Original Article

Effects of Lifestyle Intervention towards Obesity and Blood Pressure among Housewives in Klang Valley: A Quasi-Experimental Study

Submitted: 7 Feb 2017
Accepted: 19 Sep 2017
Online: 29 Dec 2017

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To cite this article: Mohd Shaiful Azlan K, Mohd Rizal AM, Nor Safiza MN, Rashidah A. Effects of lifestyle intervention towards obesity and blood pressure among housewives in Klang Valley: a quasi-experimental study. *Malays J Med Sci.* 2017;**24(6)**:83–91. https://doi.org/10.21315/mjms2017.24.6.10

To link to this article: https://doi.org/10.21315/mjms2017.24.6.10

Abstract

***Background*: The obesity rate in Malaysia is the highest in Asia. Half its population is obese or overweight. The present study aims to determine the effects of lifestyle intervention on weight loss and blood pressure among Malaysian overweight and obese housewives in Klang Valley.**

***Methods*: A quasi-experimental study with 328 obese and overweight low socio-economic status housewives aged 18–59 years old who met the screening criteria participated in the study. They were recruited into an intervention group (N = 169) or control group (N = 159). The intervention group received a lifestyle intervention consisting of a diet, physical activity and self-monitoring behavior package. The control group (delayed intervention group) received a women's health seminar package. Both groups were followed up for six months. Weight, body mass index (BMI), and blood pressure were evaluated both pre- and post-intervention.**

***Results*: A total of 124 participants from the intervention group and 93 participants from the control group completed the study. Mean weight loss was 1.13 ± 2.70 kg (P < 0.05) in the intervention group and 0.97 ± 2.60 kg (P < 0.05) in the control group. Systolic blood pressure (SBP) reductions in the intervention group were 5.84 ± 18.10 mmHg (P < 0.05). The control group showed reduction in SBP 6.04 ± 14.52 mmHg (P < 0.05). Both group had non-significant DBP reduction. Multivariate analysis via General Linear Model Repeated Measures observed no significant differences in terms of parameter changes with time in both groups for all parameters.**

***Conclusions*: The results indicate that the lifestyle interventions in this study resulted in modest weight loss and thus decreased BMI and blood pressure (SBP) within six months of intervention.**

Keywords: *obesity, blood pressure, lifestyle intervention*

Background

Obesity is a major contributor in the emerging of cardiovascular diseases, including hypertension, cerebrovascular accident (CVA), and coronary heart disease (CHD). In Malaysia, overweight and obesity are increasing at an alarming rate (1). To date, overweight and obese Malaysians make up 48% of the total population (2). Findings from both National Health and Morbidity Survey (NHMS) 2011 and NHMS 2015 have indicated that obesity rate among women is higher than among men. In addition, mean Body Mass Index (BMI) among housewives was higher than other occupations (2, 3). Hence, overweight and obese female adults (including housewives)

are high risk groups that require specific obesity intervention or weight reduction programs.

Evidence-based medicine has shown that obesity can be prevented by lifestyle intervention (4). Weight loss has been reported to improve cardiovascular risk factors such as in lowering blood pressure (5). As obesity has become epidemic worldwide, weight loss intervention has been an increasingly popular target of research. However, there have only been a few studies on obesity performed among low socio-economic housewives. This gap must be addressed to ensure the effectiveness of current obesity intervention to these groups. In previous studies, lifestyle interventions including physical activity, diet modification and smoking cessation have dominated research interest following convincing findings (6–8). Additionally, studies have found that sedentary populations adhere better to lifestyle intervention with accumulated bouts of activity compared to structured exercises (9). Lifestyle intervention does not require special equipment or facilities such as gyms, courts, or sports clothing, thus it is more convenient and cost-effective for a community intervention.

In this study, we aimed to determine the effects of a lifestyle intervention on weight loss and blood pressure factors among Malaysian low socio-economic status overweight and obese housewives in Klang Valley. We hypothesised that effective lifestyle intervention will reduce their weight and blood pressure.

