Original Research

Energy Expenditure and Enjoyment of Active Television Viewing

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ABSTRACT

International Journal of Exercise Science 9(1): 64-76, 2016. This study examined energy expenditure and enjoyment during sedentary television viewing (SED-TV), stepping in place during television commercials (COMM-TV), and physical activity prompted by common character phrases/mannerisms within a television program (PA-TV). Adults (N=38, age: 27.0±8.0 years, BMI: 25.4±4.2 kg/m2) completed three 30-minute sessions in random order: SED-TV, COMM-TV, and PA-TV. Energy expenditure and heart rate were assessed during each session. Enjoyment was assessed after the initial experimental session and at completion of the study. Energy expenditure was greater in the active versus sedentary sessions (COMM-TV vs SED-TV: difference = 32.7±1.9 kcal, p3.0 METS was lower in SED-TV (median = 0 minutes) compared to COMM-TV [median = 4.0 minutes (Inter-Quartile Range: 0.8, 7.3)] (p50% of age-predicted maximal heart rate. Both COMM-TV and PA-TV were reported to be significantly more enjoyable than SED-TV. COMM-TV and PA-TV resulted in higher energy expenditure, more minutes of moderate intensity physical activity, and higher reported enjoyment compared to SED-TV. These findings have implications for reducing sedentary time during television viewing, which may impact health-related outcomes. Intervention trials are warranted to determine the effectiveness of these strategies.

KEY WORDS: Physical activity, exercise, sedentary behavior, caloric expenditure

INTRODUCTION

The benefits of regular, moderate-to-vigorous physical activity on health are well-established (33). Unfortunately, only 48% of adults in the United States meet the recommended moderate-to-vigorous physical activity guidelines and on average more than 90% of one's day is spent engaged in light activity, sedentary behavior, or sleep (15).

The negative health consequences of prolonged sedentary behavior include increased mortality (21, 22, 36), cardiovascular disease (15, 23, 27), type 2 diabetes (5, 12, 17, 18), metabolic risk factors (14), metabolic syndrome (1, 10, 25, 26) and obesity (2, 3, 11, 19, 26, 28). The

association between sedentary behavior and health risk has also been shown to be independent of engagement in moderate-to-vigorous physical activity (11). Therefore, strategies to reduce sedentary behavior may have public health implications.

Based on the 2013 American Time Use Survey, the most commonly reported leisure time activity is television viewing, with the average individual over the age of 15 watching television 2.8 hours per day (34). Thus, this may be an intervention target for reducing sedentary behavior. While one approach would be to replace television viewing with more active forms of behavior, another approach is to determine methods by which one can engage in physical activity while continuing to watch television.

It has been suggested that establishing antecedents to behavior, such as physical activity, may be an effective strategy to change behavior (37). When applied within the context of television viewing, antecedents could be prompts that occur during television viewing that promote reduced sedentary behavior and increased physical activity. One common occurrence that could serve as an antecedent to prompt engagement in physical activity during television viewing is commercials. In a laboratory-based study Steeves et al. (31) have shown that stepping in place during television commercials resulted in significantly higher energy expenditure (148 ± 40 kcal/hour) compared to sedentary television viewing (81 ± 19 kcal/hour). Steeves et al. (30) have also shown that across a six-month intervention that previously sedentary, overweight/obese participants randomized to a condition that recommended stepping in place during the commercials of their normally viewed television programs resulted in similar increases in weight loss when compared to participants encouraged to engage in traditional forms of exercise. However, advances in technology allow one to skip commercials, which may reduce the effectiveness of this strategy. Alternatively, prompted active television viewing (PA-TV), which would use common character phrases or mannerisms within the television program itself as the antecedent to promote physical activity, may be an effective approach. However, a PA-TV strategy to increase physical activity and energy expenditure has not been formally evaluated.

Therefore, this study was designed to compare PA-TV to both sedentary television viewing (SED-TV) and television viewing that included stepping during commercials (COMM-TV) on the following: 1) energy expenditure, 2) engagement in moderate-to-vigorous physical activity, and 3) perceived enjoyment.

METHODS

Participants

Thirty-eight (n= 38) apparently healthy men (n=19) and women (n=19) between the ages of 18-55 years, with a BMI of 18.5 to <40.0 kg/m^2 were recruited to participate in this study from the University of Pittsburgh and the surrounding community. Descriptive characteristics are shown in Table 1. Participants for this study were recruited by flyer and internet advertisements, or by referral from others who were aware of this study. A physical

Table 1. Subject characteristics.

