

THE EFFECT OF 8 WEEKS OF GROUP BASED STEP AEROBIC EXERCISE  
(GBSAE) VERSUS INDIVIDUAL BASED STEP AEROBIC EXERCISE (IBSAE)  
ON WEIGHT MANAGEMENT IN OBESE YOUNG WOMEN

By

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## **ABSTRAK**

### **KESAN 8 MINGGU SENAMAN EROBIK LANGKAH BERASASKAN KUMPULAN (GBSAE) BERBANDING SENAMAN EROBIK LANGKAH BERASASKAN INDIVIDU (IBSAE) KE ATAS PENGURUSAN BERAT BADAN DALAM KALANGAN WANITA MUDA YANG MENGALAMI OBESITI**

**PENGENALAN:** Pematuhan yang konsisten kepada preskripsi senaman adalah rendah dalam kalangan individu yang mengalami berat badan yang berlebihan atau obesiti. Hal ini disebabkan faktor kurang keyakinan diri, mood yang tidak baik dan kurang arif dengan teknik senaman. Namun begitu, pematuhan terhadap senaman boleh ditingkatkan dengan menggunakan khidmat jurulatih senaman. Namun, terdapat beberapa halangan yang mungkin dihadapi sekiranya menggunakan khidmat jurulatih senaman contohnya, ketiadaan pelatih, kurang keseronokan terhadap senaman, kekurangan masa dan masalah kewangan. Kaedah alternatif yang boleh mengatasi masalah ini adalah dengan menggunakan bantuan video senaman di rumah.

**MALAMAT:** Tujuan kajian ini dijalankan adalah untuk mengkaji kesan 8 minggu senaman erobik langkah berasaskan kumpulan (GBSAE) berbanding senaman erobik langkah berasaskan individu dan kaitannya dengan komposisi badan, kecergasan kardiovaskular dan keseronokan terhadap aktiviti fizikal. **KAEDAH:** 20 peserta wanita yang mengalami obesiti, berumur (21-26 tahun), dengan indek berat badan ( $27\text{kg/m}^2$ - $41\text{kg/m}^2$ ) ditempatkan ke dalam dua kumpulan, 10 peserta setiap kumpulan: senaman erobik langkah berasaskan kumpulan (GBSAE) dan senaman erobik langkah berasaskan individu (IBSAE). Dalam kumpulan GBSAE, senaman erobik langkah dijalankan selama 70 minit setiap sesi, tiga kali seminggu, selama 8 minggu dan diselia oleh jurulatih senaman. Manakala, kumpulan IBSAE menjalankan senaman erobik langkah yang sama menggunakan bantuan video senaman selama 70 minit setiap sesi, tiga kali seminggu, selama 8 minggu. Sebelum dan selepas 8 minggu, komposisi

badan, kecergasan kardiovaskular dan tahap keseronokan terhadap aktiviti fizikal diukur. **KEPUTUSAN:** Pada akhir minggu ke 8, terdapat penurunan yang signifikan dilaporkan diantara kumpulan dimana kumpulan GBSAE menunjukkan penurunan terhadap berat badan ( $p=0.035$ ), indeks berat badan ( $p=0.032$ ), peratusan lemak badan ( $p=0.012$ ), jisim lemak badan ( $p=0.007$ ) dan nisbah pinggang-pinggul ( $0.038$ ). Namun begitu, tiada perbezaan yang signifikan terhadap jisim bebas lemak ( $p=0.578$ ), kecergasan kardiovaskular ( $p=0.463$ ) dan keseronokan terhadap aktiviti fizikal ( $p=0.658$ ) dilaporkan diantara kumpulan selepas 8 minggu kajian intervensi. Walaupun tiada perbezaan yang signifikan dilaporkan terhadap jisim bebas lemak, kecergasan kardiovaskular dan keseronokan terhadap aktiviti fizikal, kumpulan GBSAE melaporkan perkembangan yang lebih baik terhadap pembolehubah tersebut berbanding kumpulan IBSAE. **KESIMPULAN:** Keputusan kajian semasa mencadangkan bahawa intervensi senaman berasaskan kumpulan memberikan kaedah yang lebih banyak kepada individu dalam mencapai matlamat penurunan berat badan dalam kaitannya dengan komposisi badan, kecergasan kardiovaskular dan keseronokan terhadap aktiviti fizikal.

