ORIGINAL ARTICLE

An intervention based on the stages of change, health profiles and physical activity levels of overweight and obese adults in Sarawak, Malaysia – a feasibility study

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Abstract

Introduction: Physical inactivity is the one of the leading causes of major non-communicable diseases in the world. The aim of this study is to assess the feasibility of an intervention program based on the stages of change, physical activity levels and health profiles of selected overweight and obese adults in Sarawak.
Methods: This intervention study was carried out using selected overweight and obese adults in Sarawak. A total of 75 participants were placed in the intervention group, and 80 respondents were placed in the control group participated. Respondent-determined weekly aerobic exercise sessions were conducted for six months. The Malay version of the long-form International Physical Activity Questionnaire (IPAQ) and Transtheoretical model of change (TTM) questionnaire were used, together with anthropometric measurements and the collection of venous fasting blood profiles. Data was entered and analyzed using SPSS Version 20.
Results: The intervention group had significant better stage transitions compared to the control group ($p<0.01$). They also had significantly lower total cholesterol, although both groups showed significant results (difference= 0.53, $p<0.01$; difference= 0.38, $p=0.01$). The respondent-determined intervention program was effective in improving stage transition; however, an intervention of longer duration could provide more conclusive health outcomes.
Conclusion: Physical activity plays a role in assisting overweight and obese adults to be more active and healthier.

Introduction

According to the World Health Organization (WHO),[1] one of the factors in global mortality is physical inactivity. Physical inactivity is listed as the fourth leading risk factor related to non-communicable diseases and is said to contribute to 6% of deaths globally.[1] Many rapidly developing countries, including Malaysia, have a high prevalence of obesity and diet-related disease. This prevalence is linked to rapid economic growth and heavy consumption of unhealthy foods, coupled with more sedentary lives.[2] In addition, individuals can also become physically inactive after they become obese. Thus, obese individuals should be encouraged to perform physical activities. Although regular physical activities are beneficial, not many Malaysian adults in Sarawak are active. In the Malaysian Adults Nutrition Survey 2002 – 2003, out of 6926 respondents, approximately 10% were adults from Sarawak.[3] The study found that for Sarawak, 31.4% (95% CI =26.2 – 37.1) reported they had ever exercised, and 14.0% claimed that they had adequate exercise (95% CI = 10.7 – 18.1). In the same study, 31.1% (95% CI = 26.3-36.3) of the respondents were sedentary, 50.9% (95% CI = 45.6-56.3) were moderately active, and 18% (95% CI = 14.3-22.3) were active. A recent study suggested that inactive individuals may reap health benefits from even a small increase in activity.[4] The same study also suggested that avoiding all inactivity would theoretically reduce all-cause mortality more than avoiding obesity.[4]

However, it is not easy to change behavior. According to the Theory of Planned Behavior, in order for individuals to change, it is important to identify their intentions regarding the change.[5] The transtheoretical model of change (TTM) developed by Prochaska and DiClemente can be used to determine individuals' intentions regarding the change by determining their stages of change. These stages include: precontemplation (the new behavior is not considered), contemplation (the new behavior is contemplated but not acted upon), preparation (efforts are

made to prepare for adopting the new behavior), action (the initial behavior change is made), and maintenance (the new behavior is maintained over time).[6] TTM has been used in stage-matched intervention programs targeting several behavioral changes, including physical activity.[7]

A local study among the indigenous groups of Sarawak indicated that 39.6% of the respondents were overweight, with 11.9% of them being obese, a three-fold increase over a span of 16 years.[8] These findings indicate that being overweight or obese is a problem in this population. No published study was found regarding the physical activity levels of indigenous overweight and obese adults in Sarawak;, however, one study among adolescents found a high prevalence of physical inactivity.[9]

The current study was a non-randomization intervention study used to examine the feasibility of, and extent to which, a respondent-determined intervention program for physical activity could affect the stages of change and health profiles of overweight and obese adults in Sarawak. The outcome of this study can help to determine if a larger-scale, community-based intervention could be implemented. The feedback provided, such as acceptance by the community, the process of conducting the research and its relevance to public health, knowledge transfers and ultimately the empowerment of the community itself to take care of its health will be useful in planning a sustainable intervention program.

