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College of Food Innovation and Technology

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Introduction and Statement of the Problem

Sedentary behavior is extremely common in the workplace and has resulted in low employment-related physical activity and increased body weight among U.S. adults (Malaeb et al.). Additionally, sedentary behavior is associated with an increased risk of mortality, type II diabetes, cardiovascular disease, and some cancers (Edwardson et al.). As a result of these comorbidities, there is reduced workforce and labor productivity with increased rates for early retirement and disability (Karatrantou et al.). According to the Social Security Administration and Code of Federal Regulations, a sedentary job is defined as "work that involves lifting no more than 10 pounds at a time, and which mainly involves sitting" (Malaeb et al.). Based on this definition, office workers are one of the most sedentary populations, spending 70-85% of work time sitting (Edwardson et al.).

Luckily, physical activity reduces the risk of cancers, cardiovascular disease, type II diabetes, obesity, and other chronic illnesses (Robertson et al., 2020). Unfortunately, however, the World Health Organization (WHO) and the American College of Sports Medicine (ACSM) estimate that a large number of adults do not regularly achieve the recommended levels of physical activity (Karatrantou et al.). Specifically, less than a third of Americans meet this requirement, with self-efficacy being a large contributing factor to the amount of physical activity performed by overweight and obese individuals (Robertson et al., 2020). Sitting all day at work may also result in musculoskeletal pain, affecting productivity in the workplace, which, as previously stated, is associated with early retirement and work disability (Ting et al., 2019). Research focused on implementing active rest protocols reveals that employees tend to spend their lunch breaks sitting and using electronic devices, which increases worker fatigue and decreases interpersonal relationships (Michishita et al., 2017). The main reason most people do

not exercise or incorporate physical activity into their daily lives is because of "lack of time" (Metcalfe et al., 2020). If these concerns are not addressed, physical activity will continue to decline while negative health consequences will increase.

Defintion of Terms

For the purpose of this study, "Quality of life" is defined as, "the standard of health, comfort, and happiness experienced by an individual or group" (Oxford Dictionary, 2019).

Also, for the purpose of this study, "physical health" will be defined as, "the state of being free from illness or injury" (NHS Foundation Trust, 2021).

Purpose of the Study

The purpose of this study is to determine if the implementation of walking workstations in a sedentary workplace environment has a positive impact on mental and physical health of workers. This study aims to investigate if ergonomic changes in the workplace are beneficial to the health of workers by increasing physical activity. This study also addresses multiple factors, such as lack of time, that have contributed to low adherence in regards to physical activity interventions in previous studies. This intervention will not deter from time spent working or interfere with productivity of daily life in any way. Although studies have been conducted on implementation of physical activity interventions in the workplace, the research is limited due to small sample size and unequal representation of gender. Therefore, this study will address a large sample of office workers so that the information can be generalized across multiple populations.

Hypotheses

This study will aim to test the following hypotheses:

H1: Implementing walking workstations in the workplace will increase the perceived quality of life of adult employees working sedentary jobs.

H2: Implementing walking workstations in the workplace will decrease physical health concerns of adult employees working sedentary jobs.

Literature Review

Many studies have been conducted regarding workplace wellness, some of which have used the approach of implementing exercise interventions, while others have taken the approach of implementing ergonomic changes in the workplace to increase non-exercise activity thermogenesis (NEAT) (Malaeb et al.). This paper reviews these studies and the conclusions drawn, with the outcome of each study playing an integral role in the creation of this specific study.