	Variable	All Subjects (n=38)	Male (n=19)	Female (n=19)	p-value for Gender Comparison
Gender	Male	19 (50%)			
	Female	19 (50%)			
Age (years)		27.0 ± 8.0	27.0 ± 8.0	29.0 ± 7.0	0.527
Height (m)		1.7 ± 0.1	1.8 ± 0.1	1.6 ± 0.1	<0.001
Body Weight (kg)		74.2 ± 16.3	84.3 ± 15.6	64.1 ± 9.2	<0.001
BMI (kg/m^2)		25.4 ± 4.2	27.3 ± 4.3	23.6 ± 3.2	0.005

Values are n (%) or mean ± standard deviation. BMI=body mass index

activity readiness questionnaire (32) was used to identify individuals with contraindications to exercise. Participants were excluded if they reported not being able to walk or if they were taking any medication that would influence metabolic rate or heart rate. Participants provided written informed consent before engaging in this study. All procedures were approved by the University of Pittsburgh Institutional Review Board.

Protocol

Eligible subjects participated in a randomized, cross-over study that included three experimental sessions, with each session held on a separate day with a minimum of 24 hours between experimental visits. Prior to each experimental session, participants were instructed to fast for 4 hours and to refrain from exercise for 24 hours, which was intended to minimize the effect of acute meal ingestion and recent exercise on measures of energy expenditure. The experimental sessions included sedentary television viewing (SED-TV), stepping during television commercials (COMM-TV), or stepping during prompted active television viewing (PA-TV) session, with the order of these sessions being randomly determined.

The experimental sessions had common elements that included the following. On the day of each experimental session, subjects arrived at the laboratory where self-reported fasting and abstention from moderate-to-vigorous exercise was confirmed. Subjects were required to sit quietly with their feet flat on the floor for a period of 5 minutes to allow for a brief rest period and acclimation to the testing equipment and environment. Following this 5 minute rest period, subjects watched an episode of a syndicated sitcom television show in its entirety, including commercials. The sitcom episode selected included approximately 21 minutes of the television show and 9 minutes of commercial time, for a total of 30 minutes of television program time. The same episode of the television show was viewed during each of the experimental sessions. During the experimental sessions, subjects were instructed not to talk to or engage with the investigators or study staff. Throughout the 30 minute television viewing period, both energy expenditure and heart rate were assessed.

For the SED-TV session, the subjects sat quietly in a chair during the entire 30 minute television session. The differences between SED-TV and both COMM-TV and PA-TV sessions are described below.

For the COMM-TV session, during each of the commercial breaks of the program, subjects were instructed to stand up and step in place continuously at a self-selected "moderate pace" (e.g. 100-120 steps per minute), with each foot stepping up off the ground 15-20 cm as demonstrated by the investigator. A total of 9 minutes of commercial time occurred during this 30 minute session. This study protocol was similar to the procedures described by Steeves et al. (31). During the stepping portion of the session, if the heart rate exceeded 80% of age-predicted maximal heart rate, the study staff instructed subjects to reduce the cadence of stepping until the heart rate was below this value. This intensity was established as a safety threshold that was approved by the University of Pittsburgh Institutional Review Board. Subjects returned to a seated position once the commercial break had finished.

During the PA-TV session, subjects were instructed to stand up and step in place continuously for a period of 1 minute each time a predetermined prompt within the television show occurred (e.g., a character said a certain phrase, a common visual cue occurred, etc.). To assist in this process, a visual cue occurred on the viewing screen to prompt participants to stand and step in place, and this included a timer to ensure accurate timing of these 1 minute activity periods. If an activity prompt occurred while subjects were already standing and stepping, they were instructed to add an additional 1 minute of stepping to the end of their current stepping bout for each prompt that occurred. A total of 9 prompts occurred during the 30 minute session. Similar to COMM-TV, the stepping occurred at a self-selected "moderate pace" (e.g. 100-120 steps per minute), with each foot stepping up off the ground 15-20 cm as demonstrated by the investigator. If heart rate exceeded 80% of age-predicted maximal heart rate during these stepping sessions, the study staff instructed subjects to reduce the cadence of their stepping until the heart rate was below this value. Subjects returned to a seated position once the 1 minute prompted stepping bout finished.

