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A feasibility of simulation-based exercise programme for overweight adult in higher learning institutions ☆

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Abstract

Objective: This study was conducted to evaluate the feasibility of simulation-based exercise programme among overweight adult in higher learning institutes.

Method: A quasi-randomized controlled trial was conducted recruiting students from two different higher learning institutions in Kuantan, Pahang, Malaysia. Students are selected after fulfilling the criteria such as body mass index (BMI) of ≥ 23 kg/m^2, no chronic diseases that may influence by exercise, no significant changes in body weight within two months and not taking any medications or supplements. One institution was purposely chosen as a simulation-based group and another one control group. In the simulation-based group, participants were given a booklet and CD to do aerobic and resistance exercise for a minimum of 25 min per day, three times a week for 10 weeks. No exercise was given to the control group. Participants were measured with the International Physical Activity Questionnaire (IPAQ), BMI, waist circumference (WC), body fat percentage before and after 10 weeks of simulation-based exercise.

Results: A total of 52 (control: 25, simulation-based: 27) participants involved in the study. There was no baseline characteristics difference between the two groups ($p > 0.005$). All 27 participants in the simulation-based group reported performing the exercise based on the recommendation. The retention rate at three months was 100%. No adverse events were reported throughout the study. Better outcomes ($p < 0.001$) were reported among participants in the simulation-based group for BMI, WC and body fat percentage.

Conclusions: The findings of this study indicate that the simulation-based exercise programme may be feasible for an overweight adult in higher learning institutes. As a feasibility study this is not powered to detect significant differences on the outcomes. However, participants reported positive views towards the recommended exercise with significant improvements in body mass index, body fat percentage and reduced the waist circumference.

Introduction

Prevalence of overweight and obesity among Malaysian adults is increasing over the past few years[1] and another part of the world including the United States.[2] The epidemic of obesity internationally determined a load of several well-known non-communicable diseases (NCDs) particularly diabetes and heart disease including cancers.[3] Obesity among young people and adult becomes major attention to not only the family members but also all physical health instructors comprising healthcare professionals (HCPs). Based on the World Health Organization (WHO) definition, obesity is an abnormal or excessive fat accumulation that definite harm people's health.[4] The percentage is estimated to increase by years due to many associated factors. Among the prominent factors are the reduction of physical activity and a more sedentary lifestyle among the population. People nowadays are risky for obesity or overweight by spending more time to watch television, play computer games[5] and also use a smartphone for daily business. This phenomenon becomes chronic day by day as people get used to technology and reluctant to do more activities. Due to this, using technology to support performing physical activities is one of the methods to prevent obesity[6] and further associated problems. A recent study aimed to reduce the obesity among adolescents using the internet-based approach in Kuala Lumpur, Malaysia was found to be effective.[7] Many types of simulation-based activities, for instance, web-based, video games,[8,9] and recorded exercise video were introduced to the public to draw their awareness and interest to do exercise typed physical activity.

Method

A quasi-experimental study was conducted from February 2015 until April 2015 among overweight adult students in two higher learning institutions in Kuantan, Pahang. Students were sampled purposively to involve in this study using a questionnaire survey and exercise videos (Fig. 1). The participants from institution numbered as one, International Islamic University Malaysia (IIUM) were recruited into simulation-based group whereas the participants from Sultan Ahmad Shah Polytechnic (POLISAS), numbered as two, into control group based on flip-coin. Participation in this study was declared as voluntary, and all participants were informed consent before taking part. The age range of participants in this study was 19–25 years old, and the BMI of each participant must be more than or equal to 23 kg/m² indicative for overweight.[10] Participants who have an existing medical problem and chronic illness such as asthma and heart failure, active in the sport, had significant changes in weight during two months and taking medication or any supplements were excluded from this study. The sample size of this study comprised of 52 students, 27 students from IIUM and 25 students from POLISAS were calculated based on the following equation added with dropout rate:

$$n = 1 + 2C\left(\frac{s}{d}\right)^2$$

$$s = 1.9$$

$$d = 1.7$$

$$C = \text{constant if } \alpha = 0.05 \& 1 - \beta = 0.8, \text{ then } C = 7.85$$

$$\text{Thus, } n = 1 + 2\,(7.85)(1.9/1.7)^2 = 21 + 20\%\,\text{dropout rate}$$
$$= 25\,\text{subjects for each group}$$

