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(Original Article)

Harmful Effects of Prolonged Sitting Behavior on the General Health of Employees of the University of Hail

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ABSTRACT

Background: Prolonged sitting time has negative consequences on health, although the people is not well aware of these harmful effects. There are limited studies conducted in Saudi Arabia on sitting behavior and its health effects.

Objectives: The purpose of the study was to assess the health status of the prevalence of sitting behavior and its adverse effects among teaching and non-teaching female staff in the University of Hail.

Methodology: Sample of 209 female teaching and non-teaching female staff in the University of Hail were enrolled for the survey. The first part surveyed the demographic characteristics and general health of the respondents, while the second part contained the Nordic Musculoskeletal Questionnaire (NMQ) to assess symptoms. The data collected was coded, entered and statistically analyzed.

Results: The demographic profile of the study population states that overweight people take the highest percent which accounts for 42.58% and 24.88% of study population were normal healthy weight and 19.62% of them were moderately obese. The percentage of weight change during past two years was 41.15% of people gained weight and 30.14% of them reported no change during that period and 28.71% of them lost weight during the past two years. 29.7% of people reported that they stay in sitting position for 5-6 hours at work and 27.3% reported that they spent 7 and more than 7 hours sitting at work. 38.76% of study population reported that they are suffering from lower back pain probably due to prolonged sitting hours and 33.97% of them reported shoulder pain, while 32.06% of them were suffering from neck pain. The results revealed that lower back (38.76%), shoulders (33.97%), and neck (32.06%) symptoms were the most prevalent problems reported by study population in the past 7 days.

Conclusion: Our findings suggest that sitting behavior had adverse effects on the employees. Active workstations are therefore recommended to improve working conditions. The data shows that compared with those who sit the least, those who sit the most have over twice the risk of developing type 2 diabetes and cardiovascular disease, and a 13 percent and 17 percent increased risk of cancer incidence and mortality respectively.

Key words: Musculoskeletal diseases, Sitting, Workplace.

1. INTRODUCTION

Modern workplaces have shifted the nature of occupations from active to sedentary and promote lengthy sitting behavior. One cause of this change is transitioning from paper-based work to computerized and paperless work (Dang et al., 2024; Daneshmandi et al., 2017). Office workers are part of a large group of occupations that generally work in a sitting position for much of the day (Evans et al., 2012). These people remain in a sitting posture for about two-thirds of their working hours, and their bouts of sitting periods typically last at least 30 minutes ((Thorp et al., 2012; Tremblay et al., 2012). Sedentary behavior (SB) is increasing in modern society and appears to differ from physical inactivity. Sedentary behavior is characterized by sitting or lying down and any low energy expenditure behaviors and is defined as any waking behavior that is done in a sitting or reclining posture that expends ≤1.5 metabolic equivalents (METs) (Baker et al., 2018). Common sedentary behaviors include watching television, working on a computer, or driving a vehicle. Notably, a worker can be physically active (meeting the physical activity guidelines of at least 2.5 to 5 hours of moderate-intensity or "huff and puff" physical activity per week), and still spend much of their time being sedentary. Sedentary behavior is common in Saudi Arabia and is linked with an increased risk of premature mortality, chronic health disorders, and detrimental work outcomes. Moreover, with the rapid advances in technology and the changes in the environment in the last few decades, the proportion of time spent sitting is likely increasing across the transport, leisure, domestic, and occupational domains (Moshref Javadi et al., 2022; Chomistek et al., 2013). A range of initiatives has been proposed to reduce occupational sitting exposure, including those focused on the design of safe work systems via the work environment (physical and psychosocial), work tasks, work tools, and the individual worker. Multi-component interventions targeting multiple elements of work systems appear to have been most successful. To date, assessment of occupational exposure and workplace interventions to reduce sitting have largely been focused on office work environments, with limited evidence for exposure or interventions in non-office environments. The increasing public awareness, along with a rapidly growing evidence base on health impacts and interventions, the widespread exposure of workers, and growing advice from various authorities suggest it is time to consider the growing hazard of excessive occupational sitting (Chomistek et al., 2013). It has been demonstrated that Sedentary behavior may increase the risk of obesity and cardiovascular disease (CVD) mortality, which may be partly independent of PA (Warren et al., 2010; Lynch, 2010). Biological mechanisms are still not completely known, but adiposity, metabolic (glucose, insulin), hormonal (sex hormones), inflammatory, and vitamin D deficiency among others have been proposed as important factors in the development and progression of some cancers (Patel, et al., 2015). In epidemiological studies, Sedentary behavior has often been expressed by proxy measures of sitting time, such as television viewing and computer use (Schmid &Leitzmann). A meta-analysis examined Sedentary behavior about cancer risk, but evidence was limited for specific cancer types because of differences in types of Sedentary behaviors and few studies considered specific cancers (Hildebrand, et al., 2015). A comprehensive prospective study [10] that examined Sedentary behavior in leisure time about total and specific cancer incidence, found that women who reported leisure time spent sitting more than 6 h/day had a 10% higher risk of total cancer compared to women who reported less than 3 h/day. The association was not modified by PA.

