EFFECTS OF JOGGING AND LOW CALORIE DIET ON BODY WEIGHT LOSS AND FAT PERCENTAGE AMONG OVERWEIGHT WOMEN

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CERTIFICATE

This is to certify that the thesis entitled EFFECTS OF JOGGING AND LOW CALORIE DIET ON BODY WEIGHT LOSS AND FAT PERCENTAGE AMONG OVERWEIGHT WOMEN is the bona fide record of research work done by Ms SITI NORISHAH BINTI ZAHARI during the period from February 2018 to June 2018 under my supervision. I have read this thesis and that in my opinion it confirms to acceptable standards of scholar presentation and is fully adequate, in scope and quality, as a thesis to be submitted in partial fulfilment for the Master of Science (Sport Science).

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DECLARATION

I hereby declare that the research entitled EFFECTS OF JOGGING AND LOW CALORIE DIET ON BODY WEIGHT LOSS AND FAT PERCENTAGE AMONG OVERWEIGHT WOMEN submitted to the School of Health Sciences, Universiti Sains Malaysia, is a record of an original work done by me under the supervision of Dr. Ayu Suzailiana Muhamad and Dr. Nur Syamsina Ahmad, Lecturers of Exercise and Sports Science Programme, School of Health Science, Universiti Sains Malaysia. This thesis of research is submitted in the partial fulfilment of the requirements for the Master of Sciences (Sports Science).

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LIST OF ABBREVIATIONS

Abbreviation	Definition
BMI	Body Mass Index
PAR-Q	Physical Activity Readiness Questionnaire
SPSS	Statistical Package for Social Science
USM	Universiti Sains Malaysia
CVD	Cardiovascular Disease
HR_{max}	Heart rate maximum
EER	Estimated Energy Requirement

KESAN JOGING DAN DIET RENDAH KALORI KE ATAS PENURUNAN BERAT BADAN DAN PERATUSAN LEMAK DALAM GOLONGAN WANITA BERLEBIHAN BERAT BADAN

ABSTRAK

Malaysia mengalami peningkatan masalah kesihatan dan kadar penyakit kronik yang berkaitan dengan berat badan berlebihan yang disebabkan oleh perubahan gaya hidup seperti pengurangan aktiviti fizikal, peningkatan tingkah laku yang sedentari dan tabiat makan yang tidak sihat. Kajian ini bertujuan untuk membandingkan antara kesan senaman sahaja dan pemakanan sahaja terhadap penurunan berat badan dan peratusan lemak dalam kalangan wanita yang berlebihan berat badan. Sebanyak sepuluh orang peserta (N = 10) telah direkrut dalam kajian ini dan dibahagikan secara rawak samada ke dalam kumpulan intervensi senaman (n = 6) atau kumpulan diet (n = 4). Semasa tempoh 4 minggu intervensi, para peserta dalam kumpulan senaman melakukan joging sebanyak lima kali seminggu (30 min per sesi) pada intensiti 60-80% kadar degupan jantung maksimum (HR_{max}) manakala para peserta dalam kumpulan diet mengambil diet rendah kalori sepanjang empat minggu tempoh kajian. Ukuran berat badan dan peratusan lemak dalam badan para peserta telah diukur sebelum dan selepas tempoh intervensi tersebut. Sebagai keputusan, telah didapati bahawa tiada perbezaan yang signifikan ($p > 0.05$) dalam pengurangan berat badan di antara kumpulan selepas tempoh 4 minggu intervensi. Walau bagaimanapun, pengurangan berat badan adalah lebih besar dalam kumpulan senaman berbanding kumpulan diet. Terdapat perbezaan yang signifikan dalam penurunan peratusan lemak dalam badan dalam kumpulan senaman ($p = 0.008$) tetapi tidak ($p = 0.361$) dalam kumpulan diet. Sebagai kesimpulan, kajian ini mendapati

bahawa diet adalah lebih efektif dalam mengurangkan berat badan manakala senaman adalah jalan yang lebih efektif untuk membuang lemak badan yang berlebihan.