Assisted administered questionnaire

Assisted administered questionnaire was distributed prior to the study to collect the baseline data, and the same questionnaire was used at the end of the study to evaluate the effect of the study. The questionnaire consists of Part A: Sociodemographic data, Part B: Physical activity data and Part C: Anthropometrics measurement on body weight, height, BMI, body fat and waist circumference of the participants. A validated International Physical Activity Questionnaire (IPAQ) was used, to measure participants' physical activity in seven days.[11,12] The questionnaire asked about the days of doing vigorous physical activity, time spent on vigorous activity, days of doing moderate physical activity, time spent on moderate physical activity, days of walking at least 10 min at a time, time spent on walking on one of the day and time spent on sitting on a weekday. The answers categorized into three categories which were a low, moderate and high level of activities. Individuals that performed three or more days of vigorous activity of at least 20 min per day OR 5 or more days of moderate-intensity activity or walking of at least 30 min per day OR 5 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 600 MET-min/week considered as moderately active. Individuals that performed a vigorous-intensity activity on at least three days and accumulating at least 1500 MET-min week OR seven or more days of anycombination of walking,
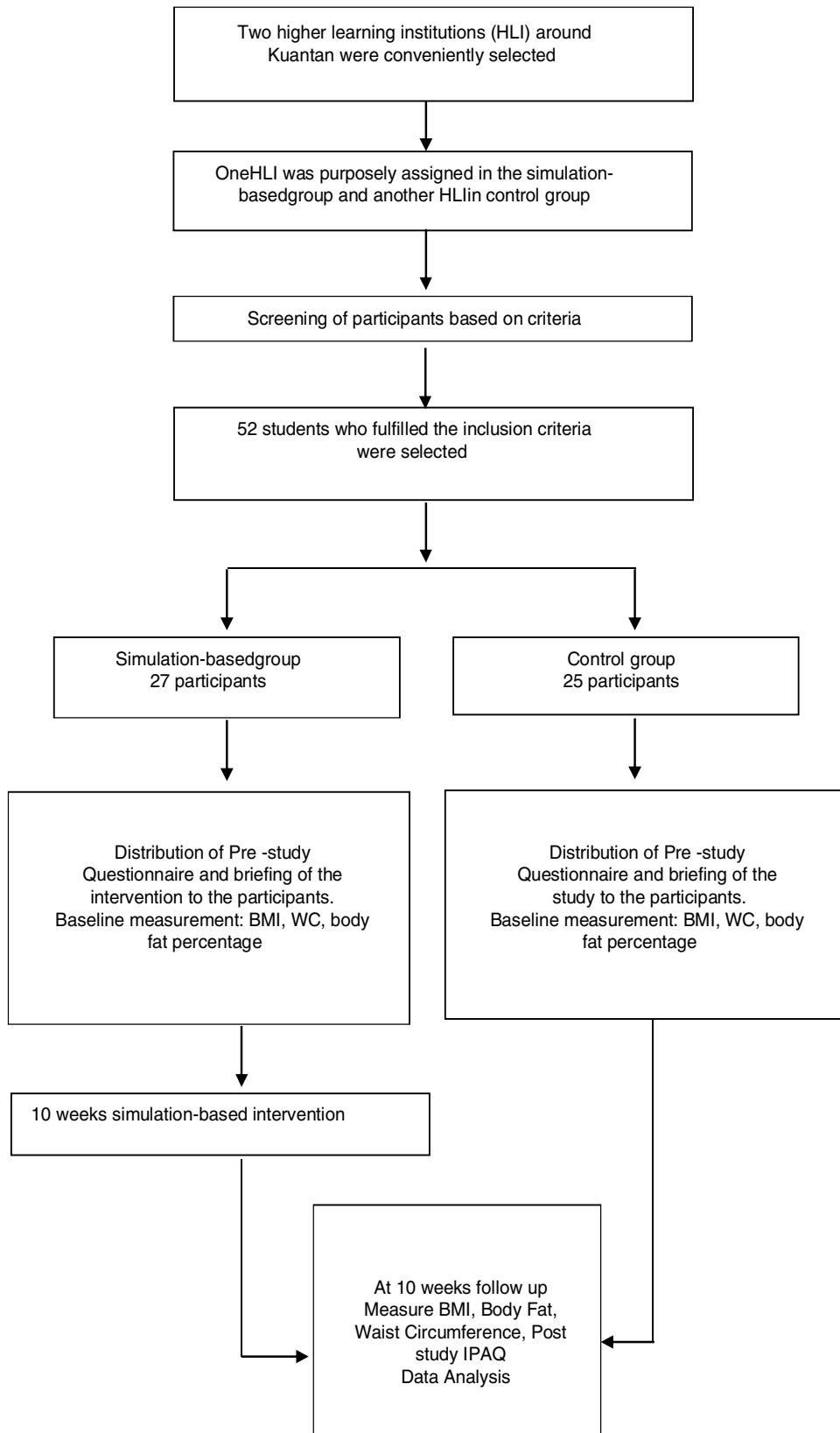
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│  Two higher learning institutions (HLI) around│
│       Kuantan were conveniently selected      │
└─────────────────────────────────────────────┘
                      ↓
┌─────────────────────────────────────────────┐
│  OneHLI was purposely assigned in the simulation-│
│  basedgroup and another HLIin control group    │
└─────────────────────────────────────────────┘
                      ↓
┌─────────────────────────────────────────────┐
│     Screening of participants based on criteria│
└─────────────────────────────────────────────┘
                      ↓
┌─────────────────────────────────────────────┐
│   52 students who fulfilled the inclusion criteria│
│              were selected                    │
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Simulation-basedgroup
27 participants

