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An Investigation of Exercise and the Placebo Effect

Dixie Stanforth, PhD; Mary Steinhardt, EdD, LPC; Michael Mackert, PhD; Philip R. Stanforth, MS; Christian T. Gloria, MA

***Objective*: To replicate previous research that concluded exercise affects health via a placebo effect: simply telling workers with physically active jobs that their "work is exercise" improves health. *Method*: A convenience sample of university building service workers (n=53) learned "their work is exercise" or about job safety. *Results*: Groups demonstrated similar outcomes at 4 and 8 weeks for weight, percent fat, waist circumference, and behavioral measures. Both groups increased self-perception as "regular exercisers"; blood pressure was reduced only in the intervention group. *Conclusion*: This research did not support the placebo effect. Although enticing, simply changing mind-set does not alter the relationship between exercise and health.**

***Key words*: exercise, mind-set, placebo, work**

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The health benefits of exercise are well documented and include a decreased risk for obesity, heart disease, hypertension, diabetes, certain cancers, and premature mortality. Numerous organizations recommend that adults engage in at least 30 minutes of moderate physical activity on most or preferably all days.[1] Despite the known benefits of regular exercise, most Americans are not physically active. The Department of Health and Human Services estimates that 38% of adults engage in no leisure-time activity of any kind, and only 23% of adults perform vigorous physical activity (sufficient to promote cardiovascular fitness) at least 3 times a week for more than 20 minutes.[2] Despite the implementation of promising evidence-based intervention strategies[3] and community-based approaches for promoting increased physical activity,[4] the rate of obesity continues to rise, along with the associated economic and health costs.[5]

The search for solutions to the obesity epidemic has expanded beyond the prescription of exercise[6] to include the psychological benefits of physical activity.[7] An interesting segment of the psychological research has considered how self-perceptions of health affect subsequent health outcomes. For example, one group of researchers demonstrated that self-rated health is a significant predictor of mortality in the elderly,[8] whereas another group showed similar results for older individuals with diabetes.[9] Evolving from this work is the question of what drives physiological changes: is it biology or simply a placebo effect, which is based on one's expectations in the positive outcomes of the treatment? Lundh[10] demonstrated that medical and psychological treatments have the potential to create a

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belief system that "this treatment is going to cure me," which is similar to Bandura's model of self-efficacy and outcome expectancies.[11]

In his classic article, Bandura[11] addressed this issue of a potential placebo effect, questioning whether it is possible to "instill outcome expectations in people simply by telling them what to expect" (p. 198). In addition, Bandura[11] stated that "simply informing participants that they will or will not benefit from treatment does not mean that they will necessarily believe what they are told, especially when it contradicts their personal experiences" (p. 198). Over the years, the placebo effect has been questioned,[12] deconstructed,[13] and hotly debated from both scientific and ethical perspectives.[14-16] Only recently has the placebo effect been analyzed to determine whether mind-set affects the relationship between exercise and health.

There is some evidence to indicate that a placebo effect may be operative in the psychological benefits associated with exercise. Plante et al[17] note that although most reviews and even the position paper on the psychological benefits of exercise by the International Society of Sports Psychology state that exercise reduces stress, depression, state anxiety, and neuroticism for both genders at any age, the biological and psychosocial mechanisms are not fully understood. Their study investigating how perceived versus actual aerobic fitness influences psychological and physical functioning was grounded in the hypothesis that exercise may act as a placebo and that suggestion plays a major role in the psychological benefits of exercise. They concluded that the association between perceived fitness and psychological functioning may be as important as, or even more important than, aerobic fitness, highlighting the power of beliefs over physiology.

Desharnis et al[18] used an expectancy modification procedure in which half of the participants in a 10-week exercise program were told that their program was designed to improve psychological well-being as well as aerobic fitness. The control group was informed throughout the training period only of the biological aspects of the program and the expected gains in aerobic fitness. There were no differences in self-perceived physical or psychological fitness following the exercise program, and both groups demonstrated significant increases in aerobic capacity as measured by maximal oxygen uptake (VO_{2max}). The intervention group, however, showed significant increases in self-esteem compared to the controls, which the authors attributed to a strong placebo effect whereby exercise enhanced psychological well-being. Despite a growing body of evidence in the field of psychology, the question of whether individual perceptions and beliefs have a measurable effect on physiological markers of health or fitness has received little attention.