EFFECTS OF JOGGING AND LOW CALORIE DIET ON BODY WEIGHT LOSS AND FAT PERCENTAGE AMONG OVERWEIGHT WOMEN

ABSTRACT

Malaysia has growing health problem and increase rate of community with chronic diseases which relate to overweight due to lifestyle changes such as decrease physical activity, increase sedentary behaviour and unhealthy eating habits. This study aims to compare between the effects of exercise alone and diet alone on body weight loss and fat percentage among overweight women. A total of ten sedentary and overweight women (N = 10) were recruited in this study and were randomly assigned into either exercise group (n = 6) or diet group (n = 4). During the four weeks of the intervention period, participants in the exercise group performed jogging five times per week (30 min per session) at 60-80% of maximum heart rate (HR_{max}) intensity while participants in the diet group consumed low calorie diet throughout the 4 weeks of the study duration. The measurements of body weight and body fat percentage of all the participants were measured before and after the intervention period. As a result, it was found that there was no significant difference ($p > 0.05$) on body weight loss between groups after the 4 weeks of intervention period. However, body weight loss was greater in the exercise group compared to the diet group. There was a significant decrement ($p = 0.008$) of body fat percentage in the exercise group after the 4 weeks of the intervention period but not ($p = 0.361$) in the diet group. As a conclusion, this study found that diet is more effective in

reducing body weight while exercise is a more effective way to shed excessive body fat.

CHAPTER 1: INTRODUCTION

1.1 Background of the study

Malaysia is one of the Asian countries that have seen increase in industrialisation and economic growth in the past decade. The increased industrialisation and globalisation contributes to the improvement of the nutritional status of the population. The first national estimates of overweight and obesity were reported in the Second National Health and Morbidity Survey (NHMS) in 1996 as 20.7% and 5.5% respectively. A systematic review of the national prevalence of overweight and obesity by Khambalia and Seen (2010) indicated that in Malaysia there were rise in overweight adults in the years 2003 and 2006 (26.7% and 29.1% respectively) and more dramatic increase in obesity in 2003, 2004 and 2006 (12.2%, 12.3% and 14.0% respectively). The last past decade ministers suggested that as the population achieve affluence, their energy intake of fats and sugar increased as reflected in the rising and now substantial portion of food importation bills. The 'westernisation' of global eating habits has also brought an increase in the number of fast food branches outlets in Malaysia since in the middle of 1990's (Ismail et al., 2002).

Overweight and obesity can be defined as abnormal or excessive fat accumulation that may impair health for an individual. Body mass index (BMI) is a simple index of weight-for-height that is commonly used to classify overweight and obesity adults. BMI can be calculated by a person's body weight in kilograms divided by the square of their height in meters (kg/m^2). A person who has a BMI between 25 to 29.9 kg/m^2 can be considered as overweight while obesity is a BMI

equal or greater than 30 kg/m^2 (WHO, 2017). BMI provides the friendliest population-level to measure overweight and obesity as the same for both sexes and all ages of adults. However, BMI is considered as a rough guide because it may not correspond to the same degree of fatness and muscularity in different individuals (WHO, 2017).

The other way that can correspond to the calculations to the amount of fat contains in body is body fat percentage. It is measured as a percentage based on the difference between fat and fat free mass in the body (Kioskea, 2014). The healthy determination of fat percentage differs between man and woman as woman is healthier with higher fat percentage than man. For woman age 20 to 40 years old, 19% to 26% of body fat is generally good to excellent and the body fat percentage for man age 20 to 40 years old in the range of 10% to 20% is considered good to excellent (Health Status, 2017).

Obesity has become a burden on the health care cost, reducing quality of life with increased the incidence of cardiovascular diseases (CVD) and type 2 diabetes, and some type of cancers (Mohamud et al., 2011). Therefore, there are many ways to prevent the risk of getting chronic diseases. For example, low calorie diet is commonly related to weight loss and the primary choices for most of overweight individuals. A low calorie diet intake can be defined as restricting calorie intake to 1,200 to 1,500 calories per day for woman and 1,500 to 1,800 calories per day for man. The number of calories may be adjusted based on the individual's age, weight and daily calorie output. A low calorie diet usually consists of regular foods, with limited amount of fat intake to restrict the amount of the calorie without skipping any meal daily to lose weight effectively (NIH, 2017).