Control group
25 participants

Distribution of Pre -study Questionnaire and briefing of the intervention to the participants. Baseline measurement: BMI, WC, body fat percentage

Distribution of Pre -study Questionnaire and briefing of the study to the participants. Baseline measurement: BMI, WC, body fat percentage

10 weeks simulation-based intervention

At 10 weeks follow up Measure BMI, Body Fat, Waist Circumference, Post study IPAQ Data Analysis

Figure 1   Study flow chart.

moderate-intensity or vigorous intensity activities achieving a minimum of at least 3000 MET-min/week was considered as active. Individuals who do not meet criteria for moderately active and highly active categories considered to have low/inactive activity.

Simulation-based exercise programme

As for the simulation-based group, a set of exercise videos was distributed to each participant after pre-measurements of anthropometric. Participants in the simulation-based group performed the simulation exercise based on the global recommendations of the World Health Organization WHO.[13] The recommendation comprised of vigorous-intensity physical activity where participants performed the aerobic exercise for 25 min per session in three days per week in combination with muscle strengthening/resistance activities (i.e. sit-ups, pushups, squats, etc.). For feasibility data, participants were advised to record their activities in a diary using exercise simulation based within 10 weeks. The intervention completed in 10 consecutive weeks and the post measurements of anthropometric data and IPAQ in both groups were assessed in order to evaluate the effect of the intervention. The control group was given with the same set of simulation-based after completion of the study. Data were analyzed using a statistical software package for social sciences (SPSS) version 18.0.

Results

The participants were grouped into simulation-based group and control group with 27 and 25 participants respectively. Of the total participants, 28.8% were male, and 71.2% were female. Participants were categorized based on their physical activity as inactive (40.4%), minimally active (55.8%) and 3.8% were active. The age, weight, height, BMI, waist circumference, body fat percentage and physical activity (MET-minutes/week) were expressed in mean and standard deviation as presented in Table 1.