Methods

Based on a non-randomized feasibility study method, this intervention study was conducted in Kuching and Samarahan divisions, two of the 12 divisions in Sarawak, which is located on the Island of Borneo, Malaysia. The population of these two divisions is ethnicity diverse, with a majority of Bidayuh, Iban, Malay and Chinese. Kuching division consists of three districts (Kuching, Lundu and Bau), whereas Samarahan division consists of four districts (Samarahan, Asajaya, Serian and Simunjan). The inclusion criteria for the respondents required that they be between 18 to 65 years old, either overweight (body mass index [BMI] 25 to 29.9 kg/m^2) or obese (BMI ≥30 kg/m^2), physically capable and not intellectually challenged.

The recruitment of the respondents was carried out in six villages in both rural and urban areas of the Kuching and Samarahan divisions and was done via health screenings held in each of the villages. The researchers approached the head of each of the village and planned the health screening activity. For each of the villages, a day was fixed to gather all villagers, and the health screenings were conducted at the community hall. A total of 317 villagers were screened, and 190 villagers who met the inclusion criteria were recruited. Three of the six villages were purposively selected as the intervention sites, as they had suitable infrastructures for supporting group intervention activities.

A focus group discussion was conducted in each intervention village to determine the respondents-chosen intervention, that is, the type of physical activity suitable for the respondents, while taking into consideration the resource available. All intervention groups unanimously chose weekly aerobic exercise throughout the intervention period in addition to their other routine daily physical activities. Aerobic exercise was chosen over other types of sport activities because it was simpler and no additional equipment was needed. Furthermore, they could perform it in the villages without traveling outside, which may have involved extra costs and time.

A motivational talk on the importance of physical activity was given to intervention group as a mediator to motivate respondents to be more responsive to the program. The control group was informed that a second data collection would take place in six months. The respondents in the intervention group were informed that they would be engaging in weekly, 90-minute aerobic sessions for six months. Each intervention group consisted of 20-30 respondents. They were also informed that a second data collection would take place at the completion of the intervention period (six months). Two professional trainers were provided to train the respondents weekly for the first four sessions, per request. During these sessions, two respondents were identified and trained, who then led the subsequent sessions until the completion of the intervention. Respondents were also encouraged to perform additional physical activity on their own. They were followed up monthly by a research assistant after the initial four weeks of intervention. A logbook was used to record the attendance at, and duration of, the intervention activity. Motivational talks were given during each monthly follow-up. To compensate for the time involved in the intervention program, respondents who attended at least three intervention sessions per month were given

a small monetary incentive. To avoid variability in physical activity, all respondents were required to attend the session in full and monitored by the group leader. Only those who fulfilled the attendance requirements satisfactorily were given the monetary incentive. Data were collected pre- and six months post-intervention. The details of the activity are presented in **Figure 1**.