In a provocative article, Crum and Langer[19] considered whether work-based physical activity affects health, and to what extent, via the placebo effect. They compared a group of hotel maids who received information regarding the health benefits of their "work as exercise" with others who received no information. In just 4 weeks, they found that the group who learned that their jobs "counted" as exercise had significant increases in their perceived amount of exercise and self-ratings as "regular exercisers." Further, they reported that the informed group also decreased body weight, percent body fat, body mass index (BMI), waist-to-hip ratio, and blood pressure. In addition to calling for further research, Crum and Langer[19] concluded their findings might be particularly relevant when addressing health issues associated with a sedentary lifestyle, because changing beliefs may be easier than changing actual behaviors. A greater understanding of the role of mind-set and its relationship to health warrants further exploration and holds promise for the development of a scientifically grounded model for substantiating this relationship.

In this study, we attempted to replicate the work of Crum and Langer[19] using building service employees at a major public university, because their jobs require a level of activity and tasks throughout the day similar to those of hotel workers, such as cleaning and taking out trash. The goal of the study was to determine whether increasing *perceived* levels of exercise, without altering activity levels, would result in improved health measures, which is indicative of a placebo effect. Based on the work of Crum and Langer,[19] we hypothesized that building service workers who received information about the caloric expenditure of their work activities would demonstrate improvements in specific health measures (blood pressure, body weight, body fat, and abdominal girth), compared to workers who did not receive that information.

Crum and Langer[19] detailed the reasons for choosing a population whose occupation involves at least the minimum amount of physical activity necessary to meet the "30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week" recommended for health.[20] Building service workers are similar to the hotel workers involved in their study, as both jobs require that they walk, bend, push, pull, lift, and climb stairs throughout the workday. Additionally, if they do not initially perceive their work as exercise, shifting beliefs to reflect an understanding that simply performing everyday work activities results in health benefits has the potential to produce health improvements. Every attempt was made to duplicate the behavioral survey information as reported in Crum and Langer's original paper,[19] and the same physiological measures were assessed, with the exception of waist-to-hip ratio. Waist circumference was selected as a simpler and potentially superior measure for this population.[21] One significant difference between the studies is that the groups in the Crum and Langer study[19] were not treated equally: the intervention group received the attention associated with an educational session, whereas the control group participated only in the health screenings. To avoid that potential bias, we provided the control participants with an equivalent educational session on an unrelated topic, along with an equivalent amount and type of related educational materials throughout the study. In addition, although Crum and Langer[19] collected data at 4 weeks, we felt it would be valuable to determine not only if we saw similar changes at 4 weeks, but also whether any further changes occurred after 8 weeks.

METHODS

Design and Participants

All experimental procedures were reviewed and approved by the Institutional Review Board of The University of Texas at Austin. Participants were recruited from the Division of Housing and Food Service (DHFS) during 2 separate building service employee meetings on either the north or south end of campus. All employees in attendance performed identical jobs, albeit on opposite sides of campus. Employees were invited to participate based on their campus job locations, which were randomly assigned as either intervention (north-end workers) or control (south-end workers). Job activities for different work positions were the same, regardless of campus location, and the amount and type of activities performed were consistent throughout the data collection period. Both groups were told that we wanted to learn more about ways to improve employee health, and they were invited to participate in a series of health screenings in which they would receive personal health information and educational materials.

Following the design of Crum and Langer,[19] the intervention group received a 30-minute educational session regarding the potential health benefits of their job-related duties and information that their work satisfied the Centers for Disease Control (CDC) recommendations for an active lifestyle. Participants received a handout detailing the average caloric expenditure for typical tasks, such as vacuuming, bagging/carrying trash, cleaning bathrooms, and carpet extraction.[22] In addition, the handout contained general information regarding the health benefits of low-level activities to increase caloric expenditure, such as "activity does not have to be hard to have value." The text included on the initial handouts was identical to that used by Crum and Langer; the graphics were updated to enhance visual appeal. Separate handouts were created based on 190-lb males and 140-lb females and offered to all participants in either English or Spanish. Handouts were also posted in break rooms and inside area work closets following participant recruitment and data collection. Participants returning for the second health screening received new handouts, which were also posted in work areas, containing information about caloric expenditure during stair climbing. See Figure 1 for sample intervention group handouts.

