



# Methodology of the My Body is Fit and Fabulous at Home (MyBFF@home): An Intervention Study to Combat Obesity Among Housewives in Malaysia

Noor Safiza Mohamad Nor<sup>1</sup>, Rashidah Ambak<sup>1\*</sup>, Mohd Azahadi Omar<sup>1</sup>, Suzana Shahar<sup>2</sup>, Nur Shahida Abdul Aziz<sup>1</sup>, Muhammad Fadhli Mohd Yusoff<sup>1</sup>, Fazliana Mansor<sup>3</sup>, Ahmad Taufik Jamil<sup>4</sup>, Noor Ani Ahmad<sup>1</sup> and Tahir Aris<sup>1</sup>

## Abstract

**Introduction:** The National Health and Morbidity Survey Malaysia (NHMS 2011) finding showed that female adults (including housewives) are one of the high risk groups that require specific obesity intervention. This paper describes the development and methodology of the My Body is Fit and Fabulous at home (MyBFF@home), an intervention study to combat obesity among housewives.

**Methods:** The MyBFF@home was conducted in 2 phases and involved mixed quantitative and qualitative methods. Phase I (development of the intervention package) included scoping review, construction and development of initial package, in-depth interviews and, consultations with experts and stakeholders. Phase II (intervention) was a quasi-experimental study which involved pre-post intervention (6 months of weight loss intervention and 6 months of weight sustainability) among 18-59 year old housewives in Klang Valley, Malaysia.

**Results:** Four components were identified for the Intervention Group: individual diet and physical activity (PA) counselling, self-monitoring tools (food diary and PA diary), group exercise (brisk walking and pillow dumbbell) and a reduced calorie diet. Weight loss was targeted at 5% from the initial weight, and implemented for 6 months of intervention, and another 6 months of weight sustainability. Monitoring of anthropometric, cardiometabolic parameters, body composition, dietary intake, PA, body pain, quality of life, symptoms related to weight loss and health literacy were included. The Control Group was involved in series of women's seminar and the self-monitoring tools. A total of 328 housewives were recruited from 14 low cost flats.

**Conclusion:** MyBFF@home weight loss intervention for housewives was developed in a systematic manner. The methodology utilised local and international guidelines on the obesity management and it provides evidence on the community-based weight loss intervention among adult females in Malaysia. The package can

be modified and adapted to the current weight loss programme to combat obesity among the Malaysian population.

## Keywords

Methodology; MyBFF@home; Overweight; Obesity; Intervention; Housewives; Malaysia

## Introduction

The prevalence of obesity in Malaysia has reached an upward trend [1-3]. In 1996, the Second National Health and Morbidity Survey (NHMS,1996) revealed the national prevalence of overweight and obesity as 16.6% and 4.4% respectively, and the mean body mass index (BMI) of the Malaysian adults at that time was 22.48 kg/m [2]. In the third NHMS (2006), the national prevalence of overweight among the Malaysian adult was 29.1% and obesity was 14.0%, respectively [2]. This figure has shown that in less than 20 years, the proportion of overweight adults has doubled whilst the obese proportion has tripled. In the NHMS 2011, the prevalence of obesity among female has doubled (29.6%), and this prevalence was also found to be higher than men (25.0%) [3]. Findings from both NHMS 2006 and NHMS 2011 have indicated that obesity among women was found to be higher than man. In addition, the mean Body Mass Index (BMI) among housewives was also higher than other job categories (Mean BMI: 26.6 kg/m<sup>2</sup>) [3]. These findings have revealed that overweight and obese female adults (including housewives) are also one of the high risk groups that require specific obesity intervention or weight reduction programme.

Obesity is a major public health threat worldwide and is a known risk factor for a number of chronic diseases such as cardiovascular diseases, hypertension, Type 2 Diabetes, dyslipidaemia and cancer [4,5]. Another health consequence of obesity is knee osteoarthritis (OA) and knee pain [6-8]. Weight loss of 5% to 15% of excess total body weight reduces the risk factors for some diseases related to obesity including OA and knee pain [9]. There is large evidence that shows weight reduction programme which incorporated dietary, physical activity (PA) and behavioural intervention was successful in reducing body weight and percentage of body fat, improving glycaemic control and dyslipidaemia in obese patients [5,10,11]. Besides changes of weight and other blood parameters, weight reduction programme often report of life satisfaction, positive feelings, new learned abilities such as being physically active and self-weight monitoring. In addition, Kolotkin et al. also reported significant associations between health-related quality of life and weight loss among overweight and obese adults [12].