Emerging research indicates that Sedentary behavior is independently associated with cancer; however, few studies have examined the association between PA and sitting time with cancer within the same population (Owen et al., 2010). In addition, there is epidemiological evidence of increased risk of premature mortality and obesity however this is inconclusive. As sedentary (e.g., office) jobs become more prevalent (Ainsworth et al., 2000). The health risks for office workers are an increasing concern for society and industry. Sedentary behaviors (from the Latin sedere, ''to sit'') include sitting during commuting, in the workplace, in the domestic environment, and during leisure time. Sedentary behaviors such as TV viewing, computer use, or sitting in an automobile typically are in the energy expenditure range of 1.0-1.5 METs (multiples of

the basal metabolic rate). Thus, sedentary behaviors are those that involve sitting and low levels of energy expenditure (Warburton et al., 2006). Recently, the use of computers and daily sitting behavior has increased dramatically among workers and children. Additionally, household internet availability has increased, leading to more extended leisure time playing computer games and watching television (nearly 4 hrs a day or more) (Ainsworth et al., 2000). There's a growing preference for activities that require less human energy expenditure, leading to a widespread increase in sedentary behavior. In contrast, an active lifestyle improves general health and decreases the risk of chronic diseases (Warburton et al., 2006). It has been reported that active rest bouts between prolonged sitting periods are associated with beneficial metabolic profiles in adults and decreased waist circumference, body mass index (BMI), triglyceride levels, and two-hour plasma glucose levels (Healy et al., 2008). Therefore, this study aimed to assess the health status of the prevalence of sitting behavior and its adverse effects among teaching and non-teaching female staff of the University of Hail and recommend solutions.

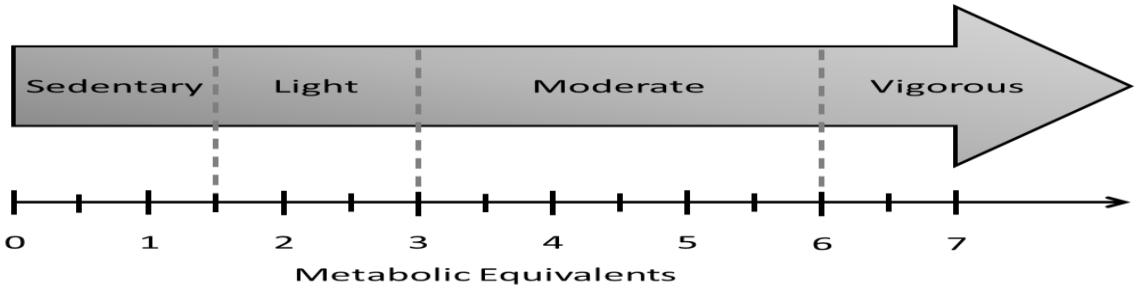

Figure (1) Energy expenditure continuum adapted from Sedentary Behavior Research Network, (J.M. Blodgett).

2. MATERIALS AND METHODS

2.1. Study protocol

This survey included the university employees both teaching and non-teaching staff, 209 employees participated in this study, which was conducted in all different colleges in the University Of Hail. A two-part questionnaire was used as the data collection tool. The first part surveyed the demographic characteristics and general health of the respondents, while the second part contained a Nordic Musculoskeletal Questionnaire (NMQ) to assess symptoms. Statistical analyses were performed using the Excel program and (SPSS) program. The study was approved in accordance with Helsinki Declaration of 1964 by the ethics and research committee prior data collection.