## ABSTRACT

### THE EFFECT OF 8 WEEKS OF GROUP BASED STEP AEROBIC EXERCISE (GBSAE) VERSUS INDIVIDUAL BASED STEP AEROBIC EXERCISE (IBSAE) ON WEIGHT MANAGEMENT IN OBESE YOUNG WOMEN

**INTRODUCTION:** Consistent adherence to prescribed exercise is low for individuals who are overweight or obese due to low self-efficacy, poor mood status, and unfamiliar exercise technique. However, adherence has been shown to improve with the use of an instructor or with supervised activity. Meanwhile, there are barriers to exercising with an instructor such as instructor availability, lack of enjoyment of exercise, time constraints, and cost. An alternative to overcome some of these potential barriers is to exercise with video-guided exercise at home. **PURPOSE:** the aims of this present study is to investigate the effects of 8 weeks of group-based step aerobic exercise (GBSAE) versus individual-based step aerobic exercise (IBSAE) on weight management in obese young women in regard to body composition, cardiorespiratory fitness and exercise enjoyment. **METHODS:** Twenty subjects, obese young women (21-26 years old) with a BMI of Asian cut-off points range from ( $26 \text{ kg/m}^2$  to  $41 \text{ kg/m}^2$ ) were subsequently being assigned into two groups with  $n=10$  per group: group-based step aerobic exercise (GBSAE) and individual-based step aerobic exercise (IBSAE). In GBSAE group, step aerobic exercise was carried out for 70 minutes per session, three time per week for eight weeks and was supervised by an exercise instructor. While IBSAE group carried out a similar step aerobic exercise via pre-recorded video for 70 minutes per session, three time per week for eight weeks. Before and after 8 weeks of intervention, subject's body composition, cardiovascular fitness and physical activity enjoyment were measured. **RESULTS:** The end of 8 weeks of intervention, significant different were found between groups where GBSAE reported significant

decrease on body mass ( $p=0.035$ ), BMI ( $p=0.032$ ), fat percentage ( $p=0.012$ ), fat mass ( $p=0.007$ ) and waist-hip ratio ( $p=0.038$ ). However, no significant differences were found on fat free mass ( $p=0.578$ ), cardiovascular fitness ( $p=0.463$ ) and physical activity enjoyment ( $p=0.658$ ) between groups after 8 weeks of intervention. Despite no significant difference reported on free fat mass, cardiovascular fitness and physical activity enjoyment, GBSAE showed higher improvement on these parameters compared to IBSAE group. **CONCLUSION:** The results of present study suggest that group-based intervention elicited more beneficial effects on achieving weight loss goals with regards to body composition, waist-hip ratio, cardiovascular fitness and physical activity enjoyment.



# CHAPTER 1

## INTRODUCTION

Obesity remains a major health concern as it is a risk factors for heart disease, strokes and diabetes which increase steadily with increasing body mass index (BMI), an indicator of overweight and obesity. According to the National Health and Morbidity Survey of 2011, almost 18% of Malaysian population or more than five million people were classified as obese and 30% were overweight (Institute for Public Health, 2015). In 20 years ago, only 4.4 percent of Malaysians were considered obese but a decade later the statistic had jumped to 14 percent (Letchuman, 2010). The trend is keep increasing due to excessive calorie intake and less physical activity reported among Malaysian society.

According to Ng *et al.* (2017), the prevalence of obesity in Malaysia (11.4% in males; 16.7% in females) almost three to four times higher than in other Asian countries, such as India (3.7% in males; 4.2% in females), China (3.8% in males; 5.0% in females), Taiwan (4.3% in males; 6.4% in females) and Japan (4.5% in males; 3.3% in females). This may due to variety of food that is cheaper and high in calories as well as Malaysian's strong culture of entertaining guests with food that contributed to the obesity problem as well as low level of physical activity especially among overweight and obese group (Chan *et al.*, 2017).

Numerous reports have shown that there are many health concerns associated with being obese such as hypertension, arthritis, certain types of cancers, and premature death (Brown *et al.*, 2009; Guh *et al.*, 2009). However, these health and mortality risks can be decreased or reversed with weight loss (Waleekhachonloet *et*

*al.*, 2007). Many researches have shown that weight loss should occur when energy expenditure is higher than energy intake (Creasy *et al.*, 2017; Brown *et al.*, 2009; Donnelly *et al.*, 2004; Perri *et al.*, 2000).

Aerobic exercise is characterized by the execution of cyclic exercises that resulted in contraction of large muscle groups at low to high intensities for a long period of time (Belay *et al.*, 2013). Different types, amounts and intensities of PA are needed for different health outcomes. According to the WHO guidelines (2010), an adult aged 18 to 64 years should engaged with physical activity (PA) at least 150 minutes/week of aerobic exercise of moderate intensity, or 75 mins/week of aerobic exercise of vigorous intensity, or an equivalent combination of moderate and vigorous intensity of aerobic exercise, which is equivalent to a total PA level of at least 600 metabolic equivalent minutes per week (MET-minutes/week) or 10 MET-hours/week (WHO, 2010).

For instance, a person who engaged in regular PA of moderate intensity for a duration of 30 mins or more on most days of the week has a lower risk for cardiovascular disease, diabetes, colon cancer and breast cancer (Guh *et al.*, 2009). However, for body weight control and to prevent unhealthy weight gain in adulthood, approximately 60 mins of aerobic PA of moderate to vigorous intensity in a day, preferably all days per week may be needed (Haskell *et al.*, 2007). While, overweight/obese people require approximately 60 to 90 mins of moderate intensity each day to maintain weight loss (WHO, 2010).

