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FEASIBILITY OF A WALKING WORKSTATION TO INCREASE DAILY WALKING

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ABSTRACT

Objective: The number of calories expended in the workplace has declined significantly in past 75 years. A walking workstation allowing workers to walk while they work has the potential to increase caloric expenditure. We evaluated whether employees can and will use walking workstations while performing their jobs.

Methods and Procedures: We studied nurses, clinical assistants, secretaries, and appointment secretaries using the StepWatch Activity Monitor System (which accurately measures steps taken at slow speeds) while performing their job functions in their usual fashion and while using the walking workstation.

Results: Subjects increased the number of steps taken during the workday by 2000 steps per day ($p < 0.05$). This was equivalent to an increase in caloric expenditure of 100 kcal/day. Subjects reported that they enjoyed using the workstation, that it could be used in the actual work arena and that, if available, they would use it.

Discussion: Walking workstations have the potential for promoting physical activity and facilitating weight loss. Several subjects in this study expended more than 200 extra calories daily using such a system. Further trials are indicated.

What is Already Known on This Topic

Non-exercise activity thermogenesis (NEAT) is a key component of caloric expenditure. The amount of human activity in the workplace has declined substantially in the last 100 years because humans are now sitting instead of walking. Increasing NEAT in the workplace has the potential to impact obesity significantly, but it is not known whether humans will voluntarily increase NEAT while working.

What This Study Adds

This study shows that it is feasible to increase NEAT in the workplace. Subjects were able to perform their job functions while walking on a treadmill at one mile per hour. The treadmills were not disruptive to the office setting. Clinical trials using walking workstations for the treatment of obesity are indicated.

INTRODUCTION

The obesity epidemic has global implications for health.¹ Caloric restriction has been the main method used to combat this epidemic, yet long-term studies of diets have shown little effectiveness.² Exercise has also been studied in the fight against obesity, but it too has little effect.³ This is not surprising because exercise most often represents a small proportion of calorie expenditure. Non-exercise activity thermogenesis (NEAT) is the main component of calorie expenditure other than basal metabolic rate.⁴ NEAT is all energy expenditure except that used in sleeping, eating, and formal exercise. There has been a dramatic decline in NEAT over the last 100 years corresponding to the dramatic rise in obesity.⁵ The automobile, the television, mechanical aids to household chores, and the nature of the work place have combined to result in a reduction in caloric consumption between 500 and 1000 calories daily.⁵

The importance of NEAT and low levels of physical activity in the pathogenesis of obesity has been demonstrated in several studies. Sixteen subjects were overfed by 1000 calories daily and not allowed to exercise. There were significant differences in weight gain with NEAT explaining about 2/3 of the variation.⁶ Those patients who had more spontaneous activity such as fidgeting, walking, and standing gained less weight. A subsequent study demonstrated that metabolic rate increased with sitting motionless by 4%, with sitting while fidgeting by 54%, and with walking 1 MPH by 154%.⁷ Finally a study comparing non-exercising subjects who were thin with non-exercising subjects who were obese demonstrated that the thin subjects were on their feet at least 2 hours a day more than the obese subjects which translates into a 350 calorie expenditure increase each day.⁸

Most people spend 40 to 65 hours weekly at work. They are generally sitting. We have shown that people who are sitting expend 75 to 100 calories an hour; however, if people walk at just 1 MPH, they use an additional 100 - 150 calories an hour.^{9 10 11 12} Walking while working has the potential to significantly increase calorie expenditure and facilitate weight loss.¹² However, it is not clear that it is feasible for people to walk and work effectively, nor is it clear that people will do so even if it is feasible. We wanted to assess whether free-living people can and will use a walking workstation in their actual work environment (previous studies have shown it feasible in an exercise laboratory).

METHODS AND PROCEDURES

The study was conducted among employees (n = 25) in the Executive Health Program at the Mayo Clinic. Two volunteers from each of the 4 main occupations in the program (nurses, clinical assistants, secretaries, and appointment secretaries) were recruited. The Mayo Foundation Institutional Review Board approved the study and written informed consent was obtained.

We purchased 3 treadmills (Pacemaster, Bronze Basic) selected for quietness and devised and built workstations to use with them (Figure 1). Because the secretaries use a foot pedal to transcribe dictation, we constructed a special keyboard so that the Dictaphone could be controlled from the keyboard (Figure 2). We measured daily steps taken with the StepWatch Activity Monitor system (Cyma, Inc., Mountlake Terrace,

WA). This system provides an accurate and precise measure of steps per day and has been shown to be superior to pedometers particularly at slow speeds.^{13 14} Using methods previously described,¹³ we calculated the extra calories used above basal metabolic rate. Subjects used the StepWatch Activity Monitor system for six weeks in total, two weeks while performing their jobs in the usual fashion (i.e., seated), two weeks acclimating to the walking workstation, and then two weeks using the walking workstation. Subjects were able to get off the workstation and sit any time they wished. We did not send reminders to subjects to use the workstation, nor provide any behavioral support or instruction.