2.2. *Data-gathering tools and study procedure*

An anonymous, self-administered questionnaire was used to collect the required data from each participant. The questionnaire contained two parts: Personal details (including age, weight, height, job tenure, daily working time, marital status, education, daily exercise, and so on). The general Nordic Musculoskeletal Questionnaire (NMQ) assesses symptoms and examines reported cases of musculoskeletal disorders (MSDs) in different body regions among the study population and faculty members. Reported musculoskeletal symptoms were limited to the past 12 months. Each participant received the questionnaire to complete in person at his or her workplace.

2.3. Validation of the Questionnaire:

For content validity (back-to-back translation), the questionnaire was initially translated into Arabic and then converted back to English and pre-tested for question accuracy and clarity.

2.4. Statistical analysis

The data collected was coded and entered. The raw data was cleaned and edited for inconsistencies. The data was statistically analyzed by using Statistical Package for Social Sciences (version 16.0, SPSS, Inc.) software. The results were presented as frequencies and percentages for qualitative data. Means and standard deviations were calculated for the continuous variables.

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3. RESULTS

Table 1 shows that the overweight people take the highest percent which accounts for 42.58% and 24.88% of study population were normal healthy weight and 19.62% of them were moderately obese. Figure 2 represents the percentages of weight changes during the past two years: 41.15% of people gained weight, 30.14% reported no change, and 28.71% lost weight. Figure 3 represents the percentages of time spent sitting at work per day. 29.7% of people reported staying in a sitting position for 5-6 hours at work, and 27.3% reported that they spent 7 and more than 7 hours sitting at work. Figure 4 represents the percentages of time spent in a sitting position at home per day.31.6% of people reported that they spent 3-4 hours while sitting, and 28.2% reported that they spent 7 and more than 7 hours sitting at home. Figure 5 represents the percentages or frequencies of people who exercise per week. 42.58% of people reported that they exercise sometimes, 24.88% do not, and 19% reported that they exercise infrequently or once a week.

Table 1. Demographic Profile of the Study Population

	Frequency	Percent%	Cumulative Percent%
Severely underweight	1	0.48	0.48
Underweight	3	1.44	1.91
Normal (healthy weight)	52	24.88	26.79
Overweight	89	42.58	69.38
Obese class I (Moderately obese)	41	19.62	89.00
Obese class II (Severely obese)	16	7.66	96.65
Obese class III (Very severely obese)	7	3.35	100.00
Total	209	100	

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
Age (Year)	209	35	23	58	36.07	7.039
Height (cm)	209	75	120	195	160.29	8.136
Weight (kg)	209	138	40	178	73.50	18.444
TOTAL	209					