Unlike the original study in which no information was provided to the control group, we felt it was important to provide the same amount and type of education on a neutral topic in order to control for attention bias between treatment of the 2

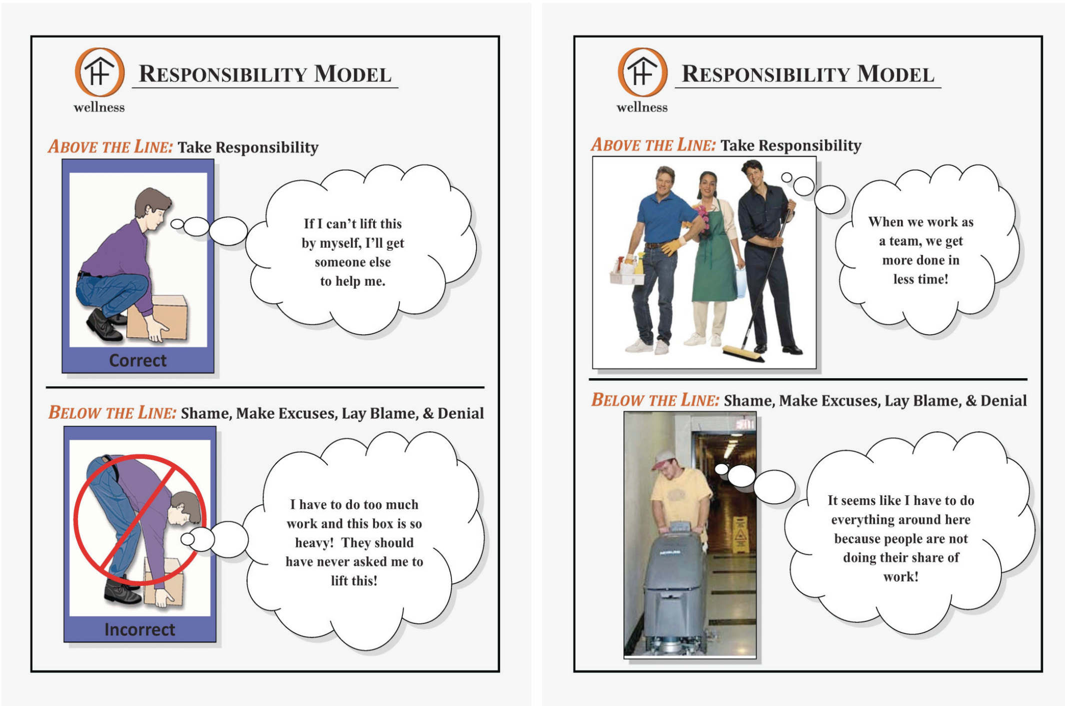
Figure 1
Sample Intervention Group Handouts at Time 1 and Time 2: Your Work Is Exercise

groups. To provide that balance, the control group received a 30-minute educational session on taking greater responsibility for job safety, but they did not receive information regarding their work as exercise until after the final post-intervention data collection at week 8. Employees received safety handouts in either English or Spanish, which were also posted in break rooms and inside work closets following data collection. Participants returning for the second health screening received new handouts containing information about proper lifting technique and job safety, and these handouts were subsequently posted in work areas. See Figure 2 for sample control group handouts.

At initial educational sessions held for both groups, employees were given the opportunity to ask questions about the health screenings and to schedule an early morning appointment at the testing site for their assigned group no more than 2 work days later. Further, they were instructed to not eat, consume caffeine, or exercise prior to testing. Upon arrival at the baseline screening, participants completed an informed consent, followed by a behavioral survey and physiological data collection. Prior to leaving, each participant also received a printout containing individual health screening results along with a brief description of each physiological measure. All of these measures was reassessed after 4 weeks and again 8 weeks after the initial screening.

DHFS provided an employee to translate the surveys and handouts. This employee is principally responsible for translating DHFS documents and had previously translated materials for the wellness

Figure 2
Sample Control Group Handouts at Time 1 and Time 2: Neutral Topics



team. Following all translations, 2 fitness professionals who were conversant in Spanish were asked to read the documents to ensure that the Spanish versions were as clear and unambiguous as possible. Spanish speakers were also available at all data collections to present information, answer questions, and clarify anything about the surveys or health screenings that participants did not understand.

