Effects of workplace incremental increases in exercise to 150 minutes per week (MissFiTT@UMMC) compared to incremental increases in steps to reach 10,000 steps a day on fitness, body compositions and health behavior among overweight and obese women with low physical activity.

A protocol for a quasi-experimental study.

Abstract

Background: Compared to men, women have been found to be less physically active due to various reasons. This is a concern as physical inactivity puts women at risk of adverse health effects. Given that working-age women spend a substantial proportion of their waking hours at work, places of employment is an ideal avenue to implement programs to increase physical activity. The purpose of this paper is to describe MissFiTT@UMMC intervention, a workplace incremental increases in an exercise program designed to increase fitness level among women with low physical activity level as compared to a known effective intervention of walking 10,000 steps a day.

Methods: This 16-week quasi-experimental intervention study will include an 8-week active and 8-week maintenance phase. The study aims to collect a minimum sample of 60 healthy women from a university-based workplace, aged between 25 to 49 years, within Asian classification of BMI for overweight and obese class 1 and have low physical activity level as measured by Global International PA Questionnaire. Participants will be recruited into either incremental increases in exercise to reach 150 minutes per week (IE) group or incremental increases in steps to reach 10,000 steps per day (IS) group. Data collection at baseline, end of active phase and end of maintenance phase measure the change in the primary outcome, which is cardiorespiratory fitness. The secondary outcome measures are changes in anthropometric indicators, physical fitness as well as health behaviours.

Discussion: The MissFiTT@UMMC will be evaluating the effectiveness of incremental increases in exercise intervention among women at workplace, aimed to improve fitness level. The incremental increases in exercise and steps approach in women with low physical activity level will help to inform future exercise programs.

Trial Registrations: ISRCTN 19404478. This clinical trial started on 1 January 2019 and is due to be completed on the 29 February 2020.

Abbreviations: CRF = cardiorespiratory fitness, PA = physical activity, VO2max = maximal oxygen uptake, BMI = body mass index, IE = Incremental increases in exercise, IS = incremental increases in steps.

Keywords: Cardiorespiratory fitness, workplace exercise program, women, exercise.

1. Introduction

Many adults do not engage in sufficient physical activity (PA) to impact health. A population-based survey based on 1.9 million participants conducted between 2001 and 2016 found that 1 in 4 adults does not meet the exercise recommendation of 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity exercise each week. Women, in particular, are more inactive when compared to men.[1] This is a concern as low physical activity, in the long run, predisposes to many adverse health outcomes including chronic health disease.[2]

In response to this, structured PA or exercise has been regarded as the main strategy for chronic diseases prevention.[3] High fitness level achieved through regular PA provides an effective primary preventive strategy to reduce the risk of chronic diseases and other conditions such as those related to cancers and osteoporosis.[4] Positive health benefits are also observed with modest increment in fitness level among sedentary individuals. Blair SN et al[5] conducted a prospective study over 5 years and found that those who went from unfit to fit had a reduction of 44% in the relative risk of death compared with people who remained unfit at 5 years follow up. Other than exercising, more recently, a systematic review of the literature on primary prevention in women[6] revealed the protective effects of walking as little as 1 hour per week. Women who are physically active had a lower relative risk of cardiovascular-related death as compared with the least active group. Improvement in cardiorespiratory fitness over time has also been observed among participants of a study that encourages participants to increase their overall PA by walking 10,000 steps per day.[7] A simple and cheap tool, the pedometer is an accepted device to be utilised to enhance PA through walking in a community setting and has been widely advocated.[8]

Women face a greater risk of drifting into a less active lifestyle starting in their 20s.[4,9] This transition often resulted from changes in academic status, employment, and assuming new social roles through marriage and childbirth.[10] Moreover, women tend to put family needs before their own[11] and in doing so, their health priority becomes secondary.[12] Qualitative studies have found unique barriers to PA participation among women. Common barriers cited included lack of time due to work, school, home demand[13–15] and lack of support from the

family or friends.[15,16] Additionally, mental fatigue from physically demanding jobs and household work are among other commonly cited barriers.[17]

