Nursing Science Quarterly
2023, Vol. 36(2) 186–193

DOI: 10.1177/08943184221150260
journals.sagepub.com/home/nsq
SAGE

Improving Physical Fitness and Health of Office Workers in Iran

Behnam Shakerian, MD,[1] RafatiFard Mohammad, PhD,[2] Dashti Saeid, PhD,[3] Mehdi Haghi, PhD,[4] Mojtaba Fattahi Ardakani, PhD,[5] Hadi Ahmadi Chenari, PhD,[6] and Steven L. Baumann, RN; PhD[7]

Abstract

This paper reports on a study on improving the health and fitness of office workers in Iran using a comprehensive model. The research design was a randomized controlled trial involving 294 employees. The intervention was a 6-month program to promote physical activity. The primary outcome measure was their scores on the physical activity (PA) index recorded at 3 and 6 months. A statistically significantly increase in PA was found in the intervention group over the control group. In addition, the mean values of related health and physiological indices of the intervention group demonstrated a statistically significant increase compared to the control group. The conclusions of this study support research findings in multiple countries, that the physical activity and health of office workers can be improved in a short period.

Keywords

comprehensive model, Iran, office workers, physical activity

It is globally recognized that remaining physically active along with sufficient clean drinking water and healthy foods are critically to health. Unfortunately, in industrialized countries, most jobs do not involve daily physical activity (Pronk et al., 2004). This lack of daily physical activity is estimated to result in 5.3 million premature deaths annually worldwide (Wen & Wu, 2012). In particular physical inactivity is associated with cardiovascular disease and other chronic noncommunicable diseases (Lee et al., 2012). This is as true in Iran today as it is in Western Europe and the United States. The economic burden of physical inactivity related health problems has been estimated to account for 11% of healthcare cost in the United States, or $120 billion dollars, each year (Carlson et al., 2015). The scope of this issue has led the World Health Organization (WHO, 2018) to establish a global action plan on physical activity (2018–2030), which recommends that "countries and industry partners provide diverse opportunities for physical activities, in their words create active societies, environments, people, and systems" (pp. 9–10). Studies in Iran have reported the rate of physical inactivity to be about 30% to 70% (Fakhrzadeh et al., 2016). Reports from various countries have addressed workplace health as a key point for initiating and maintaining the physical activity of the workforce.

An integrative review of the literature by Calderwood and colleagues (2021) reported that physical activity interventions in employees' health reduces organizational healthcare costs as much as 25% to 30% due to less employee absenteeism and increased productivity. Furthermore, a study by Taylor and colleagues (2016) found that using computer prompts and Booster Breaks for desk-based workers

[1]Assistant Professor of Cardiovascular Surgery, Department of Cardiology, School of Medicine, Shahrekord University of Medical Sciences, Shahrekord, Iran
[2]Health Science/Physiology, Clinical Research Development Unit, Hajar Hospital, Shahrekord University of Medical Sciences, Shahrekord, Iran
[3]Department of Public Health, Ferdows School of Allied medicine and public Health, Birjand University of Medical Sciences, Birjand, Iran
[4]Assistant Professor of Health Education and Promotion, Department of Public Health, School of Health and Nutrition, Social Determinants of Health Research Center, Shohadaye Ashayer Hospital, Lorestan University of Medical Sciences
[5]Shahid Sadoughi University of Medical Sciences and Health Services, Yazd, Iran
[6]Department of Nursing, Ferdows School of Allied medicine and public Health, Birjand University of Medical Sciences, Birjand, Iran
[7]Professor of Nursing, Hunter College, The City University of New York, USA

Contributing Editor:
Steven L. Baumann, RN; PhD, Professor, Hunter College of the City University of New York, 82 Sherman Ave, Williston Park, NY 11596, USA.
Email: sbaumann@hunter.cuny.edu

was associated with increases of physical activity and the reduction of sedentary behavior and body mass index. Therefore, promoting physical activity (PA) in the workplace can be an important component in prevention of noncommunicable diseases. Over the last decade, the development of ecological–social models of health behaviors has focused on the potential impact of environmental, social, and physical factors on routine physical activity.