Exercise is frequently compared with diet as a means of reducing and maintaining body weight. Most studies evaluating the efficacy of exercise to promote body weight loss tend to report the mean data and overlook the inter-individual variability. It is unlikely that a fixed dose of exercise will be effective to the same extent in all individuals that trying to lose their weight. However, even when compliance is near perfect, the effectiveness of exercise will be undermined by compensatory responses that could potentially offset the energy deficit.

1.2 Problem statement

Despite increases awareness of childhood overweight and obesity, the prevalence of overweight and obesity continues to increase, making obesity is the most common problem which leads to chronic diseases among adult. There are many negative consequences that often results from overweight and obese such as diabetes, heart attack and stroke that may leads to cease. Exercise and diet control are among the strategies to reduce body weight. However, a clear scientific data on which method is more effective is lacking to date. Therefore, this study is proposed to be carried out.

1.3 Objectives of the research

The general objective for this research is to compare between the effects of exercise alone and diet alone on weight loss and fat percentage among overweight women.

The specific objectives of this research are:

I. To compare between the effects of exercise alone and diet alone to reduce body weight in overweight women.

II. To compare between the effects of exercise alone and diet alone to reduce body fat percentage in overweight women.

1.4 Hypotheses of the research

H_{o1}: There are no significant difference between the effects of exercise alone and diet alone to reduce body weight in overweight women.

H_{A1}: There are significant differences between the effects of exercise alone and diet alone to reduce body weight in overweight women.

H_{o2}: There are no significant difference between the effects of exercise alone and diet alone to reduce body fat percentage in overweight women.

H_{A2}: There are significant differences between the effects of exercise alone and diet alone to reduce body fat percentage in overweight women.

1.5 Research questions

1. Does exercise alone or diet alone is more effective in reducing body weight among overweight women?

2. Does exercise alone or diet alone is more effective in reducing body fat percentage among overweight women?

1.6 Significance of the research

Overweight and obese individuals always claiming that losing body weight and excess fat is very hard to achieve. Leaving unhealthy food and sedentary lifestyle are not an easy task. This study will provide scientific data on which method is more effective in reducing body weight and fat percentage. Although data on effectiveness of exercise alone, diet alone, and combination of diet and exercise are available in the literature, scientific data on a direct comparison between diet alone and exercise alone is very limited. It is hope that, findings from this study will add knowledge and help in planning proper weight loss programme among overweight and obese individuals.

1.7 Operational definition

Conceptual Term	Definition
Overweight	Individual who has a BMI between 25 to 29.9 kg/m^2
Obese	Individual who has a BMI equal or greater than 30 kg/m^2
Jogging	Running at a slow regular pace at moderate intensity of 60-80% of heart rate maximum
Sedentary	In this study, sedentary is defined as those who exercise not more than twice per week
Low Calorie Diet	Restricting calorie intake to 1,200 to 1,500 calories per day for woman and 1,500 to 1,800 calories per day for man
1-week menu	Suggested meal plan given to the participants as a reference to prepare their daily meals throughout this study

CHAPTER 2: LITERATURE REVIEW

2.1 Negative impact of overweight and obesity on health

In 2016, there are more than 1.9 billion overweight adults and over 650 million obese adults in the world. Most of the world population living in the countries where overweight and obesity kills more people than underweight (WHO, 2017). According to Ismail et al. (2002) the prevalence of obesity was clearly greater in women than in men. Obesity among women, rates higher in Indian and Malay women compared to Chinese women while in men, Chinese man recorded the highest obesity prevalence compared to the other two races. At the high prevalence in population results from a complex interaction between changes in the lifestyle, involving a higher calorie and fat consumption and an increasingly sedentary lifestyle. Therefore, the effects of these changes being particularly severe if the population has an inherited metabolic predisposition to fatness due to sustaining in this unhealthy type of lifestyle.