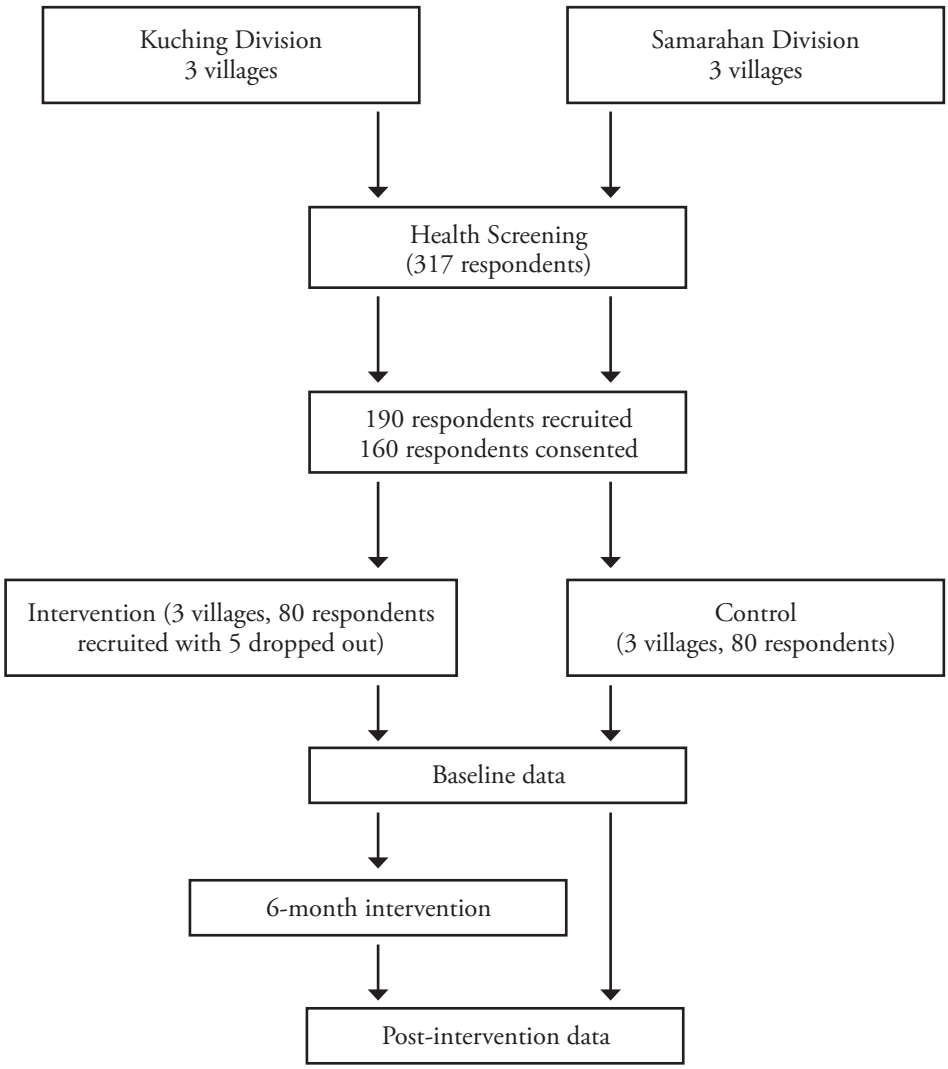

Figure 1. Intervention activity

To measure the primary outcomes of this feasibility study, three outcomes were chosen: recruitment, retention and amount of exercise achieved. The recruitment rate was calculated based on the number of respondents who participated over the total number of respondents approached. Retention was defined as completion of the six-month intervention, health screening, and questionnaire on physical activity and stages of change at the post-intervention follow up. The amount of exercise was calculated based on the number of sessions attended by the respondents over the six months of the intervention.

Respondents were interviewed using validated questions. The translated Malay version of the long form of the International Physical Activity Questionnaires (IPAQ) (validated for Malaysia)[10] was used to assess the physical activity level of the respondents. The TTM stages of change questionnaire was adopted from Marcus et al.[11] and translated into the Malay language based on the Guidelines for the Process of Cross-Cultural Adaptation of Self-Report Measures.[12] The levels of physical activity were categorized into two groups based on the values of the Metabolic Equivalent (MET)-minutes per week, that is, low to moderate at < 3000 MET minutes/week, and high at ≥ 3000 MET minutes/week.

The questionnaire also asked for socio-demographic data, blood pressure (BP) measurements, height,

weight, body fat percentage, fasting blood sugar and a lipid profile. Blood pressure was measured using an Accoson mercury sphygmomanometer (AC Cossor & Son [Surgical] Ltd, Essex, GB) while the participant was seated. The Malaysian Hypertension Consensus Guidelines on the measurement of BP were used.[13] The average of two BP measurements was used in the statistical analysis.