BMI was assessed from measures of height and weight to confirm that the participant met the BMI eligibility criteria of 18.5 to <40.0 kg/m^2. Height was measured using a wall-mounted stadiometer (Perspective Enterprises; Portage, MI) with shoes removed. Body weight was measured in light clothing with shoes removed using a Tanita WB-110A digital scale (Tanita Corporation; Arlington Heights, IL). BMI was calculated from body weight and height (kg/m^2).

Energy expenditure during the 30 minute television session was measured for each of the experimental sessions using indirect calorimetry (CareFusion Encore Metabolic Cart, Vorba Linda, CA). The system was calibrated for air volume and gas concentrations prior to each test according to the manufacturer's specifications. Subjects were fitted with a facemask that was worn during the data collection period. Minute-by-minute energy expenditure was computed as the product of liters of oxygen consumed and the non-protein caloric equivalent based on the respiratory exchange ratio. These data were summed to provide a measure of total energy

expenditure during each of the experimental sessions.

Heart rate was measured continuously throughout the experimental session using a Polar heart rate monitor (Port Washington, NY). The subject was fitted with a heart rate monitor placed at the level of the xiphoid process and attached to the subject using an elastic strap according the manufacturer's specifications. Feedback on heart rate was not provided to the participant during the experimental session unless they exceeded 80% of their age-predicted maximal heart rate during the stepping component of the session, and if so, were instructed to reduce the cadence of stepping until the heart rate was below this value.

Enjoyment was assessed with the Physical Activity Enjoyment Scale (PACES) (24) that includes 16 statements scored on a 5-point Likert scale ranging from 1 (disagree a lot) to 5 (agree a lot). Participants completed the PACES questionnaire after their first experimental visit to allow for cross-sectional comparison of the data based on the first experimental session completed that would not be influenced by the other experimental sessions.

To compare enjoyment of SED-TV versus COMM-TV within each participant, at the conclusion of all 3 experimental session, the participants responded to the 16 statements from the PACES questionnaire and indicated whether the statement favored SED-TV, COMM-TV, or neither. To compare enjoyment of SED-TV versus PA-TV within each participant, at the conclusion of all 3 experimental session the participants responded to the 16 statements from the PACES questionnaire and indicated whether the statement favored SED-TV, PA-TV, or neither.

Statistical Analysis

SPSS version 22.0.0 (SPSS INC., Chicago, Illinois) was used for statistical analysis. An alpha level of 0.05 was used to define statistical significance.

One-way analysis of variance (ANOVA) was used to examine gender differences in subject characteristics. Separate repeated measures ANOVAs were used to compare energy expenditure and heart rate across the experimental sessions. If the assumption of sphericity was not met, the Greenhouse-Geisser correction was used. When appropriate, post-hoc analysis with Bonferroni adjustment was performed to determine differences between experimental sessions. Gender effects on energy expenditure and heart rate were examined using separate 2-factor (Gender x Condition) repeated measures ANOVAs.

Wilcoxon Signed Ranks tests were performed to compare minutes above selected intensity thresholds between experimental sessions. The intensities examined were: 1) minutes $\geq$3 metabolic equivalents (METs), 2) minutes $\geq$50% of age-predicted maximal heart rate, 3) minutes $\geq$70% of age-predicted maximal heart rate.

Enjoyment following the initial experimental session was examined using a one-way ANOVA with Bonferroni post-hoc testing. The Wilcoxon Signed Ranks test was performed on enjoyment scores obtained after all experimental sessions to

compare enjoyment of SED-TV versus COMM-TV and SED-TV versus PA-TV.

RESULTS

The 38 subjects (19 males and 19 females) recruited to participate in this study completed all of the experimental sessions. The mean BMI was 25.4 ± 4.2 kg/m^2 with a range of 18.7 to 36.0 kg/m^2. Compared to females, males were taller ($p<0.001$), weighed more ($p<0.001$) and had a higher BMI ($p=0.005$). Subject characteristics are shown in Table 1.