Due to the unique and varied challenges faced by women, and that 50-60% of waking hours are spent at the workplace[18], there is a need for studies to focus on the potential impact of workplace exercise intervention for women and identify how intervention approaches may have effect on exercise or PA uptake and maintenance. The workplace has been suggested as a specially prioritized arena for health promotion, as it provides an opportunity to engage individuals who might not otherwise have time to participate in PA.[19] Workplace intervention can reach a large number of employees who spend a large proportion of their time at work.[20,21] Additional positive beneficial effects have also been identified on reducing sickness absenteeism, job stress, and musculoskeletal pain.[22] Women are specifically targeted in this study as they generally have a large input into their families. Thus, any lifestyle changes can potentially exert positive domino effects on family members. The potential to reduce the risk of healthcare chronic diseases and enhancing employee as well and productivity and probable influence onto family members represent a strong rationale for workplace programs implementation.

Here, we describe MissFiTT@UMMC programme, an intervention study to evaluate the effectiveness of incremental increases in exercise to 150 minutes a week as compared to incremental increases in steps to 10,000 steps a day among women working in a university hospital. This study aimes to improve fitness level among overweight and obese women between 25 to 49 years with low PA level. Exercising 150 minutes of moderate-intensity activity a week may be too challenging and too far-reaching for individuals with low PA level and can result in poor compliance. A progressive incremental approach to increasing PA weekly to meet the target may be more feasible for this study population. Currently, little is known about the fitness outcomes that occur “en-route” through this approach. To accomplish this, the study observes overweight and obese women with low PA enrolling in a workplace PA program that uses an incremental approach to increase PA.

Thus, we present a study design and protocol of a quasi-experimental controlled study, single-blinded to assess the effect of incremental increases in exercise (IE) to 150 minutes per

week and as compared to incremental increases in steps (IS) to 10,000 per day on fitness level among overweight and obese women with low PA.

2. Methods

2.1. Objective

The primary objective of this study is to assess the changes in cardiorespiratory fitness. The secondary objectives of this study are to assess the change in anthropometric, physical fitness and health behaviour indicators.

2.2 Trial design and setting

This is a single centre, quasi-experimental controlled study comparing two approaches to increase PA, namely the IE or IS groups. The total study period is 16 weeks, including 8-week active phase and 8-week maintenance phase (Fig. 1). In the active phase, participants in both the IE and IS groups will increase their PA to meet their goals while receiving regular performance feedback, positive reinforcement, push encouragement, support group, active choices and rewards. Evidence have shown that these motivational strategies are effective in promoting adherence to PA by creating the desire and energy to initiate, continue and maintain their PA.[23,24] In the maintenance phase, participants will continue to maintain their PA goals without regular performance feedback, positive reinforcement or push encouragement components. Additionally, in both groups, participants are required to adhere to the healthy eating plate guide to eating choices with half-portion for vegetables and fruits, quarter-portion for carbohydrate and intact grains, and quarter-portion for protein.[19] The study will be conducted at the Sports Medicine Department, University of Malaya, Kuala Lumpur, Malaysia. Seventy-two volunteers who meet the eligibility criteria and sign the informed consent form will be randomly divided into 2 groups either IE or IS alone.

3 Participants

3.1.Recruitment strategies

Employers from the University of Malaya Medical Centre, Kuala Lumpur, Malaysia will be recruited through research advertisements sent out using a university email list. Supplementary recruitment strategies included tapping on the contact list of participants who are due to commence another on-site structured exercise program, word of mouth and WhatsApp flyer. Brief descriptions of eligible criteria, duration and commitment to the study regimes will be given. A complimentary sports voucher will be distributed upon completion of the study. All patients have the right to participate or drop out at any time, and will be required to sign the informed consent before the trial begins.

3.2 *Eligibility criteria*

The inclusion criteria will be as follows: female gender; age between 25 to 49 years; body mass index (BMI) between 23 to 29.9 kg/m2; has no significant medical conditions (i.e., cardiovascular disease and stroke); currently has low PA level as measured by Global International PA Questionnaire (GPAQ); answered no to all 7 of the PA readiness questionnaire (PAR-Q); able to speak and understand English/Malay language; willing to commit to the study protocol requirement; and signed informed consent. The BMI cut-off points at 23kg/m^2 in this study reflect the increased risks of co-morbidities with obesity within the Asian population, where public health action in a form of the preventive programme would be beneficial to reduce future risks of adverse health outcomes.[25] The exclusion criteria will be as follows: BMI at and over 39.9kg/m^2 or below 23kg/m^2; having physical limitation or impairment to exercise; enrolled in a structured exercise programme over the past 3 months; moderate or vigorous PA level as measured by GPAQ; and currently pregnant.

