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Effect of Short Term Workplace Exercise Intervention on Lipid Profile, Depression, Work Ability and Selected Physical Parameters of University Employees in Saudi Arabia: A Randomized Controlled Trail

Rakesh Tomar* **and John Ainsworth Allen**

King Fahd University of Petroleum and Minerals, Saudi Arabia; rtau@rediffmail.com, cecily@kfupm.edu.sa

Abstract

Objectives: The aim of the study was to examine the effect of 12 week exercise programme on lipid profile, depression, work ability and selected physical parametersin university employees. **Methods/Analysis:** Twenty-seven males with age ranging from (27–57 years) were randomized into intervention (n = 13) and control group (n =14). Twelve weeks of non-supervised exerciseprogramme was administered to intervention group. Exercise was performed twice a week consisting of 30 min of aerobic and resistance training.Mann Whitney Test was used to explore differences between two groups after 12 weeks of exercise programme. **Findings:** After 12 weeks significant improvement was seen in depression (P = 0.035), total cholesterol (P = 0.027), low density lipoprotein (P = 0.016), body weight (P=.0003), fat percent (P= 0.001), body mass index (P=0.01) and resting heart rate (P= 0.036) in exercise group while no significant improvement was observed in work ability (P = 0.138), high density lipoprotein (P = 0.097) triglycerides (P = 0.582), very low density lipoprotein (P = 0.523), fasting blood sugar (P= 0.233), systolic pressure (P= 0.223) and diastolic pressure (P= 0.908). **Applications/ Improvement:** Twelve weeks of non-supervised exercise programmewas effective and enhanced improvementin physical parameters and lowered total cholesterol and low density lipoprotein in maleemployees of university

Keywords: Depression, Intervention, Lipid Profile, University Employees, Workplace, Work Ability

1. Introduction

Work places are important settings for interventions to increase physical activity[1]and physical activity is one option to increase work ability[2] but systematic reviews didn't conclude that past interventions were successful[3,4]. From public health perspective, workplace has been suggested as a particularly promising arena for physical exercise interventions[5,6]. Considering that employed adults spend much time at work, work-based interventions have the potential to overcome one of the most commonly reported barriers for physical exercise, namely lack of time[7,8]. Moreover, workplace gives ideal opportunity to reach large numbers of people for promoting good health and preventing disease[9]. There was enough evidence which indicates that people who exercise are healthier than those who do not, but still significant number of adults doesn't perform enough physical activity to desired benefits[10]. Work places may implement physical programs in hopes of keeping workers healthy and reducing healthcare costs[10,11]. Depression leads not only to considerable direct costs but also to substantial indirect costs such as reduced productivity, absenteeism, work disability and early retirement[12–14]. Peer support is one of the factors significantly associated with depression[15].

Unhealthy lifestyle, behaviors and obesity in employees may lead to negative effects related to work[16]. Further, many studies have indicated that unhealthy employees with unhealthy lifestyle are less productive, have decreased work ability and take more sick leaves[17–21].

* *Author for correspondence*

Work ability is result of interaction between individual resources and work, person's individual resources included health, functional capacity, education and know-how[22]. It is known that individual may gain health benefits by doing at least 30 min of moderate intensity physical activity five times a week[23]. This need not only occur through sports or gym-based exercise, but also through lifestyle based activities such as walking[24]. Most of previous studies underwent 3–5 days a week and its well established that 3–5 days week exercises will illicit beneficial effects. But it has been observed that many times 3-5 days a week becomes difficult for person to carry out exercise on regular basis.

We choose non-supervised intervention because at workplace it may not be feasible to go for supervised exercise programme during office hours. However, supervised exercise programme generally tend to illicit beneficial effect. Our goal is to see if non-supervised exercise can generate desired effects in employees and whether it can be sustained for longer period. Many studies were found studying physical intervention at work place such as factories, industries, companies, municipal services etc. but there were very few studies done at university work place. Therefore we examined whether non-supervised 30 min of session for 2 days a week during lunch break or immediately after end of office hours will illicit beneficial effects on depression, work ability and selected physical and physiological parameters in male university employees.