A total of 53 participants completed the initial health screening (intervention=33; control=20), 50 completed the second health screening (intervention=31; control=19), and 39 completed all 3 assessments (intervention=25; control=14). Both groups were predominantly Hispanic and female, although some males (n=9) and other ethnicities (n=8) completed all 3 assessments.

Measures

Physiological measures. Blood pressure and resting heart rate were measured using an Omron HEM-780N3 Automatic Blood Pressure Monitor (Omron Co, Tokyo, Japan), which takes 3 consecutive readings one minute apart and displays the average. Participants were seated for at least 10 minutes prior to testing, and investigators recorded the average value displayed after 3 readings.

Height was measured to the nearest 0.1 cm using a portable stadiometer (PE-AIM-101 Portable Adult/Infant Measuring Unit, Perspective Enterprises, Inc, Portage, MI). Two readings were taken with the participant standing on the platform without shoes or socks and stepping off between readings. A third measurement was taken if the values differed by more than 0.5 cm, and the final value used for analysis was the mean of the 2 closest values.

Body weight and percentage of body fat were measured using leg-to-leg bioelectrical impedance with the professional grade Tanita BF 350 Professional Digital Scale (Tanita Manufacturing Co, Tokyo, Japan). Two measures were recorded. If body fat differed by more than 1%, a third measurement was recorded. The final value used for analysis was the mean of the 2 closest values.

BMI (kg/m²) was calculated from final weight and height values. Waist circumference was taken to the nearest 0.1 cm at the level of the umbilicus with a professional grade plastic tape. Two measurements were recorded. If they differed by more than 0.5 cm, a third measurement was recorded. The final value used for analysis was the mean of the 2 closest values. Employees wore required work uniforms for each of the assessments, and clothing was lifted and/or lowered so the measurement was always taken against skin.

Behavioral survey measures. Participants completed a written questionnaire with 11 items in either Spanish or English. Survey questions included information regarding perceived exercise level and dietary and smoking behaviors (see Table 2), as reported in Crum and Langer's original paper.[19]

Self-reported exercise. Subjects indicated if they were a regular exerciser (no/yes) and the amount of exercise they get on a scale ranging from 0 (none) to 10 (a lot). They were asked to describe their exercise by listing specific types and amounts of activities performed each week, as well as whether they use a gym/workout facility (no/yes) and if they walk/bike to work (no/yes).

Dietary and smoking behaviors. Participants responded to all questions in this section based on average daily consumption and habitual choices over the previous 30 days. Categories included how much they consumed relative to their normal intake and serving ranges of fruits and vegetables, sugary foods, water, drinks containing caffeine, and alcohol. Participants also indicated if they smoked and, if so, how many cigarettes or number of packs per day.

Statistical Analyses

We had both continuous and binary outcome variables. Descriptive statistics, including means and standard deviations, were calculated for all continuous variables; proportions and confidence intervals were calculated for binary variables. All dependent variables were examined using a 3 (Time: baseline, 4 weeks, 8 weeks; within subjects) x 2 (Condition: control, intervention; between subjects) repeated-measures analysis of variance (ANOVA). Because of the attrition rate between 4 and 8 weeks, those participants completing the first 2 assessments were examined using a 2x2 repeated-measures ANOVA. The 2x2 and 3x2 repeated-measures ANOVA yielded similar results despite the reduction in sample size; therefore, only data from participants completing all 3 assessments is given. A generalized estimating equation (GEE) model was used for noncontinuous variables, including regular exercise, use of gym, walk/bike to work, and smoking. The structure of the model with GEE was the same as with the ANOVAs. The tests of model effects for time (baseline, 4 weeks, 8 weeks), group (control, intervention), and interaction were determined using Wald chi-square values from the GEE.

Power analysis using G*Power,[23] a software program for sample-size estimation, indicates that the sample size necessary to find significant large (.5), moderate (.3), or small (.15) effects for repeated-measures ANOVA (within-between interaction) would require sample sizes of 10, 20, and 74, respectively. The final sample size of N=39 should be sufficient to detect moderate to large statistical effects, and supports the choice of examining those participants who completed all 3 screenings, as there were not sufficient numbers at any of the time points to detect small effects. The only available power analysis technique for GEE is an approximate method, based on the same technique used in meta-analysis. The analysis involved determining the effect size (index f) for the GEE to assess whether the study was powered adequately to conclude that the effect size was significant. Consistent with the findings for the continuous variables, analysis revealed 84 participants would have been necessary to get a significant P-value from the GEE ($f = .14$). SPSS 15.0 was used for all analyses, with an alpha level set at 0.05 and 2-sided hypotheses.