Spence and Lee (2003) effectively argued for attention to environmental, biological, and psychological factors in designing and implementing health promotion and physical activity behavior programs in what they referred to as The Comprehensive Model. The model specifies four dimensions: the macrosystem (social class and culture), the exosystem (existing health promotion program), the mesosystem (workplace), and the microsystem (facilities and verbal encouragement) (Spence & Lee, 2003, p. 12). Physical activity behavior is seen as influenced by the interactions of each of these dimensions as well as environmental, psychological, and biological factors, and assists in recognizing the opportunities for participation in physical activity and multiple factors affecting behavior. Since behavioral models and theories can be a good guide for interventions in physical activity programs, this study was conducted with the aim of investigating whether a comprehensive model-based integrated interventional strategy could be effective in promoting physical activity and health-related and physiological physical fitness indices in the administrative employees of the oil industry in Iran.

Methodology

Study Design and Population

This randomized controlled trial included an intervention group and a control group. The study was done in the second half of 2020, in Asaluyeh, Iran, on the Persian Gulf. The sample size needed for each group was calculated to be 123, which would assure a significance level of 5% and the test power of 90%, with a desired outcome of 7.5-point difference in average peak oxygen consumption (VO_2 max) before and after the intervention. Anticipating an attrition rate of up to 20%, the sample size for each of the two groups was set at 147. Recruitment took place at two centers that had a large number of office-based employees, all of whom worked for Pars Special Economic Energy Zone (PSEEZ), which is one of the world's largest energy worksites. One of the centers at PSEEZ was randomly selected to be the site of intervention and the other the control group. The inclusion criteria were that participants had to be between the ages of 20 and 60 years old, with no history of rare diseases, cardiovascular disease, asthma, or diabetes, and the ability to participate in physical exercises. Excluded from the study were those unable to attend all of the training sessions and those who transferred to another work organization during the study.

The potential participants were randomly selected from all of the workers in the selected offices. The purpose and procedure of the study was explained via a face-to-face meeting for potential participants (about 1000 employees) in the two sites. A demographic information survey and the Baecke Habitual Physical Activity Questionnaire (an indirect, self-report measure of physical activity) was distributed along with the invitation to participate. After 300 participants signed the consent form for their participation collecting they were provided the questionnaires. Six of the participants were not included because their questionnaires were not complete, thus 294 individuals were included in the study. The 294 individuals were randomly selected to either the intervention or the control group. The result was that 85 individuals from one administrative center were assigned to the intervention group, and 147 from the other administrative center to the control group. A random number table was used to do the randomization. Participants were blinded to which group they had been assigned, and the person who entered the data into the software was also blinded.

Data Collection Tools

The instruments used in this study were a demographic information checklist, the Baecke Habitual Physical Activity Questionnaire (Baecke et al., 1982; Sadeghisani et al., 2016), and a questionnaire developed for this study based on the comprehensive model constructs. The demographic information checklist included age, gender, marital status, number of children, education level, economic status, working hours, and work experience. The Baecke Habitual Physical Activity Questionnaire (Baecke et al., 1982) is an international questionnaire for indirectly and subjectively assessing the level of physical activity. The questionnaire contains 16 items, rated on a 5-point Likert scale (1–5), to measure the levels of physical activity at work and in exercise and leisure time. In order to determine the internal consistency of the questionnaire, Cronbach's alpha was used, which was calculated at 0.79% for the questionnaire, confirming the internal consistency of the items.

The health-related physical fitness (cardiorespiratory fitness, muscular strength and endurance, and flexibility), and body composition (body mass index [BMI], fat percentage and waist-hip ratio [WHR]) indices were measured. The maximum oxygen consumption (VO2 max) index was used as a measure of cardiorespiratory fitness. The maximum oxygen consumption (VO2 max) was measured using an exercise test and the Queens College step test (QCT), which calculated the oxygen consumed (ml) in 1 minute per 1 kg of body weight (ml/min/kg). The QCT is an exercise test that is widely used to measure cardiorespiratory fitness in several countries.

The sum of the left and right handgrip strength (HGS) were used in this study. The measurements were mad by using the Jamar® Plus+ Digital Hand Dynamometer. The reliability of the Jamar dynamometer has been demonstrated (Mathiowetz et al., 1984). To measure muscular endurance, the Crunch (partial curl-up) test was used, and to measure flexibility, the trunk-flexure test with some modifications was used (American College of Sports Medicine, 2018). Before the physical fitness tests, the participants performed a brief warm-up and stretches for 7 to 10 minutes. The BMI was calculated as well as the skin fold method using the Slim Guide Skinfold Caliper, which provides an estimate of the body fat percentage (BFP). It was read to the nearest 0.5 mm at the following body sites: abdominal fat, triceps, and suprailiac. For improved accuracy, each point was calculated three times and then the average of these three measurements was recorded. Later, the recorded mean scores were put into the Jackson and Pollock (1985) formula (as represented below) with the participants' BFP calculated for percent of Body Fat = (0.39287 × sum of three skinfolds) – (0.00105 × [sum of three skinfolds] 2) + (0.15772 × age) – 5.18845(28).