2. Materials and Methods

2.1 Participants

Participants were voluntarily recruited from King Fahd University of Petroleum and Minerals (KFUPM). Fifty two male employees of university volunteered themselves for study. Since, KFUPM is male university and because of cultural limitations, we did not consider female employees for the study. Following exclusion criteria was applied to all participants; cardiovascular diseases requiring medication, on medication that alters heart rate, breathing problems including asthma, chest pain in past month, heart attack, angina, heart surgery in past 3 months, history of psychological treatment. Out of interested 52 only 45 reported for initial screening. Following exclusion criteria 34 participants were called for baseline testing. Four didn't turn up for baseline measurements. After baseline assessments all 30 participants were randomly allocated to two equal groups; intervention (n = 15) and control group (n = 15). To permit blinding, none of the research team members handled randomization process. Randomization was done by independent person not related to study. Participants were randomly assigned (by drawing sealed envelopes) to exercise group and control group. During intervention two participants withdrew from exercise group for personal reasons. One participant in control group didn't report for post exercise measurement. All participants signed written informed consent after being informed personally. Diet and life style of participants were not controlled. The study was approved by Research Committee of King Fahd University of Petroleum and Minerals.

2.2 Study Design

Participants in intervention group performed two non-supervised exercise sessions per week. Participants in control group followed their normal lifestyle. Post-test measurements were taken after 12 weeks. Immediately after baseline measurements intervention group were called for interaction with investigators. We gave them intervention at baseline and in 6th week in form of a lecture. Written exercise guidelines were issued in form of leaf lets and posters. A formatted diary was given to each participant in intervention group to record his activities on daily basis. Intervention group also received booster email every week about exercise guidelines and related information.

2.3 Intervention

Duration of intervention was 12 weeks with two sessions per week. Intervention consisted of one session of aerobic training and one of resistance training in a week. Aerobic exercise included 30 minutes of running on a treadmill or outdoors. Intensity of aerobic training was fixed at 65%, 75% and 85% of maximum heart rate (MHR) for week 1-4, 5-8 and 9-12 respectively. Each participant was given heart rate monitor (Polar FT 60) to control intensity of exercise. Resistance training consisted of eight exercises; pectoral fly, chest press, abdomen curl, triceps extension, biceps curl, leg curl, leg extension and shoulder press. We did 1RM testing on each participant. Thereafter, intensity was fixed at 60%, 70% and 80% of 1RM for week 1-4, 5-8 and 9-12 respectively. Participants performed 3 sets for each exercise. Each set consisted of 12, 10 and 8 repetitions for week 1-4, 5-8 and 9-12 respectively. Aerobic training was done on every Sunday and resistance training on every

Wednesday of week. Both aerobic and resistance training included 10 minutes of warming up (slow jogging and stretching exercise) and 10 minutes of cooling down (slow jogging and relaxation exercises). Participants were asked to maintain self-recorded diary to log daily activities.

2.4 Measurements and Tools

2.4.1 Depression

Depressive symptoms were assessed by using PHQ-9 depression scale[25]. PHQ-9 is self-reported questionnaire consisting of 9 questions to assess depression. PHQ-9 has a high internal consistency (α =0.84)[26]. Respondents answered on a Likert scale ranged from 0 to 3 (not at all, several days, more than half the days, nearly every day). Overall score ranged from 0 to 27. Higher scores indicate more severe depression. PHQ-9 manual have five categories of scores; no depression (0-4), minimal symptoms of depression (5-9), mild depression (10-14), moderately severe depression (15-19), and severe depression (20-27).

2.4.2 Work Ability

Work Ability Index (WAI) was employed to assess work ability of participants[27,28]. WAI is the sum of scores, which can be classified into following categories; poor (7–27), moderate (28–36), good (37–43) and excellent (44–49).

2.4.3 Physical and Physiological Measures

Blood Pressure and heart rate was measured in seated position after 10 minutes of rest using Omron M6 Comfort and Polar FT 60 respectively. Body fat percent was measured by Omron body composition monitor BF508. Three measurements were taken for above mentioned tests with one minute apart and the average was recorded. Test for lipid profile and fasting blood sugar was done between 8.30 am and 10 am after observing 12 hours of fasting.