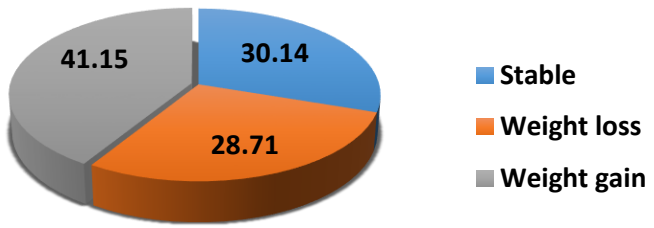

Figure 2: Weight changes during past two years

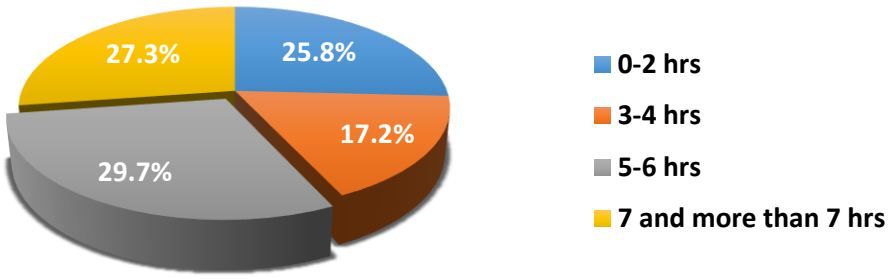

Figure 3: Time spent sitting at work per day

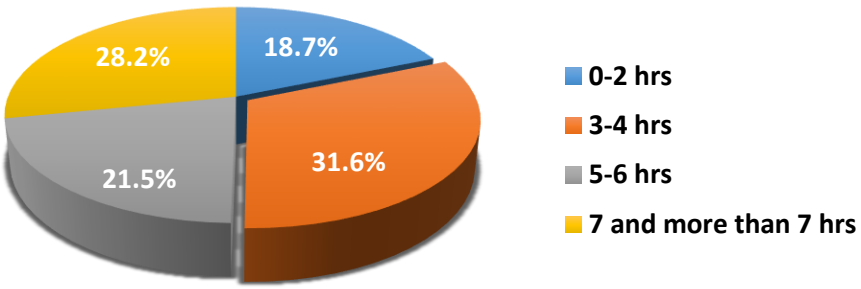

Figure 4. Time spent sitting at home per day

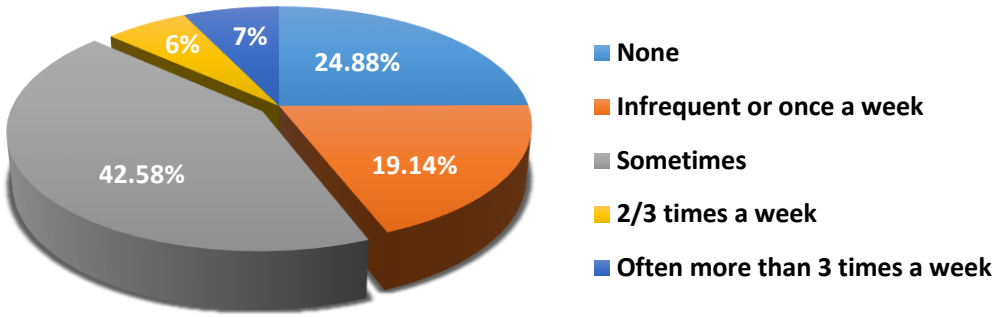

Figure 5: Frequency of exercise

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Table 2: Work Related Data among the Study Population

Variables	Yes	No
Is your work station comfortable	75.12%	24.88%
Are you careless about the job	6.22%	93.78%
Do you feel exhausted during the work day	62.2%	37.8%

Table 2 represents the percentages of people feeling comfortable in their workstations. 75.12% of them reported that they were comfortable in their current workstation, while 24.88% reported that they were not. And the percentages of people who care about and do not care about their jobs. 93.78% reported that they care about their jobs, while 6.22%, accounting for 6.22%, reported that they do not care about their jobs. And the proportion of people who feel exhausted during the work day. 62.20% of people reported feeling exhausted during the workday, while 37.8% reported that they did not. This indicated that prolonged sitting times affect exhaustion during the working day. Figure 6 represents the musculoskeletal symptoms in the body during the past 12 months. 38.76% of the study population reported suffering from lower back pain, probably due to prolonged sitting hours, 33.97% of them reported shoulder pain, and 32.06% suffered from neck pain. Figure 7 represents the percentages of the study population who had been prevented from carrying out normal activities because of their trouble with different body parts. 23.92% of the study population reported being prevented from performing normal activities because of lower back pain 16. 27% of them had been prevented but because of knee pain.

In comparison, 15.79% of them had been prevented because of pain in the ankles/feet. Figure 8 represents the musculoskeletal symptoms in different body parts during the last 7 days. The results revealed that lower back (38.76%), shoulders (33.97%), and neck (32.06%) symptoms were the most prevalent problems reported by the study population in the past seven days.