This condition with rapidly increase rates not only of overweight and obesity but particularly with abdominal obesity has its recognized serious health outcome associated with high rate of cardiovascular disease and diabetes as a consequence of the high prevalence of overweight and obesity (Ismail et al., 2002). Other than that, if the trend persists, this condition may have enormous long term consequences of overweight and obesity for the health and economy of the country. Malaysia's potential economic growth in development and financial sectors is at risk of being overshadowed by the economic burden of obesity and its effect on the country's healthcare system (Khambalia & Seen, 2010).

Although it is solely recently that concern has been raised concerning the matter of obesity in Malaysia, these preliminary knowledge counsels that Malaysia will expect to visualize an awfully high rate of cardiovascular disease and diabetes within the near future as a consequence of the high prevalence of overweight and obesity. All ethnic groups in Malaysia seem to be concerned in nutritional transition, with speedily increasing rates not only of overweight however particularly of abdominal obesity with its recognized serious health outcomes.

There are new analyses underway within the Ministry of Health which will allow a transparent national image to be constructed of the national prevalence of lipid disorders, hypertension, and diabetes. However, the current outline suggests that the issues are already serious. Other studies also highlight the terribly low levels of physical activity in young Malaysian adults, who, even in their twenties, are gaining weight at substantial rates. Inactivity may somewhat be a significant contributor as to why women are more susceptible to obesity problems than men. Given the known interactions of the energy density of the diet and physical activity, and the emergence of substantial rates of overweight in these populations on only a 20% fat intake, it is becoming clear that a 30% fat intake is high if this occurs in relatively inactive or only modestly active adults (Ismail et al., 2002).

Recently, WHO reported that in addition to the benefit of maintaining good physical activity, the optimum fat intake for preventing weight gain is probably only 20–25%. This contrasts with the usual advice for the prevention of cardiovascular disease where the emphasis is on the fatty acid content of the diet, with a 30% total fat value being a pragmatically derived goal as part of the need to limit saturated fatty acid intakes. Clearly there is the need for a national strategy to tackle both contributors to the excess weight gain of the Malaysian population (Ismail et al., 2002).

2.2 Strategies to lose weight

There are ambulatory treatments for overweight and obesity including introducing intuitive eating and intuitive exercising among this individual. Intuitive eating refers to an individual's ability to make or choose food based on one's awareness of their body's response while intuitive exercise encourages people in finding enjoyable ways of being physically active. Nevertheless, eating and exercise intuitively is a challenge and gradual process which requires replacing the old habit with the new and better lifestyle to sustain the result (Brevers et al., 2017).

A study by Curioni and Lourenco (2005) on long term weight loss after diet and exercise reported that among many strategies for overweight and obese treatment, diet and exercise are considered useful and effective for losing weight. Diet included any type of caloric restriction, and exercise included any type of exercise in which possible to reduce weight. In this study, the researchers compare the data obtained after the intervention period and after one year of the unsupervised follow-up. The result shows that the diet associated with exercise has greater initial weight loss (*p*- value =0.063) compared to the exercise intervention alone and diet intervention alone towards the reduction of body weight among overweight and obese individuals.

Similarly, a study by Bish et al. (2005) on diet and physical activity and behaviours among Americans who were trying to lose weight described that decreased calorie intake and increased physical activity are the strategies of weight loss and weight control. The researchers have advised the overweight and obese individuals to reduce calorie energy intake levels by 500 to 1000 calories per day. The researchers also stated that reduced calorie intake is the most important dietary components for

weight loss. In addition, reducing the dietary fat alone without reducing calories did not effective for weight loss programme.

2.3 Diet and weight loss

Sustenance tendencies of weight reduction in the midst of various eating regimens could educate endeavours to customize dietary recommendation and give understanding into weight reduction instruments. A study by McVay et al. (2016) on food preferences and body weight changes during low-fat and low-carbohydrate diets stated that identifying factors that differentiate which kind of diet will be more successful on which diet regimen may facilitate personalised weight loss programme. One factor that may differentiate which individuals are likely to be more successful with one dietary approach over another is food preferences. According to the researcher, the food preferences influence food selection in greater dietary adherence, and therefore potentially weight loss.