2.5 Statistical Analysis

Normality of distribution was assessed by Shapiro–Wilk test. Since our sample size was small and data was not normal, we employed non parametric statistics to study the effect. Mann Whitney Test was used to explore differences between two groups after 12 weeks of exercise programme. Statistical significance was assumed for P values < 0.05. Data were shown as median and ranges except stated otherwise. Baseline comparison was assessed by Man Whitney U test for non-parametric comparisons to check if any differences existed between groups.

3. Results and Discussion

Baseline characteristics are shown in Table 1. Mean age of participants was 38.8 years. No adverse complications

Table 1. Physical, physiological and biochemical parameters at baseline

Variable	Intervention Group	Control Group	P Value
Age (years)	32 (29-42)	39(35.5-45)	.16
Body Weight (kg)	84.4 (70.9 – 99.5)	76.6(71.65-83)	.369
Body Fat Percent (%)	25.6 (22.5 – 28.4)	25.6(22.65-28.35)	.908
Body Mass Index (kg/m2)	26 (22.6-29.5)	25.9(25.35-27.05)	.977
Systolic Blood Pressure (mmhg)	127 (116-132)	125(111-135)	.794
Diastolic Blood Pressure (mmhg)	78 (76-86)	78(73-89)	.954
Resting Heart Rate (bpm)	75 (65-80)	67(32-75)	.258
Fasting Blood Sugar (mg/dl)	96 (89 – 105)	95(90-99)	.685
Total Cholesterol (mg/dl)	171 (139-189)	198 (174-234)	.020*
Triglyceride (mg/dl)	115 (78-144)	182 (149-199)	.006*
High Density Lipoprotein (mg/dl)	47 (40-51)	42 (38-51)	.728
Low Density Lipoprotein (mg/dl)	99 (71-110)	120 (96-146)	.111
Very Low Density Lipoprotein (mg/dl)	23 (16-29)	36 (30-40)	.007*
Depression (Score)	2 (.0 – 8)	2(1-5)	.570
Work Ability Index (Score)	44.5 (42-47.5)	45(43-46)	.843

Data is shown as median (IQR)

Table 2. Physical, physiological and biochemical parameters after 12 weeks(difference between post and pre scores, Mann Whitney test)

Variable	Intervention Group	Control Group	P Value
Body Weight (kg)	−1.9 (−2.6 to −.2)	.6(−.3 – 1.6)	.003*
Body Fat Percent (%)	−1.4 (−2.9 to – .4)	.7 (−.1 – 1.4)	.001*
Body Mass Index (kg/m2)	−.5 (−.8 to - .1)	.5 (−.25 - .9)	.01*
Systolic Blood Pressure (mmhg)	−.7 (−12 to −.5)	−1 (−11 -1.5)	.223
Diastolic Blood Pressure (mmhg)	−.6 (−11 - 1)	−.7 (−12.5 to −1)	.908
Resting Heart Rate (bpm)	− 4 (−14 to −2)	.00 (-4 to 5.5)	.036*
Fasting Blood Sugar (mg/dl)	−9 (−16 to −5)	− 6 (−8 to −4)	.233
Total Cholesterol (mg/dl)	−7 (−10 to 1)	8 (−8 to 14)	.027*
Triglyceride (mg/dl)	−16 (−87 to 10)	−62 (−75 to 29)	.582
High Density Lipoprotein (mg/dl)	1 (−3 to 2)	−2 (−4 to −2)	.097
Low Density Lipoprotein (mg/dl)	7 (3 to 10)	15 (11 to 29)	.016*
Very Low Density Lipoprotein (mg/dl)	−4 (−18 to 2)	−13 (−15 to 6)	.523
Depression (score)	−2 (−6 – .0)	.0(−.2 to .00)	.035*
Work Ability Index (score)	1.5 (.0 - 3.5)	.0 (−2 - 2)	.138

Data is shown as median (IQR)

occurred during the exercise programme. The study outcomes were shown in Table 2 comparing depression, WAI and selected physical and physiological parameters in the intervention and control groups

3.1 Results

3.1.1 Depression

Significant inter-group difference was observed in depression scores after exercise programme. There was difference between the median depression scores of intervention and control group (the mean ranks of intervention group and control group were 8.64 and 14.36 respectively; U = 29, p = 0.035).