3.3 Participants' allocation

Consented participants will be randomly assigned to either the intervention group (IE) or control group (IS). A systematic concealed allocation method will be used to allocate participants alternately. The first participant is allocated to one of the groups at random, using random numbers generated by a random number generator. The next participant will be allocated to the other, and the process continues.

3.4.Blinding

A single-blinded method will be used. While the participants, researcher and exercise trainers cannot be blinded, the outcome assessor and statistics analyzer will be blinded to the groups the participants are assigned to. An independent outcome assessor will be recruited and instructed not to communicate with participants about their intervention groups and will be blinded to the previous fitness scores of participants. The statistics analyzer will be appointed from a different study site.

3.5.Study Tool – Exercise Video

Two 35-minute structured exercise pre-recorded videos will be the main tools for the IE group. These 35-minute structured exercise pre-recorded videos are the outcome from a collaborative work between sports medicine specialist, exercise physiologist experts and primary care medicine specialists. The two 35-minute structured exercise pre-recorded videos are each for the upper and lower body.

The structured exercise videos included movements based on the American Academy of Sports Medicine recommendations[26] and guided by the findings of Hong et al [27] who reported higher adherence to exercise when a combination of both aerobic and muscle-strengthening activities are used. The exercise incorporated a comprehensive set of movement routines choreographed to meet the functional needs of our participants who work in a busy university hospital setting, known to be exposed to job-related musculoskeletal complaints.[28] Each video is set for 35-minutes, making it a time-efficient exercise, to address their busy work schedule. The structure of each exercise video is sequenced as follows: 5-minute dynamic warm-up; 12-

minute endurance interval consisted of three-movement sets of focusing on either the upper or lower body (each set has 2-minute of cardio and 2-minute of strengthening exercises); 2-minute core muscle exercises; 10-minute cool-down stretching exercises; and a total of 6-minute rest interval. For the present study, we recorded the movement into an online-video-based package so that participants can use the exercise video elsewhere other than the workplace. Table 1 describes the exercise structure.

3.6. Intervention group: IE group

Participants in the IE group will be instructed to gradually achieve and maintain 150 minutes of moderate-intensity exercise per week, to meet the recommended guidelines from the American College of Sports Medicine.[26] At week-0, participants will receive 2 familiarization sessions, one session for familiarization to the lower body exercise video and a second familiarization session for the upper body exercise video. The following 8-week is an active phase and it is designed to foster a manageable feeling to exercise. Participants will need to perform 16 compulsory supervised exercise video sessions over the 8-week intervention period. The supervised sessions will take place in a gym studio, under the supervision of one of the sports sciences expert or a researcher, who will be providing technical assistance. For the first 2 weeks, participants will start with only 2 exercise video sessions a week. Each exercise session will need to be at least 48-hour apart to allow enough time to recover from delayed onset of muscle soreness (DOMS),[29] which is expected within individuals with low PA.

To enhance a manageable feeling to exercise, from week-3 onwards participants will be requested to exercise a minimum of 2 sessions a week for 35-minutes each session using the exercise video tool. They will also be encouraged to increase their exercise sessions from two to five sessions a week. In following 8-week of the maintenance phase, participants will be asked to continue maintaining their exercise goals without regular performance feedback, positive reinforcement or push encouragement components. Participants will self-report their exercise sessions using a logbook. This logbook is assessed and updated by the researcher on a daily basis.