In order to measure the abdominal obesity, the ratio of waist circumstance to hip circumstance was used (American College of Sports Medicine, 2018). The anthropometric indices were measured in an indoor sport club where the temperature is maintained at 25 °C to 35 °C. Data were collected from 4 pm to 8 pm. Another tool used in this study was a researcher-developed questionnaire based on the components of the comprehensive model. The factors that were included in this study were from a protocol of physical activity behavior developed by Spence and Lee (2003). After careful review of the literature found no questionnaires that addressed the research questions, one was developed for this study using the constructs of the comprehensive model for measuring the components physical environment, pressure for macrosystem, mesosystem, exosystem, and microsystem changes, and individual factors including psychological factors (awareness, attitude, and self-efficacy).

Psychometric analyses (item clarity, face validity, content validity, and reliability coefficient calculation) were done on the instrument. In order to determine the face and content validity of the questionnaire, the tool was provided to 12 professors and exercise experts, consisting of eight health education experts, two physical education and sports science experts, one psychologist and one biostatistician. According to their suggestions and comments, changes were made to the wording and phrases of the items, and then the instrument was found reliable to gather the data of interest. Content validity index and ratio were over 0.79 and over 0.59, respectively. In order to calculate the reliability of the questionnaire, internal consistency (Cronbach's alpha) coefficient and test–retest reliability coefficient were measured. In this study, the questionnaire was also piloted with 30 employees, and the Cronbach's alpha coefficients for different constructs of the questionnaire was obtained to range between 0.73 and 0.95, which are statistically acceptable. Before the intervention, both groups completed the questionnaire.

Interventions Based on the Comprehensive Model Constructs

According to the comprehensive model, certain interventions focusing on the model's constructs, such as environmental and social factors, changes in organizational rules and policies, and training in individual (psychological and biological) factors were performed in the intervention group. In addition, a health center was established providing the necessary facilities and equipment for physical activity in the workplace and the residential campus. Daily advice exercise consultation was also provided in the workplace, as well as giving training material and theoretical–practical training in the methods of performing physical activities. The situations in which physical activities can be performed included the demonstration of activities involving the lower extremities, the trunk, and the upper extremities. These did not require sports equipment and could be carried out at work and home. A few physical activities were demonstrated and recommendations for how to increase physical activities were given. For example, participants were encouraged to use the stairs instead of the escalator or to park their car at a 10-minute walking distance from the workplace, likewise other moderate-intensity activities were discussed, such as housekeeping, shopping, and commuting to increase their physical activity level.

Certain changes were also made to laws and regulations with an emphasis on organizational support for promoting employees' physical activity behaviors and health, so that employees were allowed to refer to the established health center during the workday and have 30 minutes of physical activity during the daytime depending on their working hours. A commuting service was provided for participants to facilitate their participation in the (1 hour long) public exercise program in the morning. To further encourage employees, sports clothing and equipment were provided and they were allowed to use the sports pool for 1 hour (the last working hour). General training was also given to the intervention group, including the harms and risks of physical inactivity and obesity in the workplace, such as musculoskeletal problems, cardiovascular disease and other adverse health effects. The role of physical activity in life and the techniques of physical exercises were discussed. In addition, psychological factors related to physical activity and employees' attitudes toward physical activity were included. The goal was to increase their awareness of the importance of the role of colleagues, friends, and family in promoting the activity by accompanying them in performing physical activities and encouraging each other to perform physical activities in a friendly group to create a supportive and persuasive environment to do physical activities. Besides that, face-to-face verbal encouragement of the participants and telephone counseling were also done to increase physical activity level. Another purpose of this intervention was to emphasize self-efficacy.

Table 1. Scheduling Training Sessions.