In addition to measuring daily walking, we surveyed the subjects regarding the feasibility and productivity of the new work station. The survey consisted of ten questions answered using a Likert scale (see Appendix).

Statistics

The data analyzed were restricted to working hours (9AM - 4 PM). Days were excluded if the monitoring device was misplaced or if the worker was not at work. One subject had an entire treadmill (post-acclimation) ten-day period excluded due to bad data from a misplaced sensor. The subjects had average exclusion rates of 1.5 ± 1.7 , 1.75 ± 1.7 , and 1 ± 1.3 days per ten-day period for the initial, acclimation, and treadmill phases, respectively. Data were expressed either as the discrete step- or fold step increase over the baseline period, expressed as mean \pm S.D. The differences were not normally distributed by the Kolmogorov-Smirnov test and were thus analyzed nonparametrically using the Wilcoxon signed rank test. A probability of $p < 0.05$ was considered significant.

RESULTS

Subjects increased their steps during work hours from 2200 to 4000 during acclimation ($p = 0.01$) and to 4200 during the treadmill period ($p = 0.03$) (Figure 3). There was variability in increased steps among the subjects. Most subjects increased their steps between 1.5 and 2 times when the treadmill was available (Figure 4). All subjects walked an additional 30 minutes per day (9AM – 4PM) and two subjects walked an additional 2 hours per day. When we used the published regression equations^{Error!} Bookmark not defined. to convert step-counts from this device to energy expenditure, we estimated that subjects used an extra 44 to 253 calories during this time period while using the walking workstation (average increase was 100 kcal/day among the eight participants).

We analyzed the questionnaire responses from the subjects. Subjects reported that the walking workstation could be used in the clinical environment and they indicated that they would use it if available (Table 1).

Table 1. Average Walking Workstation Ratings*	
	Mean Score
The new workstation could be used in the clinical environment	4.1
The new workstation is too noisy	1.8
Productivity improved while using the new workstation	2.9
I was more tired at the end of the day	3.0
The new workstation did not interfere with patient care	3.9
Patients did not like the new work station	2.5
If this were an option, I would use it	4.4

*5 = Strongly Agree, 4 = Agree, 3= Neutral, 2 = Disagree, 1 = Strongly Disagree

They agreed that the walking workstations were not too noisy despite being placed in the middle of large offices. The question regarding being more tired at the end of the day generated the greatest disagreement among the participants. Some felt considerably less tired (“energized”) using the workstation while others felt more tired (the average questionnaire response was neutral). One who felt more tired indicated in the comment section that further acclimation would probably decrease fatigue. The participants did not feel the walking workstation affected productivity. There were no injuries using the workstation. Individual comments regarding the workstation are listed in Table 2.

Table 2. Individual participant comments regarding the walking workstation
1. Liked not having to sit all day
2. Workstation needs to be configured for each job function; our appointment secretaries must have scanners and wireless head sets with long battery half life; our secretaries needed a special keyboard so that they could do dictation without a foot pedal
3. Noise of the treadmill not a problem (but must use tennis shoes); space is a problem
4. The workstation helped those with back problems
5. Typing and talking on the phone were generally not a problem although long conversations could be tiring
6. Productivity does fall at first, but it probably does return to normal and for some may even improve in the long run

DISCUSSION

This study demonstrates that it is feasible to use a walking workstation while performing traditional office functions. The data demonstrate that daily walking increases when a walking workstation is provided in the workplace by as much as 2 hours per day. While more research needs to be done on employee productivity, the respondents reported that after little practice, they continued their normal office activities and, in particular, could type just as fast using the walking workstation and carry on professional conversations on the phone (with wireless headsets) in the normal manner. It is therefore feasible to use walking workstations.

We have also demonstrated that by simply providing walking workstations, people will use them. We found it interesting that no behavioral coaching appeared necessary at least at inception of the systems' use. All subjects in this study agreed that they would use such a system if it were available even after the study was complete. We noted that even the most avid subject did not use the workstation more than 4 hours in one day. This suggests that such stations might be shared effectively by two people. A number of participants reported having an improved energy level while using the walking workstation. Those participants with back pain felt the walking workstation reduced their back pain. If this holds true in larger studies in which back pain was formally measured, walking workstations could have major benefits beyond weight issues. Subjects did not feel that the walking workstation resulted in productivity declines, but this needs to be formally demonstrated.