3.7.Control group: IS group

Participants in the IS group will be instructed to gradually increase and maintain their daily steps to reach 10,000 steps/day goal. Each participant will receive a pedometer, a guide providing program details and access to the online daily step log. This study will use the Yamax Digi-Walker CW-600 which is now commercially renamed to Yamax CW-701.[30] It is a low-cost pedometer with simple functions that includes a 7-day memory, a 2-week cumulative memory, and automatically resets to zero at midnight. It is a reliable and accurate method to record steps taken among adults in a free-living activity.[30,31]

On day one, participants will wear their pedometers during waking hours and continue their daily PA behaviour as usual. This day one pedometer reading records their baseline steps. Participants will self-report their daily step via a web-based database application at https://changeandsustaininitiative.com/missfittummc/. Self-reported measures are widely used and are validated.[32] A researcher checks the web-based database daily and contacts participants with missing log to remind them to log their steps in. These records will guide the new step goal for the next day for every participant. During the first 8-week of the active phase, participants will receive encouragement to increase their daily steps by 10%. Once the steps goal has reached 10,000 steps/day, participants will receive instruction to reduce their daily steps increment to 3%.[33] In the following 8-week maintenance phase, participants will continue to maintain their steps goals of 10,000 steps a day without regular performance feedback, positive reinforcement or push encouragement components.

3.8.Adherence and completion rate

Adherence criteria will be group dependent. For the IE group, adherence is achieved when participants completed 11 out of 16 compulsory IE sessions (70%). For the IS group, the adherent is achieved when participants completed at least three logs of steps per week to include one on a weekend. In attaining valid and reliable estimates of average steps a week and to address the inherent biological variability[34], a reading made over 3 to 7 days is indicated. For both groups, adherence rate calculation will be based on a total number of adhered participants over the total number of participants in the program.

3.9. Regular performance feedback

For the IE group, exercise trainers will be available on-site to provide targeted meaningful exercise performance feedback with regards to exercise posture, techniques and endurance. For the IS group, a researcher will provide regular, tailored individualized performance feedback as well as strategies to increase daily steps to maintain the daily 10,000 steps a day goal via WhatsApp. A systematic review has found that access to PA sites and receiving informational feedback to be strong motivator tools in increasing the percentage of engagement in PA activity.[35]

3.10. Positive reinforcement and push encouragement

Positive reinforcement and push encouragement are motivational strategies found to be effective in increasing PA at the workplace.[35] Push encouragement will be implemented during the exercise or when participants do not meet their PA goals. During the exercise sessions, wearables polar chest straps sensors will be available on-site for monitoring of exercise intensity and calorie usage. These measures provide real-time information on exercise performance which will be used to motivate participants to improve and do more. For participants who were observed to potentially not meeting their weekly goal, participants will be reminded of their goals and strategies to achieve it will be discussed through personal WhatsApp and telephone calls. Additionally, barriers challenges to maintain their goals will be explored and addressed accordingly.

3.11. Support group

A support group will be used to facilitate the sharing of photos, videos, PA goals, health and wellness tips, with the purpose, to stimulate discussion among participants and to encourage them to support each other. WhatsApp and Instagram are the selected platforms to be used. Support group have been found to be effective in exercise adherence reinforcement and maintenance.[35–37]

3.12. Active choices

The study will adopt active choices to assist participants with low PA to initiate and maintain regular activity and to enhance adherence.[23] Participants will be given the choices to select between the upper and lower body exercise videos and resistance bands' strength of 2.5 to 11kg. The gym will be opened from 7.30 am to 7 pm and participants will be able to choose their preferred exercise slots and whether to have an individual or group sessions. Additionally, the online exercise video allows the flexibility of performing exercise elsewhere. These choices can contribute to greater adherence. As far as possible, the capability and effort of participants during exercise sessions will be respected, where encouragement is given to gradually increases their exercise intensity based on the participant's perceived effort. Self-selected increment of effort among sedentary individuals helps to promote positive affective responses.[38]

3.13. Rewards

The study will provide MYR100, an approximately USD24 worth of sports voucher to participants upon completion of the study. Additionally, six winners will be named from each group at the end of the study for various categories related to fitness performance. Each winner will receive a smartwatch.

3.14. Outcome measures

The primary outcome is as follows:

1. Cardiorespiratory fitness (CRF) will be measured via estimated maximal oxygen uptake (VO2max) using Åstrand-Rhyming cycle ergometer test. Considering study participants are women with low PA, the initial cycle ergometer workload will be selected at 300 watts. Following this, participants warm-up for 2 minutes and then pedal for 6 minutes to try and elicit a steady-state heart rate between 120-150 beats per minutes guided by a metronome for a constant pedalling rate at between 55 to 60 rpm and.[34]

The secondary outcomes are as follow:

[1] Anthropometric assessment

- Height

  Measurement of height will be performed with barefoot using ProDoc PD300 stadiometer and is recorded to the nearest 0.5cm.