Comparisons of energy expenditure across the experimental sessions are reported in Table 2. Across the 30 minute experimental sessions, energy expenditure was 37.3 ± 9.9 kcal for SED-TV, 69.9 ± 16.4 kcal for COMM-TV, and 71.6 ± 17.9 kcal for PA-TV, with a significant difference between conditions ($p<0.001$). Post-hoc analyses showed that there was significantly higher energy expenditure in COMM-TV compared to SED-TV ($p=0.000$) and in PA-TV compared to SED-TV ($p<0.001$). The difference in energy expenditure between COMM-TV and PA-TV was not statistically significant ($p = 0.827$). The analysis was repeated with energy expenditure expressed as kcal per kg of body weight (kcal/kg) and a similar pattern of results was observed (see Table 2).

Analysis of energy expenditure was performed to examine potential differences between genders, and this revealed a significant Gender x Condition interaction ($p= 0.016$). Males expended 14.8 ± 3.0 calories more than females during SED-TV, 21.9 ± 5.1 calories more than females during COMM-TV, and 24.7 ± 8.6 calories more than females during PATVPA-TV. The pattern of the results was similar when energy expenditure was expressed as kcal/kg (see Table 3).

There was a significant difference in mean heart rate across experimental conditions ($p<0.001$). Heart rate was 70.5 ± 12.0 bpm for SED-TV, 80.4 ± 10.8 bpm for COMM-TV, and 83.6 ± 11.4 bpm for PA-TV (Table 2). Post-hoc analysis showed a significantly higher average heart rate in COMM-TV compared to SED-TV ($p<0.001$) and in PA-TV compared to SED-TV ($p<0.001$). There was no significant difference in mean heart rate between COMM-TV and PA-TV ($p = 0.250$). Analysis also showed no difference between males and females for heart rate responses during the experimental conditions (Table 3).

Data were also examined to determine if there was a difference in engagement in moderate intensity physical activity across the 3 experimental conditions. When moderate intensity physical activity was defined as the number of minutes when energy expenditure was $\geq$3.0 METs during the 30-minute television show per session, SED-TV resulted in zero minutes, COMM-TV resulted in a median of 4.0 minutes (Inter-Quartile Range: 0.8, 7.3), and PA-TV resulted in a median of 4.0 minutes (Inter-Quartile Range: 2.0, 6.3). There was a significant lower frequency of minutes spent at $\geq$3.0 METS in SED-TV compared to COMM-TV ($p<0.001$) and SED-TV compared to PA-TV ($p<0.001$), with no significant difference between COMM-TV and PA-TV ($p=0.569$) (Figure 1).

Data were also analyzed with moderate intensity physical activity defined as the

Table 2. Comparison of energy expenditure and heart rate by experimental condition.

	Experimental Session			
	SED-TV	COMM-TV	PA-TV	p-value
Energy Expenditure (kcal)	37.3 ± 9.9	69.9 ± 16.4	71.6 ± 17.9	<0.001
Difference with SED-TV	--	-32.7 ± 1.9 (p= 0.000)	-34.4 ± 1.9 (p= 0.000)	
Difference with COMM-TV	32.7 ± 1.9 (p= 0.000)	--	-1.7 ± 1.5 (p= 0.827)	
Difference with PA-TV	34.4 ± 1.9 (p= 0.000)	1.7 ± 1.5 (p= 0.827)	--	
Energy Expenditure (kcal/kg)	0.50 ± 0.07	0.96 ± 0.18	0.97 ± 0.17	<0.001
Difference with SED-TV	--	-0.45 ± 0.03 (p= 0.000)	-0.47 ± 0.03 (p= 0.000)	
Difference with COMM-TV	0.45 ± 0.03 (p= 0.000)	--	-0.02 ± 0.02 (p= 1.000)	
Difference with PA-TV	0.47 ± 0.03 (p= 0.000)	0.02 ± 0.02 (p= 1.000)	--	
Heart Rate (beats per minute)	70.5 ± 12.0	80.4 ± 10.8	83.6 ± 11.4	<0.001
Difference with SED-TV	--	-9.9 ± 1.7 (p=0.000)	-13.1 ± 1.6 (p=0.000)	
Difference with COMM-TV	9.9 ± 1.7 (p=0.000)	--	-3.2 ± 1.8 (p=0.250)	
Difference with PA-TV	13.1 ± 1.6 (0.000)	3.2 ± 1.8 (p=0.250)	--	

