males had higher BMI, Glu, SBP, DBP, DHG and NHG values, and females had higher Fat% and Flex values ($p<0.05$, Table 1). Job role only affected BMI, which was higher in Acd than in Adm ($p<0.05$), but it had no effects on any of the remaining measured risks (Table 1). Furthermore, there were no interaction effects of gender and job role on any of the measured risks.

The risk factors of BMI, Fat% and Glu exceeded the recommended thresholds (Glu>5.9 mmol.l^{-1}, BMI>25, Fat%>26.4% and 21.1% for females and males respectively). All of the remaining variables were within the age- and gender-matched recommended thresholds (Table 1).

Total IPAQ hours were positively correlated with Glu (r=0.38, $p<0.05$), but were not correlated with any of the remaining tests for either job roles or genders. Furthermore, no correlations were found for any of the measured risks between either genders, or job roles.

The end of test survey showed that 97% of the employees assessed were positively encouraged to engage in or increase PA following their assessments; 96% stated their intention to do exercise based on the tests received, and 97% recommended the integration of this assessment regularly in the workplace, of which 92% stated willingness to pay for such a service if provided on regular bases on campus.

Table 1. Mean ± SD for all assessments indicating sedentary risk factors within university campus employees based on job role and gender

Assessment	Pooled data	Males	Females	Adm	Acd	Within adm males	Within adm females	Within acd males	Within acd females
Number (n)	34	15	19	19	15	10	9	5	10
Age (yr)	47.8 ± 11.9	47.6 ± 13.5	47.9 ± 10.9	44.3 ± 14.0	52.3 ± 6.7	44.2 ± 15.3	44.3 ± 13.4	54.4 ± 5.1	51.2 ± 7.4
Glu (mmol.l^{-1})	6.5 ± 1.5	7.2 ± 1.9*≠	5.9 ± 0.7≠	6.7 ± 1.7≠	6.2 ± 1.3≠	7.3 ± 2.1	6.1 ± 0.82	7.1 ± 1.7*	5.8 ± 0.7
Chol (mmol.l^{-1})	4.9 ± 0.7	4.9 ± 0.7	4.9 ± 0.7	4.9 ± 0.8	4.9 ± 0.6	4.9 ± 0.9	4.9 ± 0.8	5.0 ± 0.5	4.9 ± 0.6
DHG (kg)	36.1 ± 8.2	44.5 ± 6.2*	29.5 ± 4.3	36.2 ± 7.8	36.0 ± 10.9	41.9 ± 4.9*$$	29.9 ± 4.7	49.6 ± 5.5*	29.2 ± 4.2
NHG (kg)	34.2 ± 8.2	41.8 ± 4.4*	28.3 ± 4.8	34.3 ± 7.9	34.2 ± 8.8	40.4 ± 4.2*	27.4 ± 4.7	44.6 ± 3.6*	29.0 ± 5.1
SBP (mmHg)	115.2 ± 18.9	123.3 ± 21.7*	108.9 ± 13.7	112.9 ± 18.2	118.1 ± 19.9	118.2 ± 20.8	107.0 ± 13.4	133.4 ± 21.8*	110.4 ± 14.4
DBP (mmHg)	72.1 ± 10.6	76.1 ± 10.5*	69.0 ± 9.7	70.2 ± 9.5	74.7 ± 11.6	72.3 ± 9.7$$	67.8 ± 9.2	83.8 ± 8.1*	70.1 ± 10.6
Flex (cm)	17.1 ± 7.4	13.6 ± 5.7*	19.5 ± 7.5	15.6 ± 6.19	18.7 ± 8.4	14.5 ± 4.3	16.6 ± 7.6	12.0 ± 7.8	22.1 ± 6.7
$\dot{V}O_{2max}$ (ml.kg.min^{-1})	37.4 ± 8.6	36.5 ± 7.2	38.1 ± 9.6	39.9 ± 9.2	34.4 ± 6.9	39.3 ± 6.8	40.6 ± 11.3	32.0 ± 6.0	35.7 ± 7.3
BMI	25.1 ± 4.3≠	26.2 ± 5.0*≠	24.2 ± 3.5	24.2 ± 3.3	26.4 ± 5.2$	24.2 ± 4.1	24.1 ± 2.3	30.0 ± 4.9	24.4 ± 4.4
Fat (%)	27.9 ± 8.2≠	22.2 ± 6.2**≠	32.4 ± 6.8≠	26.1 ± 8.2≠	30.1 ± 8.1≠	20.8 ± 6.1**	32.1 ± 5.7	24.9 ± 6.1*	32.6 ± 7.9
IPAQ (h)	13.1 (4.1/14.3)	16.0 (4.5/17)	10.9 (3.0/12.0)	16.0 (3/17)	9.5 (5/14.0)	19.7 (3.9/39.8)	11.9 (3/10.5)	8.6 (3/15.5)	9.9 (4.5/13.6)

Mean (25th/75th percentile) was used for nonparametric IPAQ data. *Significantly higher in males than females. **Significantly lower in males than females (p<0.05). $Significantly higher in Acd than Adm. $$Significantly lower in male Adm than in male Acd. ≠Values indicating increased health risks according to ACSM's guidelines. Glu: Blood glucose, Cho: total serum blood cholesterol, DHG: dominant hand grip strength, NHG: nondominant handgrip strength, SBP: systolic blood pressure, DBP: diastolic blood pressure, Flex: trunk flexibility, BMI: body mass index, Flex: trunk flexibility, IPAQ: physical activity questionnaire (IPAQ).