In 2012, Malaysia has taken a step further to combat obesity among the Malaysian population through a collaborative research effort with the Sackler Institute for Nutrition Science, the Academy Science of New York. Under this research framework, 'My Body is Fit and Fabulous' project (My BFF) was initiated to combat obesity among school children, working adults and housewives in Malaysia. Under this umbrella, the MyBFF@home was initiated in order to combat obesity among housewives. The aims of the MyBFF@home were to develop an intervention package for weight reduction

\*Corresponding author: Rashidah Ambak, Centre for Nutrition Epidemiology Research, Institute for Public Health, Ministry of Health Malaysia, Jalan Bangsar, 50590 Kuala Lumpur, Malaysia, Tel : +603-22979400; Fax: +603-22823114; E-mail: rashidaha@moh.gov.my; rashidah662009@gmail.com

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specifically for overweight and obese housewives, and to evaluate the effectiveness of this intervention among housewives in Klang Valley, Malaysia. The outcomes of the MyBFF@home will present a set of intervention options to support the policymakers in order to enhance the current intervention programme to reduce obesity among female population in Malaysia. This paper describes the methodology of the MyBFF@home study.

## Methodology

### Study design

MyBFF@home was a 12-month community-based obesity intervention study among housewives, which involved mixed qualitative and quantitative methods. The 2 phases of the study were Phase I (development of the intervention package), which was conducted in 2013, while Phase II (weight loss intervention) was conducted in 2014 (Figure 1). 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. They could be involved with part time jobs at home with no fixed income. The MyBFF@home study was approved by the Medical Research Ethics Committee (MREC), Ministry of Health, Malaysia (NMRR-13-726-16391). This project was funded by the Ministry of Health, Malaysia.

### Study aims

Phase I aimed to develop a weight reduction intervention package for housewives, focusing on lifestyle intervention with self-monitoring tools. Phase II evaluated the effectiveness of the 6 months intervention in reducing body weight and another 6 months of weight maintenance.

**Phase I: Development of the intervention package:** In Phase I activities included scoping review (to identify diet, PA and self-monitoring tool items for the package), consultation with stakeholders, construction and development of initial package, in-depth interviews to identify the perspectives among housewives on obesity problems and weight management, pre-testing of the questionnaires and review of the weight loss package. During the development work of the intervention package, the researchers applied the 'Rational Decision Making Model' and the 'Emotional Based Decision Making Model' in the decision-making process of the development of the intervention package for weight reduction [13]. According to Schoenfeld [14], the iterative activity in the decision making process could have significant effects on the development of the intervention package of the present study.

In Phase I, the counselling protocol for diet and PA was also developed and used by the researchers. The present study used the Transtheoretical Model (TTM) as the guiding framework both in the diet and exercise counselling to motivate the housewives and to promote positive attitudes in the weight reduction [13]. Counselling was conducted by qualified health professionals (i.e. dietitians and nutritionists). They were trained to provide one-to-one weight loss counselling using a standard protocol.

Characteristics of the package developed were intervention period of 6 months to achieve weight loss of 5% of the initial weight and followed by a sustainability period of 6 months. Calorie reduction of a minimum of 500 kcal/day was targeted through diet and PA [4,5] and approximately 45 to 60 minutes per day of moderate PA (target PA level >1.70). [5,14,15]

**Phase II: Weight loss intervention among housewives:** The design of Phase II of the MyBFF@home was a quasi-experimental, which involved a pre and post intervention (unmatched control and intervention group) at the community setting. Therefore, the intervention did not involve any randomisation procedure.

### Target population

The target population was housewives living in the low cost flats around Klang Valley (Kuala Lumpur), Malaysia. The inclusion and exclusion criteria are shown in Table 1.