Teaching Method	Session Length	Subject	Session
Q & A	10 minutes	Orientation and introduction of the goals of the program; emphasizing training sessions	1st session
Lecture and Group Discussion	50 minutes	General education in regard to physical activities, the effect of physical activity in life, proper types for physical activities, the advantages and disadvantages of low activity including increased weight and obesity, back pains, etc.	
Lecture, Group Discussion and Q&A	10 + 50 minutes	Emphasis on organizational support and changes in current regulations to support physical activity	2nd session
Lecture, Group Discussion and Q&A	10 + 50 minutes	Emphasis on psychological factors, awareness, attitude, and self-efficiency in physical activities and how to remove barriers of physical activity such as laziness and procrastination	3rd session
Lecture, Group Discussion and Q&A	10 + 50 minutes	Emphasis on physical environment (availability of suitable conditions and equipment for physical activity) along with distribution of educational booklet and pamphlet	4th session
Lecture, Group Discussion and Q&A	10 + 50 minutes	Emphasis on possible physical activities at workplace and at home along with showcasing some simple physical activities and offering suggestions for starting physical activity	5th Session
Q&A	45 minutes	Answering any questions from the participants and distribution of educational booklet and pamphlet	6th session

One way to increase self-efficacy is to do certain behaviors. Given this, the physical activity was divided into smaller and simpler components representing the subdivisions of the whole behavior in question. Other measures included education on ways of remove barriers to doing regular physical activity. Theoretical training sessions were presented in five sessions of 50 minutes with a focus on the comprehensive model structures, for 3 weeks, with two sessions per week alternately and separately for all subjects in the intervention group and presented according to content specified (see Table 1). The subjects in the intervention group were divided into two groups (workers and sub-employees) and (deputies and managers), to facilitate discussions.

Practical training programs for sports activities were held for three sessions per week with 30 minutes in each session, in person, during working hours (in the health center created at work) and outside of office hours in the gym of the staffs' residential camp. This intervention program lasted for 3 months. The participants took part in practical sessions in groups based on their administrative units and according to their work schedule. The educational content was the same for all members of the intervention group. In the control group, no educational intervention was performed. The effects of the intervention on the level of physical activity of the employees were measured immediately after the end of the intervention period (3 months) and 6 months after the interventions.

After completing the study, and in order to observe research ethics, the control group was invited to attend a training session on the effective factors and strategies for promoting physical activity using the components of the comprehensive model, in which they were also given a booklet, a pamphlet and an educational CD.

Data Analyses

All statistical analyses were done using SPSS (Version 21). Chi-square tests was used to compare the demographic characteristics of the two groups, and independent and paired *t* test and the non-parametric tests Wilcoxon-Mann-Whitney U test and ANOVA to compare the data of the groups. The significance level of the tests was considered 95%.

Results

The average age of the sample of 294 male office workers was 36.90 (± 7.7 *SD*) years, their average height was 174.4 (± 6.3 *SD*) cm, weight was 84.5 (± 12.2) kg and their calculated BMI was on average 27.8 (± 3.4) kg/m^2. Most of the participants ($n = 156$, 91.8%) were married. According to the scale used in this study, 77.6% of them had a moderate economic status, 12.4% had a high economic status, and the rest had a low economic status. Most participants (45.9%) were educated at the bachelor's degree level, 23.5% at the master's degree level, and the rest held associate degrees or high school diplomas. In terms of work history, 53.6% reported a work history of 11 or more years and 8.8% reported a work history of less than 3 years, and the rest had between 3- and 10-year work histories. Regarding their reported history of physical activity, 59.6% had no regular physical activity history and 39.8% reported low to moderate physical activity levels. The demographic characteristics of the two groups had no statistical differences. According to the results of the chi-square tests, there was a significant difference in the measure of physical activity levels (by the questionnaire) before and after the intervention for the intervention group ($p \leq .002$), but not the control group ($p = .41$; see Table 2).

Table 2. Comparison of Demographics of the Intervention and Control Group.

Variables	intervention Group $M \pm SD$	Control Group $M \pm SD$	P value
Age (years)	37.18 ± 7.06	36.90 ± 7.69	.39
Height (cm)	174.29 ± 6.31	174.3 ± 6.30	.47
Weight (kg)	84.8 ± 12.23	84.6 ± 12.36	.41
BMI (kg/m^2)	26/92 ± 3/43	27/9 ± 3/88	.08
Marital Status, *n* (%)			.26
Single	31 (10.6)	17 (5.9)	
Married	263 (89.4)	277 (94.1)	
Education, *n* (%)			.48
≤ High School	55 (18.8)	38 (13.0)	
Associate Degree and BSc	166 (56.5)	190 (64.7)	
MSc and PhD	73 (24.7)	66 (22.3)	
Occupational Status, *n* (%)			.11
Workers	35 (11.8)	48 (16.5)	
Employees	186 (63.4)	190 (64.7)	
Managers	52 (17.7)	28 (9.4)	
Others	21 (7.1)	28 (9.4)	
Working Hours			.71
6–8 hr	28 (9.4)	21 (7.1)	
8–10 hr	55 (18.8)	66 (22.4)	
≥ 10	211 (71.8)	207 (70.6)	

Table 3. Frequency Distribution of Participants According to Physical Activity Level of the Intervention and Control Groups Before and 6 Months after Intervention.