Step aerobic exercise is a classic cardio workout and one of the most popular collective forms of fitness in health centers and fitness clubs (Ceylan *et al.*, 2014; Najafnia *et al.*, 2013) but in women to our knowledge, no studies have observed the

efficiency of group based versus individual based step aerobic exercise training program among obese young adult women in regards of exercise adherence and enjoyment as well as other fitness changes. Step aerobic exercise accompanied with selected motivational workout music could help individuals who is obese initiate an exercise and meet physical activity guidelines as it boosts heart rate and breathing as well as strengthen the muscles (Engels *et al.*, 2002)

Generally, consistent adherence to prescribed exercise is low for individuals who are overweight or obese (Fogelholm & Kukkonen-Harjula, 2000) due to low self-efficacy, poor mood status, and unfamiliar exercise technique (Piana *et al.*, 2013). However, adherence has been shown to improve with the use of an instructor or with supervised activity (Colley, Hills, King, & Byrne, 2010; Jeffery, Wing, Thorson, & Burton, 1998). Therefore, while some individuals are motivated to meet physical activity guidelines on their own (individual-based), others may need guidance and reinforcement from a personal trainer individually or within a small group (group-based) (Waleekhachonloet *et al.*, 2007).

However, there are barriers to exercising with an instructor such as instructor availability, lack of enjoyment of exercise, time constraints, and costs (Vickers *et al.*, 2011). An alternative to overcome some of these potential barriers is to exercise with video-guided exercise (e.g. using compact disk) at home, individually rather than with an instructor. Video-guided exercise can be similar to exercising with an instructor in that both methods provide encouragement and explanations of the different exercises throughout the workout. Further, exercising with a video-guided session offers benefits including flexibility of time, lower cost, and flexible exercise locations (Vickers *et al.*, 2011). Another benefit of using video-guided exercise is that individuals can self-select the intensity at which they wish to work.



Research has shown that exercising at home via a population-specific video to be beneficial for special populations with intellectual disabilities (Lynnes, Nichols, & Temple, 2009). Similarly, individuals who are overweight or obese report greater adherence and enjoyment when intensity is self-selected and exercise is unsupervised compared to supervised and prescribed exercise (Ekkekakis & Lind, 2006; Perri, Martin, Leermakers, Sears, & Notelovitz, 1997). Besides, a step aerobic exercise video may specifically be beneficial for individuals who are overweight or obese by not only allowing individuals to self-select exercise intensity, but it also allows individuals to rest with built-in rest periods between exercises (Irving *et al.*, 2008). Therefore, it is important to choose an exercise program that will produce clear cut results necessary for the subjects to adhere in the program that includes: an exercise program that is fun, low perceived effort and consume less time.

Thus, the aims of this present study is to investigate the effects of 8 weeks of group-based step aerobic exercise (GBSAE) versus individual-based step aerobic exercise (IBSAE) on weight management in obese young women with regard to body composition, cardiorespiratory fitness and exercise enjoyment.

## **1.1 OBJECTIVES OF THE STUDY**

To compare the effects of 8 weeks of group-based step aerobic exercise (GBSAE) versus individual-based step aerobic exercise (IBSAE) on weight management in obese young women with regard to changes in weight and body composition, exercise enjoyment, cardiovascular fitness and other possible fitness changes.

### **1.1.1 SPECIFIC OBJECTIVES**

- To compare the effects of 8 weeks of group-based step aerobic exercise (GBSAE) versus individual-based step aerobic exercise (IBSAE) on body mass in obese young women
- To compare the effects of 8 weeks of group-based step aerobic exercise (GBSAE) versus individual-based step aerobic exercise (IBSAE) on body mass index in obese young women
- To compare the effects of 8 weeks of group-based step aerobic exercise (GBSAE) versus individual-based step aerobic exercise (IBSAE) on fat percentage in obese young women
- To compare the effects of 8 weeks of group-based step aerobic exercise (GBSAE) versus individual-based step aerobic exercise (IBSAE) on fat mass in obese young women
- To compare the effects of 8 weeks of group-based step aerobic exercise (GBSAE) versus individual-based step aerobic exercise (IBSAE) on fat free mass in obese young women

- To compare the effects of 8 weeks of group-based step aerobic exercise (GBSAE) versus individual-based step aerobic exercise (IBSAE) on body circumference in obese young women
- To compare the effects of 8 weeks of group-based step aerobic exercise (GBSAE) versus individual-based step aerobic exercise (IBSAE) on cardiovascular fitness in obese young women
- To compare the effects of 8 weeks of group-based step aerobic exercise (GBSAE) versus individual-based step aerobic exercise (IBSAE) on physical activity enjoyment scale in obese young women

## **1.2 SIGNIFICANCE OF THE STUDY**

Determining the differences in mode of exercise and perceived enjoyment and exercise adherence between group-based or individual-based exercise training, step aerobic exercise will allow researchers to determine the most beneficial mode of exercise for individuals who are obese and therefore could help these individuals meet their daily physical activity recommendations. The ability to identify an effective mode of exercise lead to great potential of increasing physical activity levels which, in turn, may enhance exercise adherence, perceived enjoyment as well as could help in decreasing health and mortality risk of females who are obese.