In a study by Dansinger, Gleason, Griffith, Selker, and Schaefer (2005), 160 overweight or obese adults were recruited and randomly assigned into four groups: carbohydrate restriction, macronutrient balance, calorie restriction and fat restriction diet groups. The study was conducted for two months and the result showed that there was no statistically significant difference between the diet groups towards weight loss of the participants whereby each diet group reported only 5% of weight loss throughout the study intervention.

In 2008, Carels et al. carried out a study where 54 overweight and obese adults participated in 14 weeks' weight loss programme by creating their energy deficit to 500 calories a day. The participants provided their daily records of total energy intake and expenditure. As a result, individuals who averaged an energy deficit more than 500 kcal per day lost nearly four times the weight as individuals whose average energy deficit was below 500 kcal per day (Carels et al.,2008).

Since many individuals have struggle to lose weight and are looking for guidance on appropriate weight loss strategies, many studies have clear findings that the macronutrient composition of diet is unrelated to weight loss. Clinician as well as public health campaigns have focused recent weight loss education efforts on energy restriction while encouraging a healthful overall diet. The rational of restricting energy intake for losing weight was relating to the amount of energy expenditure. Studies shown that higher amount of energy expenditure than energy intake for several consecutive days will result in reduction of body weight (Andreyeva, Long, Henderson, & Grode, 2010).

A study by Nicklas et al. (2004) was carried out to see the independent and combined effects of the two interventions on weight loss. A total of 316 overweight and obese individuals involved in the weight-loss intervention consisted of a weekly session with a registered dietician to provide education and support for lowering energy intake. The result of the study shows that the diet-induced weight loss intervention resulted in significantly greater reduction of body weight than the exercise intervention only. This study also found that the combination of diet and exercise intervention group has higher reduction of body weight.

2.4 Exercise and weight loss

Physically active men and women may be less likely than their sedentary peers to become overweight. The addition of exercise to diet intervention produces more weight loss than does dieting alone. Exercise has a favourable effect on body fat distribution, with a reduction in waist-to-hip ratio with increased exercise. Exercise is especially important in maintaining weight loss in overweight persons. Several prospective studies have shown that overweight men and women who are active and fit have lower rates of morbidity and mortality than overweight persons who are sedentary and unfit. Therefore, exercise is benefit to overweight persons, even if it does not make them lean (Blair, 1993).

A study to compare the effects of different durations and intensities of exercise on 12-month weight loss and cardiorespiratory fitness by Jakicic, Marcus, Gallagher, Napolitano, and Lang (2003) has recruited 201 sedentary women with average BMI of 32.6 ± 4.2 kg/m^2. They were randomly assigned to four exercise groups (vigorous intensity/high duration; moderate intensity/high duration; moderate intensity/moderate duration; or vigorous intensity/moderate duration) based on estimated energy expenditure (1000 calorie per week vs 2000 calorie per week) and exercise intensity (moderate vs vigorous). All women were instructed to reduce intake of energy to between 1200 and 1500 kcal/d and dietary fat to between 20% and 30% of total energy intake. The results showed that there were significant weight loss and improved cardiorespiratory fitness achieved through the combination of exercise and diet during the 12 months' intervention period. Nevertheless, no differences were found between different exercise durations and intensities in in each group.

The impact of exercise on weight loss has variable effects because some individuals recruit adaptive mechanism to oppose the negative energy balance resulting from the imposed exercise (Stubbs et al., 2004). Compensatory adaptive responses will oppose the exercise energy deficit and therefore, partial compensation for exercise induced energy deficits is detectable over two weeks and variable between different individuals (Blundell et al., 2003). A study by King, Hopkins, Cadwell, Stubbs and Blundell (2007) on the individuality variability following 12 weeks of supervised exercise to induced weigh loss have found that the mean of weight reduction after exercising five times per week for 12 weeks had proved significant. The researcher also concludes that the result demonstrate that expressing the exercise induced change in body weight accordingly to individual variability in body weight and compensatory responses.

