Original article

Relationship Between Sitting Duration During Working Days and Level of Physical Performance

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Abstract

Background & Aims:
Increased time spent in sitting during work is associated with poor physical performance and is identified as a risk factor for health complications. The aim of this study was to assess the effect of sitting duration during working days on level of physical performance in a university setting.

Methods:
A cross-sectional study of 35 male participants aged between 19 to 48 years were recruited during a 5 kilometers running contest. Demographics and sedentary lifestyle behavior data were collected via a questionnaire which included a question about the average number of hours spent sitting during working days. Physical performance was indicated by the finishing time of the running contest for each participant.

Results:
Participants mean time interval to complete the 5 kilometers running contest was 33 ± 6.5 minutes with an average speed of 2.5 m/s. A Pearson correlation coefficient indicated that number of hours of sitting

الملخص

الخلفية والأهداف:
النشاط البدني وممارسة الرياضة أمران ضروريان لتعزيز الصحة والحماية من الإعاقة. أظهرت الأدبيات الحديثة أن زيادة النشاط البدني وتقليل أوقات الخمول لهما أدوار أساسية في تحسين النتائج الصحية. افترضنا أن الوقت الذي يقضيه الأشخاص في الجلوس خلال أيام العمل سوف يرتبط بوقت أطول لإنهاء مسابقة الجري البالغ طولها ٥ كيلومترات.

طريقة البحث:
في هذه الدراسة تم إشراك ٣٥ شخصاً من الذكور تتراوح أعمارهم بين ١٩ إلى ٤٨ عامًا خلال مسابقة جري لمسافة ٥ كيلومترات. تم جمع البيانات الديموغرافية وبيانات نمط الحياة الخاملة عبر استبيان تضمن سؤالًا عن متوسط عدد الساعات التي يقضيها في وضع الجلوس أثناء أيام العمل. وتم قياس الأداء البدني من خلال الوقت المستغرق لإكمال مسابقة الجري لكل مشارك.

النتائج:
كان متوسط وقت إنهاء السباق للمشاركين ٣٣ ± ٦,٥ دقيقة بمتوسط سرعة ٢,٥ م / ث. أشار معامل ارتباط بيرسون إلى أن عدد ساعات الجلوس خلال أيام العمل كان مرتبطًا بشكل إيجابي مع الوقت لإنهاء مسابقة الجري لمسافة ٥ كيلومترات(P ≤ ٠,٠١).

during working days was significantly positively correlated with time to finish the 5 kilometers running contest ($r = 0.62835$, $P \leq 0.01$).

Conclusions:
Increased duration of sitting during working days was associated with the worse level of physical performance.

Keywords:
Physical Performance; Sedentary Behavior; Sedentary Life Style; Physical Activity

الخلاصة:
ارتبطت زيادة مدة الجلوس خلال أيام العمل مع مستوى أسوأ من الأداء البدني.

الكلمات الدلالية:
الأداء البدني، السلوك الخامل، نمط الحياة الخامل، النشاط البدني

Introduction

Physical activity and exercise are crucial in promoting health and in protecting from disabilities. Increasing physical activity and reducing total sedentary time has been emphasized in recent literature as having fundamental role in improving health outcomes [1–5]. Ainsworth and their team defined sedentary behavior as any activity with an energy expenditure below 1.5 times the resting metabolic rate which include sitting [6]. A growing evidence is showing the adverse effects raising from spending considerable amount of time in sedentary behavior, such as reclining or sitting, on the deterioration of physical functions. Furthermore, number of hours spent in sedentary level of activity was linked to worse health outcomes [7,8].

Individuals living a nonsedentary life style, which is defined as spending less than 3 wake hours a day in sedentary state, showed better health outcomes compared to individuals living a sedentary life style[9]. Stamatakis et al assessed sedentary behavior of 649 older adults using accelerometry and found that more than 65% of the older adults spent more than 8.5 hours sedentarily [10].

The advancement of technology has increased dependency on computer in workplace and daily living. Nowadays, the majority of work environments require employees to spend most of their working hours in sitting (i.e. sedentary state) leading to increased risk of health complications [7,8,11]. Keevil et al 2016, found that increased sitting time was linked to worse performance on tests of physical function

including number of sit-to-stand repetition test and gait speed test. The increased dependence on computer in workplace, especially for faculty and students, along with the increased evidence of the negative effects of the length of sitting duration on health, were the main motivators for this study.

