

# Effects of a Worksite Health Programme on the Improvement of Physical Health among Overweight and Obese Civil Servants: A Pilot Study

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## Abstract

**Background:** Physical inactivity and reduced energy expenditure has led to increased obesity among office workers. This study was conducted to investigate the effectiveness of a worksite health programme aimed at improving physical health among obese civil servants.

**Methods:** A total of 28 employees participated in a six-month-long obesity health programme, which consisted of two weekly unsupervised exercise sessions and monthly dietary/health education sessions. The physical fitness and body fat percentages of participants were assessed at the baseline and after six months, using SPSS version 20.0.

**Results:** The participants were 31.6 years (SD 8.2) of age, and had a BMI of 27.6 kg/m<sup>2</sup> (SD 3.2). The Wilcoxon test showed significant differences in body fat percentage ( $P = 0.010$ ), gross maximum oxygen uptake ( $VO_{2max}$ ,  $P = 0.014$ ), partial curl up repetition ( $P = 0.001$ ) and sit and reach distance ( $P = 0.005$ ). However, no significant effects were observed on body mass ( $P = 0.193$ ), self-perceived level of physical activity ( $P = 0.145$ ) or behaviour toward exercise ( $P = 0.393$ ).

**Conclusion:** The worksite health programme successfully improved the physical fitness and body fat percentages of subjects, despite not improving the subjects' self-perceptions with regard to physical activity.

**Keywords:** health campaign, health promotion, obesity, physical fitness, wellness

## Introduction

The prevalence of overweight and obesity is a growing threat to the health of the global population, according to the World Health Organisation (WHO) (1). Declining daily energy expenditure that is not consistent with food intake is the most likely contributing factor to this phenomenon (2). In addition, there has been a recent trend of taking on less physically demanding jobs, and jobs are generally becoming more sedentary (3). This increase in the sedentary nature of work not only means that a shrinking percentage of people is working in agriculture and heavy industry, but also that the work within most occupations is more sedentary (3). Long hours of sitting in the workplace, easily accessible food in work environments and long sedentary working hours have resulted in a higher risk of obesity (4). According to Schulte et al., there has recently been a significant decline in the energy expenditure involved in daily living, as well as work and household-related physical activity (4).

This might be due to improvements in technology over the past few decades (4). Several studies have also recommended that an extra 60 to 90 minutes of moderate intensity physical activity per day, plus dietary intervention, is a good means of long-term weight loss (5–7). It is important that knowledge of health promotion and disease prevention be delivered to communities, and particularly to office workers.

A study by Atlantis et al. has shown that, the workplace is a suitable setting for health programmes, as it is where most adults spend much of their time (8). Many worksite health programmes have been conducted, and have been tested with regard to cost effectiveness and implementation as primary prevention programmes. The subjects of past studies came from different populations, including sedentary workers (8), health workers (9), and manual labourers (10,11). Findings have varied for most outcomes, possibly due to unclear exercise

prescriptions and inconsistent programme participation (8). In addition, there is a lack of specific studies that have focused on physical health changes among overweight and obese office workers.

Hence, this study's aim is to determine the effectiveness of a comprehensive health programme targeting office-based overweight and obese employees. The programme considered changes in anthropometry (body fat and body weight) and physical fitness (cardiovascular fitness, upper body strength and endurance, abdominal strength and endurance, and lower body flexibility), as well as participants' self-perceived levels of physical activity and behaviours toward physical activity. The hypothesis of this study was that a health programme combined with exercise and dietary/health education could improve the participants' anthropometry, physical fitness, self-perceived level of physical activity, and behaviour towards physical activity.