The main list of flats with health clinics (1Malaysia Clinics) in Klang Valley was used to identify potential list of housewives for both the control and intervention group. There were 14 low cost flats attached with 1Malaysia clinics in Klang Valley area. Housewives in six flats in the northern area were allocated as control groups, while another 8 flats in the southern as the intervention groups.

**Screening and recruitment of participants:** Screening for housewives was conducted by the public health staffs from the 1Malaysia Clinics with the support from the community representatives at different flat areas. Recruitment and screening were done in 2 batches (January to March 2014 and April to June 2014). Eligible housewives in the area were invited to take part in the study and were given information sheet of the study. The researchers then arranged appointments with the housewives to explain the study and their written consents were taken prior to the baseline assessments. Respondents who were pregnant or diagnosed with chronic illnesses were withdrawn from the study and referred to the Family Medicine Specialist at the nearest clinics.

### Sample size

The sample size calculation follows the rules required for the comparison of two groups [16]. Mean body weight of obese female adults from the NHMS 2011 was used to calculate the minimum sample size for the intervention study. The sample size was estimated using the level of significance ( $\alpha = 0.05$ ) and power of study ( $1 - \beta = 0.80$ ), maximum suggested difference (delta) of 5% weight loss that may be achieved under this intervention (3.5 kg) [11,12] and the corresponding differences between groups ( $SD = 10.0$  kg) [3]. The minimum sample size required for the study was 129 participants. By taking into consideration of 50% attrition, the required sample size for each arm was 200 housewives.

### Conduct of the intervention and data collection

The intervention was conducted for 12 months (6 months for the weight loss intervention period and 6 months for the weight sustainability), as shown in the study flow chart (Figure 1).

In this intervention phase, control group was also defined as 'delayed intervention group'. Participants received various women-related programs during the follow-up sessions (0 month (m), 1m, 2m, 3m, 6m, 9m and 12m). These included seminars on relaxation exercise, grooming, social problems and parenting skills, cancer and papsmear screening, breast self-examination (BSE) and stress management. The sessions were conducted in groups by the Nurses, Counsellor, Health Education Officer and the Family Medicine Specialists from the State Health Department. After the study, participants were given option to join the weight loss intervention programme similar as the intervention group. Housewives in the intervention group received specific intervention package for weight reduction based on the outcomes of Phase I of the study. Participants