Height was measured using a stadiometer (SECA, UK model 213). Each respondent stood underneath the body meter, and the measuring beam was pushed down to rest on top of the respondent's head. The visual display recorded the height to the nearest 0.1 cm. Respondents were weighed in their street clothing without shoes using a calibrated Seca weighing scale (Seca, JP). Weight was recorded to the nearest 0.1 kg. Both the weight and height readings were used to generate a body mass index (BMI). Classification of BMI was based on the WHO guidelines.[14] A Tanita Body Composition Analyzer (SC-240) was used to calculate body fat percentages. Blood samples were collected by a trained laboratory assistant and analyzed in a certified private laboratory by the sponsoring university. Face-to- face interviews using the validated questionnaire were conducted to ensure uniformity, as a large percentage of rural respondents claimed that they were unable to read.

This study was approved by the Human Research Ethics Committee of the Universiti Sains Malaysia (ref : USMKK/PPP/JEPeM[246.3(6)]) and conformed to the requirements for ethical research in Malaysia.

Data Analysis

Data was entered and analyzed using SPSS Version 20. Descriptive statistics, such as the means, standard deviations, frequencies and percentages for all variables, were calculated. The non-parametric Marginal Homogeneity and McNemar tests for dichotomous variables between two dependent samples were used to determine the before-after effect of an intervention. However, for continuous variables, the paired t-test was used. Confidence intervals were computed at the 95% level, and a p-value of less than 0.05 was regarded as statistically significant.

Results

The recruitment rate was 84.2% since 160/190 of candidates who met the inclusive criteria consented to participate in this study. The retention rate was 93.8%, with 75/80 of the intervention group completing the six-month weekly aerobic exercise program and follow-up assessment. The dropouts were due to "inability to cope with the timing of the aerobic exercises, conflicting social commitments, and physical ill health." The average amount of exercise the 75 respondents who were on intervention reported was 90 minutes per week. All the respondents in the intervention group fulfilled the allocated exercise duration of 90 minutes per week.

The socio-demographic characteristics of the intervention and control groups are presented in **Table 1.**

Table 1: Socio-demographic characteristics

Socio-demographic characteristics	Intervention Group (N = 75) n (%)/mean (SD)	Control Group (N= 80) n (%)/mean (SD)
Sex		
Male	11 (14.7)	23 (28.7)
Female	64 (85.3)	57 (71.3)
Race		
Malay	24 (32.0)	14 (17.5)
Bidayuh	35 (46.7)	34 (42.5)
Iban	16 (21.3)	32 (40.0)
Occupation		
Employed	12 (16.0)	23 (28.7)
Housewife	50 (66.7)	40 (50.0)
Other	13 (17.3)	17 (21.3)
Monthly household	713.03(851.45)	914.55 (1211.44)
income (RM)		
Age (in years)	44.48(10.28)	45.69(10.22)

The health profiles and activity levels before and after the intervention for both the intervention and control groups are shown in Table 2. There was a slight decrease in the mean BMI for both groups, but the drop was not significant in either group. The mean percentage of body fat for the intervention group increased by 1.72%, while, in the control group, it dropped by 0.87%. However, neither change was significant. There was a significant decrease in the mean total cholesterol for both groups; however, the mean HDL level deceased significantly in the intervention group, while it increased significantly in the control group.

Table 2: Health profile and physical activity level by group (pre & post)