- Waist to hip ratio

  Waist circumference will be measured in the horizontal plane midway (WC-mid) between the lowest ribs and the iliac crest[39,40] and recorded to the nearest 0.5cm. Hip measures the largest horizontal girth between the waist and thigh. Both WC-mid and hip measurements will be obtained in the standing position at the end of normal expiration to the nearest 0.5 cm.

- Blood pressure and pulse

  Resting systolic and diastolic blood pressure and heart rate will be taken in the left arm using Philips SureSigns VS3 automated blood pressure. Readings will be taken with participants in the seated position after a 5-minute rest period.

- Body mass index

  BMI will be calculated using the standard formula, expressed as a weight (kg)/height^2 (m^2) to the nearest one decimal point (0.1kg/ m^2).

- Body composition

  Bodyweight (kg) will be recorded to the nearest 0.1cm using bioelectrical impedance analysis (BIA) with the InBody370 whole-body BIA Biospace, California.[41] Information on gender, age and age will be recorded prior to the assessment of body composition.

[2] Fitness assessment

- Six-minute walk test

  The 6-minute walk test (6MWT) will be used to measure 6-minute distance and heart rate. Participants will be requested to walk on a flat surface, along a 30-meter unobstructed corridor track, at the sports medicine clinic. Plastic cones will be placed in both ends to mark the turnaround points of the track. The track has coloured masking tape, at the side of the floor at every 1 meter to record the exact distance of the last lap. Participants will be requested to "cover as much distance as possible" during the test. Running or jogging will not be allowed.[42] The assessor will mark on the worksheet (corresponding to 30 m) every time the participant passed each end of the tract. The study will use pulse oximetry to measure participants' heart rate at resting and at every one minute during the test. The 6MWT will be repeated after the participant has seated and rested for three minutes in a chair located near the starting position. The final distance covered and the heart rate at 6^{th} minutes will be averaged out from the two 6MWT sessions. This is a valid field tool for predicting the VO2 max of a healthy adult.[43]

- Chest and leg press

  Three repetition maximum (3RM) test will be used to measure the muscle strength of the upper and lower body. Before all tests, participants will perform a warm-up consisting of performing 5-10 repetitions with light loads. For both strength tests, participants will complete 5-10 repetitions using lightweight on the first set with a one-minute rest period. Next, 10- 20% of the weight will be added which is followed by a set of 5 repetitions. A 3 to 5 minute rest period will be given at each successive set. After increasing the weight to 20-30%, the 3RM test will be tested. For each successful test, an additional 10-20% of the weight will be added. If unsuccessful, the weight will be reduced by 5 to 10% and one attempt will be given.[44] At the end of each weight test, the participant will rate their baseline dyspnoea and overall fatigue using the Borg scale.

- Forearm Plank

  The prone forearm plank test will be used to measure anterior core musculature muscle endurance, especially the rectus abdominis and external oblique abdominis.[45] Participants will receive a brief technique demonstration and detailed instructions. Participants will be required to assume the forearm plank position with elbows in contact with the ground, directly beneath the shoulders. When participants were ready to assume the proper position, the researcher or the RA will start the stopwatch and participants will be instructed to statically hold to this position as long as possible. A standardized verbal cue informing the elapse of time at every 5 seconds will be used to promote adherence for test validity. Any deviated position away from the accepted position will be cued for correction. The test will be terminated when two consecutive corrective cues given failed to result in an adequate correction, participants become fatigued, voluntarily stop the test, and failed to maintain the proper anatomical position. At the end of the test, the participant will rate their baseline dyspnea and overall fatigue using the Borg scale and the duration time of the test is recorded to the nearest tenth of a second.

- Sit and reach test

  Assessment for hamstring, gluteus, and low back flexibility will be conducted using the sit-and-reach test following a 5-minute stretching warm-up. Participants will sit on the floor with their feet up against the sit-and-reach box and reach forward with both hands with knees remain completely locked, and hold the position for two seconds. The best of the three measurements will be recorded to the nearest 0.5cm.