The aim of the study was to assess the effect of sitting duration during working days on level of physical performance in university setting. We hypothesized that longer time spent in sitting during working days will be associated with longer time to finish the 5 kilometers running contest.

Methods

Participants

In this cross-sectional study, a convenience sample of 35 participants were recruited. All participants were male adults aged between 19 to 48 years
(mean 27.1 SD 7.1 years). Participants included students (n=22; 63%) and faculty (n=13; 27%). Participants' recruitment was performed during a 5 kilometers running contest that was organized by Majmaah University to promote healthy lifestyle among its faculty and students.

Procedures

The study protocol conforms to the ethical guidelines of the 1975 declaration of helsinki and was approved by the institutional review board at Majmaah University (Approval number MUREC-March.28/ COM-2018/04). All participants were voluntary recruited during the registration process for the 5 kilometers running contest in Majmaah University. The study investigator explained the study to interested participants in detail and obtained written informed consent from each participant. No compensation for participation was offered to the participants. Consenting and demographics questionnaire were completed in a private area after the participant registered for the running contest and were assigned a shirt number. The author consented all participants and measured the participants weight and height while the questionnaire and timing were performed by the 5 kilometers running contest organizers. Participants provided demographics and sedentary lifestyle behavior via a questionnaire which included a question about the average number of hours they spent sitting during working days. Next, all participants simultaneously started the 5 kilometers running contest in which each participant had a unique shirt number and the time to finish was recorded by the contest organizers by marking finishing time for each participant. Due to the contest rules, the participants were allowed a maximum of 45 minutes to complete the 5 kilometers

running contest. Finishing time was not recorded for participants reaching the finish line after the allowed time. Participants' physical performance was assessed during the 5 kilometers running contest by recording their ability to finish the 5 kilometers running contest and their finish time.

Physical performance

The 5 km running performance was shown to be a valid and reliable method to measure performance [12,13]. Fisher et al 2017, examined the reliability of the 5 km running performance in laboratory setting. They recruited 6 male-competitive runners to perform the 5 km running performance on 5 occasions separated by 48 hours to calculate the intra-subject variability of the 5 km running performance. They found that the intra-subject variability of the 5 km running performance was low with a coefficient of variation (CV) of 1.5% and a standard error of measurement (SEM) = 14.2 seconds. The inter-class correlation (ICC) of time to finish the 5 km running performance was 0.99 [12].

Hurst et al 2017, examined the reliability of the 5 km running performance in outdoor setting during 2 events of 5 km running that were 2 weeks apart. They recruited 15 endurance runners to perform the 5 km running performance on the 2 events. They found a CV of 0.95% and an ICC of 0.97[13].

Statistical Analysis

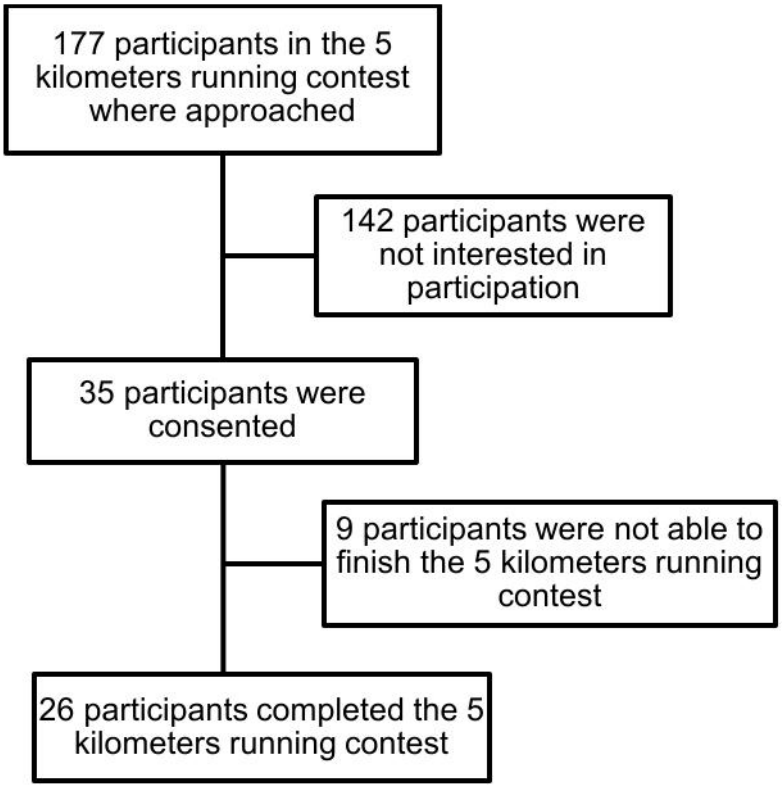
Demographics and descriptive information were presented as means and standard deviations for continuous data and percentages for ordinal and dichotomous data. The assumption of normality of the distribution of the variables was tested using the Shapiro-Wilk test of normality. The relationship between the variables were tested using Pearson correlation coefficient for normally distributed data and using Spearman rank-order correlation coefficient for not normally distributed data. Comparisons based on dichotomous outcomes were performed using the independent samples t test. All statistical analyses were conducted using SPSS version 22.0 with a significance level of $P < 0.05$.