RESULTS

The 2x2 and 3x2 repeated-measures analyses yielded similar results despite the reduction in sample size; therefore, only data from participants completing all

Table 1
Physiological Measures by Time and Condition and Time, Group, and Interaction Effects

Measure	Group IG (n=25) CG (n=14)	Baseline (Mean±SD)	4 Weeks (Mean±SD)	8 Weeks (Mean±SD)	Time (2,36) F	Time (2,36) η^2	Group (1,37) F	Group (1,37) η^2	Interaction (2,36) F	Interaction (2,36) η^2
Body Weight (kg)	Intervention	79.7±13.7	79.4±13.8	79.4±14.4	1.89	.05	.07	.00	.36	.01
	Control	81.1±15.8	80.8±15.4	80.5±15.5						
BMI (kg/m²)	Intervention	30.8±5.2	30.8±5.3	30.8±5.4	.77	.02	.07	.00	1.09	.03
	Control	31.4±6.6	31.3±6.4	31.2±6.4						
Percent Body Fat (%)	Intervention	37.8±9.2	38.1±9.0	37.7±9.7	2.35	.06	.39	.01	1.60	.04
	Control	39.4±8.6	39.9±8.2	40.0±8.0						
Waist Circumference (cm)	Intervention	98.6±12.2	97.7±12.6	98.7±13.0	4.12*	.10	.06	.00	.53	.01
	Control	97.3±15.5	96.2±14.2	98.3±14.9						
Systolic Blood Pressure (mmHg)	Intervention[c]	127.1±19.8[a]	122.2±18.6	118.0±13.9[a]	.01	.00	.37	.01	8.70**	.19
	Control[c]	121.1±12.9[b]	125.2±15.9	129.9±13.1[b]						
Diastolic Blood Pressure (mmHg)	Intervention[c]	80.3±11.5[a]	78.0±10.1	75.8±9.7[a]	.39	.01	2.20	.06	5.10**	.12
	Control[c]	81.8±9.8	82.5±10.8	84.4±11.2						
Resting Heart Rate (beats/min⁻¹)	Intervention	72.7±11.1	73.5±11.0	75.3±10.1	2.53	.06	.01	.00	.62	.01
	Control	74.3±10.3	72.4±12.4	75.8±9.8						

Notes.
a $T_1 > T_3$ (P < .05)
b $T_1 < T_3$ (P < .05)
c Interaction between intervention and control groups (P<.05)
*** P<.05**
**** P<.01**

3 health screenings are reported.

Physiological Measures

The descriptive and statistical data for all physiological measures by time and condition are listed in Table 1. There were no significant main effects for group or time, nor any significant interaction effects for body weight, BMI, percent body fat, or resting heart rate. For systolic blood pressure (SBP), there were no significant main effects for group [F(1,37) = .37, P>.05] or time [F(2,36) = .01, P>.05], but there was a significant interaction effect [F(2,36) = 8.70, P<.001, η^2 = .19]. Multivariate simple main effects tests of time within group indicated that the control group significantly increased in SBP over time [F(2, 36) = 4.49, P<.05], whereas the intervention group significantly decreased [F(2, 36) = 8.31, P<.001]. For diastolic blood pressure (DBP), there were no significant main effects for group [F(1,37) = 2.20, P>.05] or time [F(2,36) = .39, P>.05], but there was a significant interaction effect [F(2,36) = 5.10, P<.01, η^2 = .12]. Multivariate simple main effects tests indicated that the control group did not significantly change in DBP across time [$F(2, 36) = 1.41$, $P>.05$], whereas the intervention group significantly decreased [$F(2,36) = 6.89$, $P<.01$]. For waist circumference, there was a significant main effect for time [$F(2,36) = 4.12$, $P<.05$, $\eta^2 = .10$], but not group [$F(1,37) = .06$, $P>.05$], and there was not a significant interaction effect [$F(2,36) = .53$, $P>.05$]. A pairwise comparison determined that the waist circumference at Time 2 was significantly less than Time 3 ($P<.05$).