Total Physical Activity Group		Low	Moderate	High	
		N (%)	N (%)	N (%)	P value
Intervention	Before	180 (61/2)	107 (36/5)	7 (2/4)	0/002*
	After	35 (11/8)	197 (67/1)	62 (21/2)	
Control	Before	187 (63/5)	104 (35/3)	3 (1/2)	0/41
	After	180 (61/2)	111 (37/6)	3 (1/2)	

There was no statistical difference in the participants scores on total physical activity level in sports, leisure time, and the workplace between the two-intervention group and control group before intervention ($p > .05$). The repeated measures ANOVA results showed there was an interaction effect between time passage and intervention group ($p > .001$; see Table 3). Therefore, the difference in the mean score on the total physical activity (in sports, leisure and the workplace) between the two groups were separately measures at 3 and 6 months after the intervention. In addition, the mean physical activity scores were also analyzed using multiple linear regression models.

The results of multiple linear regression showed that after controlling for the effect of the mean difference, the total physical activity scores before and 3 months after the intervention were significantly different between intervention and control groups ($p < .01$). The mean score of total physical activity in the intervention group was higher by 1.63 points when compared to the control group, and the scores six months after intervention were significantly different between intervention and control groups, with the mean score of total physical activity in the intervention group being higher by 3.69 points when compared to the control group. The repeated measures ANOVA results showed in the intervention group, the mean score of the total physical activity level (in sports, leisure time, and the workplace) was significantly different at Time 1 (before) and Time 2 (3 months) and at Time 3 (6 months) after intervention ($p < .001$) with an increasing trend, but not in the control group ($p > .11$) (see Table 4).

The results of statistical analysis showed that there was no significant difference in the health-related and physiological physical fitness indices between the two groups before intervention. The independent t test results showed that mean VO2 max, muscular endurance, muscular strength, BMI, BFP, and WHR in the intervention group significantly changed at 6 months after intervention compared to the control group. The Mann-Whitney U test showed the mean

Table 4. The Distribution of Mean Total Physical Activity Index and Walking Before, 3, and 6 Months After Intervention in the 2 Groups.

Variables	Group	Before Intervention *M* ± *SD*	3 Months After Intervention *M* ± *SD*	6 Months After Intervention *M* ± *SD*	*P* value
Total Physical Activity Index	Intervention	7/02 ± 1/83	9/23 ± 1/63	11/07 ± 2/33	.001
	Control	7/10 ± 1/51	7/6 ± 1/84	7/03 ± 1/54	.11
	p value RMANOVA*	0/6	0/01	0/001	
Sports Index	Intervention	2/46 ± 0/85	3/3 ± 0/55	4/1 ± 0/89	.001
	Control	2/57 ± 0/9	2/69 ± 0/87	2/55 ± 0/87	.28
	p value RMANOVA*	0/42	0/001	0/001	
Leisure Time Index	Intervention	0/62 ± 2/24	3/1 ± 0/32	3/59 ± 0/7	.001
	Control	62/0 ± 24/2	61/0 ± 43/2	61/0 ± 21/2	.03
	p value RMANOVA*	0.39	0.02	0.001	
Workplace Index	Intervention	2/20 ± 0/73	2/83 ± 0/21	3/38 ± 0/75	.001
	Control	2/29 ± 0/62	2/48 ± 0/32	2/26 ± 0/61	.33
	p value RMANOVA*	0.39	0.001	0.001	
Walking	Intervention	3655 4169	6237 2744	6178 2634	0.001
	Control	3622 4145	3598 1329	3529 1292	0.13
	p value RMANOVA*	0/41	0/001	0/001	

Note. p value RMANOVA (before and after intervention in each group). **p* value RMANOVA (between intervention and control groups).

flexibility in the intervention group significantly changed compared to the control group 6 months after intervention ($p < .001$). The paired *t* test results on the changes in each group showed, first, in the intervention group a significant difference in the mean VO2 max. The sit-up test was observed before and 6 months after intervention, with an increasing trend; and a significant difference in the mean BMI, BFP, and WHR was observed before and 6 months after intervention, with a decreasing trend ($p < .03$).