As previously mentioned, musculoskeletal pain affects productivity in the workplace, and poor work ability is associated with early retirement and work disability (Ting et al., 2019). The prevalence of musculoskeletal pain is high among workers in physically demanding jobs, specifically those in the healthcare field (Jakobsen et al., 2015). These physical impairments contribute to societal, economic, and personal problems, with lower back pain specifically being the leading cause of disability in several countries (Moreira et al., 2020). One study assessed the effectiveness of therapeutic exercises on strengthening specific muscle groups and flexibility in order to help decrease lower back symptoms among a group of nursing assistants (Moreira et al., 2020). The results showed that these therapeutic exercises positively affect lower back symptoms and improve muscle control (Moreira et al., 2020). Musculoskeletal pain does not only impact those with physically demanding jobs; it also impacts those working sedentary office jobs. In response to the high levels of neck and shoulder pain associated with office jobs, another study

investigated whether ergonomic changes to the office or implementation of exercise would have a greater impact on reducing neck pain (Ting et al., 2019). Of those who had not reported neck pain at baseline, there were no significant differences between the exercise group and the standing group; however, those who had experienced neck pain at baseline experienced more significant benefits from the exercise intervention than from the ergonomic changes (Ting et al., 2019).

Since workers in the U.S. and most developed countries spend 70-80% of their work time sedentary, and time spent sedentary is associated with chronic disease and premature mortality, more studies are being conducted in hopes of decreasing workplace sitting time (Pereira et al., 2020). In one study, researchers chose to implement a *Stand and Move at Work* intervention in hopes of reducing workplace sitting, increasing light physical activity and decreasing cardiometabolic risk through the use of sit-stand workstations (Pereira et al., 2020). The results showed strong evidence that implementing sit-stand workstations over twelve months is effective for reducing sedentary time among office workers (Pereira et al., 2020). The results also showed that those in the subgroup with prediabetes or diabetes experienced positive changes in blood glucose, glycated hemoglobin, triglycerides, LDL-cholesterol, systolic blood pressure, body weight, and body fat (Pereira et al., 2020). A similar approach was used in another study, in which the SMArT (Stand More at Work) intervention was implemented (Edwardson et al.). This intervention provided workers with wrist monitors designed to track time spent sitting versus standing, in hopes of encouraging more movement throughout the day (Edwardson et al.). Unfortunately, the results showed no significant changes in occupational sitting time for the office workers, demonstrating that changing sedentary behavior requires more than simply using tracking devices to motivate individuals (Edwardson et al.).

A separate study was conducted with a similar approach, but instead implemented treadmill workstations as opposed to sit-stand workstations. This study also highlighted the importance of non-exercise activity thermogenesis (NEAT), which encompasses all activities of daily living other than exercise (Malaeb et al.). The researchers believed that increasing the NEAT levels in each office worker would potentially be more beneficial than implementing exercise interventions, which sometimes create compensatory behaviors such as increased caloric intake (Malaeb et al.). The results from this study showed a significant loss of fat mass and a significant increase in lean mass in the treadmill workstation group as opposed to the control group (Malaeb et al.). Additionally, following the intervention, 95% of the participants agreed that they would use the treadmill workstations in their work environment if they were available (Malaeb et al.). This represents a level of adherence higher than exhibited in other studies that implement exercise or physical activity regimens.

Similarly, another study compared workplace-based versus home-based workouts in terms of level of adherence, since implementing workouts in the workplace setting detracts from time spent working. The results showed that the workplace intervention group had a 4% higher adherence than the at-home workout group, demonstrating that workplace interventions are more beneficial than home-based interventions (Jakobsen et al., 2015). A common reason why people do not exercise at home is “lack of time” (Metcalfe et al., 2020). In response to this, researchers studied the implementation of HIIT workouts in the workplace setting, where the workers would do short-duration, high-intensity workouts (Metcalfe et al., 2020). Following the intervention, participants reported that these workouts were not only enjoyable, but that they would recommend them to their family and friends and felt that they, in no way, interfered with other aspects of their life due to time commitment (Metcalfe et al., 2020). This shows that adherence

levels will be higher if the interventions implemented are not time-consuming and will not interfere with other aspects of their life.