## **1.3 HYPOTHESIS**

HO1: There is no significant difference in weight and body composition between the GBSAE and IBSAE groups in obese young women after 8-weeks of intervention.

HA1: There is a significant difference on weight and body composition between the GBSAE and IBSAE groups in obese young women after 8-weeks of intervention.

HO2: There is no significant difference in body circumference between the GBSAE and IBSAE groups in obese young women after 8-weeks of intervention.

HA2: There is a significant difference on body circumference between the GBSAE and IBSAE groups in obese young women after 8-weeks of intervention.

HO3: There is no significant difference in cardiorespiratory fitness between the GBSAE and IBSAE groups in obese young women after 8-weeks of intervention.

HA3: There is a significant difference in cardiorespiratory fitness between the GBSAE and IBSAE groups in obese young women after 8-weeks of intervention.

HO4: There is no significant difference in exercise enjoyment between the GBSAE and IBSAE groups in obese young women after 8-weeks of intervention.

HA4: There is a significant difference in exercise enjoyment between the GBSAE and IBSAE groups in obese young women after 8-weeks of intervention.

#### **1.4 OPERATIONAL DEFINITIONS**

**Group-based step aerobic exercise programme (GBSAE):** The exercise session was carried out for 70 minutes per session, 3 times per week for a duration of 8 weeks in a group at aerobic hall with the help of an aerobic instructor, (please refer to section 3.4.4 of ‘Exercise programme’ for the details of group based step aerobic exercise programme).

**Individual-based step aerobic exercise programme (IBSAE):** The exercise session was carried out individually for 70 minutes per session, 3 times per week for a duration of 8 weeks. The subjects viewed the pre-recorded video of SAE provided by the researcher. The pre-recorded video of SAE for IBSAE group consisted of similar movements, tempo and step aerobic choreography as GBSAE group and conducted by the same instructor as a guide and reference for their exercise training session at their preferable place and time.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 OBESITY

##### 2.1.1 Definitions

Overweight and obese are labels given to individuals when weight exceeds a range of what is considered healthy for a given height (World Health Organization and Organization, 2004). According to World Health Organization (WHO) (2017), overweight is defined as a body mass index (BMI) of 25 to 29.9 kg/m<sup>2</sup> while obesity is defined as a BMI of  $\geq 30$  kg/m<sup>2</sup> (WHO, 2017). Body mass index (BMI) which is calculated as weight in kilograms divided by the square of height in meters is the most widely used and is a simple measure of body size (WHO, 2017).

In recent years, there was a debate on whether there are possible needs for developing different BMI cut-off points for different ethnic groups due to the increasing evidence that the associations between BMI, percentage of body fat, and body fat distribution differ across populations (WHO, 2004). Therefore, in a previous attempts to interpret the BMI cut-offs in Asian and Pacific populations, they concluded that the proportion of Asian people with a high risk of type 2 diabetes and cardiovascular disease is substantial at BMIs lower than the existing WHO cut-off point for overweight ( $\geq 25$  kg/m<sup>2</sup>) where the cut-off point for observed risk varies from 22 kg/m<sup>2</sup> to 25 kg/m<sup>2</sup> while for high risk it varies from 26 kg/m<sup>2</sup> to 31 kg/m<sup>2</sup> in different Asian populations (International Diabetes Institute/ Western Pacific World Health Organization/ International and Force, 2000).

It is common to categorize individuals as being overweight or obese by using BMI, however, BMI does not distinguish between fat and fat-free mass, and several studies have shown that a low BMI is not associated with a low percentage of body fat in the South Asian population (Misra & Khurana, 2011). Furthermore, study by Razak *et al.* (2007) showed that South Asians have greater abdominal obesity, total abdominal fat and intra-abdominal adipose tissue for a similar value of BMI compared to white Caucasian populations. One of the popular methods to estimate body fat is by using bioelectrical impedance (Kalra *et al.*, 2013).

Simple anthropometrical measurements such as waist and hip measurement are also taken to rule out obesity and do account for variation in body fat distribution and abdominal fat mass which BMI alone does not (Kaur & Walia, 2007). These measures are independent of height and muscle mass, have emerged as important predictors of risk of obesity related diseases and thus very useful indicators of excess body fat and increased health risk (Kaur & Walia, 2007). Measurements of waist and hip circumference relatively simple and easier to calculate as well as more practical both in the clinical practice and for large scale epidemiological studies.

### **2.1.2 Obesity and women**

Women are at a distinct disadvantage when compared to men when it comes to obesity. Women generally have smaller body sizes, and, as a result, their energy expenditures have been shown to be less than that of men performing the same activities (Gleim, 1993). The lower energy output is due to the woman's smaller body mass. Women are also at a disadvantage because they tend to have less fat-free mass than men. The average daily metabolic rates (ADMR) for women will therefore be less

than that of men of the same ages and body sizes (Westerterp, 1998). The average basal metabolic rate (BMR) for men is considered to be 38 kcal/m<sup>2</sup>/h while it is only 35 kcal/m<sup>2</sup>/h for women (McArdle *et al.*, 1996).