	Intervention Group (N=75)	p-value	Control Group (N=80)	p-value
	Mean (SD)/n(%)		Mean (SD)n(%)	
BMI (kg/m^2) [a]				
Baseline	30.75 (4.449)		28.90 (3.325)	
Month 6	29.95 (5.447)		28.63 (3.928)	
Change	0.80 (6.893)	0.317	0.26 (5.111)	0.646
Body fat (%)[a]				
Baseline	38.19 (11.906)		36.03 (7.481)	
Month 6	39.92 (7.875)		0.87 (11.276)	
Change	-1.72 (13.317)	0.266	0.87 (11.276)	0.490
Total cholesterol (mmol/L) [a]				
Baseline	5.72 (0.955)		5.43 (1.021)	
Month 6	5.18 (0.841)		5.05 (.93267)	
Change	0.53 (1.297)	**0.001***	0.38 (1.296)	**0.010***
Fasting blood sugar (mmol /L) [a]				
Baseline	5.88 (2.039)		6.02 (2.80)	
Month 6	5.60 (1.811)		5.89 (2.488)	
Change	0.27 (2.766)	0.395	0.13 (3.715)	0.748
Triglycerides (mmol /L) [a]				
Baseline	1.87 (1.134)		1.69 (.892)	
Month 6	1.64 (0.895)		1.75 (1.060)	
Change	0.22 (1.394)	0.162	-0.05 (1.423)	0.718
HDL (mmol /L) [a]				
Baseline	1.40 (0.266)		1.24 (0.340)	
Month 6	1.26 (0.295)		1.37 (0.702)	
Change	0.13 (.392)	**0.003***	-0.12 (0.691)	0.108
LDL (mmol /L) [a]				
Baseline	3.09 (1.252)		2.87 (1.211)	
Month 6	3.20 (0.880)		3.03 (0.942)	
Change	-0.10 (13.317)	0.567	-0.16 (1.504)	0.335
Hypertension, at risk [b]		0.441		1.000
Baseline				
No	63 (84.0)		65 (81.3%)	
Yes	17 (16.0)		15 (18.8%)	
Month 6				
No	58 (77.3)		66 (82.5)	
Yes	12 (22.7)		14 (17.5)	

[a] Paired t-test; [b] McNemar Test, p<0.05 and significant*

In terms of the stages of change in physical activity, there was a significant difference in the intervention group before and after intervention (p<0.001). There were no respondents in the pre-contemplation stage after the intervention, while there was an increase of 26.7% in respondents in the maintenance stage. In contrast, in the control group, there was an increase of 6.3% in respondents in the pre-contemplation stage, while the percentage in the maintenance stage remained unchanged. The percentage of respondents having low or moderate activity level decreased by 12% in the intervention group and 8.7% in the control group (**Table 3**).

Table 3: Stages of change and physical activity of respondents

	Intervention Group (N=75)	p-value	Control Group (N=80)	p-value
	n(%)		n(%)	
Stages of change [a]		**<0.001***		0.457
Baseline				
Pre-contemplation	16 (21.3)		16 (20.0)	
Contemplation	13 (17.3)		17 (21.3)	
Preparation	19 (25.3)		12 (15.0)	
Action	12 (16.0)		12 (15.0)	
Maintenance	15 (20.0)		23 (28.8)	
Month 6				
Pre-contemplation	0 (0)		21 (26.3)	
Contemplation	14 (18.7)		10 (12.5)	
Preparation	7 (9.3)		18 (22.5)	
Action	19 (25.3)		8 (10.0)	
Maintenance	35 (46.7)		23 (28.8)	
Physical activity level [b]		**0.078**		0.265
Baseline				
Low & Moderate	18 (24.0)		27 (33.8)	
High	57 (76.0)		53 (66.3)	
Month 6				
Low & Moderate	9 (12.0)		20 (25.0)	
High	66 (88.0)		60 (75.0)	

*[a] Marginal Homogeneity test; [b] McNemar Test, *p<0.05 is significant*

Discussion

In term of the feasibility of the respondent-determined intervention, it was found to be effective in engaging people in being physically active. Approaches that allow respondents to choose their preferred activities could boost their motivation in terms of exercise[15] and may be why the retention rate in this study was high (93.8%). In addition, a monetary incentive was provided to those respondents who fulfilled the minimum participation criteria, perhaps boosting the commitment and adherence of the respondents. However, self-determination theory states that to promote long-term behavioral change, it is important to increase the quality of the motivation regulating behavior from the least autonomous form (extrinsic motivation through rewards or to avoid punishment or sanctions) to the highest (satisfaction gained intrinsically).[16]

It is interesting to note that 36% of the intervention group reported being in a higher level of behavioral change (action and maintenance) despite being overweight or obese. Studies have shown that individuals who are overweight and obese are more conscious about the adverse health effects of being overweight or obese and are more ready to make changes concerning their weight.[17,18]