Methodology

Study Setting and Participants

This paper is part of the findings from the My Body is Fit and Fabulous at home (MyBFF@home) study. The MyBFF@home is a quasi-experimental obesity conducted among housewives in Klang Valley, Malaysia. A detailed methodology of the study has been reported by Mohamad Nor et al. (10). Housewives were defined as single/ married/ widowed female adults (aged 18–59 years old) and have been staying at home for at least 6 months prior to the recruitment. The target population for both groups was housewives living in the low-cost flats (*Projek Perumahan Rakyat*, PPR) around Klang Valley. List of flats with attached 1Malaysia Clinics (*Klinik1Malaysia*, K1M) was used to identify potential housewives for both control and intervention groups. In Klang Valley, there were 19 PPRs with K1M. Housewives selected into the intervention group (eight PPRs) were involved in an obesity intervention module which was developed in the earlier phase of the study. Housewives in the other six PPRs in the control group received a series of women's health programs.

The inclusion criteria were housewives aged 18–59 years old, overweight and obese with BMI 25.0 to 39.9 kg/m^2. The criteria excluded participants who had limitations for physical activities (physical disability and bed ridden), were currently on weight loss program, pregnant, or had history of diabetes, heart disease, renal dysfunction and severe hypertension. Screening for housewives was conducted by public health nurses and medical assistants from K1M with support from community representatives. Eligible housewives in the PPRs were invited to take part in the intervention and given the information sheet of the study. The researchers explained the study details and obtained written consent during baseline visits conducted at respective PPR community halls.

This research received ethical approval from Medical Research and Ethics Committee, Ministry of Health Malaysia on August 14, 2014 (NMRR-13-726-16391).

Intervention and Control Group Task

The researchers followed up both groups (intervention and control) for a six-month period. The intervention group received lifestyle interventions consisting of a healthy diet, physical activity, and self-monitoring behavior by trained health professionals (dietitians, nutritionists and physiotherapists). They were followed up periodically at 0 months (m), 1 m, 2 m, 3 m, and 6 m. In the diet component, participants participated in one to one diet counseling with the nutritionists or dietitians to reduce calorie intake, control food portion and apply food substitutions. Their food intake was monitored using a food diary. In physical activity component, participants were advised to engage in moderate physical activities such as brisk walking, stairs climbing, and housework up to 45 minutes per day. Physiotherapist also conducted group exercise for four sessions. To assist them in performing physical activity at home for at least 30 minutes each day, participants were equipped with two mini dumbbells (300 g each) and a pedometer to measure steps. Physical activity monitoring was performed using Metabolic Equivalent Task

(MET) Calendar and Physical Activity Diary. Level of physical activity was assessed using the International Physical Activity Questionnaire. Participants in the control group received various health promotions and awareness about women's health during the follow up sessions. Seminar and discussion on Smoking, Stress Management and Child's Immunisations, Pap Smear Screening, Breast Self-Examination (BSE), Cancer, and Pregnancy were held. These sessions were conducted in group by the nurses and Family Medicine Specialists from the state health department. They were also given food diary and physical activity as means to measure dietary intake and physical activity.

Measurements and Instruments

Socio-demographic data was collected at baseline. Health screenings prior to intervention were carried out to assess the health status of the participants. These included patient health and morbidity histories, assessments regarding risks for cardiovascular, and physical examinations including anthropometrics (height, weight and waist circumference) and blood pressure.

Body height was measured using a SECA Bodymeter in centimeters, to the nearest 0.1 cm from the participant's head to toe, in an upright standing position with five points of her body touching the wall. Body weight was measured in kilograms to the nearest 0.1 kg with a digital scale (Tanita HD319, Japan). Participant weight was measured in light clothing and no shoes. Both weight and height were measured twice, and the mean values of the measurements were computed and used in analysis. BMI was calculated by dividing the measured body weight (kg) by squared body height (m^2).

Blood pressure was measured using a fully-automated blood pressure monitor (Omron HEM 907; Omron Healthcare Europe BV, Hoofdorp, The Netherlands). Participants were asked to sit on a chair with both feet resting on the floor. Measurements were taken twice 15 minutes apart and a mean value was computed.