Men have a higher BMR than women; therefore, they will in turn have a higher ADMR. Lower ADMRs in women makes the weight loss process more difficult for women than for men. Prior to puberty, men and women are physiologically similar; after puberty, the presence of either testosterone or oestrogen that leads to physiological changes. Increased testosterone leads to an increase in muscle mass whereas oestrogen leads to an increase in fat deposits. Hormonal differences caused the differences in muscle mass and BMR between men and women. Thus, exercise can increase in muscular mass and BMR by induce the secretion of testosterone in women (McArdle *et al.*, 1996).

### **2.1.3 Prevalence of obesity**

Obesity is increasing at an alarming rate due to unhealthy lifestyles and it involves the integration of social, behavioural, cultural, physiological, metabolic and genetic factors (Barnes, 2012). Obesity was once considered to only affect high-income countries, but now it has increased tremendously in developing countries, and no exception for Malaysia. Based on previous National Health and Morbidity Surveys (NHMSs) carried out in 2006, 2011 and 2015, an increasing trend of overweight and obesity prevalence was observed among Malaysian adults aged 18 years and older: 29.1% (95% CI: 28.6–29.7) and 14.5% (95% CI: 13.6–14.5) in 2006 (Institute for Public Health, 2006), 29.4% (95% CI: 28.4–30.4) and 15.1% (95% CI: 14.3–15.9) in



2011 (Institute for Public Health, 2011) , 30.0% (95% CI: 29.1–31.0) and 17.7% (95% CI: 16.9–18.5) in 2015, respectively (Institute for Public Health, 2015).

Researchers have determined this epidemic is due to various factors, including physical inactivity, unhealthy dietary habits, over consumption of large portion sizes, alcohol intake, socioeconomic conditions and genetic factors (Chan & Woo, 2010). Reduction in energy expenditure due to an increase in sedentary time in both school and daily living that associated with rapid urbanization, as well as a reduction in physical labour at job sites may also lead to an increased in obesity (Hill, Wyatt, Reed, & Peters, 2003). Regardless of the cause, the current levels of obesity within the population are concerning given the myriad of health consequences associated with being obese.

#### **2.1.4 Health consequences of being obese**

Being an obese individual poses health, social, psychological, and economical challenges (Wang, Beydoun, Liang, Caballero, & Kumanyika, 2008). It is also a condition that substantially raises their risk of morbidity from hypertension, dyslipidemia, type 2 diabetes, stroke, gallbladder disease, osteoarthritis, sleep apnea and respiratory problems, and endometrial, breast, prostate, and colon cancers as well as suffer from social stigmatization and discrimination (Institute for Public Health, 2011). Risk of premature death also increase 50% to 100% for individuals who are obese (Brown *et al.*, 2009). Although overweight and obesity rates seem to be slowing down, the current generation may still be at risk for having a shorter life span unless this epidemic can be controlled (Wang *et al.*, 2008).

Besides, an obese individual has an increased risk of having a heart attack, congestive heart failure, and sudden cardiac death, as well as being twice as likely to have high blood pressure as individuals who are not obese (Chan *et al.*, 2017). Moreover, 80% of obese individuals also have risk of developing diabetes doubles with weight gain of 5-8 kg compared to an individual that does not gain weight (National Heart Lung and Blood Institute & National Institutes of Health (NIH), 1998). Fortunately, disease risk and mortality can be decreased with weight loss for an individual who are obese by decreasing 5-15% of their body weight, particularly related to heart disease risk (Barnes, 2012). Weight loss can also reduce blood pressure, blood sugar, and improve cholesterol levels for individuals who are overweight or obese (Guh *et al.*, 2009). An effective way for individuals to decrease body weight is to meet the recommended physical activity guidelines.

## **2.2 PHYSICAL ACTIVITY GUIDELINES**

An adult needs to achieve 30 minutes of moderate intensity activity, at 40-59% of heart rate reserve, at least five or more days of the week or 20 minutes of vigorous intensity activity, at 60-89% of heart rate reserve, three or more days per week as a recommendation from American College of Sports Medicine (ACSM) (2014). While an accumulation of  $\geq 150$  minutes of moderate intensity physical activity per week or  $\geq 75$  minutes of vigorous intensity physical activity is recommended to improve health and  $> 250$  minutes of moderate-to-vigorous intensity physical activity is suggested for long term weight loss (ACSM, 2014). Thus, the recommendations for weight control or weight loss will vary from the general physical activity recommendations.

Meanwhile, those who are overweight or obese should initially exercise at a moderate intensity (40-59% of heart rate reserve) for a minimum of 30 minutes five or more days per week and progress to 60 minutes per day as recommended by ACSM (2014). It is also encouraged that this population progress to a vigorous exercise intensity ( $\geq 60\%$  of heart rate reserve) which can help further health and fitness benefits (ACSM, 2014). The accumulation of 10 minute bouts of exercise is also an effective alternative for continuous exercise such as jogging, cycling, stair climbing or aerobic dancing and could be beneficial for an individual who want to start an exercise program (ACSM, 2014).