Second, the intra-group changes in the control group showed that there was no significant difference in the mean VO2 max, sit-up test, muscular strength, BFP, and WHR before and 6 months after intervention, but the difference in mean BMI before and 6 months after intervention was significant, with an increasing trend ($p < .03$); that is, participants' BMI increased. The Wilcoxon test results showed that there was a significant difference in the mean flexibility index before and 6 months after intervention in the intervention group, with an increasing trend ($p < .001$), but there was no significant difference in flexibility index in the control group before and six months after the intervention ($p > .066$) (see Table 5).

Discussion

Although different models and behavioral theories have been used to promote the behavior of physical activity in various countries, there is limited evidence in Iran on how to promote health-related physical activity in the workplace.

Therefore, this research was conducted with the aim of investigating the effect of the comprehensive model-based interventional strategies for promoting health-related fitness in the administrative employees of the oil industry. The results of this study showed that an intervention program based on the comprehensive model increased the physical activity level of the administrative employees in one industry in Iran.

The physical activity behavior scores obtained by the Baecke Habitual Physical Activity Questionnaire showed a significant difference in the mean total physical activity scores between the intervention group and the control group in all the three measurements; that is, before, at 3 months, and again at 6 months after the intervention. Before the intervention most (61.2%) of the participants had a low physical activity level, but, after the intervention, most of the participants in the intervention group reported moderate and high physical activity levels (67.1% and 21.2%, respectively). Different studies have reported contradictory results regarding physical activity level, and we did not find any study with the model used in the current study for physical activity behavior interventions in the administrative employees of the industrial sector.

Consistent with our findings, a study by Fleury and Lee (2006) on the physical activity of African American women using the Social Ecological Model, showed that individuals' access to sports facilities and environmental resources made it easier for the women to be physically active, and improved their overall physical activity level. A study conducted by Gargari and colleagues (2018) on the use of the Social Ecological Model to develop interventions to promote the physical activity of female employees in Iran, showed that after 8 weeks of intervention, based on the model, the number of daily steps by the employees in the intervention group increased from 4204 to 7882. The total physical activity of the intervention group also increased as compared to the control group. Aittasalo and colleagues (2004) reported that their study of physical activity counseling in the workplace,

Table 5. The Distribution of Mean Physiological Physical Fitness Indices Before, 3, and 6 Months After Intervention in the Two Groups.

Variables	Group	Before Intervention *M* ± *SD*	3 Months After Intervention *M* ± *SD*	6 Months After Intervention *M* ± *SD*	*P* value
VO2 Max	Intervention	39/04 ± 6/22	46/06 ± 6/10	49/03 ± 6/11	.001
	Control	39/19 ± 5/61	39/50 ± 5/4	40/18 ± 5/4	.487
	p value*	0/704	0/038	0/041	
Muscular Endurance (Sit-Up Test)	Intervention	27/07 ± 12/83	27/32 ± 12/19	27/42 ± 12/27	.001
	Control	25/04 ± 13/41	25/17 ± 13/29	24/97 ± 13/29	.1
	p value*	0.192	0.042	0.048	
Muscular Strength (HandGrip Strength)	Intervention	101/07 ± 6/83	109/4 ± 8/46	111/4 ± 8/56	.001
	Control	102/04 ± 5/41	102/47 ± 4/40	103/7 ± 4/41	.51
	p value*	0.12	0.036	0.038	
Flexibility (Sit and Reach)	Intervention	15/29 ± 9/32	19/34 ± 10/74	20/42 ± 10/84	.001
	Control	14/47 ± 8/69	14/37 ± 7/23	14/24 ± 8/03	.09
	p value*	0.684	0.011	0.001	
Body Mass Index	Intervention	26/92 ± 3/43	26/76 ± 3/23	26/66 ± 3/23	.001
	Control	27/92 ± 3/88	27/92 ± 3/90	27/92 ± 3/93	.03
	p value*	0.08	0.022	0.020	
BFP (%)	Intervention	34/1 ± 8/72	33/78 ± 8/45	33/66 ± 8/58	.002
	Control	36/61 ± 11/44	36/60 ± 11/47	36/62 ± 11/45	.2
	p value*	0.1	0.051	0.050	
Waist-Hip Ratio	Intervention	0/91 ± 0/073	0/90 ± 0/068	0/90 ± 0/072	.001
	Control	0/92 ± 0/054	0/92 ± 0/056	0/92 ± 0/055	.15
	p value*	0.36	0.044	0.045	

Note. Paired *t* test and Wilcoxon test (before and after intervention in each group). *Independent *t* test and Mann-Whitney U test (between intervention and control groups).

guided by the transtheoretical model of health change, did not show any significant increase in the physical activity level.