Data Collection and Statistical Analysis

Analysis was performed to determine the demographic characteristics of the participants, mean weight changes (both control and intervention groups), blood pressure changes, and effectiveness of the intervention based on the weight changes. Data were analysed using IBM SPSS Version 20.0. Analyses included descriptive statistics, paired-samples *t*-tests to determine changes between baseline and post-intervention within each group, and General Linear Model Repeated Measures to determine significant effects/differences between both groups. All statistical tests were considered significant at $P < 0.05$.

Results

The total number of participants at the baseline was 328. One hundred sixty-nine respondents were assigned to the intervention group and 159 participants were assigned to the control group. After six months of intervention, 45 respondents from the intervention group and 66 respondents from the control group defaulted and withdrawn (not completed six months follow up) due to various factors mostly due to pregnancy and other job commitment. Finally, a total of 217 respondents who completed the 6-month intervention with completed BP measurement only were analysed in this study (Figure 1). Table 1 shows the socio-demographic characteristics for both the intervention and control groups. In view of high dropout in both groups (intervention 26.62%, control 41.50%), attrition analysis using *t*-test was conducted to explore the baseline characteristic of the attrition group, but the results showed no significant difference between those who completed follow-up and the attrition group.

Socio-demographically, participants were predominantly Malay, with a mean age of 43 years. About half of the respondents had completed form five schooling, and had an average of four children. Although this quasi-experimental design applied a non-randomisation procedure and unmatched control, we were quite surprised to find similar baseline characteristics among participants in both the intervention and control groups in terms of socio-demographic, anthropometric, and blood pressure results (Table 2). There was a significant difference in household income between both groups ($P = 0.004$).

In terms of anthropometric figures, participants from intervention group were heavier ($P = 0.004$). Other parameters were comparable, including systolic and diastolic blood pressure.

Weight Loss

As reported, mean weight loss, (kg ± SD) were (1.13 ± 2.70) in the intervention group and (0.97 ± 2.60) in the control group. Both groups