However, research has shown that individuals with higher body weights or BMIs perform less physical activity and exhibit poorer adherence to exercise programs (Bautista-Castano, Molina-Cabrillana, Montoya-Alonso, & Serra-Majem, 2004). Study from Fogelholm and Kukkonen-Harjula (2000) also showed that both overweight and obese individuals reported low adherence to prescribed exercise when compared to active individuals. One of the reasons may due to the intensity of training programme (Kullgren *et al.*, 2013). Even though higher intensity exercise decreases the time needed to reach caloric expenditure goals and can helps overcome the lack of time as a perceived barrier to exercise, individuals who are obese often are not successful at these higher intensity programs (King, Castro, Wilcox, Eyler, & Sallis, 2000).

Therefore, when determining exercise programs for individuals who are obese, intensity selection is an important component of exercise in that it should be high enough to expend sufficient calories, but low enough to be tolerable and comfortable. Thus, it is important to develop a balanced exercise training with right and adequate

intensity and duration to promote high caloric expenditure, as well as encourage adherence and minimize the risk of injury (Kullgren *et al.*, 2013).

### **2.3 STEP AEROBIC EXERCISE**

Since the origin of aerobic dance in 1969, different forms of this exercise format have been introduced in order to maintain the motivation and attention of its participants. Increasing needs for program diversity launched formats such as water aerobics, indoor cycling, kickboxing, and step aerobics exercise (SAE). Since the late 1980's, SAE has become a widely practiced and popular fitness modality due to the continued emphasis surrounding the benefits of aerobic exercise and the need for more low-impact activities. Step aerobic exercise is characterized by a series of choreographed movements to music using an adjustable bench to alter the intensity of the exercise (Engels *et al.*, 2002).

Both the stepping rate (music cadence) and bench height may be modified to manipulate the intensity of the workout experience. Hand weights and more complex stepping patterns may also be added to increase the aerobic benefit of the exercise (Wen *et al.*, 2016). From its establishment, SAE claimed to be a high-intensity low-impact workout with a relatively low injury risk (Engels *et al.*, 2002). With its growing popularity, researchers commenced investigations to determine the ability of SAE to effectively improve aerobic capacity, yet remain a low-impact exercise option for the population.

Study from Najafnia *et al.*, (2013) showed that there was a significant decrease in fat percentage ( $p=0.02$ ) among 30 young women that subjected in 8-week SAE and the data also revealed that SAE improved flexibility ( $p=0.003$ ), back muscle strength

( $p=0.003$ ), maximum oxygen uptake ( $p=0.000$ ), relieve fatigue ( $p=0.02$ ) and bewilderment ( $p=0.01$ ), as well as boost vitality ( $p=0.02$ ) (Najafnia *et al.*, 2013). While, two other previous studies revealed a 16% and 11% increase in VO<sub>2</sub>max after 10 and 12 weeks of SAE training, respectively (Scharff-Olson, 1991). Differing results concerning changes in body composition were found among studies, while muscular strength and endurance improvements in SAE training studies only occurred in those using hand-held weights (Scharff-Olson, 1991).

Besides, Sturm *et al.*, (1999) examined the effects of SAE on a diseased population. Twelve weeks of moderate-intensity SAE (50% of VO<sub>2</sub>peak) was assigned to 26 patients with severe chronic heart failure. At the conclusion of the training period, significant increases in VO<sub>2</sub>peak, peak workload, and percent of predicted power ability were reported. The authors concluded that SAE was not only effective for this population, but also a safe exercise option in patients with heart failure (Sturm *et al.*, 1999).

## **2.4 GROUP-BASED WITH AN EXERCISE INSTRUCTOR**

One way for individuals to increase physical activity is by exercising with an exercise instructor. An exercise instructor can offer many benefits including support, guidance, and reinforcement (Perri *et al.*, 1997). Generally, consistent adherence to a prescribed exercise is low for individuals who are overweight or obese (Fogelholm & Kukkonen-Harjula, 2000). Exercise adherence has been shown to improve with the use of an exercise instructor or supervised activity (Colley *et al.*, 2010; Jeffery *et al.*, 1998). Exercising with an exercise instructor not only leads to greater adherence and an effective way to change one's readiness to increase physical activity, but also to

higher energy expenditures and higher heart rates (Killen, Barry, Cooper, & Coons, 2014).

Colley *et al.* (2010) examined the response to a moderate walking program in women who are obese and sedentary. The participants (N = 13) who participated in this walking intervention performed 4 weeks of supervised exercise followed by 4 weeks of unsupervised walking, both with a target energy expenditure of 1,500 kcal per week of the 8 weeks study (Colley *et al.*, 2010). The researchers found that individuals who were obese (BMI > 30 kg/m<sup>2</sup>) and were supervised had greater adherence to a new exercise program than those not supervised. It was suggested adherence was high in a walking intervention because participants were monitored, reminded of exercise sessions, and provided flexible times to schedule their walks (Colley *et al.*, 2010).