Behavioral Survey Measures

The descriptive data for all binary and continuous behavioral measures by time and condition are listed in Table 2. In response to the question "Are you a regular exerciser?" there was a significant main effect for time [$\chi^2(2, N=38) = 6.72$, $P<.05$], but there were no significant group [χ^2 $(2, N=38) = .101$, $P>.05$] or interaction [$\chi^2(2, N=38) = 1.549$, $P>.05$] effects. A pairwise comparison determined that significantly more employees from both groups rated themselves as regular exercisers at Time 2 ($P<.05$) and Time 3 ($P<.05$) compared to Time 1, but there was no significant difference between Time 2 and Time 3. Although the number of participants who considered themselves regular exercisers increased, there were no significant main effects for group or time and no significant interaction effects for any of the measures used to analyze the amount of exercise. These measures included the amount of regular exercise, use of gym/workout facilities, and walking/biking to work.

For sugary food consumption, there was a significant decrease across time [$F(2,35) = 4.72$, $P<.05$], but there were no group [$F(2,35) = .879$, $P>.05$] or interaction [$F(2,35) = .102$, $P>.05$] effects. Pairwise comparisons revealed differences only between Time 1 and Time 3 ($P<.01$). In response to questions about habitual patterns over the previous 30 days, there were no significant main effects for group or time and no significant interaction effects for how much they ate relative to normal intake, daily average servings of fruits/vegetables, water, caffeine, and alcohol or cigarette use.

DISCUSSION

As in the Crum and Langer study,[19] we did not test a traditional placebo effect by administering a dummy pill or fake procedure, but rather by increasing awareness that the daily physical activity required because one's job is physically active may provide health benefits. If altering mind-set functions as a placebo, we should have seen improved health measures in conjunction with increased perceptions of being a regular exerciser for those in the intervention group. Our findings, however, were different from Crum and Langer[19] for both perceptual and physiologic changes.

We found that although significantly more employees in both groups rated themselves as regular exercisers at 4 and 8 weeks compared to baseline, neither group showed a change in perceived amount of exercise. Comparatively, Crum and Langer[19] found that their intervention group had a significant increase in those who considered themselves regular exercisers and in perceived amount of exercise, whereas the control group showed no changes, raising the possibility of a Hawthorne-type effect because of unequal treatment of groups.[24] The similar responses we report for the intervention and control groups for those who considered themselves regular exercisers, with no change in reported levels of activity, support the likelihood of that explanation, as we anticipated that the neutral topic of job safety would not impact employee perceptions of being a regular exerciser. However, it appears that simply receiving attention through an educational session, regardless of content, may have contributed to a perceptual shift in both groups. An additional explanation is that unlike Crum and Langer,[19] participants in the current study received information about their health scores at each screening, which may have contributed to a heightened awareness of the importance of physical activity. The mechanism for that perceptual change is not clear, however, and it was not accompanied by the same physiological changes reported by Crum and Langer[19] in their intervention group, findings that they described as "remarkable" (p. 170) and that we found provocative enough to attempt to replicate.

Our physiological findings were less clear-cut than those of Crum and Langer.[19] Their intervention group decreased significantly in all physiological measures,

Table 2
Self-reported Binary and Continuous Behavioral Measures by Time and Condition