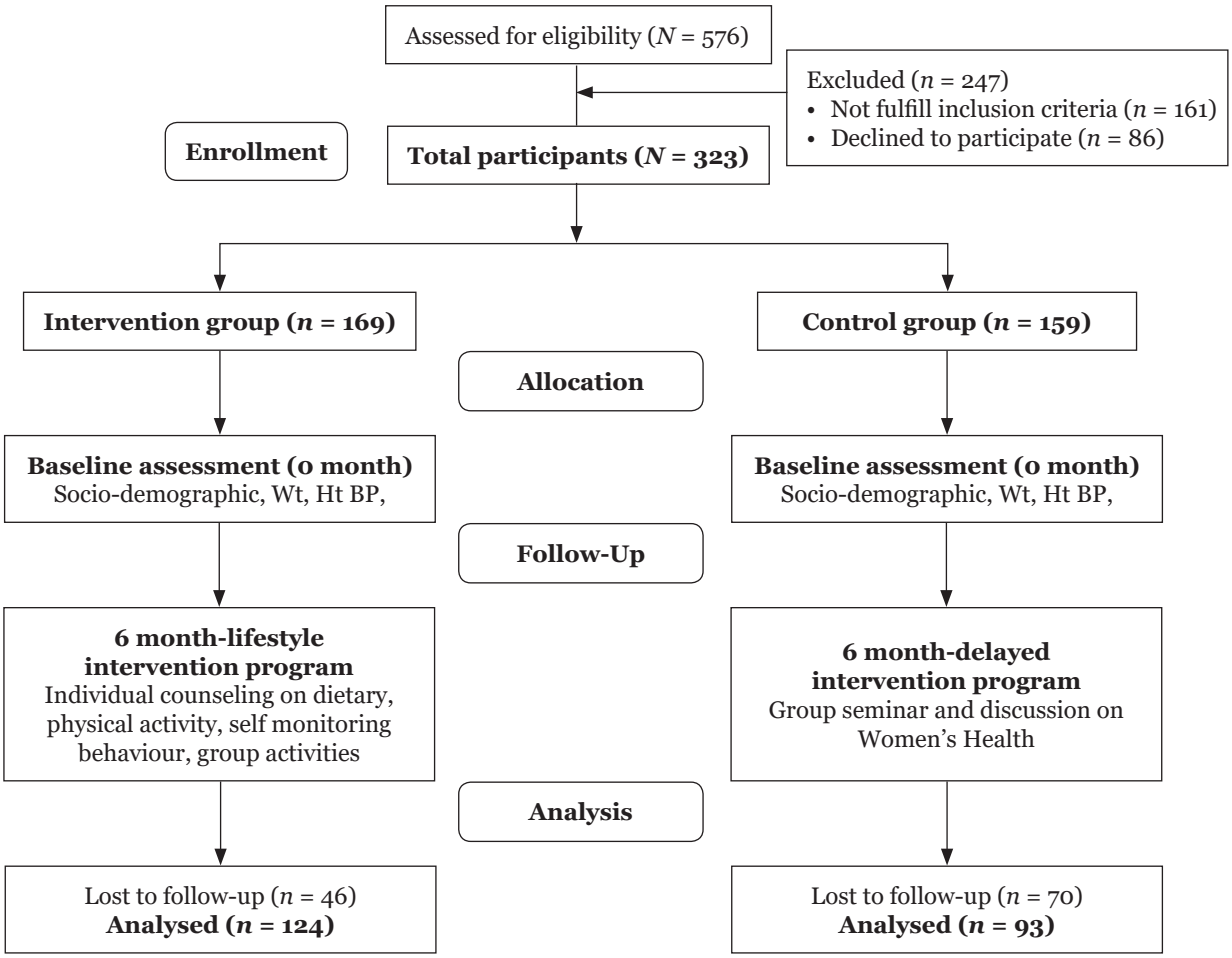


Figure 1. Study flow of the MyBFF@Home project

Table 1. Socio-demographic characteristics of participants

	Intervention group *n* = 124		Control group *n* = 93		*P*-value
	N (mean ± SD)	%	*N* (mean ± SD)	%	
Age	43.17 ± 7.85		42.94 ± 7.81		0.828[1]
Race					
Malay	111	89.1	87	93.8	0.122[2]
Non-Malay	13	10.9	6	6.2	
Education Level					
Standard 6	18	14.3	11	9.9	0.377[2]
Form 3	35	28.6	21	23.5	
Form 5	55	45.4	47	55.6	
Form 6/Diploma	11	8.4	12	11.1	
Bachelor Degree	2	0.8	2	0	
Others	3	2.5	0	0	
Number of children	3.86 ± 1.55		3.78 ± 1.60		0.717[1]
Household Income (RM)	1881.19 ± 815.32		2232.60 ± 1271.45		**0.004[1]**

[1] Independent *t*-test
[2] Chi-square test
In bold, significant difference ($P < 0.05$)

had significant weight reduction (pre- and post-) after the 6 month follow-up (Table 3). Although the weight loss difference is statistically significant, both groups failed to achieve at least 5% reduction of body weight post intervention (3.5 kg). It is also noted that 81% of intervention group participants had achieve weight loss between 0.5–5.0 kg. This result indicates that the intervention group experienced higher weight reduction as compared to the control group (Figure 2). As mentioned earlier, the reduction margin is small and clinically may not be significant. Similar results were also demonstrated in terms of BMI. A very small reduction in BMI may not be clinically significant for both groups.

Blood Pressure

The intervention and control groups both showed significant reductions in both systolic and diastolic blood pressure (Table 3). A mean reduction of 5.84 mmHg ($P < 0.001$) on the SBP and 1.45 mmHg on the DBP ($P = 0.086$) was shown in the intervention group after completing the six-month intervention. The control group had significant reduction in SBP (6.04 mmHg, $P < 0.05$) and non-significant reduction in DBP (1.73 mmHg, $P = 0.081$) (Figure 3).