Jeffery *et al.* (1998) found similar results in a walking study involving 29 males and 167 females who were obese and were assigned to 1 of 5 treatment groups. The groups ranged from a standard behaviour therapy group, considered the control group, where participants received behavioural counselling, to the most involved group where participants received standard behaviour therapy, supervised walks with a personal trainer, and monetary incentives for completed walks.

Each participant was assigned a caloric expenditure goal based on current weight status, with participants weighing less than 91 kg having a caloric expenditure goal of 1,000 kcal/day and participants weighing 91kg or more assigned an energy expenditure goal of 1,500 kcal/day (Jeffery *et al.*, 1998). Participants who were obese were twice as likely to attend an exercise session when assigned an exercise instructor or when they received a financial incentive as participants not receiving personal

training services or financial incentives. Additionally, attendance tripled with the combination of an exercise instructor and financial incentive. The high adherence results from these two studies are attributed to the positive social support that provided by an exercise instructor to the exercising individual (Colley *et al.*, 2010; Jeffery *et al.*, 1998).

An exercise instructor has also been shown to be effective in changing an individual's attitude toward exercise (Fischer & Bryant, 2008; McClaran, 2003). According to a study by McClaran (2003), the author conducted a 10 weeks study with 129 participants to determine the effectiveness of an exercise instructor using the stages of the Transtheoretical Model. After a 10 weeks intervention of using an exercise instructor, the author found 57% of the participants showed upward movement in the stages of the Transtheoretical Model, which determines how ready one is to exercise. Even more impressive, when individuals in the highest stage were excluded, 73% of participants showed upward movement in readiness to exercise, indicated a greater readiness to be physically active, following the 10 weeks intervention (McClaran, 2003).

With the importance of physical activity for health established, it is critical to determine the best practices for an individual who is obese and is trying to meet the daily recommendations for physical activity. Exercising with an exercise instructor is one way an individual could increase physical activity. An exercise instructor not only offer many benefits such as guidance and reinforcement during exercise, but have also been shown to increase adherence and improve attitudes toward readiness to exercise (Colley *et al.*, 2010; Jeffery *et al.*, 1998; Perri *et al.*, 1997). Even though research showed that individuals exercised at a higher intensity and even preferred working with an exercise instructor, compared to exercising alone with a video-guided exercise

(VGE), there are still many barriers that could prevent an individual from exercising with an exercise instructor (Killen *et al.*, 2014).

## **2.5 INDIVIDUAL-BASED WITH VIDEO-GUIDED EXERCISE**

Despite the various benefits of an individual exercising with an instructor, there remain barriers to exercising in this fashion such as trainer availability, lack of enjoyment of activity, costs, and time (Vickers *et al.*, 2011). With lack of time being one of the top barriers to individuals exercising (King *et al.*, 2000), an alternative to exercising with an instructor that maybe more convenient to schedule is to use VGE (e.g., CD-ROMs) at home. Video-guided exercise can be similar to exercising with an instructor in that both methods provide motivation as well as providing the workout and explanations of the different exercises throughout the workout.

Exercising with a VGE offers additional benefits including lower cost, flexibility of time, and versatile exercise location (Vickers *et al.*, 2011). When exercising with a VGE, an individual has the option to exercise at home or other locations as they please such as at a hotel, something that is not always an option with an instructor. Exercising with a VGE has also been shown to benefit special populations such as individuals with intellectual disabilities and individuals with Huntington's disease (Lynnes *et al.*, 2009; Khalil *et al.*, 2012).

Perri *et al.* (1997) conducted a similar study comparing group exercise versus home-based exercise with 49 female participants who were obese (BMI 27-45 kg/m<sup>2</sup>). All participants were encouraged to complete a moderate intensity (60-70% of max heart rate) walking program of 30 minutes per day and five days a week. The group-based exercisers were provided with three sessions per week for the first 26 weeks of



the program and two sessions per week for the remainder of the program and encouraged to complete the remaining sessions on their own time (Perri *et al.*, 1997), whereas, home-based exercise participants completed all sessions in their home environment. Early in the study, both groups demonstrated significant improvements in exercise participation; however, the home-based exercisers showed significantly higher exercise participation by month 12 when compared to the group-based exercisers (78.2% vs. 48.2%) (Perri *et al.*, 1997).

Although the authors found exercise participation improvement in both groups, participation in the second 6 months of the exercise program decreased for the group-based participants with the majority of dropouts reporting time demand as the primary reason to withdraw, regardless of facilities being generally available on week nights. These results suggest individuals may effectively start and maintain a home-based exercise program due to the convenience and flexibility of time to exercise. Findings were especially interesting for the authors in that the research sample included women who were obese, a population generally thought to need a supervised exercise program to maintain adherence (Colley *et al.*, 2010; Jeffery *et al.*, 1998).

An additional benefit of an individual exercising at home with a VGE is the exerciser can select the intensity at which he or she wishes to work. This could be beneficial, especially with adults who are obese, in that adherence and enjoyment are higher when participants self-select and are unsupervised during exercise compared to supervised and prescribed exercise (Ekkekakis & Lind, 2006; Perri *et al.*, 1997).