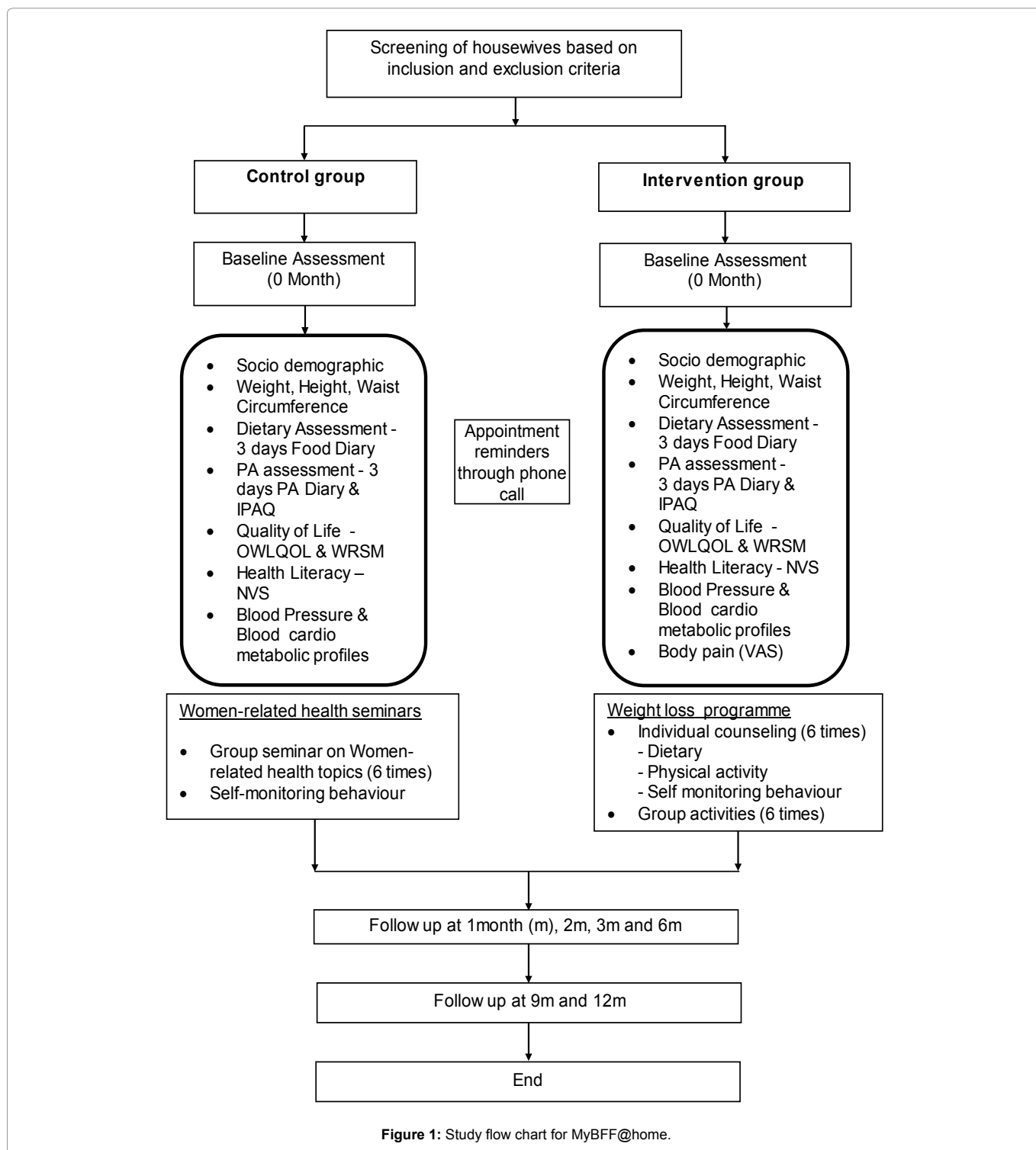


Figure 1: Study flow chart for MyBFF@home.

received individual counselling during the baseline and follow up sessions by trained health professionals (dietitians and nutritionists).

### Assessment and follow up

Socio-demographic data was collected during baseline assessment. Prior to the intervention, the Kuala Lumpur State Health Department’s team performed health screenings to confirm

the housewives’ health status. Measurement of height, weight, waist circumference, body composition, blood pressure, body pain, fasting blood test for lipids, glucose and other cardio metabolic profiles were conducted during follow-up sessions (Table 2). Information on PA / exercise, dietary intake, psychological (quality of life) and health literacy were assessed using questionnaires. Body pain was assessed using Visual Analogue Scale (VAS). Fasting blood samples of 12ml

**Table 1:** Inclusion and exclusion criteria of participants.

Inclusion	Exclusion
1. Female adult aged 18 to 59 years old	1. Participants who were morbidly obese (BMI > 40.0)
2. Not working (housewives)	2. Pregnant
3. Participants who had normal or mild hypertension (<145 mmHg systolic, < 90 mmHg diastolic)	3. Participants who had diabetes, heart disease and renal dysfunction (confirmation with self-report)
4. Overweight and obese with BMI 25.0 to 39.9 kg/m <sup>2</sup>	4. Participants who had moderate or severe hypertension and requires medication
5. Able to speak Malay language and/or English	5. Participants who had limitation for PA e.g. physical disability, bed ridden
	6. Participants who were currently on weight management programme / regime

were taken 3 times (baseline, 6 months and 12 months) from each participant during their follow-up visits. Follow-up dates were stated on the appointment cards and the respondents were reminded via phone calls.

### Questionnaires

Two self-reported questionnaires and one interviewer-based questionnaire were used before, during and after the intervention. All questionnaires were pre-tested in Phase I in order to evaluate the component of the reliability (internal consistency) and validity (content and face validity).