Multivariate analysis by General Linear Model (Table 4) was performed and adjusted by income, height, and baseline body weight. The findings showed that there were no significant changes in the body weight and BMI within the groups (pre versus post assessments). There was no intervention effect (time*group effect) shown in both groups.

Discussion

Generally, this study significantly showed that lifestyle intervention had certain positive impacts on obesity and blood pressure. The other hypothesis of this study that stated the intervention group would be better in terms of losing weight than the control group has not been proven in final multivariate analysis (Table 4).

Mean weight loss was statistically significant in both intervention and control after six months. Clinically, it might be arguable that

Table 2. Baseline anthropometrics and blood pressure characteristics

Characteristics	Intervention group $n = 124$ (mean ± SD)	Control group $n = 93$ (mean ± SD)	*P*-value
Height, cm	155.08 ± 5.72	152.35 ± 5.70	**0.001**[1]
Weight, kg	75.90 ± 11.29	71.38 ± 11.27	**0.004**[1]
BMI, kg/m^2	31.55 ± 4.23	30.74 ± 4.25	0.159[1]
SBP	122.29 ± 16.84	120.63 ± 14.62	0.449[1]
DBP	78.59 ± 12.03	77.83 ± 9.54	0.616[1]

[1] Independent *t*-test
In bold, significant difference ($P < 0.05$)

Table 3. Weight, BMI and blood pressure measurements before and after 6 months intervention and follow up

Parameters	Intervention group $n = 124$ (mean ± SD)			Control group $n = 93$ (mean ± SD)		
	Before	After	*P*-value	Before	After	*P*-value
Weight, kg	75.90 ± 11.29	74.77 ± 11.49	**< 0.001**[1]	71.38 ± 11.27	70.41 ± 11.19	**0.001**[1]
BMI, kg/m^2	31.55 ± 4.23	31.06 ± 4.23	**< 0.001**[1]	30.74 ± 4.25	30.31 ± 4.24	**0.001**[1]
SBP, mmHg	122.29 ± 16.84	116.45 ± 14.62	**< 0.001**[1]	120.63 ± 14.62	114.59 ± 14.86	**< 0.001**[1]
DBP, mmHg	78.59 ± 12.03	77.14 ± 11.15	**0.086**[1]	77.83 ± 9.54	76.10 ± 9.49	**0.081**[1]

[1] Paired *t*-test
In bold, significant difference ($P < 0.05$)