	Group IG (n = 25) CG (n = 14)	Baseline Mean (CI)	4 Weeks Mean (CI)	8 Weeks Mean (CI)
Binary Variables				
Regular exercise	Intervention	0.32 [.12, .52][a]	0.52 [.31, .73][a]	0.56 [.35, .77][a]
(N = 0; Y = 1)	Control	0.46 [.19, .74][a]	0.54 [.25, .83][a]	0.54 [.25, .83][a]
Use of gym/workout facility	Intervention	0.20 [.02, .38]	0.28 [.09, .47]	0.24 [.05, .43]
(N = 0; Y = 1)	Control	0.33 [.08, .59]	0.33 [.06, .61]	0.42 [.15, .69]
Walk/bike to work	Intervention	0.12 [-.03, .27]	0.08 [-.07, .23]	0.12 [-.02, .26]
(N = 0; Y = 1)	Control	0.25 [.03, .47]	0.33 [.12, .54]	0.17 [-.04, .37]
Smoking	Intervention	0.08 [-.06, .22]	0.12 [-.03, .27]	0.12 [-.03, .27]
(N = 0; Y = 1)	Control	0.23 [.04, .42]	0.23 [.02, .44]	0.23 [.02, .44]
Continuous Variables		**(Mean ± SD)**	**(Mean ± SD)**	**(Mean ± SD)**
Perceived amount of exercise	Intervention	4.68 ± 2.53	5.00 ± 1.94	5.24 ± 2.05
(0→10 = a lot)	Control	3.92 ± 3.50	4.46 ± 2.73	4.38 ± 2.87
Food intake	Intervention	1.56 ± 0.82	1.44 ± 0.65	1.36 ± 0.70
(Less=0; Same=1, More usual=2)	Control	1.69 ± 0.86	1.54 ± 0.66	1.31 ± 0.48
Fruit/vegetables	Intervention	2.96 ± 1.74	2.16 ± 1.28	2.44 ± 1.36
(servings/day)	Control	3.08 ± 1.61	3.08 ± 1.38	2.69 ± 1.75
Sugary foods	Intervention	3.00 ± 2.00[b]	2.32 ± 1.77	1.92 ± 1.35[b]
(servings/day)	Control	2.46 ± 1.94[b]	2.08 ± 1.61	1.46 ± 1.56[b]
Water	Intervention	4.16 ± 2.54	3.76 ± 2.07	3.20 ± 1.61
(servings/day)	Control	4.31 ± 2.56	4.08 ± 1.75	4.00 ± 2.31
Caffeine	Intervention	2.88 ± 2.30	2.64 ± 2.10	2.12 ± 1.59
(servings/day)	Control	3.31 ± 2.14	2.69 ± 1.89	2.31 ± 1.60
Alcohol consumption	Intervention	0.48 ± 0.82	0.68 ± 1.11	0.40 ± 0.76
(servings/day)	Control	0.31 ± 0.63	0.31 ± 0.63	0.00 ± 0.00

Notes.
CI = 95% confidence interval
a $T_1 < T_2, T_3$ ($P < .05$)
b $T_1 > T_3$ ($P < .05$)

whereas our groups showed no change in body weight, BMI, percent body fat, or resting heart rate at either time point. Although there was no significant difference in waist circumference between times 1 and 2 or 1 and 3, both groups were significantly lower at Time 2 than Time 3. Although these values were significantly different, they ranged from only a low of 97.1 cm (± 13.0) at Time 2 to a high of 98.6 cm (± 13.5) at Time 3. These figures represent a statistically significant (P<.05) change in girth that may not register in one's conscious awareness of clothing fit or tightness and thus may have little practical significance because there were no accompanying body weight changes, and the changes are small enough to reflect measurement error. Similarly, physiologic changes and effect sizes reported by Crum and Langer[19] for their intervention group were also small, but achieved statistical significance. For example, the mean percent body fat (η^2 = .13) went from 34.84 (±6.3) to 34.34 (±6.3), waist-to-hip ratios (η^2 = .10) decreased from 0.834 (± 0.05) to 0.826 (± 0.06), and body mass index (η^2 = .10) changed from 26.05 (±3.8) to 25.7 (± 3.8). All of these values achieved statistical significance at the .05, .01, and .001 levels, respectively, yet the practical significance, as evidenced by the small effect sizes, appears less meaningful.

Blood pressure was the only measure in which the intervention group demonstrated positive changes compared to the control group, with a significant reduction in both SBP and DBP over time. Although this finding is consistent with Crum and Langer's[19] original study, it is somewhat surprising, as there were no accompanying changes in body composition or weight. The control group showed a significant increase in SBP, with no change in DBP, which was also difficult to understand or meaningfully interpret, as there were no changes in body weight or activity levels. Data collection for both groups occurred at the same time of day, with the same automated blood pressure units, and with the same instructions for all employees regarding food, caffeine, and exercise prior to data collection. Resting blood pressure is known to be quite variable and affected by such factors as number of measures, number of days on which measures are taken, level of blood pressure, age, anxiety, emotional turmoil, and climate variation.[25,26] Although every effort was taken to ensure reliable blood pressure measures, these measures were taken during the workday, without the ability to control or measure these extraneous variables.