#### i) Obesity and weight-loss quality of life (OWLQOL) and weight related symptoms measure (WRSM)-the Malaysian-Malay version version

This validated questionnaire evaluate feeling of participants about obesity and their effort to lose weight, and symptoms related to obesity and the treatment [17]. The OWLQOL contained 17 items and responses indicated on a seven-point scale that ranged from 0 ('not at all') to 6 ('a very great deal'). Scores were transformed to a 0 to 100 scale, with higher scores indicated a higher obesity-specific quality of life. The WRSM measured 20 symptoms related to their presence and severity of bothersomeness increased from 0 ('not at all') to 6 ('severe'). Both questionnaires were introduced to the respondents at baseline (pre-intervention), at 6-month follow-up (post-intervention) and 12-month (post weight maintenance phase).. The administration of the OWLQOL and WRSM was about 10-15 minutes. Reliability of the questionnaires was 0.953 for OWLQOL and 0.810 for WRSM [18].

#### ii) Short international physical activity questionnaires (IPAQ)-Malay

The short version of the IPAQ-Malay was used to measure the PA using 4 generic items [19]. The IPAQ-Malay was validated by Chu and Moy (2011) [20] in Malaysia and it was a self-administered instrument that measured daily situations for individuals such as transportation, PA at work, household/gardening tasks and leisure time including exercise and sports participation. Respondents were required to fill in the IPAQ at baseline (pre-intervention), at 6<sup>th</sup> month and 12<sup>th</sup> month (post-intervention). The administration was between 5-10 minutes.

#### iii) Newest vital sign (nvs)-Malay version

NVS was a validated screening tool that assessed basic literacy, numeracy skills and identifies persons at risk for low health literacy [21-24]. The NVS-Malay version was translated to Malay language, pre-tested and validated in this study [25]. Respondents were tested on a nutrition label from an ice-cream container. They were interviewed on 6 questions including how they would interpret and act on the information in the label. Respondents scored one point for each correct answer and recorded

on a score sheet. A score of 0 to 1 indicated a high likelihood that the respondent had limited literacy, score of 2 to 3 indicated a possibility of limited literacy and score of 4 to 6 indicated adequate health literacy. The administration of the NVS was 10-15 minutes and respondents were assessed at baseline and at 6<sup>th</sup> month.

### Measurements and Instruments

#### i) Body weight, height and BMI

Body weight was measured in kg, to the nearest 0.1 kg with a digital scale (Tanita HD319, Japan), with participants in light clothing and no shoes. Body height was measured with a SECA Bodymeter in centimetre (cm), to the nearest 0.1 cm from the subject's head to toe in an upright standing position with five points of his body touching the wall. Both weight and height were measured twice, and mean value of the measurements were used in analysis. BMI was calculated by dividing the measured body weight (kg) by the squared of body height (m<sup>2</sup>). BMI categories were referred to WHO 1998 classification and assessed at all follow-ups (Table 2).

#### ii) Waist and hip circumference

Waist and hip circumference (in cm) was measured twice using a SECA measuring tape (SECA, Germany) with a range of 0-200 cm. Circumferences were measured twice and a mean value of the two measurements were computed and analyzed.

#### iii) Body composition

Waist-to-hip ratio was considered to be adequate for the evaluation of abdominal obesity however the value of visceral fat and percentage of body fat appear to be more predictive of some of the adverse health consequences of obesity such as hyperinsulinemia, hypertension, and hypercholesterolemia [26]. Bioelectrical impedance analyzer (In-body 720) was used to measure body composition particularly fat mass, body fat percentage, visceral fat and muscle mass. In-body 720 provides accurate estimation and has been validated in many studies as a valid tool to measure body composition among healthy, overweight and obese adult [27]. Assessments were done at baseline, 6<sup>th</sup> and 12<sup>th</sup> month.

#### Blood cardiometabolic profiles

Cardiometabolic profiles assessed were blood glucose, HbA1c, lipid profile (cholesterol, LDL-cholesterol, HDL-cholesterol, Triglycerides), insulin level, obesity-related hormones (adiponectin, leptin, ghrelin), liver enzymes (ALT, AST, GGT), and proteins (hsCRP, OGT proteins, TNF-alpha, IL-6). Fasting venous blood (12 mls) were collected into vacuum tubes containing ethylene diamine tetraacetic acid (EDTA). Plasma were collected and stored at -80°C until future detection. HbA1C test was performed with whole blood specimen and other tests were performed collectively with stored plasma using biochemistry analyser and ELISA technique. Assessments were done at baseline, 6<sup>th</sup> and 12<sup>th</sup> month.