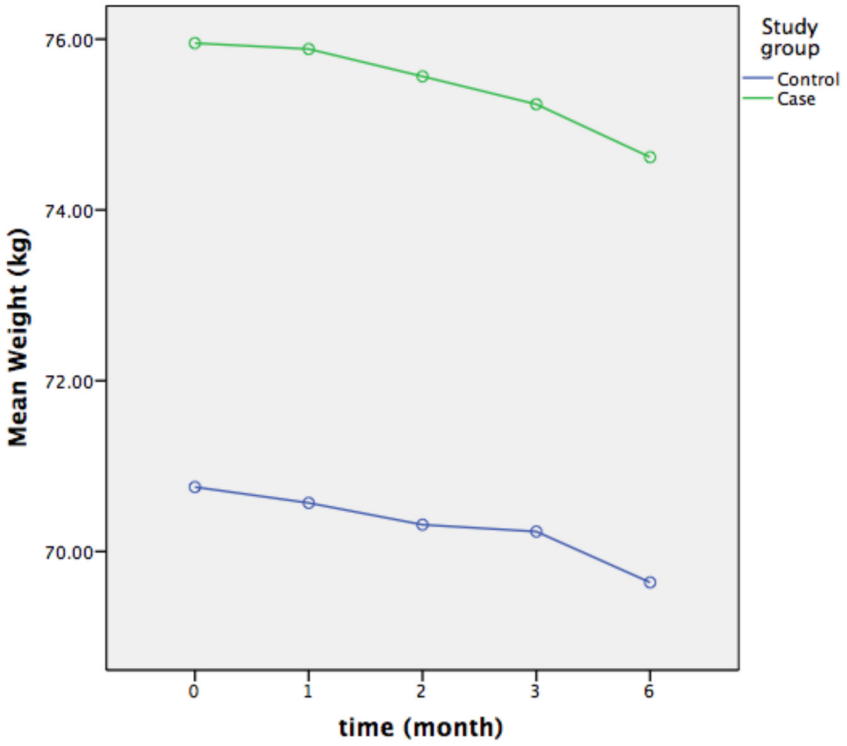
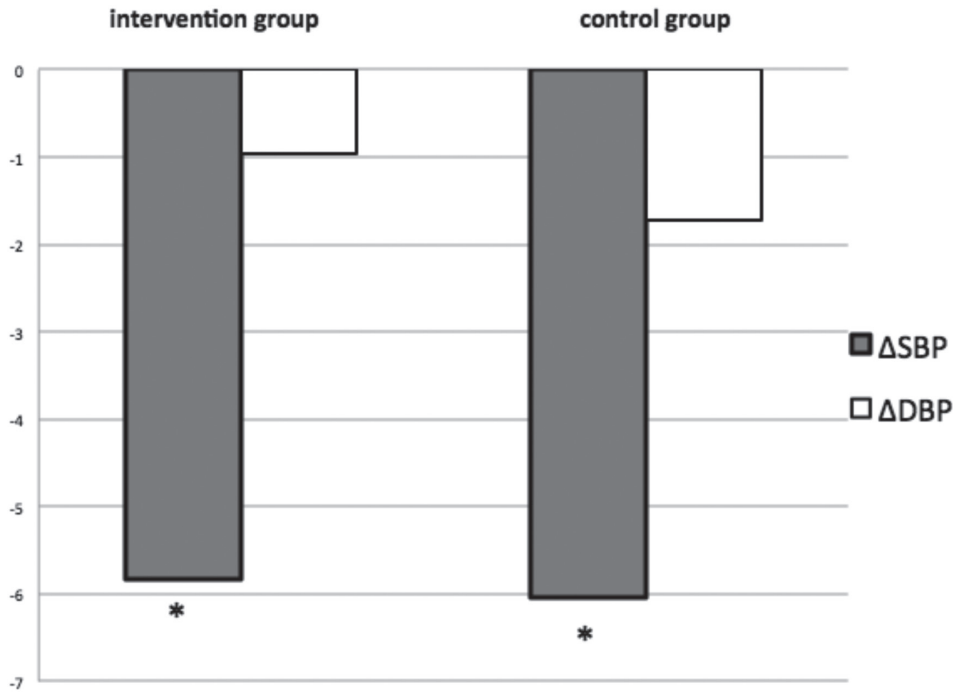


Figure 2. Relationship of weight loss trend with time of follow up at six months follow up



* $P < 0.05$ pre-post
** $P < 0.05$ between groups

Figure 3. Mean changes (SEM) of blood pressure pre-post interventions

Table 4. Changes in weight, BMI and blood pressure analysed using GLM Repeated Measures with effects size (Eta square)[1]

Parameters	Effect between group		Effect within group			
			Time		Time*group	
	P-value	n^2	*P*-value	n^2	*P*-value	n^2
Weight(kg)	0.305	0.005	0.889	< 0.001	0.154	0.010
BMI, kg/m^2	0.933	< 0.001	0.750	< 0.001	0.135	0.011
SBP, mmHg	0.608	0.001	0.414	0.003	0.947	< 0.001
DBP, mmHg	0.889	< 0.001	0.070	0.016	0.844	< 0.001

[1]Adjusted covariates: income, height and baseline weight
*Significant effect of time within group ($P < 0.05$)

as the mean weight loss was less than 5% of the baseline body weight (3.5 kg targeted weight loss), there were also no significant differences in weight change between the intervention and control group. Although the intervention failed to achieve the targeted mean weight reduction, the minimal reductions of weight by the participants were accompanied by a robust reduction in blood pressure for the intervention group. This is quite a surprising result.