In summary, VGE offers many benefits such as low cost, flexibility in when to exercise, enjoyment, personal intensity selection of the activity, and the portability to be completed at home or in other locations. Exercising with a VGE not only offers

flexibility of time in which the exercise is completed, but also flexibility of intensity in which the individual exercises. It has been found exercise adherence increases when individuals have the opportunity to participate in home-based exercise where both time and exercise intensity are self-selected versus a group-based exercise program (Ekkekakis & Lind, 2006; Perri *et al.*, 1997; King *et al.*, 1991). These findings could be beneficial for individuals who are overweight or obese in that exercise adherence rates and enjoyment of activity increased due to unsupervised and self-selected exercise intensity versus prescribed and supervised exercise such as with the help of an instructor (Jeffery *et al.*, 1998).

## **CHAPTER 3**

### **MATERIALS AND METHODS**

#### **3.1 Research design**

This study was an experimental study. The purpose of this study was to compare the effects of 8 weeks of group-based step aerobic exercise (GBSAE) versus individual-based step aerobic exercise (IBSAE) on weight management in obese young women. The pre and post intervention measurements were used to determine the effects of the trainings. This study was conducted at Health campus, Universiti Sains Malaysia (USMKK). The present study was approved by the Research Ethics Committee (Human) of Universiti Sains Malaysia (refer to appendix A).

#### **3.2 Calculation of sample size**

The key variable to be studied would be enjoyment scale between groups. The sample size is set based on Glaros's (2001) study on enjoyment scale between groups. Sample size in this study was calculated by using G Power Software version 3.1.9.2. The power to detect a significant change was set at 90% with a probability to reject type 1 error at 5% with an effect size of 1.95. In a two-tailed test to detect the differences between two groups, the minimal number of subject required in each group was 7 subjects (Glaros, 2001). By accounting for a 20% drop-out, 9 subjects were recruited for each group in this study (total 18 subjects). However, to increase the sample size strength in order to detect other possible fitness changes, we quadrupled the recruitment number to 32 per group for the sampling distribution of the mean to be normal based on Central Limit Theorem (Spatz, 1996).

### 3.3 Subjects

After two months of advertisement (refer appendix F), only a total of 26 subjects were interested and recruited in this study. The result might be because most recruited young women subjects were students and the period of data collection was near to their scheduled final exam. Therefore, they did not have much time to consistently spend for exercise training. However, only 20 clinically obese young women, age ranges from 21 to 26 years old were able to complete the protocol. Three subjects from group-based step aerobic exercise training group (GBSAE) and three subjects from individual-based step aerobic exercise training group (IBSAE) were unable to complete this training programme during the intervention period due to restriction of time (IBSAE, n=3), medical problems (GBSAE, n=2) and unknown reason (GBSAE, n=1). All subjects were students enrolled at a local university (USMKK).

The subjects who participated in this study were clinically obese, with a BMI of Asian cut-off points range from 27 kg/m<sup>2</sup> to 41 kg/m<sup>2</sup>, self-reported to be physically inactive, non-smokers, did not consume any medications and free from health problems. Subjects then were randomly assigned into group-based step aerobic exercise training group (GBSAE) and individual-based step aerobic exercise training group (IBSAE) with 10 subjects per group.

All subjects were fully informed by the researcher about the nature of the experiments, purpose of the study, procedures, benefits, risks of feeling discomforts experienced in this present study before giving their formal consent. Subjects' information sheets and consent form (refer to appendix C). All subjects were also assessed for health risks and suitability by completing the Physical Activity Readiness Questionnaire (PAR-Q) (CSEP, 2011) (refer to appendix B). Participation of a subject

in this study was on a voluntary basis and they were allowed to withdraw from this study at any time during the course of this study.

### **3.3.1 Subjects grouping**

The subjects were randomly divided into two groups with 10 subjects per group (n=10): 8 weeks of group-based step aerobic exercise (GBSAE) and 8 weeks of individual-based step aerobic exercise training group (IBSAE). Subjects were instructed to maintain their normal dietary intake and lifestyle as well as not to participate in any other routine physical activity or exercise (other than exercise programme) during the study period.

### **3.4 Experimental procedure**

All test and measurements were conducted at the Sport Science Laboratory, School of Medical Science, Health Campus, Universiti Sains Malaysia. The baseline measurements included were height, weight, body composition, waist and hip circumference and cardiovascular fitness. Subjects' physical activity enjoyment scale was obtained in the first and eighth week of intervention after the exercise session.

The dance choreography of step aerobic exercise program was designed for beginner and consisted of warming up session, actual exercises and cooling down. One week step aerobic exercise (SAE) familiarization session was conducted prior to the intervention period. During the intervention period, the exercise session for the GBSAE group was conducted in an aerobic exercise hall. The exercise session was conducted by a trained instructor for 70 minutes per session (consists of 15 min warm-up, 40 mins SAE, 15 mins cool-down), 3 times per week for 8 weeks. The intensity of