**Table 2:** Assessment schedule for housewives.

Assessment	Month						
	Baseline 0m	1m	2m	3m	6m	9m	12m
Weight (kg)	√	√	√	√	√	√	√
Height (cm)	√	-	-	-	-	-	-
Waist and hip circumference (cm)	√	√	√	√	√	√	√
Dietary intake (3 days Food Diary)	√	√	√	√	√	√	√
Exercise and PA (MET weekly calendar/ 3 days PA diary)	√	√	√	√	√	√	√
Body pain level - Visual Analog Scale (VAS)	√	√	√	√	√	√	√
Blood pressure (mmHg)	√	-	-	-	√	-	√
OWLQOL and WRSM	√	-	-	-	√	-	√
Newest Vital Sign (NVS)	√	-	-	-	√	-	-
IPAQ (MET/minute)	√	-	-	-	√	-	√
Cardiometabolic parameters	√	-	-	-	√	-	√
Body composition	√	-	-	-	√	-	√

**Table 3:** Socio-demographic characteristics of the control group (n=159) and intervention (n=169) of the MyBFF@home study.

Characteristic	Control group (n=159)	Intervention group (n=169)	p-value	X <sup>2</sup>
<b>Age, mean ± SD (years)</b>	41.66 (8.65)	42.41 (8.59)	0.433	-
<b>Age group (years), n (%)</b>				
18 -29	14 (8.8)	14 (8.3)	-	0.978
30-39	48 (30.2)	48 (28.4)	-	-
40-49	66 (41.5)	72 (42.6)	-	-
50-59	31 (19.5)	35 (20.7)	-	-
<b>Ethnicity, n (%)</b>				
Malay	144 (90.5)	140 (82.8)	-	-
Chinese	8 (5.1)	5 (3.0)	-	-
Indian	7 (4.4)	21 (12.4)	-	-
Others	-	3 (1.8)	-	-
<b>Education level, n (%)</b>				
Primary	20 (12.7)	29 (17.3)	-	0.255
Secondary / Tertiary	137 (87.3)	139 (82.7)	-	-
<b>Marital Status, n (%)</b>				
Single	3 (1.9)	3(1.8)	-	-
Married	144 (91.1)	150 (90.9)	-	-
Widow/ Divorcee	11 (7.0)	12 (7.3)	-	-
<b>Gross Household income (RM) mean ± (SD)</b>	2056.24 (1124.54)	1814.73 (843.24)	0.030	-
<b>Gross Household income (RM), n (%)</b>	155 (97.5)	166 (98.2)	-	0.054
≤ 1500	58 (37.4)	80 (48.2)	-	-
1500 - 2500	60 (38.7)	54 (32.5)	-	-
2501 - 3500	25 (16.1)	28 (16.9)	-	-
>3501	12 (7.7)	4 (2.4)	-	-
<b>Number of children, n (%)</b>	156 (98.1)	168 (99.4)	-	0.594
0 - 2	36 (23.1)	38 (22.6)	-	-
3 - 4	83 (53.2)	82 (48.8)	-	-
≥ 5	37 (23.7)	48 (28.6)	-	-

### Blood pressure

Blood pressure was measured with a fully automated blood pressure monitor (Omron HEM 907; The Netherlands). Measurements were taken on the right arm twice with 15 minutes apart and the mean value was computed. Assessments were done at baseline, 6<sup>th</sup> and 12<sup>th</sup> month.

### Body pain

Body pain was assessed using Visual Analogue Scale (VAS), which measures the intensity of pain and changes at different parts of body pain. VAS is often used in clinical settings and epidemiologic

research [28]. As such an assessment is clearly highly subjective; the scales are of most value when looking at change of different parts of body pain. The pain assessment was done at all follow-ups.