The differences in studies include different environmental conditions of the target group, the types of intervention, the measurement tools, or social and cultural factors. In our study, health-related physical fitness indices and number of daily steps were the measure of physical activity. These indices provide a great deal of information about the health and well-being of individuals (Swain & American College of Sports Medicine, 2014). In this phase of the study, the health-related and physiological physical fitness indices showed that the mean scores of the intervention group were significantly different to those of the control group ($p \leq .05$). Cardiorespiratory fitness represents the functional capacity of the heart, vessels, blood, lungs, and muscles during exercise, which, in this study, increased from an average level to higher-than-average level (American College of Sports Medicine, 2018) 6 months after intervention, according to the subjects' age and VO2 max norms.

The mean scores of muscular strength and endurance, and the fitness of individuals, measured by the test sit-and-reach, increased from moderate levels to good ones, and, regarding body composition, the BMI, BFP, and WHR of the intervention group significantly decreased in comparison to the control group ($p < .05$). Furthermore, the average number of steps for the intervention group in the workplace significantly increased compared to the control group ($p < .05$). These findings support the observation that health behaviors are formed through complex interactions of various determinants at different levels of the model (Mullane et al., 2017).

The findings of our study demonstrate the overall positive effects of interventions in improving physical activity and health outcomes. It can be argued that interventions based on a comprehensive model (Healy et al., 2016) that aimed at improving the work environment also created more opportunities for performing physical activities. The utilization of comprehensive educational methods to encourage and support employees to do physical activity, have been able to increase physical activity indirectly, and also to enhance physical activity objectively and improve health-related and physiological physical fitness indices. It is therefore recommended that in order for interventions designed to promote physical activity to be successful, physical and social environments and support policies, as well as individual factors, be considered.

Conclusion

Overall, the results of this study showed that designing interventions based on the comprehensive model demonstrate the contribution of environmental, biological, and psychological factors that affect the physical activity and promote health behavior in the office-based employees in Iran. It is suggested that health professionals in work and industrial settings use this theory as a useful theoretical framework. In line with the WHO's (2018) objectives, industrial leaders have an important role to play in national and international efforts to create active societies, environments, people, and systems.

Study's Limitations

Due to organizational regulations and the current religious and cultural limits of the society, participation of female staff in practical training sessions held by male researchers was not possible. Furthermore, nutrition and medications affecting blood factors and other physiological characteristics were not investigated in the current study, which can affect the generalizability of the results for all industrial employees. Lastly, this study—as are many in this area—is short-term and needs to be followed up with long-term evaluations and interventions.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the authorship and/or publication of this review.

Funding

The authors received no financial support for the authorship and/or publication of this review.

ORCID iD

Steven L. Baumann https://orcid.org/0000-0002-2155-848X

References

American College of Sports Medicine. (2018). *ACSM's guidelines for exercise testing and prescription* (10th ed.). Wolters Kluwer. ISBN: 9781496339065, NLM ID: 101692713 [Book]

Aittasalo, M., Miilunpalo, S., & Suni, J. (2004). The effectiveness of physical activity counseling in a work-site setting. A randomized, controlled trial. *Patient Education and Counseling*, *55*(2), 193–202. https://doi.org/10.1016/j.pec.2003.09.003

Baecke, J. A., Burema, J., & Frijters, J. E. (1982). A short questionnaire for the measurement of habitual physical activity in epidemiological studies. *The American Journal of Clinical Nutrition*, *36*(5), 936–942. https://doi.org/10.1093/ajcn/36.5.936

Calderwood, C., ten Brummelhuis, L. L., Patel, A. S., Watkins, T., Gabriel, A. S., & Rosen, C. C. (2021). Employee physical activity: A multidisciplinary integrative review. *Journal of Management*, *47*(1), 144–170. https://doi.org/10.1177/0149206320940413

Carlson, S. A., Fulton, J. E., Pratt, M., Yang, Z., & Adams, E. K. (2015). Inadequate physical activity and health care expenditures in the United States. *Progress in Cardiovascular Diseases*, *57*(4), 315–323. https://doi.org/10.1016/j.pcad.2014.08.002