Values are presented as mean ± standard deviation, SED-TV= Sedentary television viewing session, COMM-TV= Commercial stepping television session, PA-TV= Prompted active television stepping session

number of minutes when the heart rate was ≥ 50% of subjects' age-predicted maximal heart rate. SED-TV resulted in a median of 0 minutes (Inter-Quartile Range: 0.0, 0.0), COMM-TV resulted in a median of 6.0 minutes (Inter-Quartile Range: 0.0, 10.0)], and PA-TV resulted in a median of 7.0 minutes (Inter-Quartile Range: 0.0, 11.0) at this intensity. There was a significantly lower frequency of minutes spent at or above 50% of age-predicted maximal heart rate in SED-TV compared to COMM-TV (p=0.000) and SED-TV compared to PA-TV (p=0.000), with no significant difference between COMM-TV and PA-TV (p=0.423) (Figure 1). However, when intensity was defined as the number of minutes when the heart rate was ≥ 70% of a person's age-predicted maximal heart rate, there was no significant difference between the experimental conditions (Figure 1).

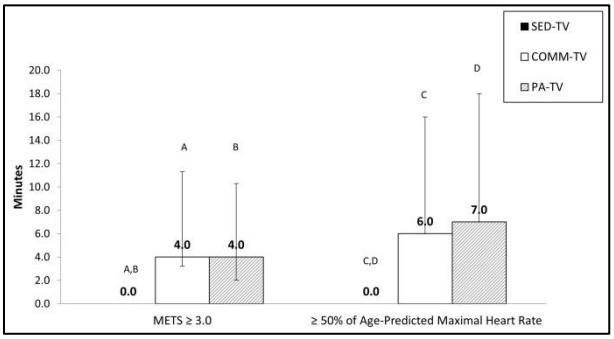

Figure 1. Amount of moderate intensity physical activity [median minutes (Inter-Quartile Range: 25th percentile, 75th percentile)].

Table 3. Comparison of energy expenditure and heart rate by gender.

		Experimental Session			p-values		
Variable	Gender	SED-TV	COMM-TV	PA-TV	Measure	Gender	Measure x Gender
Energy Expenditure (kcal)	Male (n=19)	44.7 ± 7.9	80.9 ± 14.5	84.0 ± 16.6	0.000	0.007	0.016
	Female (n=19)	29.9 ± 4.9	59.0 ± 9.4	59.3 ± 8.0			
Energy Expenditure (kcal/kg)	Male (n=19)	0.53 ± 0.06	0.98 ± 0.19	1.01 ± 0.20	0.000	0.056	0.776
	Female (n=19)	0.47 ± 0.07	0.93 ± 0.18	0.93 ± 0.12			
Heart Rate (beats per minute)	Male (n=19)	69.8 ± 11.8	79.3 ± 11.3	83.1 ± 12.1	0.000	0.92	0.888
	Female (n=19)	71.2 ± 12.5	81.5 ± 10.6	84.0 ± 10.9			

Values are presented as mean ± standard deviation, SED-TV= Sedentary television viewing session, COMM-TV= Commercial stepping television session, PA-TV= Prompted active television stepping session

Data based on the initial television session completed showed enjoyment scores of 53.9 ± 11.9 for SED-TV (N=14), 62.9 ± 7.5 for COMM-TV (N=13), and 61.4 ± 7.1 for PA-TV (N=11), with significant differences across conditions (p=0.035). Post-hoc analysis showed significantly higher enjoyment in COMM-TV compared to SED-TV (p=0.048). There was no significant difference in enjoyment between PA-TV and SED-TV (p=0.150) and between COMM-TV and PA-TV (p = 1.000).

Upon completion of the final experimental session, enjoyment was compared for SED-TV versus COMM-TV (Figure 2) and SED-TV versus PA-TV (Figure 3). A score of -1 represented a response favoring SED-TV, a score of 0 represented a neutral response, and a score of +1 represented a response favoring either COMM-TV or PA-TV. All questions had a score that was significantly different than zero (neutral score), and in both scenarios, enjoyment scores favored performing activity during television viewing (COMM-TV or PA-TV) compared to SED-TV. When analyzed separately by gender, a similar pattern of results were observed (data not shown).