## Materials and Methods

### *Subject and study design*

This study involved a non-randomised interventional pilot carried out among public sector office workers at the Ministry of Higher Education in Putrajaya, Malaysia. The study was conducted for a period of one year, from June 2011 to June 2012. The details of the programme were publicised through the organisation's notice board. The health programme targeted workers who were overweight or obese. Both male and female subjects were included in the study. Participants were only permitted to participate if they had a body mass index (BMI) of 25 kg/m<sup>2</sup> or above, and if they were between 18 and 60 years old. All of the subjects were screened for study exclusion criteria and were not included if they did not meet all of the criteria. The exclusion criteria of this study prevented the participation of subjects who were pregnant or lactating during the intervention period, had orthopaedic problems, uncontrolled hypertension, or chronic medical illnesses or were currently undertaking any health, fitness or slimming programmes. After screening for the study criteria with a baseline test using BMI, 28 employees were recruited. Written informed consent was obtained from each participant prior to the study. The ethical approval for this study was obtained from a university hospital medical research secretariat, under the ethical code NN-102-2011.

### *Intervention*

#### *Exercise sessions*

The six-month health programme was conducted during working hours, in accordance with the approaches of previous studies (8,12). It is recommended that increased physical activity in a working group involve engaging in moderate physical activity for 30 minutes on most days of the week (13). This moderate intensity and duration of exercise have also been shown to improve aerobic capacity (14). Exercising for a minimum of three days per week at an energy level of 300 kcal can lead to fat loss, based on American College of Sports Medicine (ACSM) guidelines (15). In order to lessen the chance of bone and joint injury, ACSM recommends that exercise be engaged in on alternate days (14). As aerobic dance exercises have a similar level of effectiveness to jogging (16,17), they were included in the health programme. A single session of group exercise was conducted with an instructor for an overall duration of 30 minutes, and the subsequent exercise sessions were conducted by a qualified physiotherapist. The types of exercises included in the group exercise session were stretching exercises, free exercises, strengthening exercises with minimal weights and aerobic exercises. Activities such as fast walking, jogging and active limb movements involving all major joints were also included in the exercise programme. All of the subjects were advised to perform their exercises at a self-paced intensity. Question and answer sessions on exercise techniques were conducted after each exercise session. The subjects were instructed to carry out self-directed exercises according to guidelines clearly described on workout sheets. These workout sheets, which involved at least 30 minutes of exercise, were distributed monthly. They were used as exercise guides for the subjects, and also to measure the participation of the subjects in the recommended exercise programme. Each subject was required to keep records on the workout sheet as evidence of his or her involvement in the programme, as was done in previous studies (18,19).

#### *Dietary/health education*

A group seminar was conducted monthly to gather information on dietary input, as in previous studies (10,20). Suggestions were given and discussed concerning food servings, calorie counts, and the retrieval of nutritional information when consuming foods. Interactive

activities such as forming food pyramids and testing beverages for different sugar levels were carried out through quiz sessions.

### Outcomes

Body weight and body fat were measured with a body composition analyser (Tanita TBF-300 A, Japan, 2011) Subjects were required to remove their shoes and all accessories and stand straight on the platform during the measurement. A three-minute step test using a twelve-inch stepper was carried out to obtain gross maximum oxygen uptake (gross  $VO_{2max}$ ), based on ACSM guidelines. (14,17) Gross maximum oxygen uptake (gross  $VO_{2max}$ ) was used to indicate the participants' cardiovascular functional capacity (21). One-minute partial curl ups were used to assess the subjects' abdominal endurance, following the partial curl up ACSM protocol. Upper body musculature endurance was identified with one minute of push ups (22). A sit and reach test was used to assess lower back and hamstring flexibility (23,24). The International Physical Activity Questionnaires (IPAQ) and Exercise Benefits and Barrier Scale were used to evaluate the participants' self-perceptions and behaviours involving physical activity (25,26). The outcome assessment was carried out at week one and at the end of six months after the initial assessments (21,27).

### Statistical analysis

A sample size of 34 subjects was calculated, using G power version 3.1 software, with a Cohen's  $d$  effect size of 0.64, which is considered moderate, powered at 95% and with  $\alpha$  error of 5% (9). A normality assessment was carried out with the Shapiro-Wilkis test. The results of the test showed that all of the variables were not normally distributed, except for body weight. A paired  $t$  test was used to compare data that were normally distributed, while a Wilcoxon test was used to compare data that were not. All data were analysed using the Statistical Package for Social Sciences (SPSS), version 20.0.