The potential increase in calorie expenditure using a walking workstation is not trivial. Subjects use 100 to 150 additional calories every hour they walk at 1 MPH rather than sit. It will be important to show that calorie expenditure does not diminish during the times of day when the walking workstation is not in use. Our preliminary data did not show any decrement in steps taken when not using the workstation, but more data are needed.

The walking workstation has the potential to be useful for reversing low activity and helping not only in the treatment of obesity but also in diabetes, hyperlipidemia and back pain. Our study was not designed to look at weight loss or other metabolic variables but to simply assess whether it is feasible for office workers to use walking workstations if they are provided. The study was performed using volunteers from a convenience sample and may not be representative of the general workforce. Furthermore, subjects used the walking workstation for four weeks; it is unclear if they would continue to use them on a long-term basis. However, our study demonstrated that the walking workstation is feasible. Studies using the walking workstation for weight loss should make sure that the workstation is appropriately designed for each participant job function (a one size fits all approach is likely to fail because participants will get frustrated). We did not use reminders or other behavioral interventions, but we believe that walking workstations with systems to remind participants to walk after they have been sitting for awhile may increase use.

In summary, we have demonstrated that it is feasible to place the walking workstation in the workplace and that participants will use them. Future research is needed to evaluate the workstation's effect on employee productivity, well being, health and weight loss.

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Appendix

“When completing this survey, please consider only the last two weeks you used the workstation (first two weeks were for acclimation). Please read the questions carefully as a favorable impression will sometimes be reflected with a “strongly agree” answer and sometimes with a “strongly disagree” answer.”

1. The new workstation could be used in the clinical environment
Strongly Agree Agree Neutral Disagree Strongly Disagree
2. The new workstation is too noisy
Strongly Agree Agree Neutral Disagree Strongly Disagree
3. My (the volunteer’s) productivity improved while using the new workstation
Strongly Agree Agree Neutral Disagree Strongly Disagree
4. I (the volunteer seemed) was **more tired** at the end of the day with the workstation
Strongly Agree Agree Neutral Disagree Strongly Disagree
5. I had **less back pain** using the work station (if none, leave blank)
Strongly Agree Agree Neutral Disagree Strongly Disagree
6. I had **more joint pain** using the work station (if none, leave blank)
Strongly Agree Agree Neutral Disagree Strongly Disagree
7. I had **less muscle aches** using the workstation (if none, leave blank)
Strongly Agree Agree Neutral Disagree Strongly Disagree
8. The new work station did not interfere with patient care
Strongly Agree Agree Neutral Disagree Strongly Disagree
9. Patients did not like the new work station
Strongly Agree Agree Neutral Disagree Strongly Disagree
10. If this were an option, I would use it
Strongly Agree Agree Neutral Disagree Strongly Disagree

Figure 1. The walking workstation consists of a treadmill, keyboard and computer screen. A wireless headset is used for phone calls. Additional equipment can be added depending on job function.

Figure 2. The walking workstation keyboard for dictation was designed to allow moving dictation tapes forward and backward without the use of a foot pedal. The transcriptionist uses the palm of the hand to strike the special keys rather than a foot pedal.

Figure 3. Steps taken during the workday

Figure 4. Individuals increased their steps from 1.5 to 4 times during the workday.

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Figure 3. Steps taken during the workday

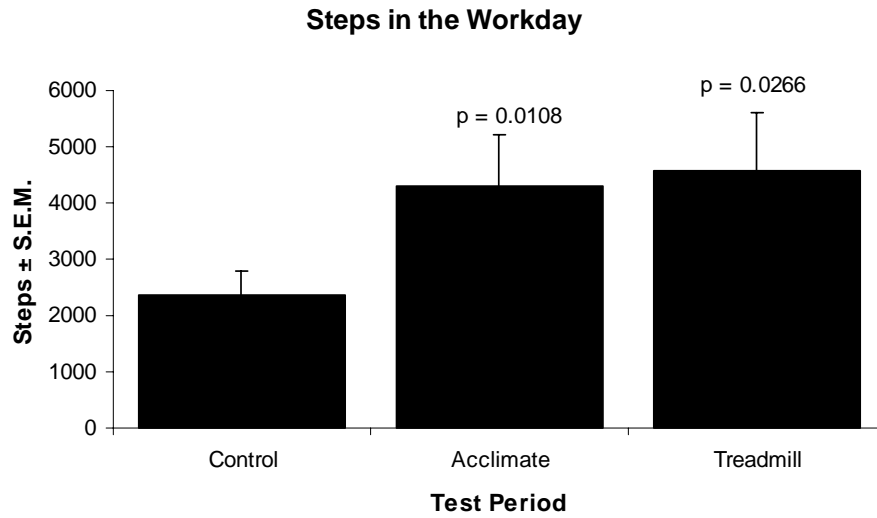


Figure 4. Individuals increased their steps from 1.5 to 4 times during the workday.