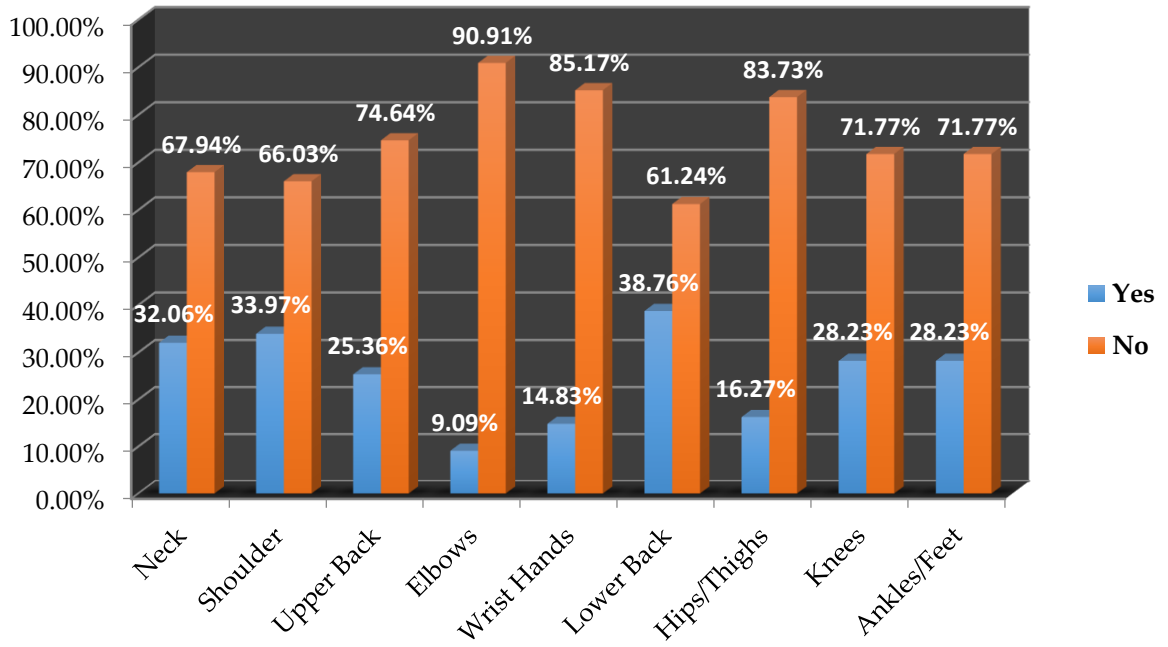

Figure 6. Musculoskeletal symptoms in different body regions during the past 12 months among the study population

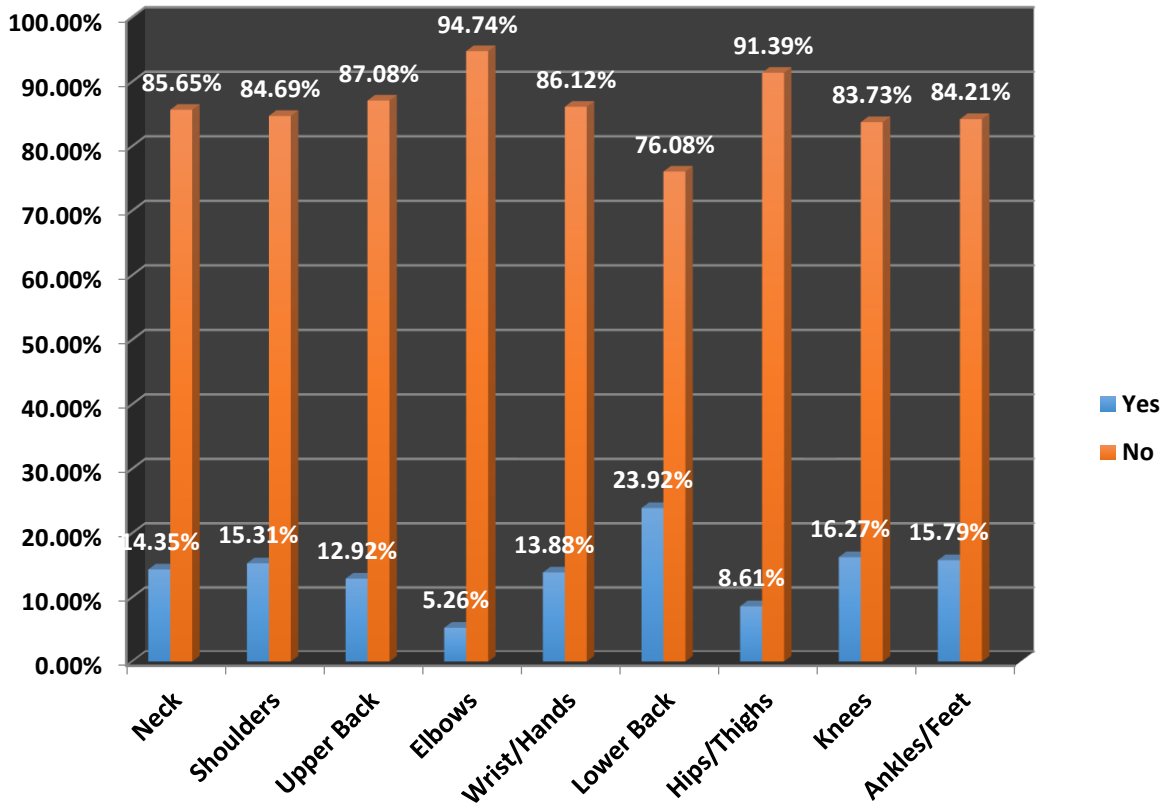

Figure 7. Prevented from carrying out normal activities because trouble in different body parts