### Dietary intake

The assessment of dietary intake was done at baseline and all follow-ups using a 3-day food diary. Detail information during the weekdays (2 days) and one weekend were types of food and drink, quantity consumed (based on household measures or actual weights from labels or packets) and dietary pattern (eating out, fast food consumption and night eating). Any foods likely be eaten

**Table 4:** Attemption and ways to lose weight, anthropometric, body composition, blood pressure, body pain, quality of life and obesity bothersomeness of the control (n=159) and intervention group (n=169).

Characteristic	Control group	Intervention group	p-value
<b>Attempted to lose weight (YES), n (%)</b>	120 (75.5)	134 (79.3)	0.408
<b>Ways to lose weight, n (%)</b>			
Medication	28 (24.3)	32 (27.1)	0.629
Fasting	46 (40.4)	38 (34.2)	0.343
Exercise	65 (56.5)	84 (68.3)	0.061
Others	46 (39.7)	62 (53.0)	0.041
All above	9 (8.0)	9 (8.1)	0.968
<b>Anthropometry</b>			
Weight (kg)	72.83 (10.93)	75.58 (11.30)	0.026
Height (m)	153.57 (5.74)	154.98 (5.45)	0.024
BMI (kg/m <sup>2</sup> )	30.87 (4.12)	31.44 (4.11)	0.212
Waist circumference (cm)	92.97 (9.51)	94.62 (9.60)	0.119
Hip circumference (cm)	109.50 (8.68)	111.16 (8.98)	0.112
<b>Body composition</b>			
Fat mass (kg)	33.10 (7.67)	34.65 (8.09)	0.102
Muscle mass (kg)	21.69 (2.84)	22.39 (2.81)	0.041
Visceral fat	121.74 (23.42)	127.36 (24.52)	0.059
Body fat (%)	44.77 (4.77)	45.03 (4.91)	0.656
<b>Blood pressure, mmHg</b>			
Systolic	120.67 (16.57)	120.89 (16.60)	0.906
Diastolic	78.03 (10.82)	77.58 (11.42)	0.659
<b>Body pain site</b>			
Back	0.00 (2)	0.00 (1)	0.384
Hand joint	0.00 (0)	0.00 (1)	0.215
Leg joint	0.00 (3)	0.00 (0)	0.232
Multiple joints	0.00 (5)	1.50 (5)	0.040
<b>Quality of life – Mean Score</b>	56.8 (24.6)	58.7 (26.6)	0.513
<b>Obesity bothersomeness – Mean Score</b>	22.3 (16.9)	18.2 (19.4)	0.048

**Note:** Number of housewives may differ for each variable; Independent t-test applied for continuous variables and presented as mean ± sd

in combination and specific recipes were also sought. Energy and nutrient intakes were analysed using Nutri Pro version 2.4.

### Physical activity and exercise

Housewives were asked to self-monitor their PA and exercise activities using a 3-day PA diary during the weekdays (2 days) and one weekend. Those in the intervention group were given the OMRON pedometer (Model HJ321) with 7-day memory to monitor their daily steps and 2 pillow dumbbells (weighed 300g each) as part of the exercise regime. The pillow dumbbells exercise (made from cloth and filled with brown rice with 12 exercise steps) was adapted from Japan [29]. The PA diary also contained list of housework chores (moderate to vigorous) and leisure activities based on the Metabolic Equivalence for Compendium List (MET) 2011 [30].

### Data analysis

Data analysis used various analyses to report the demographic characteristics of housewives, and the primary and secondary outcomes of the study. The primary outcomes included mean weight loss and all clinical parameters, changes of weight and BMI, changes in the body composition and cardiometabolic parameters (before, during and after intervention). The secondary outcomes included the effectiveness of the intervention to reduce weight and clinical parameters, mean energy

intake, energy expenditure, dietary pattern, exercise and PA pattern, association of weight loss and quality of life, symptoms related to obesity, level of body pain and health literacy level. Analyses conducted in this paper included descriptive statistics, independent t-test and chi-square test. All data were analysed using STATA and SPSS (version 19) software. Significant difference was set at  $p < 0.05$ .