3.1.2 Work Ability Index

No significant inter-group difference was observed in WAI scores after exercise programme. There was no difference between the median WAI scores of the intervention and control group (the mean ranks of intervention group and control group were 13.55 and 9.64 respectively; U = 38, p = 0.138).

3.1.3 Lipid Profiles and Fasting Blood Sugar

Total cholesterol levels in exercise group were reduced significantly after 12 weeks of non-supervised exercise programme when compared to the control group. There was statistically significant difference between intervention and control group's median total cholesterol values (the mean ranks of intervention group and control group was 9.05 and 15.42 respectively; U = 33.5, P = .027).

Low Density Lipoproteins (LDL) were also reduced significantly after exercise programme. Statistically significant difference was found between intervention and control group's median LDL values (the mean ranks of intervention group and control group was 8.73 and 15.69 respectively; U = 30, P = .016). Therefore, it can be concluded that exercise was able to brought statistically significant lower total cholesterol (p = .027) and LDL values (p = .016) in intervention group as compared to control group.

However, High Density Lipoproteins (HDL) did not show any significant change after 12 weeks of exercise programme (the mean ranks of intervention group and control group were 15.09 and 10.31 respectively; U = 43, P = .097). Triglycerides (TG) also did not differ significantly between intervention and control group (the mean ranks of intervention group and control group were 11.64 and 13.23 respectively; U = 62, P = .582). Further, Very Low Density Lipoproteins (VLDL) also did not show any significant change after 12 weeks of exercise programme (the mean ranks of intervention group and control group were 11.50 and 13.35 respectively; U = 60.5, P = .523). Fasting blood sugar also did not differ significantly between intervention and control group (the mean ranks of intervention group and control group were 10.64 and 14.08 respectively; U = 51, P = .233).

3.1.4 Physical Parameters

Significant reduction was seen in body weight, body fat percent, Body Mass Index (BMI) and resting heart rate. There was statistically significant difference between intervention and control group's median body weight (the mean ranks of intervention group and control group was 7.91 and 16.38 respectively; U = 21, P = .003); body fat percent (the mean ranks of intervention group and control group was 7.45 and 16.77 respectively; U = 16, P = .001); BMI (the mean ranks of intervention group and control group was 8.45 and 15.92 respectively; U = 27, P = .01); resting heart rate (the mean ranks of intervention group and control group was 9.23 and 15.27 respectively; U = 35.5, P = .036).

However, systolic and diastolic blood pressure did not show any significant change after 12 weeks of exercise programme. There was no statistically significant difference between intervention and control group's median systolic blood pressure (the mean ranks of intervention group and control group were 10.59 and 14.12 respectively; U = 50.5, P = .223) and diastolic blood pressure (the mean ranks of intervention group and control group were 12.68 and 12.35 respectively; U = 69.5, P = .908).

3.2 Discussions

3.2.1 Physical Parameters

Twelve weeks of aerobic and resistance training at the work place was effective in improving body weight, body fat percent and BMI in the male employees of KFUPM. There was significant reduction in body weight, body fat percent and BMI in the intervention group compared to control group. Our findings were supported by previous studies where, intervention group achieved greater weight loss compared to control group[29]. In an uncontrolled intervention study done by[30], participants decreased their fat and also lost body weight. According to worksite health promotion interventions have positive effects on employee body weight but effect sizes are small[31].

Although there was significant improvement in weight and fat loss but we could not found significant improvement in blood pressure as a result of training programme at work place. There were studies which found reductions in blood pressure through work place interventions[32,33]. Also suggested that intervention at work place significantly decreased body weight, BMI, body fat percentage compared to the reference group. However, there were no significant differences between the two groups over time in blood pressure[34]. In our study we could not elicit significant difference in blood pressure, this may indicate that either participants have not strongly complied with the programme or intensity was not high enough. Nevertheless, there was improvement in both systolic and diastolic blood pressure within the intervention group when compared to baseline. We found significant reduction in resting heart rate in intervention group. In their 10 weeks supervised programme couldn't find any significant change in systolic and diastolic blood pressure scores, however resting hear rate was reportedly reduced significantly[35]. Also concluded that Worksiteaerobicexerciseseemstorestingandsleepingheart rate,butincreasesystolicBPamongcleaners[36]. The possible reason could be that we did not control the diet and other lifestyle factors of the participant. There is also a possibility that control group might have involved in sports and exercise programme at their own.