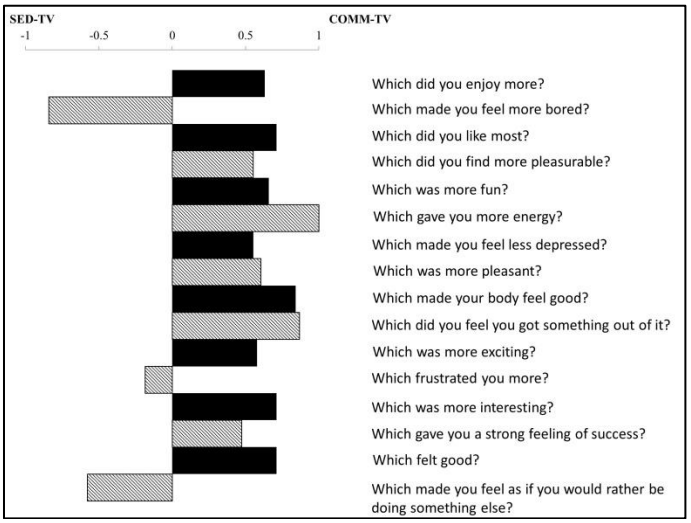

Figure 2. Enjoyment of sedentary television viewing (SED-TV) versus stepping during television commercials (COMM-TV).

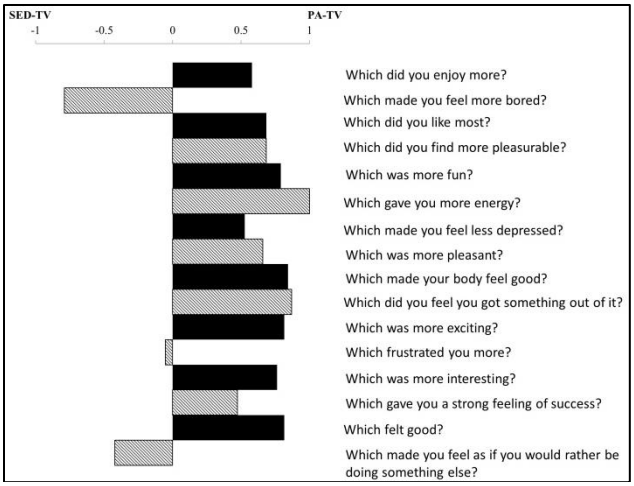

Figure 3. Enjoyment of sedentary television viewing (SED-TV) versus stepping during prompted television viewing (PA-TV).

DISCUSSION

The primary aim of this study was to examine energy expenditure during SED-TV, COMM-TV, and PA-TV. Results showed that both COMM-TV and PA-TV resulted in significantly high energy expenditure compared to SED-TV, with no difference between COMM-TV and PA-TV ($p = 0.827$). Steeves et al. (31) reported that stepping during television commercials achieved an energy expenditure of 148 ± 40 kcal during a 60-minute television show. By comparison, the approximately 70 kcal energy expenditure observed in both COMM-TV and PA-TV in this current study was achieved in 30 minutes. If extrapolated to 60 minutes, the energy expenditure achieved with COMM-TV and PA-TV would be comparable to the 148 kcal reported by Steeves et al. (31).

The energy expenditure achieved with active television viewing may have important public health implications. One health benefit that could be realized from either COMM-TV or PA-TV may be prevention of weight gain, or potentially modest weight loss. Both COMM-TV and PA-TV increased energy expenditure by approximately 30-35 kcal above the energy expenditure of SED-TV. When extrapolated across 60 minutes, this would result in an additional 60 to 70 kcal in energy expenditure. Hill et al. reported that an increase in energy expenditure of 50-100 kcals per day may be sufficient to prevent weight gain, which may be important for the prevention of overweight or obesity (16). Thus, replacement of sedentary television viewing sessions with active television viewing, such as what can be achieved with COMM-TV or PA-TV, may be sufficient to prevent weight gain, and this warrants further study in a longitudinal clinical trial.

This study also showed that both COMM-TV and PA-TV increased engagement in moderate intensity physical activity compared to SED-TV (see Figure 1). Both COMM-TV and PA-TV resulted in 5 to 7 minutes of moderate intensity physical activity accumulated across the 30 minute television viewing sessions. It has also been reported that the average individual in the United States over the age of 15 watches approximately 2.8 hours of television per day (34), and engagement in either COMM-TV or PA-TV during these periods of television viewing would translate into approximately 15 minutes of moderate intensity physical activity per day. However, current physical activity guidelines also recommend that physical activity be accumulated in bouts of at least 10 minutes in duration (33), which was not achieved with either COMM-TV or PA-TV. Despite the recommendation for accumulating physical activity in bouts of

at least 10 minutes, it has been shown that shorter intermittent bouts of activity (<6 minutes) can significantly improve fitness in sedentary adults that is similar in magnitude to one continuous bout of activity (20). Moreover, more frequent breaks in sedentary time is associated with favorable measures of waist circumference, BMI, triglycerides and 2-hour plasma glucose (4, 13, 14). Whether the short periods of physical activity achieved with either COMM-TV or PA-TV, as implemented in this current study, would result in health improvements is unknown and warrants additional investigation.