CHAPTER 3: METHODOLOGY

3.1 Research participant

The participant recruitment process involved convenience sampling method via poster advertisement (Appendix A). The participants' inclusion criteria for this research are healthy women, sedentary (exercise less than 2 times per week), age of 20 to 40 years old (23.29, 0.5) with the mean and standard deviation respectively; and overweight with BMI between 25 kg/m^2 and 29.9 kg/m^2. The exclusion criteria of the participant include anyone who has BMI more than 30 kg/m^2, pregnant, smoker, or anyone that is currently injured or taking any medicine or supplements.

3.2 Research design and location

This was a pre and post-test research design where, in this research there were two groups receiving different treatments to reduce body weight among overweight and obese individuals. The first group received exercise treatment and the second group received diet treatment. The participants were grouped randomly by using blocked randomisation in the SPSS. Body weight and body fat percentage of the participants were measured before the interventions started (pre-test). After four weeks of the intervention, body weight and body fat percentage were measured once again (post-test).

This pre and post-test measurements conducted at the Exercise and Sports Science Laboratory, School of Health Sciences, Health Campus, Universiti Sains

Malaysia, Kubang Kerian, Kelantan. The exercise training took place at the jogging track of the Health Campus, Universiti Sains Malaysia, Kubang Kerian, Kelantan.

3.3 Sample size calculation

Sample size was calculated by using G power 3.0.10 analysis. The significant level was set at 0.05 and the power of the study was set at 0.80 to achieve moderate effect size of 2.00 (Ross et al., 2000). The calculated sample size showed that at least four participants were needed for each group in this research. With the dropout rate of 10%; another one participant is added to each group. Therefore, 10 participants are needed for this study.

3.4 Research procedures

Figure 3.1 summarised the procedures that were carried out in this research. Before conducting this study, ethical approval was obtained from the Human Research Ethics Committee of the Universiti Sains Malaysia with the study protocol code USM/JEPeM/17120703. Upon receiving the ethical approval, participants were recruited whereby during the recruitment process, participants were explained regarding the study objectives and procedures. Participants that fulfil all the inclusion criteria without having any exclusion criteria and agree to participate were asked to sign the consent form (Appendix B) and the Physical Activity Readiness (PAR-Q) form (Appendix C). Then, participants were randomly assigned into either exercise group or diet group.