Results

Participants

A total of 177 potentially eligible adults participating in the 5 kilometers running contest were approached for enrollment in the study. A total of 35/177 (20%) of potentially eligible participants were enrolled into the study. A flowchart indicating reasons for exclusion or inability to recruit participants is provided in Fig. 1.

Fig. 1: Participant enrollment flowchart



Twenty-four participants were able to finish the 5 kilometers running contest within the allowed time of 45 minutes, while 2 participants completed the running contest after the allowed time and were assigned a 45-minute finishing time. Twenty-six participants (74%) completed the 5 kilometers running contest and the length of time to finish the running contest ranged from 23.3 to 45 minutes. The mean time interval to complete the 5 kilometers running contest was 33 ± 6.38 minutes with an average speed of 2.5 m/s. Although the mean age of finishers was younger than non-finishers (m=26.5 years SD 6.5) and (m=29.2 years SD 8.5), respectively, this difference did not reach statistical significance (p = 0.3607). The reported average number of hours spent in sitting during working days ranged from 2 to 9 hours per working day (m=5.76 SD 1.92 hour). Twenty-two participants (63%) described their selves as athletics and half of the participants reported that they drove their own car to school/work while the other half walked and/or used public transportation. Demographic data of the participants are reported in Table 1.

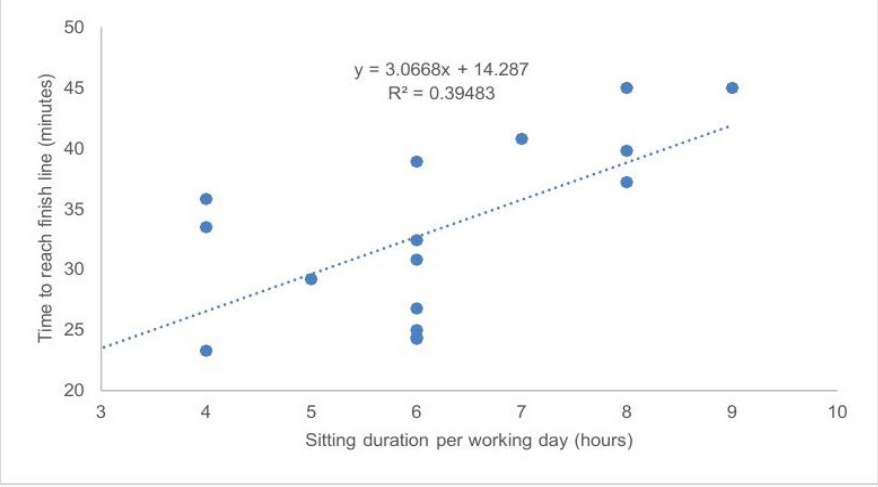
Table. 1 Demographics and baseline characteristics of the participants.