Lastly, an additional article took a different approach by assessing self-efficacy as a predictor for entering an active state (Robertson et al., 2020). Based on the results of this study, researchers were able to conclude that self-efficacy is an important predictor for physical activity alterations in overweight and obese adults (Robertson et al., 2020). This further emphasizes the role mental health plays in physical activity, and vice versa. Likewise, another study looked at active rest as opposed to sedentary rest for improving personal relationships and mental health in the workplace (Michishita et al., 2017). The results showed that after the ten-week intervention, there was a decrease in fatigue, an increase in friendliness, an increase in social support from superiors, an increase in support from colleagues, and an increase in support from family and friends (Michishita et al., 2017). The collective results of these studies show that in order to increase workplace wellness and decrease the side-effects of chronic sedentary behavior, an intervention must be implemented that does not interfere with daily work, is not time-consuming, and addresses the impact of physical activity on both the mental and physical health of workers.

Methodology

Design

This quantitative study aims to understand the impact of walking workstations on the mental and physical health of sedentary office workers. To test the hypotheses described in the introduction of this proposal, a six-month long walking workstation intervention will be implemented in various workplaces in New England. At the end of the intervention, physical and mental health outcomes will be tested to see how they compare to baseline results. To determine

the validity of this study, sedentary work is defined as “work that involves lifting no more than 10 pounds at a time, and which mainly involves sitting” (Malaeb et al.).

Baseline data will be collected on two hundred participants via anthropometric testing and questionnaires, which will be administered and collected by research assistants. Anthropometric measures will include height (cm), weight (kg), body mass index (BMI), blood pressure (mmHg), and heart rate (bpm). The questionnaire used will assess the quality of life (QOL) for each participant, *see Appendix A.* This questionnaire was created based on Flanagan’s QOL (1978) design, which uses two different, five-point, Likert Scales to determine the importance of each item as well as how well participants feel their needs are being met for that specific item (Burckhardt et al., 2003). Participants will then be divided into two groups using a randomized computer generating system. The two groups will consist of a control group (n = 100), and a walking workstation group (n = 100). The walking workstation group will have treadmill workstations implemented into their place of work and will be required to use these walking workstations for three hours per workday for the length of the six-month intervention. The control group will not change anything about their normal work habits and will continue to work at their seated workstations for the duration of the six-month intervention. At the end of the six-month intervention, all quantitative data will be entered into SPSS software and p-values will be generated to see if there is statistical significance between baseline and post-intervention values.

Sampling

This study will consist of two hundred participants (n = 200), with as close to an even distribution of males and females as possible. To be eligible for this study, participants must work a sedentary office job in the New England region. As a reminder, "sedentary work" is defined as "work that involves lifting no more than 10 pounds at a time, and which mainly involves sitting" (Malaeb et al.). Eligibility requirements also include that participants must be at least 18 years old, must work at least 40 hours per week, and must be able to walk at a slow pace for three consecutive hours, with minimal break times allotted.

A random computer generating system will separate the two hundred participants into two groups: a control group (n = 100) and a walking workstation group (n = 100).
The control group will continue to work at their seated workstations and conduct their usual work for the six-month intervention, while the walking workstation group will work at a treadmill workstation for three hours per workday for the six-month intervention.

Instrumentation

This quantitative study will use a questionnaire with a Likert scale to determine a quality of life (QOL) score at baseline and again at the end of the six-month intervention for both the control and intervention groups. Also tested at baseline and at the end of the six months will be anthropometric measures of blood pressure, heart rate, weight, and BMI to determine baseline physical health as compared to physical health at the end of the intervention.

**See Appendix A for an example of the questionnaire, and reference Tables 1-3 in the Data Collection and Analysis section to see how anthropometric data will be collected.*

Data Collection and Analysis

At the end of the study, two hundred questionnaires will be scored, and the scores of each participant at baseline will be compared to those of each participant at the end of the intervention to note any changes in perceived quality of life. Individual anthropometric measures of each participant will also be analyzed at the end of the intervention to see how their physical health compares to baseline testing. Data points for each individual from the questionnaire scores and anthropometric measures will be recorded using SPSS, and p-values will be generated to determine conclusions on the statistical significance between the implementation of walking treadmills in the workplace and the mental and physical health of workers.

Table 1. Baseline characteristics of participants prior to the six-month walking workstation intervention.