3.2.2 Lipid Profile

There was significant improvement in total cholesterol and LDL following 12 weeks exercise programme. In a study by[37], total cholesterol and LDL levels were significantly reduced with intervention however; HDL levels did not change significantly during 7-month intervention. In[38] also observed significant differences between pre- and post-intervention measurements of total cholesterol, LDL cholesterol, total cholesterol/HDL cholesterol ratio, triglycerides, and weight. Concluded in their study that 24 weeks of exercise training resulted in loss in fat percent ($p<0.0001$), and a decrease in TC ($p<0.0001$) and LDL-C ($p<0.0001$). No differences were observed between groups or over the training period for VLDL-C or TG. Although HDL-C increased 6 mg/dl in the Ex group but not in Control group, this difference did not reach statistical significance ($p<0.0625$)[39].

3.2.3 Depression

In our study depression symptoms in exercise group were reduced significantly after the 12 weeks of non-supervised exercise programme when compared to the control group. Our findings support the current knowledge on relation between physical activity and depression. According to these reviews exercise reduces the severity

of depression among clinical populations[40–43]. Recently a study done by also confirmed the significant decrease in depression symptoms in experimental group compared to control group ($p< 0.5$)[44].Also confirmed that 10 weeks of supervised exercise can reduce the risk of depression in employees with sedentary jobs, an inactive lifestyle, and a high-risk of depression[35].According to no differences were found in the degree of depression according to the general characteristics of subjects such as age, level of education, BMI, marital status, religion, and exercise[45]. Aquarobics also tend to reduce depression and develop positive[46]. Little is known about the level of exercise needed to influence depressive symptoms[47]. Therefore, we decided to implement for short and non-supervised programme of 12 weeks with two sessions per week. Such programme is feasible and employees found it convenient to perform after office hours/during lunch hours at the work place. Adherence to the programme was very motivating and encouraging.

3.2.4 Work Ability

Despite improvement in depression and other fitness parameters such as body fat percent and resting heart rate there were no significant improvements in perceived work ability. Therefore, present finding do not follow models linking individual improvements in fitness to productivity[48,49]. Although work ability in the exercise group did not improve significantly but there were signs of improvement in work ability of the employees. Suggested that strength training at work place prevents deterioration of work ability among workers[50]. According to there were no statistically significant differences between the two groups as regards job satisfaction and work ability index. Although, physical activity once a week at worksites improved the perceived work ability of women with physically demanding work only slightly[2]. According[51] average WAI score at baseline was excellent and did not change during the 2-year physical activity interventions. Suggested that a physical exercise intervention may improve work ability[52].

Despite short duration and lesser frequency of exercise programme, we were able to reveal significant effects on most of the outcomes. Following could be the limitations in the study; the study population only consists of males and the results cannot be translated to females. Further we didn't assess the exact relevance of the diet or the other factors related to lifestyle in the intervention. Selection bias might be one of the limitations as employees who volunteered might be motivated by certain factors not related to this program. We followed a well-defined protocol for physical exercise and training logbook was primarily used to facilitate the individual record which could have served as a motivating factor for the participants. Attendance rate while performing exercise as evident from the log book was very encouraging, probably because it was arranged during or immediately after work hours. Despite certain limitations, our findings were quite encouraging and suggest continuing this programme with larger group to determine the efficacy. Further, because of life style and cultural factors along with climatic conditions in Saudi Arabia, we also recommend to use motivational techniques along with the exercise programme.

4. Conclusions

Overall twelve weeks of non-supervised physical exercise at work place was effective and significantly decreased body weight, BMI, body fat percentage, resting heart rate, TC, LDL and depression in university employees. However, no significant differences were seen in WAI, HDL, VLDL, TG, fasting blood sugar and blood pressure.

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