One possible explanation is that conducting blood pressure measurements on 3 separate occasions reduced psychological stress associated with measuring blood pressure for some participants; however, if that were the case we would expect both groups to change. It is also possible that there were different dynamics occurring at the workplace among the 2 employee groups on their scheduled testing days, yet the study was not designed to measure interpersonal variables. Further research, including assessment of psychological stress and exit interviews with participants, might uncover more of the subjective measures that have potential to affect blood pressure. Identifying personnel or personal issues through interviews would be one way to attempt to understand this type of result. As mentioned previously, another potential explanation of the difference between our findings and those of Crum and Langer[19] is that in our study, we provided health-related information to participants following baseline testing. It could be that doing so resulted in an increased awareness of personal health risk in both groups, causing participants to pay attention to their health. However, if that were the case, we would have anticipated seeing reductions in blood pressure regardless of study condition, as well as subsequent behavioral changes, which did not occur.

The scant behavioral change reported over 4 and 8 weeks is compatible with the lack of reported body composition changes in both groups. There was, however, a decreased consumption of sugary foods from Time 1 to Time 3 in both groups, supporting the interpretation that simply participating in an educational intervention and/or health screening could have cued participants to pay greater attention to their sugar intake regardless of the study condition they were in. Future studies could explore why employees reduced sugary food intake rather than making some other change, whether this reduction was real or perceived, and why that reduction had no impact on body weight.

Limitations

There are several limitations to consider when interpreting these results. First is the possibility that the 2 groups of workers in our study were not similar to the participants in Crum and Langer's work.[19] Despite comparable occupations, those in our groups had higher body fat (38.4 ± 8.9% vs. 35.3 ± 5.6%) and BMI values (31.0 ± 5.7 kg/m^2 vs. 26.5 ± 4.3 kg/m^2) at the start of the study. Discussing test results following each of the health screenings may have affected participants and impacted subsequent behaviors or perceptions. The addition of the content-neutral educational component to establish a true control group was made to improve the methodological rigor of the study, but it does inhibit our ability to compare our results directly with those of Crum and Langer.[19] Because all participants worked for the same campus division, there is some chance that there was interaction between the intervention and control groups. The opportunity for contamination existed; however, it was felt to be minimal, as participants were assigned to specific work areas on either the north or south sides of campus. The additional intervention handout developed for the second 4 weeks was not optimal, as it included a line that was more suggestive than passively linking work and exercise (Figure 1). Despite the move away from a passive placebo ideal, the mostly unremarkable physiological and behavioral changes indicate that even more directive text on a handout is not sufficient to drive measurable changes in physiology or behavior. Lastly, compared to Crum and Langer,[19] there were fewer participants in both groups in our study, which affects statistical power and the ability to generalize these results. The power analyses indicated that the study was insufficiently powered to detect small effects.

Implications

Overall, the changes in physiological measures are unimpressive and do not support the contention that simply altering mind-set through enhanced perception of exercise yields substantial health improvements. The fact that both groups increased self-perception as exercisers suggests that any type of intervention or interaction with researchers, accompanied by explained health measures, may raise awareness, but not necessarily impact health. Further research is necessary to determine the existence or extent of a placebo effect for the moderating role of mind-set in the relationship of exercise and health. Including additional physiological measures, validated tools for measuring health behaviors, objective methods for quantifying activity levels, and longer follow-up periods with larger sample sizes from a number of different occupations will help establish if mind-set really matters in causing meaningful behavior change and improved health.

The bottom line for those interested in workplace wellness is that health improvements require more than simply telling employees, "Your work is exercise." The concept is enticing, because it is an inexpensive and easily diffused intervention, yet the lack of significant changes in this employee group raises concerns regarding its efficacy. It is likely that the numerous concerns with this approach that Bandura[11] initially raised, and the subsequent wealth of research attempting to unravel the complexity of behavior change, represent a more accurate picture of the challenges faced by worksite wellness programs. Although personal beliefs are powerful, simply being told that work counts as exercise does not necessarily improve health – particularly when workers' past beliefs and experiences do not lead them to conclude this will be the case. As Bandura[11] cautioned years ago: "...to raise by persuasion expectations of personal competence without arranging conditions to facilitate effective performance will most likely lead to failures..." (p. 198). This is not to say that mind-set does not matter, but perhaps it does not matter as much as identifying ways to empower workers to regularly make choices that promote health and well-being in an environment that fosters personal responsibility.

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