Fakhrzadeh, H., Djalalinia, S., Mirarefin, M., Arefirad, T., Asayesh, H., Safiri, S., Samami, E., Mansourian, M., Shamsizadeh, M., & Qorbani, M. (2016). Prevalence of physical inactivity in Iran: a systematic review. *Journal of Cardiovascular and Thoracic Research*, *8*(3), 92–97. https://doi.org/10.15171/jcvtr.2016.20

Fleury, J., & Lee, S. M. (2006). The social ecological model and physical activity in African American women. *American Journal of Community Psychology*, *37*(1–2), 129–140. https://doi.org/10.1007/s10464-005-9002-7

Gargari, A. S., Hosseini, F. S., & Ahmadi, M. (2018), Effect of an intervention based on socio-ecological model in promoting physical activity of female employees. *Journal of Research and Health*, *8*(2), 163–172. https://doi.org/10.29252/jrh.8.2.163

Healy, G. N., Eakin, E. G., Owen, N., Lamontagne, A. D., Moodie, M., Winkler, E. A., Fjeldsoe, B. S., Wiesner, G., Willenberg, L., & Dunstan, D. W. (2016). A cluster randomized controlled trial to reduce office workers' sitting time: Effect on activity outcomes. *Medicine and Science in Sports and Exercise*, *48*(9), 1787–1797. https://doi.org/10.1249/MSS.0000000000000972

Jackson, A. S., & Pollock, M. L. (1985). Practical assessment of body composition. *The Physician and Sportsmedicine*, *13*(5), 76–90. https://doi.org/10.1080/00913847.1985.11708790

Lee, I. M., Shiroma, E. J., Lobelo, F., Puska, P., Blair, S. N., Katzmarzyk, P. T., & Lancet Physical Activity Series Working Group (2012). Effect of physical inactivity on major non-communicable diseases worldwide: An analysis of burden of disease and life expectancy. *Lancet*, *380*(9838), 219–229. https://doi.org/10.1016/S0140-6736(12)61031-9

Mathiowetz, V., Weber, K., Volland, G., & Kashman, N. (1984). Reliability and validity of grip and pinch strength evaluations. *The Journal of Hand Surgery*, *9*(2), 222–226. https://doi.org/10.1016/s0363-5023(84)80146-x

Mullane, S. L., Toledo, M., Rydell, S. A., Feltes, L. H., Vuong, B., Crespo, N. C., Pereira, M. A., & Buman, M. P. (2017). Social ecological correlates of workplace sedentary behavior. The *International Journal of Behavioral Nutrition and Physical Activity*, *14*(1), 117. https://doi.org/10.1186/s12966-017-0576-x

Pronk, N. P., Martinson, B., Kessler, R. C., Beck, A. L., Simon, G. E., & Wang, P. (2004). The association between work performance and physical activity, cardiorespiratory fitness, and obesity. *Journal of Occupational and Environmental Medicine*, *46*(1), 19–25. https://doi.org/10.1097/01.jom.0000105910.69449.b7

Sadeghisani, M., Dehghan Manshadi, F., Azimi, H., & Montazeri, A. (2016). Validity and reliability of the Persian version of Baecke habitual physical activity questionnaire in healthy subjects. *Asian Journal of Sports Medicine*, *7*(3), e31778. https://doi.org/10.5812/asjsm.31778

Spence, J. C., & Lee, R. E. (2003). Toward a comprehensive model of physical activity. *Psychology of Sport and Exercise*, *4*(1), 7–24. https://doi.org/10.1016/S1469-0292(02)00014-6

Swain, D. P. & American College of Sports Medicine. (2014). *ACSM's resource manual for guidelines for exercise testing and prescription* (7th ed.). Wolters Kluwer Health/Lippincott Williams & Wilkins.

Taylor, W. C., Paxton, R. J., Shegog, R., Coan, S. P., Dubin, A., Page, T. F., & Rempel, D. M. (2016). Impact of booster breaks and computer prompts on physical activity and sedentary behavior among desk-based workers: A cluster-randomized controlled trial. *Preventing Chronic Disease*, *13*, E155. https://doi.org/10.5888/pcd13.160231

Wen, C. P., & Wu, X. (2012). Stressing harms of physical inactivity to promote exercise. *Lancet*, *380*(9838), 192–193. https://doi.org/10.1016/S0140-6736(12)60954-4

World Health Organization. (2018). *Global action plan on physical activity 2018–2030: More active people for a healthier world*. https://creativecommons.org/licenses/by-nc-sa/3.0/igo