Characteristic	Mean	SD	Min	Max
Age (year)	27.1	7.1	19	48
Number of days exercised per week (day)	3.4	2.0	0	7
Number of minutes of exercise per week (minute)	191	204	0	750
Number of kilometers of walking/running per week (kilometer)	8.0	7.6	0	30
Sitting duration per working day (hour)	5.8	2.0	2	9
Last night sleep duration (hour)	6.0	1.8	3	11
Body mass index (BMI)	23.9	4.0	17.8	37
Weight (Kg)	70.8	10.9	49.7	93
Height (cm)	172.9	6.5	163	192
Time duration to complete the 5 kilometers running contest (minutes)	33.0	6.5	23.3	45

Relationship between sitting duration and physical performance

Results of the Pearson correlation coefficient (fig. 2) indicated that number of hours of sitting during working days was significantly positively correlated with time to finish the 5 kilometers running contest showing that when the number of hours spent in sitting during working days increased the time to finish the 5 kilometers running contest increased ($r = 0.62835$, $P \leq 0.01$).

Fig. 2: The relationship between sitting duration and physical performance



Relationship of age, weight and BMI with physical performance

Results of multiple Spearman rank order correlation coefficients indicated that age, weight, and BMI were significantly positively correlated with time to finish the 5

kilometers running contest. Which means the participants with older age, heavier weight, and higher BMI took longer duration to finish the 5 kilometers running contest (Table 2).

Table. 2 Spearman's rank correlation coefficient of study variables

Variable	1	2	3	4	6	7	8	9	10
Age (year)	-								
Number of days exercised per week (day)	-.04	-							
Number of minutes of exercise per week (minute)	-.28	.75**	-						
Number of kilometers of walking/running per week (kilometer)	-.13	.52**	.60**	-					
Last night sleep duration (hour)	.12	.09	.32	.25	-				
BMI	.53**	-.34	-.15	.01	.09	-			
Weight (Kg)	.47**	-.25	-.05	.11	.06	.87**	-		
Height (cm)	-.10	-.02	.04	-.02	.03	-.09	.24	-	
Time duration to complete the 5 kilometers running contest (minutes)	.54*	-.11	-.04	.33	.16	.70**	.62**	.07	-

*p < .05; **p < .01; BMI = Body mass index.

Discussion

The results of this study was in line with our hypothesis of the relationship between number hours spent in sitting during working days and level of physical performance as indicated by the length of the time needed to finish the 5 kilometers running contest. Furthermore, other statistically significant relationships of the level of physical performance with the participants' age, weight, and body mass index were found. Multiple studies assessed the association of physical function with sedentary life style behavior most of these studies used objective and/or subjective methods to assess or estimate the level of physical function and the sedentary life style. In this study we provided an objective measurement of the level of functional performance during a real-life rigorous activity to provide a meaningful results of the effect of sitting duration on the level of functional performance.

León-Muñoz et al. defined a non-sedentary life style as spending less than 3 wake-hours a day in sedentary state [9]. Using the definition of León-Muñoz et al., 2013

of living a non-sedentary life style only 2 individuals in our sample were classified as living a non-sedentary life style which limits the generalizability of our results to individuals living a sedentary life style.

The current findings support previous research of Keevil et al 2016, they found that increased sitting time was linked to worse performance on physical functions tests.

Our sample had an average time to finish the 5 kilometers running contest of 33 minutes which was longer than the time reported by Hanson NJ, et al., 2018 of 24.5 minutes in 11 male and female recreational runners. This difference was expected since 92% our sample were classified as living a sedentary life style according to León-Muñoz et al. definition.

Due to the aim of this study, we focused on university setting which limited the age range and the number of potential participants. Furthermore, we recruited the participants during a running contest which gave us access to a specific population who were willing to participate in the running contest. This may have limited the generalizability of our results and conclusions. Future studies should use larger sample of participants with a wider range of age with different occupations to improve generalizability. Another main limitation to our study is that no female participants were included in this study. This was due to the regulations of the running contest as it was for male participants only.

Although our results showed that participants with longer duration spent in sitting during working days had the least level of physical performance, causality cannot be inferred in this study. However, it is appropriate to advice for decreasing time spent in sitting during working days.

Conclusion

Duration of sitting during working days was negatively associated with the level of physical performance. With the increased dependency on computers in many work environment, modifications to the work environment to decrease the time spent in sitting may improve the physical performance and health of the workers.

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