Table 2 shows the median of physical activity among university students at baseline and after 10 weeks of interventions. The data showed that daily physical activity among participants in the simulation-based group was improved after 10 weeks of intervention as compared to those in the control group ($t = 0.462$. $p < 0.001$)*.

Table 3 presents the mean and standard deviation of BMI, waist circumference and body fat percentage of participants in simulation-based group and control group at baseline and after 10 weeks of intervention. Participants in the simulation-based group showed a significant reduction in BMI, waist circumference and body fat percentage after the study as compared to control group participants ($p < 0.001$).

Discussion

According to Khambalia and Seen,[14] female was expected to have a greater risk of overweight before proceed to obese as compared to the male. The analysis of

overweight conducted among participants in this study has shown that female has a higher percentage compared to male. Similar observation showed both in simulation-based and control group. Among all participants, female reported as 74.1% in simulation-based group (25.9% male) and 68.0% of a participant in the control group (32.0% male). The number of female students was also observed domineered the participation in secondary school within the area of current study.[15] Meanwhile, out of 49 students, 19.4% ($n = 12$) were physically active, 13.5% ($n = 20$) were moderately active and 10.5% ($n = 17$) were inactive or have lower physical activity. In comparison, all respondents were overweight and the physical activity level of each category in this study slightly high due to the number of participants. A similar finding from Al-Naggar, Bobryshev, and Mohd Noor[16] stated that Malaysian university students were inactive. This finding reflects the insufficient healthy lifestyle practice among university students. However, in this study, Kendall's Coefficient of Concordance proves that there is a slight increase in physical activity found in the present study for simulation-based group participants compared to the control group counterparts. This shows that students' physical activity in the simulation-based group has increased during participated in this study, possibly due to the recommended exercise is given.

According to Reinehr et al.,[17] lifestyle interventions with improvements of the dietary pattern were effective in reducing the degree of overweight. The study showed that there was a significant difference ($p < 0.001$) of BMI between participants in simulation-based group and participants in the control group after six months of intervention. A randomized cluster trial involving adolescent in promoting the healthy lifestyle and diet done by[7] showed that internet-based programme has a significant effect in delivering the health education hence significantly reduce the BMI, waist circumference and body fat percentage. One of the modules in the simulation-based also involved the aerobic exercise which the one being used in this study. So, it is parallel with the result of the study which showed that simulation-based physical activity was feasible to reduce the BMI of participants.

Referring to Table 3 participants in the simulation-based group has shown a reduction of waist circumference after 10 weeks of intervention. This result is similar to Willis et al.,[18] of an eight months study of exercise protocol comparing the effectiveness of aerobic and/or resistance training on body mass and fat mass in overweight or obese adults. Their study found a significant difference in waist circumference of the participants only in both the aerobic training group and aerobic/resistance training group but no significant finding in the resistance training group. The study shows that aerobic training and a combination of aerobic training with resistance training were practicable in order to reduce waist circumference.

Thivel, Chaput, Adamo, and Goldfield[19] found that a 10-week aerobic exercise programme is resulting in body fat decrease among older adolescents. Correspondingly, the reduction of body fat percentage was revealed among participants who underwent 10 weeks of simulation-based activity intervention.

Table 1 Characteristics of participants, $n = 52$.

	Simulation-based $n = 27$	Control $n = 25$	Overall $n = 52$
		Frequency (%)	
Gender			
Male	7 (25.9)	8 (32.0)	15 (28.8)
Female	20 (74.1)	17 (68.0)	37 (71.2)
		Mean (SD)	
Age	22.37 (1.18)	21.44 (1.29)	21.29 (1.31)
Body mass index (kg/m^2)	30.57 (5.26)	29.09 (3.59)	29.86 (4.55)
Waist circumference (cm)	91.63 (13.02)	88.88 (11.79)	90.31 (12.39)
Body fat (%)	34.46 (4.79)	33.46 (5.35)	33.98 (5.04)
Physical activity (MET-minutes/week)	811.00 (648.50)[a]	645.00 (516.75)[a]	693.00 (678.00)[a]
		Frequency (%)	
Inactive	10 (37.0)	11 (44.0)	21 (40.4)
Minimally active	16 (59.3)	13 (52.0)	29 (55.8)
Active	1 (3.7)	1 (4.0)	2 (3.8)

[a] Median (IQR).