[3] Behavioural change

- Exercise stage of change

  The exercise stage of change (ESC) will be assessed using a self-reported questionnaire, consisting of four-items, with a dichotomous scale of ‘yes’ or ‘no’ related to regular exercise behaviour and intentions. The question will be: 1) I am regularly active; 2) I

intend to become more physically active in the next six months; 3) I currently engage in regular PA, and 4) I have been regularly physically active for the past six months. Based on participants' replies, they will be divided into five groups: 1) Pre-contemplation are participants who do not exercise and do not intend to start exercising; 2) Contemplation are participants are those who do not exercise but do intend to start exercising; 3) Preparation are participants who exercised some but not regularly; 4) Action will include participants who currently exercise regularly but had started doing so recently; and 5) Maintenance are participants who are currently exercising and has been doing so for the past six month.[46] Similar measures of the stages of exercise adoption have been shown to be reliable.[47] The five ESC reflects the cyclical behavioural and cognitive process individuals may go through before they meet their goals and has been tested among the workforce population.[48]

- Self-efficacy to exercise

  Self-efficacy to exercise will be measured using a self-reported questionnaire consisting of Bandura's Exercise Self-Efficacy[49] which had demonstrated high reliability in women.[50] It rates the strength of participants' belief in their ability to exercise three or more times a week. The 18-item scale has answer choices in 10-unit intervals, ranging from 0 (cannot do at all) through intermediate degrees of assurance, 50 (moderately can do) to complete assurance, 10 (highly certain can do)[49]. The score will be averaged to generate scores. Higher scores reflect greater exercise self-efficacy.

- Exercise benefit/barrier scale

  The perceived benefits and barriers of engaging in PA will be assessed using the Exercise Benefits/Barriers Scale. Its is a reliable and valid tool and has been used in research to measure perception to benefits and barriers to exercise in adult populations.[26] Participants will complete the self-administered questionnaire, consisting of 43 statements regarding the perceived benefits and the perceived barriers to exercise with a four-response in Likert format from 4 (strongly agree), 3 (agree), 2(disagree) and 1 (strongly disagree).

The scale contains 14 barrier items and 29 benefit items. The 29 benefit items are categorised into five subscales: life enhancement, physical performance, psychological outlook, social interaction, and preventative health with a possible range of scores on the benefits scale is 116 with higher scores indicating greater perceived benefits. The barrier component includes 14 barrier items categorised into four subscales: exercise milieu; time expenditure; physical exertion; and family discouragement with a possible range of scores for the barriers scale 56, with lower scores indicating greater perceived barriers to exercise.

- Subjective exercise experience scale

  Subjective responses to exercise stimuli will be assessed using a valid and reliable instrument[51], the subjective exercise experience scale questionnaire. Participants will complete the self-administered questionnaire, consisting of 12-item questions representing four domains. There are three domains which are positive well-being, psychological distress and fatigue. Each domain contains for questionnaire items which is rated along a Likert scale from 1 (not at all) to 7 (very much so). The domains are Scores will be reported as the sum of the scores for the four items that represent each domain, with a maximum attainable score of 28.

3.15. Outcome assessment

Fitness and anthropometric measures will be assessed in a performance laboratory within the University Malaya Medical Centre, Sports Medicine Clinic which is equipped with fitness facilities. The study measurement will be conducted at baseline, at the end of the active phase (week 9), and at the end of the maintenance phase (week 17). The flowchart of the trial is shown in Fig 2. An independent research assistant blinded to the previous fitness scores of participants will conduct the assessment. Anthropometric measurements, body composition analyses, and vital signs will be measured first. Participants then complete a battery of fitness and physical function measures, starting from sub-optimal VO2max, 6MWT, muscle endurance and flexibility tests. The results will be recorded in a data collection file.

3.16. Sample size

The primary outcome for this study is CRF. Statistical power calculations will be used to ensure that the final sample size is adequate to detect between-group differences. Prior data indicated that the difference in the response of matched pairs is normally distributed with a standard deviation of 4. If the true difference in the mean response of matched pairs is 2.1 (VO2Max) Keating SE et al,[52] this study requires 30 participants in each arm to have sufficient power (80%) to detect a difference in CRF in the two arms, using a two-tailed significance level $\alpha = 0.05$. With a 20% attrition rate, the study will need a minimum of 36 participants in each group.