The improvement in blood pressure usually follows weight reduction. For example, Neter et al. (2003) concluded that one-kilogram loss of body weight was associated with an approximate one mmHg dropped in the systolic blood pressure (11). Another study by Trials of Hypertension Phase 1 (TOHP1) using a similar method reported that a two-kilogram weight loss over a six-month period resulted in a decline of 3.7 mmHg in systolic blood pressure (12). Surprisingly, our result showed that for one kilogram of weight loss, 5 mmHg reduction of SBP. This higher level of improvement need to be explored in future studies. We can further predict that the weight reduction serves as protective effect for risk of cardiovascular diseases such as hypertension, cerebrovascular accidents (CVA) and coronary heart diseases (CHD).

A small improvement in the blood pressure risk factors may have a profound impact on the population's health. For instance, two mmHg reduction of DBP decreased the prevalence of hypertension in the United States by 17% and reduced the risk of CHD and CVA by 6% and 15%, respectively (13). Other studies also proved that cardiovascular protectiveness resulted from blood pressure reduction (14, 15). In this study, we find out that SBP in both groups significantly reduced by as much as 5.84 mmHg and 6.04 mmHg.

This study demonstrates that lifestyle intervention practice among low socio-economic obese and overweight housewives has developed positive outcomes in reducing weight and blood pressure. The control group also showed some positive improvements in terms of reduction of blood pressure. We hypothesised the findings were due to self- monitoring behavior introduced to the participants for both groups. However, these findings might be arguable due to some limitations. For instance, there were certain environmental confounders, which we were unable to control. For example, one of the main predictors for weight reduction and blood pressure reduction would be diet control (16). However, in this study this confounder was not assessed, especially in the control group. The participants in the control group may also have been previously exposed to numerous health programs from the Ministry of Health Malaysia such as the 10,000 Steps Program, Healthy Cities Program, and local community empowerment behavioral change oriented programs, which have previously introduced them to healthy lifestyle behavior. Those programs may have empowered them with knowledge and awareness on healthy lifestyle prior to this study.

Several limitations were encountered in our study. As a quasi-experimental design, lack of randomisation in sampling technique would be key to generalising the study's outcomes and results. However, randomisation was not feasible for this community intervention for various reasons, including ethics, logistics and human resources. The other limitation included confounders from environment, especially in the control group, which might have affected the weight loss among the participants in the control group. We are certainly unable to control self-motivation for weight loss among participants

in the control groups whose are aware of their involvement in the weight loss program. These factors might have motivated the control group to improve their lifestyle practice to achieve their weight loss goal. Factors such as the Hawthorne effect may have potentially introduced biases in both groups. As far as community is concerned and from a public health standpoint, this study demonstrates good outcomes in terms of weight reduction and improvements in blood pressure among participants, one of the main advantages of its quasi-experiment design. This has also been the largest and longest structured community-based obesity intervention yet involving a vulnerable group in the population.

We suggest further study to examine the effects of weight loss towards pre- hypertensive and hypertensive participants for better understanding of the relationship and temporal effects of weight reduction and blood pressure control. We also would like to suggest extended time period of follow up and monitoring to see the sustainability of this weight loss intervention to examine participant's self-efficacy and behavioral change.

Conclusion

This study shows lifestyle intervention with modest weight loss resulted in robust reduction in weight, BMI and SBP within six months of intervention among overweight or obese housewives in Klang Valley. The reduction was seen throughout the six-month period without any rebound increment. Hence, the obesity rate decreased after the study. Therefore, in order to improve current public health programs and reduce the growing burden of non-communicable diseases, the essential components of this study need to be addressed and applied in formulating future health programs.

Conflict of Interests

The authors declare that they have no conflicts of interest pertaining to this study.

Authors' Contributions

Conception and design: RA
Analysis and interpretation of the data: MSAK, MRAM, NSMN, RA
Drafting of the article: MSAK, MRAM, NSMN
Collection and assembly of data: NSMN
Final approval of the article: MSAK, MRAM, NSMN, RA

Acknowledgements

The authors would like to thank the Director General of Health, Ministry of Health for permission to publish this study. We also thank all individuals who directly or indirectly contributed to the success of this study.

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