Table 2 Physical activity among adult in university.

	Pre Median (IQR)	Post Median (IQR)	t-Value[a]	p-Value
Simulation-based $n = 27$	811.00.00 (648.50)	1431.00 (459.00)	0.462	<0.001[*]
Control $n = 25$	645.00 (516.75)	624.00 (587.00)	0.019	0.491

[a] Kendall's coefficient of concordance.
[*] Significant at level 0.05.

Table 3 The effectiveness of simulation-based physical activity within groups (simulation-based group and control group).

	Simulation-based ($n = 27$)				Control ($n = 25$)			
	Pre	Post			Pre	Post		
	Mean (SD)	Mean (SD)	t-Value[a]	p-Value	Mean (SD)	Mean (SD)	t-Value[a]	p-Value[a]
Body mass index (kg/m^2)	30.57 (5.26)	29.75 (5.13)	6.60	<0.001[*]	29.09 (3.59)	29.06 (3.57)	0.58	0.570
Waist circumference (cm)	91.63 (13.02)	90.37 (12.89)	7.25	0.001[*]	88.88 (11.79)	89.96 (11.23)	−1.34	0.193
Body fat (%)	34.46 (4.79)	33.44 (5.13)	4.53	0.001[*]	33.46 (5.45)	33.27 (5.35)	0.71	0.483

[a] Paired. *t*-test.
[*] Significant at level 0.05.

This simulation-based physical activity intervention was feasible to reduce overweight and obesity prevalence among university students. As hypothesized, paired *t*-test has proved that there was a significant difference (all $p < 0.001$) of BMI, waist circumference and body fat percentage of respondents in the simulation-based group compared to the respondents in control group. Individual's physical health, well-being, mood, and self-esteem can be promoted through regular exercise.[20] In Malaysia, the level of participation in exercise is low regardless of age, including the older people[21] even though information and benefit have been published publicly. Sharif et al.[22] stated that majority of Malaysian children and adolescent were not physically active, active commuting, high level of screen time engagement and extremely low compliance with dietary recommendations for fruits and vegetable. However, there was an improvement regarding respondents' participation in performing daily physical activity after the intervention.

There are several limitations encountered in this study although the results are all significant. The first limitation is the co-founder has been found during this study is done. The co-founder such as in terms of dietary habit has been distinguished. Some participants in this study claimed that once they have started the exercise intervention, they tend to control their daily dietary intake. The participants were asked if they have undergone any diet plan during this intervention. Their answer was neg-

ative, but they only reduced their portions in each meal in which lessen rice portion and increase fibre intake such as vegetables and consume fruits as a snack. Another co-founder revealed in this study is the participants' daily activity may influence the result of this study. Some of the respondents claimed that their schedule was packed and they were busy during this study is done. They agreed that they had missed one or two sessions to perform exercise per week. Anyhow, the result turned out significant because of their busy schedule and activities indirectly increased their physical activity. Next limitation is the samples were recruited among two universities' students around Kuantan, thus it could not represent a whole population of university students in Malaysia. The last limitation found in this study is a time constraint. This study only took 10 weeks to be completed and it is considered too short. A better impact may be discovered if the period of this study is longer.

By having such a programme, university students will have the opportunity to engage in daily physical activity interactively instead of spending time on the on-screen all day long.

The findings of this study indicate that the simulation-based exercise programme may be feasible for an overweight adult in higher learning institutes. As a feasibility study, this is not powered to detect significant differences in the outcomes. However, participants reported positive views towards the recommended exercise with significant improvements in body mass index, body fat percentage and reduced the waist circumference. Through this activity, it is highly hoped that further risk of non-communicable diseases could be reduced or even prevented. A fuller definitive trial is suggested for future study including reducing the risk of bias within the study.

Conflict of interests

The authors declare no conflict of interest.

Acknowledgements

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