

**OUTCOME OF KOSPEN WEIGHT  
MANAGEMENT PROGRAM AND ASSOCIATION  
BETWEEN WEIGHT LOSS, BLOOD PRESSURE  
AND BLOOD GLUCOSE AMONG FEMALE  
PARTICIPANTS IN TERENGGANU**

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LOSS, BLOOD PRESSURE AND BLOOD GLUCOSE  
AMONG FEMALE PARTICIPANTS IN TERENGGANU**

**By**

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## LIST OF ABBREVIATIONS

ACSM	American college of sports medicine
BMI	Body mass index
BP	Blood pressure
CI	Confidence interval
DALYs	Disability-adjusted life years
DBP	Diastolic blood pressure
GS1M	<i>Gerak sihat 1 Malaysia</i>
JPNN	<i>Jabatan perpaduan negara dan integriti nasional</i>
KEMAS	<i>Jabatan kemajuan masyarakat</i>
kg	kilogram
KOSPEN	<i>Komuniti sihat pembina negara</i>
KPI	Key performance index
MET	Metabolic equivalent task
mmHg	Millimeter mercury
MOH	Ministry of health
NCD	Non-communicable disease
NHMS	National health and morbidity survey
PYs	Persons years
SBP	Systolic blood pressure
SD	Standard deviation
SPSS	Statistical package for social sciences
U.S	United states
WHO	World health organization

## LIST OF SYMBOLS

$=$	Equal to
$>$	More than
$\geq$	Equal and more than
$<$	Less than
$\alpha$	Alpha
$\beta$	Beta
$\delta$	Delta
$\Delta$	Precision

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## ABSTRAK

### PENCAPAIAN PROGRAM PENGURUSAN BERAT BADAN KOSPEN DAN HUBUNGKAIT ANTARA PENURUNAN BERAT BADAN DENGAN TEKANAN DARAH DAN PARAS GLUKOSA DARAH DALAM KALANGAN PESERTA WANITA DI TERENGGANU

**Latar belakang:** Kajian morbiditi dan kesihatan kebangsaan pada tahun 2015 menunjukkan prevalens lebih berat badan dalam kalangan rakyat Malaysia meningkat dari 29.4% pada tahun 2011 kepada 30.0% pada tahun 2015. Prevalens obesiti turut meningkat dari 15.1% kepada 17.1% dalam tempoh masa yang sama. Walaupun banyak usaha telah dilakukan oleh kementerian kesihatan Malaysia dalam mempromosikan budaya hidup yang sihat dalam kalangan masyarakat seperti pemakanan sihat, tidak merokok dan aktif secara fizikal, prevalens faktor risiko penyakit tidak berjangkit ini masih meningkat.

**Objektif:** Kajian ini bertujuan untuk mengenalpasti peratusan peserta berlebihan berat badan dan obes yang mencapai keberjayaan penurunan berat badan  $\geq 5\%$  daripada berat badan semasa permulaan program. Ia juga bertujuan untuk membandingkan perubahan purata berat, tekanan darah dan paras glukosa dalam darah sebelum dan selepas intervensi serta mengenalpasti kaitan antara sebarang penurunan berat badan dengan bacaan tekanan darah dan paras glukosa dalam darah.

**Kaedah:** Kajian secara hirisan lintang telah dijalankan daripada bulan Februari sehingga April 2018 dengan menggunakan data sekunder. Kajian melibatkan peserta dari tujuh daerah di negeri Terengganu. Data diperolehi daripada pangkalan data di

unit kawalan penyakit tidak berjangkit, jabatan kesihatan negeri Terengganu serta buku rekod aktiviti peserta. Data telah dikumpul menggunakan proforma dan dipindahkan ke format excel yang kemudian dianalisa menggunakan perisian IBM SPSS Statistik versi 24.

***Keputusan:*** Pada tahun 2017, seramai 125 peserta wanita telah menyertai Program Pengurusan Berat Badan KOSPEN. Seramai 123 individu memenuhi kriteria kajian. Analisa diskriptif, ujian T berpasangan dan regresi linear ringkas telah dijalankan. Dalam kajian selama enam bulan ini, 105 (85.4%) daripada mereka turun berat badan, 4 (3.3%) tiada perubahan pada berat badan dan 14 (11.4%) mengalami kenaikan berat badan. Purata penurunan berat badan adalah sebanyak -3.62 kg (3.46). Penurunan berat badan tertinggi yang dicatatkan adalah -21.8 kg manakala kenaikan berat badan terbanyak dicatatkan adalah sebanyak 5.2 kg. Satu per tiga daripada wanita dalam program ini (n=42) mencapai keberjayaan penurunan berat badan, iaitu penurunan  $\geq$  5% daripada permulaan program. Analisa ke atas berat, tekanan darah dan paras glukosa dalam darah sebelum dan pada enam bulan (perbezaan min, selang keyakinan 95%) menunjukkan bahawa purata penurunan berat adalah sebanyak -2.93 kg (2.27 hingga 3.60,  $p < 0.001$ ), purata penurunan tekanan darah sistolik adalah sebanyak -1.44 mmHg (-0.54 hingga 3.42,  $p = 0.153$ ), purata penurunan tekanan darah diastolik adalah sebanyak -2.04 mmHg (0.71 hingga 3.37,  $p = 0.003$ ) dan purata penurunan paras glukosa dalam darah adalah sebanyak -0.25 mmol/L (0.09 hingga 0.42,  $p = 0.003$ ). Namun, tiada hubungkait yang signifikan antara penurunan berat dengan tekanan darah sistolik ( $p = 0.894$ ), penurunan berat dengan tekanan darah diastolik ( $p = 0.518$ ) penurunan berat dengan paras glukosa dalam darah ( $p = 0.524$ ).