## Results

The socio-demographic characteristics of the subjects are shown in Table 1. A total of twenty-eight employees aged 31.6 years (SD 8.2) with BMI of 27.6 kg/m<sup>2</sup> (SD 3.2) participated in this programme. At the end of six months, only 24 subjects had completed the health programme and were included in the data analysis. Overall,

there was a dropout rate of 14%. Four subjects discontinued the study due to a lack of time. The results showed significant differences in body fat percentages ( $t = 47, z = -2.58, P = 0.010$ , gross  $VO_{2max}, t = 141, z = -2.46, P = 0.014$ ), partial curl up repetition ( $t = 192.5, z = -3.27, P = 0.001$ ) and sit and reach distance ( $t = 195.5, z = -2.78, P = 0.005$ ). However, there were no significant changes seen in the mean of body weight ( $t (22) = -1.34, P = 0.193, 95\% CI (-1.64, 0.35)$ ), International Physical Activity Questionnaire (IPAQ) scores ( $t = 144, z = -1.46, P = 0.145$ ), or Exercise Benefits and Barrier (EBBS) scores ( $t = 51.5, z = -0.85, P = 0.393$ ) (see Table 1). The change in the study variables before and after the intervention is indicated in Table 2.

## Discussion

The results of this study suggest that the six-month health programme involved can effectively reduce the body fat percentages of subjects who complete the programme. However, the positive findings of the study were based on a pilot study involving a small sample size, and so their application to clinical practice needs to be interpreted with caution. This health programme needs to be investigated in a well-controlled longitudinal study with a larger sample size before its beneficial effects can be embraced. However, the current findings were consistent with those of a previous study that tested the effects of six months of active intervention (28), comparing the effects of two different interventions (structured and lifestyle) on normal working adults. In contrast, the current study looked into the effects of a combined intervention on an overweight and

**Table 1:** Socio-demographic characteristics of the subjects

Variable	Characteristics of the subjects
Gender	
Females	$n = 20$
Males	$n = 4$
Age (years)	32.96 (SD 9.59)
Body mass (kg)	70.83 (SD 11.73)
Height (m)	1.57 (SD 0.81)
Body mass index (kg/m <sup>2</sup> )	28.63 (SD 3.65)
Percentage of body fat (%)	41.60 (SD 8.70)

obese working population. Based on the findings from these studies, it could be suggested that six-month active intervention programmes, along with health education, might have beneficial effects for obese and overweight individuals. Past studies have suggested that reductions in body fat percentage might be linked to intra-abdominal obesity (29,30). It has also been proposed that the body system increases the use of lipids by muscles rather than relying mainly on carbohydrate reserves during exercise (30). Thus, the benefits achieved from active health interventions through exercise and health education might be related to the principle of body system adaptation to the use of lipids rather than carbohydrates. However, this kind of adaptive response of the body system is not investigated in this study, and so could be considered in future studies.

On the other hand, the results showed that there were no significant changes in body weight. This was in line with a previous study by Skovgaard in a Danish workplace health promotion programme (31), which involved weight training, fitness training, and advice on healthy living given to health care workers for a duration of 20 weeks. It has also been reported that weight training particularly increases fat-free mass (32). Under this study's exercise regime, the subjects performed strengthening exercises with minimal weights, which was a form of weight training. However, it is unclear whether these strengthening exercises with weights were related to non-significant changes in body weight. Hence, further studies might be needed to determine the mechanism of weight reduction, which could be confounded by strength improvement.

Beside body composition, physical fitness

programmes must address cardiorespiratory fitness, muscular strength and endurance and flexibility level (33). The findings of the current study showed that subjects experienced significant changes in cardiorespiratory fitness, which was in line with the previous study conducted by Atlantis et al. (8). The randomised controlled trial on healthy but sedentary workers showed significant cardiorespiratory fitness changes after the six-month programme. Good cardiorespiratory fitness is considered to significantly reduce the risk of coronary artery disease (34), which is one of the four leading chronic illnesses, and which led to 29 million deaths globally in 2002 (35). Therefore, the positive effects on cardiorespiratory fitness shown in this pilot study needed to be pursued in further studies with larger samples.