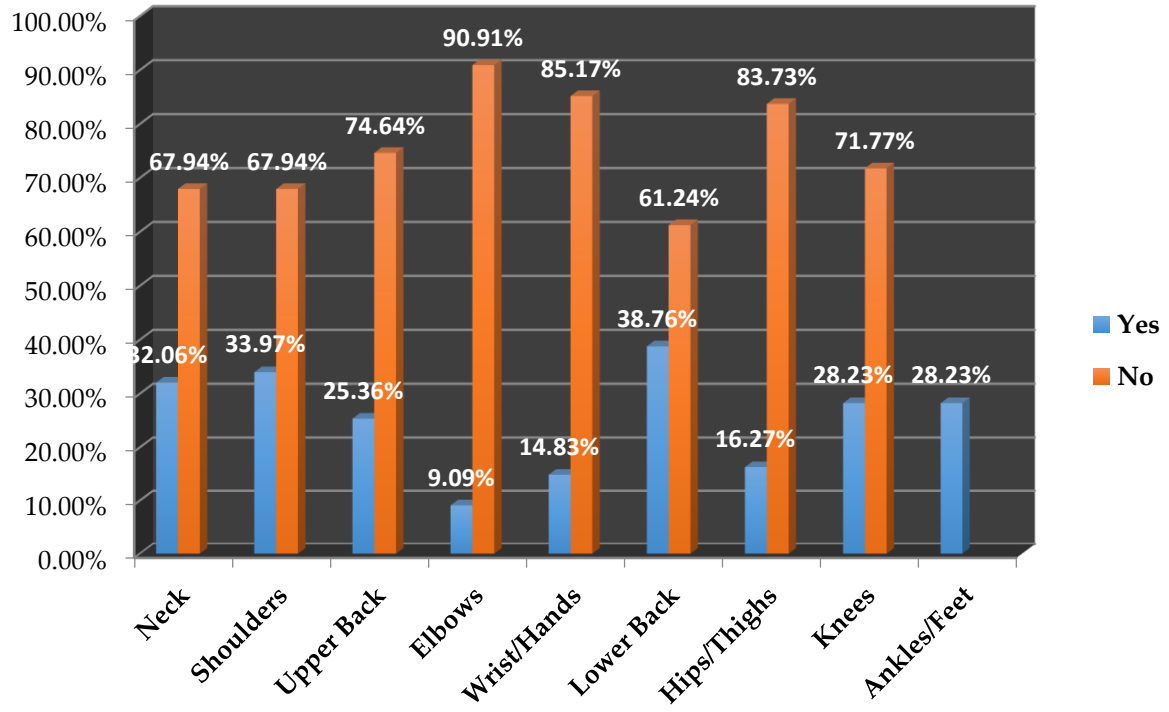

Figure 8. Musculoskeletal symptoms in different body regions during the last 7 days among the study population

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4. DISCUSSION

Prolonged sitting has emerged as a significant health concern, particularly for office workers. This sedentary lifestyle can have detrimental effects on various aspects of physical and mental well-being Other studies have shown that reducing one's energy expenditure and the lack of localized excitation-contraction of muscles that results from a prolonged sitting position can cause suppression of lipoprotein lipase activity. Lipoprotein lipase activity is critical for the attraction of triglycerides and the production of high-density lipoprotein cholesterol. Prolonged sitting additionally reduces insulin secretion, interferes with the uptake of blood glucose by skeletal muscles (Koh et al., 2022; Hamilton et al., 2004), and may also increase proinflammatory cytokines, which are associated with the development and progression of many cardiovascular disorders (Yates et al., 2004). Previous studies have demonstrated that office workers' musculoskeletal problems in different body regions, especially in the upper limbs, neck, shoulders, and lower back, are common (Bashatah et al., 2023; Rempel et al., 2006). According to the present study's findings, the use of active workstations for decreasing sitting time and its adverse effects would benefit the study population who have reported musculoskeletal problems, especially in the lower back, neck, and shoulders. However, it should be pointed out that an appropriate schedule for changing from a sitting to a standing position must be followed because sitting and standing postures may cause pain in the lower limbs. In a sitting position, the spine deviates from a normal shape to an S-shape, causing extra pressure on the spine but less pressure on the lower extremities. In contrast, in a standing position, the spine retains its normal shape and bears less pressure, but the lower extremities receive more biomechanical pressure due to the body's weight (Daneshmandi et al., 2017). As long as these considerations are considered, sit-stand workstations can reduce the harm of both positions.