3.27. Statistical analysis, ethics and dissemination

The SPSS25.0 (IBM SPSS Statistics, IBM Corp, Somers, NY) will be used for data analysis. All participants who were recruited at baseline will be included in the outcome analysis.[53] Intention to treat analysis will be adopted. Any missing data will be replaced by the last measured value. The last-observed value will be carried forward and used to impute the outcome values. Categorical variables will be described in numbers and percentages whereas continuous variables will be presented in mean ± standard deviation (SD) for normally distributed data or median with interquartile range (IQR) for non-normally distributed data. For data that meet all parametric assumptions, the two-way repeated-measures ANOVA test will be used to determine for a statistically significant interaction effect between groups. If there is a normality violation, the dependent data will be transformed. For all analyses, P values of <0.05 will be taken as the significance level.

3.28. Ethics and dissemination

Ethical approval has been obtained from the Ethics and Research Committee of the University of Malaya Medical Centre and Universiti Teknologi MARA Research Ethics Committee (600-IRMI (5/1/6), Malaysia. Should there will be a need for any protocol modifications, we will report and apply to the Ethics and Research Committee for approval. Informed consent will be obtained from all study participants and they can withdraw anytime during the study without

giving any explanation. Participant information will be kept confidential. All experimental data will be stored in a secure storage area with access limited to the researchers of this study alone. Dissemination of results of this study will be in conferences or publications when the trial is completed.

4. Discussion

The trial was designed to compare the changes in cardiorespiratory fitness between an incremental increases in exercise to 150 minutes a week group and an incremental increases in steps to 10,000 steps a day group. A practical approach to promote PA among women employees in a demanding environment of a university hospital setting is essential to promote positive health outcome. Many workplace exercise intervention studies have been conducted, showing favourable improvement in fitness level with variable significant results.[54–56] As far as the authors are concerned, there is currently no local study specifically looking at the effect of incremental PA at the workplace in improving fitness level. Therefore, this study will provide additional information to the current body of knowledge. This study will measure the change is fitness levels following a 16 weeks exercise program study within a university setting.

Additionally, this study will help to address important gaps in research on strategies to promote PA in the current workplace by evaluating the adherence and completion rate of incremental PA programme. Workplace exercise intervention offers an excellent avenue to improve fitness level through exercise. A well-accepted PA programme at work can further improve employers' wellness. Personal achievement to increase PA can positively impact others, and this is especially important when the university hospital workforce has a lot of contact with patients. Through personal involvement in exercise, participants can gradually become active, acquire the skills and experience which can enhance ones' confidence and willingness to promote PA to patients and family members.[57] When a program is able to generate long-term compliance, it can become an inexpensive tool to reduce the future risk of cardiovascular disease. Moreover, a well-targeted intervention can further improve women's motivation to increase their physical activity and eventually reap the benefits of positive health outcome. Women who are keen to improve their fitness but struggle to find sufficient time outside of their work time to exercise may find this workplace exercise intervention an ideal and enticing. No doubt physical

inactivity is a significant public health issue requiring multifaceted approaches including strategies to influence behaviour change.

The study has many strengths in both its design. The intervention group (IE) is compared to the control group (IS) group which uses a pedometer to increase daily steps with the aim to maintain 10,000 steps a day. The use of a pedometer in the controlled group provides a stringent comparison between workplace PA interventions and current standard of care. The study implementation of gradual progression in exercise and steps/day, which will be a pragmatic way to slowly ease participants into higher levels of PA, improving self-efficacy, and adherence. Additionally, the study will address challenges to initiation and maintenance of PA through the delivery of motivational strategies to include regular performance feedback, positive reinforcement, push encouragement, support group, active choices and rewards which are effective in helping participants to engage in the new healthy behaviours.[35,58] It is hoped that the study will enable participants to reap the benefits of improving health find the increasing physical activity a manageable task that they can fit into their daily life. The results of the study, MissFiTT@UMMC are expected to be analyzed in March 2020.

Trial status: Completed

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