### Results

Phase I developed the intervention package of the MyBFF@home, which consisted of a multi-component tailored intervention and was conducted for 12 months (weight loss intervention: 6 months, weight loss sustainability: 6 months). This included PA/exercise, individual diet counselling, dietary modification and self-monitoring tools. The final intervention package was developed in 2 languages (Malay and English languages). The target was 5% weight loss based on the initial weight of the housewives. In Phase II, a total of 328 housewives (intervention: 169, control: 159) were recruited during the baseline and the socio-demographic characteristics of the housewives in control and intervention group are shown in Table 2.

Majority of respondents were Malay, secondary education attainers and married (Table 3). Assessment of the readiness to lose weight among the housewives in both groups was high (77.0%, n=254) and various attempts have been made by the housewives to reduce their weight prior to their involvement in this study, including fasting, exercise, slimming pills and herbs and diet control (Table 4). There were no differences between the control and intervention group in terms of their baseline mean age (Table 3), BMI, waist circumference, blood pressure, fat mass, visceral fat, body fat percentage, pain site (back, hand and leg) and quality of life. Baseline analyses found that mean score of health literacy was low (mean score of 1.2).

### Discussion

The intervention package was developed based on the current evidence on weight loss management and it was refined based on the outcomes from the in-depth interviews among the housewives in Malaysia. The items included diet counselling, standard PA regime, dietary modification and self-monitoring tools. The package was also developed in line with past studies which highlighted the importance of the mixed approaches (diet and PA) to reduce weight [31]. The items for the weight loss package in the MyBFF@home were also considered modest in order to cater the specific needs of the housewives who lived in the low cost flat areas. Brisk walking was the preferable method of PA among the housewives compared to other types of exercise. Another unique characteristic of the package was that self-monitoring for diet and PA (Food diary and PA diary) were introduced and emphasised among the housewives (both in the control and intervention group) to empower the housewives to monitor their daily food intake and activity patterns. According to Burke, self-monitoring tools such as diet and PA diaries helped overweight and obese individuals to reduce weight more effectively [32]. Weight reduction may occur due to participants' awareness of being involved in an experimental trial; or due to the delivery of more intensive 'usual care' than would be encountered beyond the research context [10]. It is possible that control group improvements may also occur in behavioural weight loss intervention trials. Hence control group improvements have the potential to reduce or even nullify intervention effects through reducing statistical power to detect significant effects.

To our knowledge, this is the first and the largest community-based weight loss intervention study targeted for housewives in Malaysia. The final outcomes of the MyBFF@home will present a set of intervention options to support policy makers in enhancing the current intervention programme to reduce obesity among the adult population in Malaysia. Thus, this methodology could be adapted to other weight loss intervention programme for other sub-populations in Malaysia. The package can be also modified and adapted to the current weight management programme to combat obesity among the Malaysian population.

There are several challenges and limitations in this study. Adherence to the self-monitoring tools and contributing factors to self-monitoring behaviours are still not known and further analyses are required to examine these aspects. One of the challenges was that the health literacy level among the housewives was also low. Hence, the use of food and PA diary are not suitable for housewives who were not able to write and read. Similar to other intervention studies, the number of response rate and withdrawal is a big concern. Preliminary analysis showed a response of between 30% to 50%, in similar as reported by other intervention studies. Majority of the housewives were Malays, and due to limitations in communicating in Malay and English language, there were not many Chinese and Indians who joined this study. Hence, further intervention among other ethnic group is required to assess the effectiveness of the MyBFF@home package.

In conclusion, the MYBFF@home weight loss intervention for overweight and obese housewives was developed in a systematic manner. The methodology of the MyBFF@home utilised local and international guidelines on the obesity management and it provides an evidence on the community based weight loss intervention among adult females in Malaysia.

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#### Conflict of interest

The authors declare that they have no conflict of interests.

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### Author Affiliations

[Top](#)

<sup>1</sup>Institute for Public Health, Ministry of Health Malaysia

<sup>2</sup>Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia

<sup>3</sup>Institute for Medical Research, Ministry of Health Malaysia

<sup>4</sup>Universiti Kebangsaan Malaysia Medical Centre, Kuala Lumpur, Malaysia

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