5. CONCLUSION

Sitting behavior had adverse effects on the employees. Active workstations are therefore recommended to improve working conditions. Evidence showed that prolonged sitting is independently associated with negative health outcomes and mortality. The data shows that compared with those who sit the least, those who sit the most have over twice the risk of developing type 2 diabetes and cardiovascular diseases and a 13 percent and 17 percent increased risk of cancer incidence and mortality, respectively. The most encouraging evidence so far demonstrates that avoiding long sessions of sitting coupled with even short but frequent sessions of more light-intensity movement improves glucose and insulin levels. Such strategies have also been shown to reduce musculoskeletal discomfort and fatigue in office workers. Thus, the intervention includes information on the importance of reducing sitting time and its health benefits. It also offers alternatives to prolonged sitting time in the personal, working, and traveling environment proposed by the participants in the present qualitative study.

Future Recommendation

- Encouraging workers to accumulate two hours a day of standing and light activity during working hours, eventually progressing to four.
- Regularly breaking up seated-based work with standing-based work, with sit-stand desks highly recommended.
- Like prolonged static seated positions, prolonged static standing postures should also be avoided.
- Along with other health promotion goals, employers should promote that prolonged sitting, related to work and leisure time, may significantly increase a person's risk of cardiometabolic diseases and premature mortality.

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AUTHOR CONTRIBUTIONS:

All authors contributed equally to this work as follows

S. Shamsuddeen: H.O. designed and performed the experiments, Conceptualization, H.O., H.T. and E.A.; methodology, H.O.; validation, H.T. and E.A investigation, H.O..; scientific writing and manuscript preparation, H.T. and E.A.; supervision, project administration.

Maram Abdulaziz Aljudaiae; Rehab Sulaiman Alshammari: Data presentation, H.O.; manuscript revision and editing, H.T. and E.A.; proof reading, H.O.;

CONFLICTS OF INTEREST:

The authors declare no conflicts of interest with respect to the research, authorship and publication of this article.

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REFERENCES

Ainsworth, B. Haskell, W. Whitt, M. 2000.' Compendium of physical activities' An update of activity codes and MET intensities', Med.Sports Exerc.vol. 32,no. 9,pp.498-504.

Baker, R. Coenen, P. Howie, E. Williamson, A. Straker, L, 2018, ' The Short Term Musculoskeletal and Cognitive Effects of Prolonged Sitting During Office Computer Work', International Journal of Environmental Research and Public Health, vol.15, no.8, pp.1678

Bashatah A, Ali WS, Al-Rawi MBA. Attitudes towards Exercise, Leisure Activities, and Sedentary Behavior among Adults: A Cross-Sectional, Community-Based Study in Saudi Arabia. Medicina (Kaunas). 2023 Aug 23;59(9):1524. doi: 10.3390/medicina59091524. PMID: 37763642; PMCID: PMC10532842

Blodgett J.M, 'The association between sedentary behaviour, moderate-vigorous physical activity and frailty', Medicine, Published 25 August 2014.

Chomistek, A. Manson, J. Stefanick, M. Lu, B. Sands-Lincoln,M. Going , S. Garcia, L. Allison, M. Sims, S. LaMonte, M. Johnson, K. Eaton, C, 2013, ' The Relationship of Sedentary Behavior and Physical Activity to Incident Cardiovascular Disease: Results from the Women's Health Initiative', Journal of American College of Cardiology, vol.61, no.23, pp.2346-2354.

Daneshmandi, H. Choobineh, A. Ghaem, H. Karimi, M, 2017, 'Adverse Effects of Prolonged Sitting Behavior on the General Health of Office Workers', Journal of Lifestyle Medicine, vol.7, no.2, pp.69-75.

Dang THA, Starke KR, Liebers F, Burr H, Seidler A, Hegewald J. Impact of sitting at work on musculoskeletal complaints of German workers - results from the study on mental health at work (S-MGA). J Occup Med Toxicol. 2024 Mar 27;19(1):9. doi: 10.1186/s12995-024-00408-7. PMID: 38539214; PMCID: PMC10967152.

Evans, R. Fawole, H. Sheriff, S. Dall, P. Grant, P. Ryan, C. 2012, 'Point-of-Choice Prompts to Reduce Sitting Time at Work', American Journal of Preventive Medicine, vol.43, no.3, pp.293-297.