	All Participants (*n* = *200)*	**Control Group (n = 100)**	**Walking Workstation Group (n = 100)**
Age (mean)			
Gender, *n* (female/male)			
Gender, % (% female/% male)			
Height (cm)			
Weight (kg)			
Body mass index (BMI)			
Blood pressure (mmHg)			
Heart rate (bpm)			
QOL score, *total points* (out of 100)			
QOL score, %			

Table 2. Characteristics of participants following the six-month walking workstation intervention.

	All Participants (*n* = *200)*	**Control Group (n = 100)**	**Walking Workstation Group (n = 100)**
Age (mean)			
Gender, *n* (female/male)			
Gender, % (%			

female/% male)			
Height (cm)			
Weight (kg)			
Body mass index (BMI)			
Blood pressure (mmHg)			
Heart rate (bpm)			
QOL score, *total points* (out of 100)			
QOL score, %			

Table 3. P-values generated using SPSS software to determine statistical significance between variable outcomes.

	Age (mean)	**Gender, *n* (female/ male)**	**Gender, % (% female/% male)**	**Height (cm)**	**Weight (kg)**	**Body mass index (BMI)**	**Blood pressure (mmHg)**	**Heart rate (bpm)**
Age (mean)								
Gender, *n* (female/ male)								
Gender, % (% female/ % male)								
Height (cm)								
Weight (kg)								

Body mass index (BMI)								
Blood pressure (mmHg)								
Heart rate (bpm)								

Confidentiality of Participants

To ensure confidentiality of participants, each participant will be assigned a randomly selected three-digit number at baseline testing, and all other personal information collected during recruitment, such as name and age, will be discarded. Prior to enrollment, participants will receive a thorough explanation of the study and will understand that they are allowed to withdraw from the study at any point, without consequence. The participants will be required to sign waivers of consent during baseline testing. Following the finalization of the study, each participant will be given an in-depth copy of the study that will include results and conclusions drawn.

Implications for Future Research

These results will be imperative in determining the future dynamic of the workplace in the United States, and in helping public health professionals continue to address the declining levels of physical activity and increasing levels of comorbidities seen in working adults. The results of this study will also help researchers decide which direction to take regarding the benefits of exercise interventions versus changes in workplace ergonomics. An idea for future research would be a study that uses a crossover design using two interventions, one being an exercise intervention and the other a walking workstation intervention. Such research would

allow for a direct comparison between exercise regimens and office ergonomics, thereby enabling researchers to determine which has a greater impact on the mental and physical health of sedentary office workers.

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Appendix A (Sample Instrument)

Instructions: Please respond to the following twenty questions honestly and to the best of your ability. We ask that you answer all twenty questions, and know that there are no wrong answers. The reason for this survey is to better understand the quality of life for individuals in the workplace.

Please refer to Key A to answer how important you believe the items in questions 1-10 are in your life:

Key A:

1 = Not at all important

2 = Slightly important

3 = Moderately important

4 = Important

5 = Very important

1. Physical activity:
    a. _____
2. Having a support system:
    a. _____
3. Job satisfaction:
    a. _____
4. Job autonomy:
    a. _____
5. Safety and security:
    a. _____
6. Self-efficacy:
    a. _____
7. A positive outlook on life:
    a. _____
8. Self-confidence:
    a. _____
9. Feeling secure in my relationships:
    a. _____
10. Excitement for my future:
    a. _____

Please refer to Key B to answer how well your needs are being met regarding the items in questions 11-20:

Key B:

1 = Not at all well

2 = Slightly well

3 = Moderately well

4 = Well

5 = Very well

11. Physical activity:
    a. _____
12. Having a support system:
    a. _____
13. Job satisfaction:
    a. _____
14. Job autonomy:
    a. _____
15. Safety and security:
    a. _____
16. Self-efficacy:
    a. _____
17. A positive outlook on life:
    a. _____
18. Self-confidence:
    a. _____

19. Feeling secure in my relationships:
    a. _____
20. Excitement for my future:
    a. _____

Thank you for answering these questions! Please sign and date the line below to consent to being a participant in this study.

_____ _____

(Name) (Date)