This study also showed that, after study participants were exposed to all of the television viewing sessions, enjoyment favored both COMM-TV and PA-TV over SED-TV. This finding has important implications for interventions focused on reducing sedentary behavior and increasing physical activity. For example, Wankel (35) reported that enjoyment was predictive of retention in an exercise program, and Salmon et al. (29) reported that enjoyment of physical activity was associated with greater participation in physical activity. Thus, identifying strategies to increase enjoyment in physical activity, particularly if this is perceived to be more enjoyable than a sedentary alternative, may translate into improved engagement and adherence in physical activity in individuals who otherwise would remain sedentary.

The findings from this study have additional important implications for reducing sedentary time resulting from television viewing. For example, intervention studies aimed at reducing television time have not necessarily observed an increase in moderate intensity physical activity, but rather a transition from television viewing to other forms of sedentary behavior (6-9). Thus, rather than discouraging television viewing, which may not reduce sedentary time, the results from this study in combination with the findings from other studies (30) suggest that engagement in physical activity during periods of television viewing may be an effective strategy to increase physical activity and to reduce sedentary time.

There are several limitations to this study that need to be acknowledged. This was a cross-sectional study and only measured acute differences among SED-TV, COMM-TV, and PA-TV, which limits the ability to determine the long-term effectiveness of these interventions. During this study, extraneous movement was limited during the experimental sessions, and this may not represent the natural pattern of activity of most individuals when watching television. Examination of COMM-TV and PA-TV in a more natural environment may provide important insights into the effectiveness of these strategies to reduce sedentary behavior and to increase physical activity. COMM-TV and PA-TV also required participants to respond to a commercial prompt or other prompts embedded within the television show. While this occurred within a controlled laboratory environment, it is cannot be determined if individuals would respond to these prompts to engage in physical activity if in a non-laboratory setting. For PA-TV to be effective, common themes within a television program need to be present. This study used a popular television sitcom in which common prompts were able to be identified. However, this may not be possible in all

types of television programming, which may limit the effectiveness of PA-TV. Moreover, while COMM-TV was also effective for increasing energy expenditure and physical activity, technology exists that allows individuals to skip television commercials, and this may limit the effectiveness of COMM-TV as an intervention strategy. Additional research is also needed to determine the effectiveness of COMM-TV and PA-TV across a variety of populations. It is also recognized that the sedentary condition in this study required the participant to remain seated without engagement in any form of activity, and this may have impacted the comparison of enjoyment rating between the sedentary and television viewing experimental conditions. Within this study differences in energy expenditure were observed between males and females, and this was observed even after correcting for differences in body mass. However, body composition data were not available, and therefore it is unable to be determined if this difference would be observed if energy expenditure was also corrected for lean mass.

In summary, this study showed that prompted stepping during television viewing (PA-TV) resulted in energy expenditure and engagement in moderate intensity physical activity that was comparable to stepping during television commercials (COMM-TV), and both produced higher energy expenditure and more physical activity than sedentary television viewing (SED-TV). Additionally, both forms of active television viewing (COMM-TV and PA-TV) were reported to be more enjoyable than SED-TV. These findings have important implications for interventions to reduce sedentary time resulting from television viewing and could assist in the identification of strategies to increase physical activity. Thus, COMM-TV and PA-TV may provide effective alternatives to traditional exercise interventions for increasing physical activity engagement.

ACKNOWLEDGEMENTS

This study was supported by internal funding through the University of Pittsburgh, Department of Health and Physical Activity, Physical Activity and Weight Management Research Center. We recognize the contribution of the staff and graduate students at the Physical Activity and Weight Management Research Center in the Department of Health and Physical Activity at the University of Pittsburgh for their contribution to recruitment, assessments, and data management for this study.

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