Hamilton, M. Hamilton, D. Zderic, T, 2004,' Exercise physiology versus inactivity physiology: an essential concept for understanding lipoprotein lipase regulation', Exerc Sport Sci Rev, vol.32, no.4, pp.161-166.

Healy, G. Dunstan, D. Salmon, J. Cerin, E. Shaw, J. Zimmet, P. Owen, N,2008, ' Objectively Measured Sedentary Time, Physical Activity, and Metabolic Risk', Diabetes Care, vol.31, no.2, pp.369-371.

Hildebrand, J. Gapstur ,S. Gaudet, M. Campbell, P. Patel, A. 2015' Moderate-to-vigorous physical activity and leisure-time sitting in relation to ovarian cancer risk in a large prospective US cohort. Cancer Causes Control '.vol. 26,no. 11,pp.1691–1697.

Koh YS, Asharani PV, Devi F, Roystonn K, Wang P, Vaingankar JA, Abdin E, Sum CF, Lee ES, Müller-Riemenschneider F, Chong SA, Subramaniam M. A cross-sectional study on the perceived barriers to physical activity and their associations with domain-specific physical activity and sedentary behaviour. BMC Public Health. 2022 May 26;22(1):1051. doi: 10.1186/s12889-022-13431-2. PMID: 35614402; PMCID: PMC9132675.

Lynch, B. 2010, 'Sedentary Behavior and Cancer: A Systematic Review of the Literature and Proposed Biological Mechanisms', Cancer Epidem Biomar.vol. 19,no.11,pp. 2691–2709.

Moshref Javadi AM, Choobineh A, Razeghi M, Ghaem H, Daneshmandi H. Adverse Effects of Sit and Stand Workstations on the Health Outcomes

of Assembly Line Workers: A Cross-sectional Study. J Prev Med Hyg. 2022 Jul 31;63(2):E344-E350. doi: 10.15167/2421-4248/jpmh2022.63.2.1567. PMID: 35968062; PMCID: PMC9351412.

Owen, N. Sparling, P. Healy, G. Dunstan, D. Matthews, C. 2010,'Sedentary behavior: Emerging evidence for a new health risk (commentary)'. Mayo Clin. Proc. Vol.85, pp.1138–1141.

Patel, A. Hildebrand ,J. Campbell, P. Teras, L. Craft ,L.. 2015,' Time Spent Sitting and Site-Specific Cancer Incidence in a Large US Cohort', Cancer Epidem Biomar.vol. 24,no. 9,pp. 1350–1359.

Rempel, D. Krause, N. Goldberg, R. Benner, D. Hudes, M. Goldner, G, 2006, 'A randomised controlled trial evaluating the effects of two workstation interventions on upper body pain and incident musculoskeletal disorders among computer operators', J Occup Env Med, vol.63, no.5, pp.300-306.

Schmid, D. Leitzmann, M. 2014,' Television Viewing and Time Spent Sedentary in Relation to Cancer Risk: A Meta-Analysis. Jnci-J Natl Cancer .vol. 106,no. 7,pp.198-199.

Thorp, A. Healy, G. Winkler, E. Clark, B. Gardiner, P. Owen, N. Dunstan, D, 2012,'Prolonged sedentary time and physical activity in workplace and non-work contexts: a cross-sectional study of office, customer service and call centre employees', International Journal of Behavioral Nutrition and Physical Activity, vol.9, pp.128.

Tremblay, M,2012,'Letter to the Editor: Standardized use of the terms “sedentary” and “sedentary behaviours”', Applied physiology,Nutrition,and Metabolism, vol.37, no.3, pp.540-542.

Warburton, D. Nicol ,C. Bredin, S. 2006,' Health benefits of physical activity', Can Med Assoc J, vol.174,no.9,pp.801.

Warren, T. Barry ,V. Hooker, S., Sui, X. Church, T., Blair, S. 2010,'The Sedentary behaviors increase risk of cardiovascular disease mortality in men',Medicine and science in sports and exercise,vol.42,no.5,pp. 879–885.

Yates, T. Khunti, K. Wilmot, E. Brady, E. Webb, D. Srinivasan, B. Henson, J. Talbot, D. Davies, M, 2012, 'Self-reported sitting time and markers of inflammation, insulin resistance, and adiposity', Am J Prev Med, vol.42, no.1, pp.1-7.