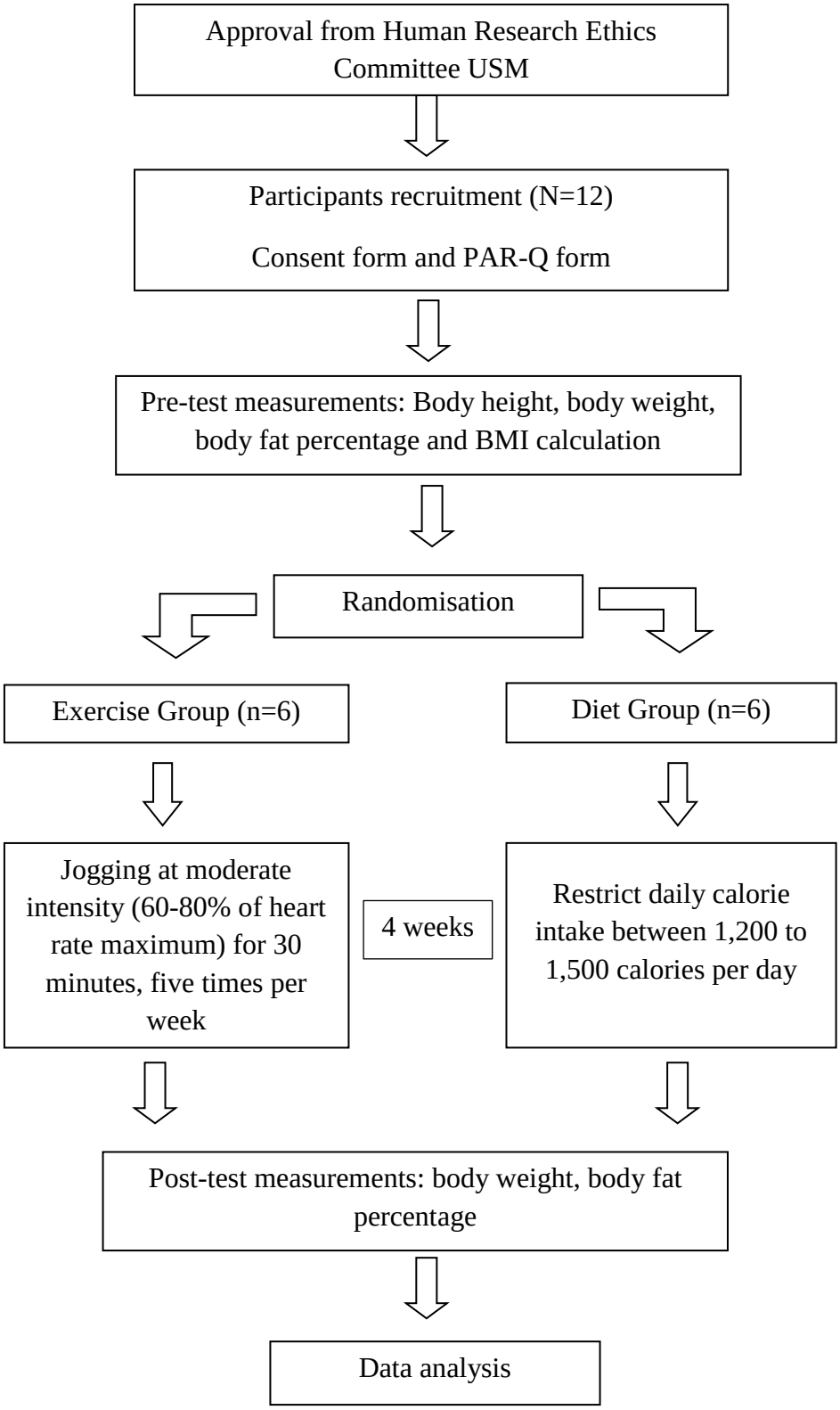

Figure 3.1 Flowchart of the study procedures

Upon starting this study, baseline measurement of body weight and body fat percentage of all the participants were taken (pre-test). After that, participants in the exercise group started the exercise intervention (jogging) at moderate intensity (progressively increased intensity ranging from 60-80% of HR_{max}) for 30 minutes, five times per week for 4 weeks. Calculation of HR_{max} and the targeted heart rate based on the desired intensity were shown below.

Age predicted HR_{max}

$$HR_{max} = 220 - age$$

Karvonen formula

$$\% \text{ targeted heart rate} = ([HR_{max} - HR_{rest}] \times \% \text{ intensity}) + HR_{rest}$$

The jogging intervention was took place at the jogging track of USM Health Campus for every jogging session and the intervention were supervised by the researcher during the first week of intervention. The first week is considered as familiarisation week which it was to ensure the participants were jogging at the correct pace and targeted intensity. Each exercise session began with 5 min warm up and finished with 5 min cool down to avoid muscle cramp during the jogging session. The participants in the exercise group were also asked to wear a suitable sport attire and sport shoes during the jogging. In addition, participants in the exercise group were asked to follow their normal daily diet throughout the 4 weeks of the intervention period.

On the other hand, participants in the diet group were asked to restrict their daily calorie intake between 1,200 to 1,500 calories per day. A 1-week menu (Appendix D) was given to each participant in the diet group as a reference but they were asked to record their actual food intake in a food diary (Appendix E). The participants in the diet group were asked to not involved in any exercise programme during the intervention period (remain being sedentary).

After 4 weeks of the intervention period, measurement of body weight and body fat percentage of all the participants were taken once again (post-test). After completion of the data collection, data analysis was carried out.

3.5 Research measurements

1) Physical Activity Readiness (PAR-Q) Form

A short information form was used to collect the details simple self-screening tool that related to the condition of the participant before joining this study. This form was used to check the participant readiness before starting to exercise.

2) Body Weight

In this study, the progressive of the body weight of all the participants were assessed. At the beginning of the study, the body weight was measured as a baseline before the intervention starts. At the end of the intervention, the body weight of the participants was measured to see the difference after the three weeks of the exercise and diet session.