Discussion

The study aimed to demonstrate the prevalence of sedentary risk factors within a university campus workplace, which may be dependent on job role and gender. Following individual comparisons for each risk factor with internationally recommended healthy values[16], not all of the measured factors met those criteria, including Fat%, BMI and Glu (Table 1). Excess body fat is known to be a leading cause of chronic diseases including cardiovascular diseases, type-II diabetes and cancer[20], and high fasting glucose is a risk factor for type-II diabetes[6]. Therefore, the results suggest that the employees' health did not fully reflect a "healthy" university workplace, which is known to be an ideal place for making lifestyle changes.

The direct physiological measurements, which combined health and fitness measurements, provided within this study could serve as an evaluative tool specific to a campus workplace, which may provide the bases for tailored effective intervention programs to reduce the health risks associated with the workplace sedentary lifestyle[12] and improving existing university campus health behaviors[9]. Furthermore, given the relatively high mean age of campus employees, the risks found may provide a baseline for the identification of long-term employees work limitations, and even early retirement[21, 22], and potentially reduced workplace absenteeism and overall costs[1, 6].

Job roles that are performed predominately by females have previously been associated with a high prevalence of overweight and reduced physical capacity, including in females working in the health-care sector[23], university campus nursing student staff[9] and campus administrators[11]. The lack of a significant difference in any of the measured risks between campus administrators and academics coupled with higher Glu, Fat% and BMI values in both males and females suggests that sedentary risk factors are equally prevalent irrespective of job role but not necessarily irrespective of gender within a university campus workplace.

The present study demonstrated no effects of the main job roles within a typical UK campus involving white-collar employees and showed no difference between academics and administrators in almost all of the twelve sedentary risks measured, which remained the case for job roles within female tests and within most male tests (Table 1). There have been no reports made encompassing all of these comparisons prior to this study, with the exception of a limited communication at an international congress[24]. The present study provided more comprehensive measurements and relied on less disparity in the gender distribution compared with another UK campus study[11], with the sample in the present study containing 44% males compared with 10% reported for only one risk factor of blood pressure in that study, and a similar ratio of job roles (around 50%). This study did not intend to measure sitting times; instead, a more accurate representation of the cardiorespiratory status of $\dot{V}O_{2max}$ measurement, which did not correlate with the reported IPAQ hours of PA, but neither values differed between academics and administrators. Therefore, the similar sedentary health risks measured in this study advocate allocating targeted intervention for administrators and academics with equal importance.

The results of the present study found significant effects of gender, and males had 18, 12, 10 and 8% higher Glu, SBP, DBP and BMI respectively than in females (Table 1), with no interaction of gender with job role for any of these risks. This suggests higher risk of type-II diabetes, hypertension and excess body fat in male campus employees than in female campus employees. Intervention programmes have regularly focussed on female participants at the workplace being more susceptible to sedentary lifestyle than males[9, 25] and occupying primarily administrative roles within a university campy[11]. However, higher prevalence of sedentary risks in males suggests the necessity for interventions targeted at male campus employees. Even though campus life seems to offer similar lifestyles for males and females and equally promoted health and well-being occupational policies, this was not reflected by similar risk factor measurements.

A global economic recession and reduction in government subsidies have led to organizational changes including educational institutions and have evidently placed high demands on employees of this sector[26]. Work stress levels and reduced psychological well-being have been systematically linked with several cardiovascular diseases including high blood pressure, myocardial infarction, stroke and angina pectoris[27]. It is not clear whether the risk factors tested within this study, especially the increased risk of hypertension within male academics, are linked to the increased job role demands. Nevertheless, the health risks found within this study suggest that future organizational changes in higher education may need to embed considerations for reducing cardiovascular disease risk factors within university campus employees.

The combination of assessments in this study has been reported to be motivational for instigating healthy and physically active lifestyle changes[5, 12] and to help prevent disease[4]. This has been supported by the present assessment survey showing a positive intention towards engaging in or increased engagement in PA following participation. In particular, 92% of the subjects suggested the necessity to integrate the assessments of this study regularly within the campus workplace, and 96% stated their willingness to pay for it if provided regularly in their workplace, especially with the detailed report they received following individualized analysis of their own data. Future studies may assess integrating a similar evaluation as part of well-being policies for employees within a university campus workplace.

Limitations

The study relied on several robust indicators for PA including $\dot{V}O_{2max}$ and upper body strength that fell within the recommended average scores for $\dot{V}O_{2max}$, strength and flexibility (Table 1) and suggests that university campus employees overall are fairly active. As subjectivity in IPAQ scores tends to overestimate PA levels[28], the cardiorespiratory indices provided through $\dot{V}O_{2max}$ in this study is a better PA indicator, and its levels inversely related to metabolic syndrome and associated risk of mortality[29].

The nature of the individualized direct physiological measurements presented within this study makes multisite or task intensity comparisons with a larger sample impractical. Furthermore, this study provided more comprehensive physiological measurements that are comparable to limited data available for a typical UK campus[11]. The analyses of combined physical capacity and health risks factors for campus employees in this study may provide a baseline for effective PA intervention based on job roles and gender. Perhaps future studies should focus on explaining whether campus workplace PA alone can explain the increased sedentary health risks factors found in this study.

Conclusions

This study is the first to apply combined health with exercise tolerance assessments in order to compare job role and gender-dependent risk factors within a university campus workplace. It is concluded that campus prevalence of sedentary risk factors is irrespective of job role but not irrespective of gender. This combination of health and cardiorespiratory indices may provide a baseline for initiating tailored campus organizational planning and targeted policies aimed at reducing sedentary risk factors associated with job role and gender. Efforts made in the university campus, as a workplace reaching large population groups, alongside wider strategies to increase physical activity levels[30] could help improve people's health significantly.

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