The success rate in using interventions to influence physical activity levels has always been reported to be low.[19] Nevertheless, higher success rates were found among interventions that match individuals' levels of readiness for behavioral

change. In successful intervention studies using TTM, researchers used stage-match interventions to facilitate stage transitions. This study attempted to give monthly motivational talks to all respondents in intervention group to encourage those respondents in the pre-contemplation and contemplation groups to engage in physical activity and those in the higher stages of change to continue their physical activity efforts. Aerobic exercise was conducted for two purposes: (a) ensuring additional physical activities, and (b) initiating group support for physical activities. The effect of the intervention program was obvious in terms of stage transition. In the intervention group, the stage of change transition was significant. All 16 respondents in the pre-contemplation stage transited to higher stages of change, and more than twice the number of respondents had moved from other stages to the maintenance stage of change. This finding showed that motivational talks and a respondent-determined intervention were effective in terms of stage transitions.

Significant changes in stages of change did not result in concomitant changes in physical activity levels. These findings may reflect limitations in the sensitivity of the instrument used for measuring physical activity levels. Although a previous study carried out among type 2 diabetes patients showed that intervention groups adopted regular physical activity more often than the control groups and significant relationship was found between physical activity level and stage transition in the intervention group,[20] these findings do not support the presence of a significant relationship between the two groups as well as between stages and physical activity level. Perhaps the duration of the intervention was too short to observe the difference, as other factors may limit the effectiveness of a community-setting intervention.[21]

The effect of the intervention on health profiles was only significant for the mean total cholesterol level, where there was a drop of 0.53 mmol/L (9.27%), which was supported further by the drop in triglycerides of 0.22 mmol/L(11.76%). Nevertheless, there was an inverse pattern observed both in HDL-cholesterol (decrease of 0.13 mmol/L, 10%) and LDL-cholesterol (increase of 0.10 mmol/L, 3.24%). Although the literature indicates physical activity has a positive effect on reducing lipid profiles,[22] the magnitude of the exercise effect is influenced by characteristics of the exercise intervention itself, the variations within each individual, and whether the exercise itself produces concomitant reductions in body weight and fat. To achieve a maximal blood lipid-lowering effect, the training intensity must reach 40-70 percent of maximal capacity, with a minimum of 30 minutes per session, corresponding to 1200-2000 kcal per week.[22] In the intervention group, the respondents had probably only engaged in one hour of aerobic exercise per week with an average of 350 – 530 calories burned,[23] perhaps contributing to the inconclusiveness of the results. A longer period of training may have yielded a better result.

This study is based on self-reported stages of change and physical activity levels; therefore, there could have been recall as well as response bias. However, self-reported questionnaires remained the choice of this study because they are less time consuming, simple and less likely to influence behavior. The findings of this study are also limited by the non-randomized design and short intervention period. In addition, the eating patterns of the respondents were not evaluated, making it difficult to attribute the outcomes solely to the intervention. Nevertheless, it was based on community-based approach that encompassed the influences of social and environmental factors. Future studies could overcome these limitations by using a randomized sample, a longer intervention period and evaluating pre- and post- evaluation eating patterns.

Although there was significant stage transitioning in the intervention group and the respondent-determined intervention produced significant changes in behavior, a longer duration of the intervention could provide more conclusive outcomes in terms of physical activity levels and health profiles. Physical activity itself has an impact on health status provided that the respondents maintain their physical activities continuously. Future research on the effectiveness of respondent-determined interventions should consider increasing the intensity and duration of the intervention and utilizing specific physical activity instruments which can capture physical activity more accurately.

Having respondents at different stages of change in the intervention group was an advantage, as those in the higher stages could help to sustain interest in the intervention in those in the lower stages. Nevertheless, the outcomes cannot be attributed to a stage-match intervention. Future studies should also consider utilizing only respondents in the pre-contemplation

and contemplation stages for a stage-match intervention and a long post-intervention follow-up.

Conflicts of interest

The authors declare that they have no competing interests.

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How does this paper make a difference to general practice?

- It utilized a community-based intervention approach that encompassed the influences of social and environmental factors.
- It used the Transtheoretical model of change stages of change as one measure of the outcome of the intervention program.
- It was based on a respondent-determined approach to designing the intervention activities.

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