3) Body Fat Percentage

Same as the body weight, at the beginning and the end of the study, the body fat percentage of the participants was measured to determine the different of the body fat percentage before and after the participant undergo the intervention for the four weeks.

3.6 Research tools

1) Bioelectrical Impedance Analysis (BIA) Machine

The BIA machine that was used is the Tanita BIA (TBF-410, Japan). It is commonly used for estimating body composition, and in particular body fat. Early BIA equations only included height^2/resistance, later equations include many parameters such as weight, height, age, gender, body types, BMI, BMR, body fat percentage, fat mass, and free fat mass. However, in this study only taken body weight, height, BMI and body fat percentage into matter.

2) 1-week Menu

The 1-week menu is a meal plan that will be given to the participants in the diet group. It is planned according to the targeted calorie intake which is between 1,200 to 1,500 calories per day. This suggested meal plan will be a reference to the participants to prepare their daily meals throughout the 4 weeks of the intervention period.

3) Food Diary

A food diary was provided to each participant in the diet group to record their meal every day throughout the four weeks of intervention. After the four weeks of intervention period, the food diary was collected and the amount of calories intake daily for each participant was analysed using the food analysis software available online: https://www.supertracker.usda.gov/foodtracker.aspx

This analysis was important to ensure that participant in the diet group did not excessively eat or snacking over their calories allowance.

3.7 Data analysis

All the data were analysed by using Statistical Package for Social Science (SPSS) Version 22.0. For normality test of the data were tested by using Shapiro-Wilk test. All numerical variables for comparing the value of baseline data to compare the starting point were described using mean and standard deviation and they were presented in descriptive statistics. Independent t-test was used to compare data obtained between groups at pre and post-test. Paired t-test was used to compare between pre and post-test in each group. Statistical significance was accepted at $p < 0.05$ and results were expressed as mean and standard deviation.

CHAPTER 4: RESULT

4.1 Participants

At the beginning of the study, 12 participants (six participants per group) were recruited among USM students. However, two participants from diet group were excluded due to non-compliance to the intervention programme. Thus, the total number of participants that were successfully completed the intervention was ten participants; exercise group (n=6) and diet group (n=4). Calculated sample size was 4 participants plus 1 participant in case of drop out. Thus, total number of participants in the exercise group achieved the calculated sample size. However, due to time constraints, new recruitments of participants for the diet group cannot be done to achieve the calculated sample size. Mean age, height, body mass index (BMI) of the participants in each group are tabulated in the Table 4.1. In addition, HR_{max}, 60% and 80% of the HR_{max} for exercise group and the mean daily calorie intake throughout the intervention period for the participants in the diet group were also shown in the Table 4.1.

The BMI of the participants in the exercise and diet group before the intervention was tested using independent t-test which showed that there was no significant difference of the BMI at the baseline between the two groups (p = 0.235).

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Table 4.1 Physical and physiological characteristic of participants

	Exercise group **Mean (SD)**	**Diet group** **Mean (SD)**
Total numbers	n = 6	n = 4
Age (years)	23.33 (0.5)	23.25 (0.5)
Height (cm)	160.8 (7.5)	154.5 (5.2)
BMI (kg/m^2)	29.4 (3.1)	26.8 (3.1)
HR_{max} (bpm)	196.67 (0.5)	-
60% HR_{max} (bpm)	145.67 (0.9)	-
80% HR_{max} (bpm)	172.18 (1.2)	-
Mean of daily calorie intake throughout the 4 weeks of intervention period (kcal)	-	1339.5 (85)

4.2 Physical Activity Readiness (PAR-Q)

Prior to the research, participants were given the Physical Activity Readiness questionnaire (PAR-Q) to determine whether or not they should see a doctor before starting physical activity since they are previously living a sedentary lifestyle. The findings are tabulated in Table 4.2.

Table 4.2 Physical Activity Readiness (PAR-Q) of the participants

	Exercise group (n=6)	**Diet group (n=4)**
Heart condition	Normal	Normal
Chest pain symptom	No	No
Symptom that cause loss of consciousness	No	No
Bone or joint problem	No	No
Taken any medication	No	No