The significant change in abdominal strength and endurance in this study was consistent with the results of a previous study (9), which explored the effects of a 12-week aerobic intervention programme on worksite health-related physical fitness. In line with that study, the results of this research found positive changes in abdominal muscle strength and flexibility. Aerobic exercises have been reported to increase capillary density and mitochondrial content in muscles (36–38). Evidence also shows that muscle flexibility is improved by stretching exercises, which cause improvement in stretch tolerance rather than viscoelastic accommodation in increasing the range of motion of the joints involved (39). Thus, the aerobic and stretching exercises prescribed in the current six-month programme might aid in the improvement of flexibility and abdominal muscle strength among our subjects. The self-perceived level of physical activity scores showed

**Table 2:** Changes in variables after participation in six-month programme

Variables	Pre-	Post-	Changes	P value
Body weight (kg) <sup>a</sup>	71.1 (11.9)	71.8 (12.9)	0.7 (1.0)	0.193 <sup>b</sup>
Body fat (%) <sup>c</sup>	40.2 (5.9)	39.3 (9.3)	-0.9 (3.4)	0.010 <sup>d</sup>
Gross VO <sub>2max</sub> (ml kg <sup>-1</sup> min <sup>-1</sup> ) <sup>c</sup>	24.0 (3.8)	26.0 (4.0)	2.0 (0.2)	0.014 <sup>d</sup>
Partial curl up repetition (n min <sup>-1</sup> ) <sup>c</sup>	22.0 (4.0)	27.5 (8.0)	5.5 (4.0)	0.001 <sup>d</sup>
Push up repetition (n min <sup>-1</sup> ) <sup>c</sup>	23.0 (6.00)	22.0 (7.00)	-1.0 (1.0)	0.812 <sup>d</sup>
Sit and reach distance (cm) <sup>c</sup>	1.0 (12.8)	7.5 (13.0)	6.5 (0.2)	0.005 <sup>d</sup>
IPAQ score (METs-minute) <sup>c</sup>	1852.5 (7047.0)	4638.0 (8827.0)	2785.5 (1780)	0.145 <sup>d</sup>
EBBS score <sup>c</sup>	129.50 (29.25)	131.00 (13.50)	1.5 (-15.75)	0.393 <sup>d</sup>

<sup>a</sup>Mean (SD), <sup>b</sup>P-value using paired *t* test, <sup>c</sup>Median (interquartile range), <sup>d</sup>P value using Wilcoxon signed ranks test. Abbreviations: IPAQ = International Physical Activity Questionnaire, EBBS = Exercise Benefits and Barrier.

no significant changes after the intervention in the current study. It has been reported that the self-perceived level of physical activity declines among females when an exercise programme is conducted over a longer duration (40). As the majority of the subjects in our study were female, this might explain their gradual decline in interest in physical activity.

The major limitation of this study was its design, which did not involve a control group arm. However, as this was a pilot study for testing the effectiveness of the intervention prior to the commencement of a full scale longitudinal study with a control arm, this is not a significant shortcoming.

## Conclusion

In conclusion, the proposed six-month programme, which combined dietary input and physical exercises, effectively reduced body fat percentage, increased cardiorespiratory fitness, built abdominal strength and endurance and improved lower body flexibility. However, the self-perceived levels of physical activity and behaviours toward physical activity did not change among participants.

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## Conflict of Interest

None.

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## Authors' Contribution

Conception and design: AR, LJ  
Analysis and interpretation of the data, drafting of the article, critical revision of the article for the important intellectual content, final approval of the article, provision of study materials or patient, statistical expertise, obtaining of funding: AR, LJ, YFL, JYB  
Administrative, technical or logistic support, collection, and assembly of data: AR

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