***Kesimpulan:*** Kajian ini menunjukkan bukti bahawa Program Pengurusan Berat Badan KOSPEN telah berjaya menurunkan faktor risiko penyakit tidak berjangkit seperti berat, tekanan darah dan paras glukosa dalam darah. Program ini telah menanamkan kesedaran mengenai cara hidup sihat and inisiatif mengurangkan berat badan yang menjurus kepada perubahan tingkahlaku kepada peserta wanita di Terengganu. Kerjasama berterusan daripada Jabatan Kebajikan Masyarakat (KEMAS), Jabatan Perpaduan Nasional dan Integriti Negara (JPNIN) pemimpin setempat dan sukarelawan di komuniti diharapkan dapat memastikan perubahan ini berterusan.

**KATA KUNCI:**

Obesiti, berat badan berlebihan, wanita, penurunan berat badan, keberjayaan penurunan berat badan, intervensi komuniti



## ABSTRACT

### OUTCOME OF KOSPEN WEIGHT MANAGEMENT PROGRAM AND ASSOCIATION BETWEEN WEIGHT LOSS, BLOOD PRESSURE AND BLOOD GLUCOSE AMONG FEMALE PARTICIPANTS IN TERENGGANU

**Background:** The National Health and Morbidity Survey (NHMS) 2015 reported that the prevalence of overweight among Malaysian increased from 29.4% in 2011 to 30.0%, and obesity increased from 15.1% in 2011 to 17.7%. The *Komuniti Sihat Perkasa Negara* (KOSPEN) was introduced in 2013, which emphasises on community empowerment in preventing the Non-Communicable Diseases (NCD).

**Objective:** The objectives of this study were to determine the proportion of successful weight loss (achieved weight loss  $\geq 5\%$  from baseline), to compare weight, blood pressure and blood glucose level before and after the six-months program and to determine the association between weight loss with blood pressure and blood glucose among female participants of KOSPEN Weight Management Program in Terengganu.

**Methodology:** This was a cross sectional study conducted from February until April 2018 using secondary data involving seven out of eight districts in Terengganu. The data was obtained from the Terengganu State Health Department KOSPEN Weight Management Program Database for the year 2017 and participants log book. The information was transferred to proforma which then was exported from Excel to SPSS v.24 for analysis.

**Results:** In 2017, there were 125 female participants who took part in this KOSPEN Weight Management Program and 123 participants were included in this study. Descriptive analysis, Paired t-test and simple linear regression was conducted. In this six-months program, 105 (85.4%) of the women lose weight, 4 (3.3%) maintained their weight while 14 (11.4%) gained weight. The mean weight loss was -3.62 kg (3.46). The maximum weight loss was -21.8 kg and the maximum weight gain was 5.2 kg. One-third of the women (n=42) had successful weight loss at six-months post program. Analysis on weight, blood pressure and blood glucose at six months (mean difference, 95% CI) revealed that the mean weight reduced by -2.93 kg (2.27 to 3.60,  $p < 0.001$ ), systolic blood pressure reduced by -1.44 mmHg (-0.54 to 3.42,  $p = 0.153$ ), diastolic blood pressure reduced by -2.04 mmHg (0.71 to 3.37,  $p = 0.003$ ) and blood glucose reduced by -0.25 mmol/L (0.09 to 0.42,  $p = 0.003$ ). Unfortunately, there was no significant association between weight loss and SBP ( $p = 0.894$ ), weight loss and DBP ( $p = 0.518$ ) and weight loss and blood glucose ( $p = 0.524$ ).

**Conclusion:** This study provides the evidence that the KOSPEN Weight Management Program had shown to reduce the NCD risk factors, particularly weight, blood pressure and blood glucose. It can be assumed that this program may have successful in instilling self-awareness about healthy lifestyle and weight loss initiative, leading to individualized behavioural modification among its female participants in Terengganu. Hopefully, continuous partnership with *Jabatan Kemajuan Masyarakat (KEMAS)*, *Jabatan Perpaduan Nasional dan Integriti Negara (JPNIN)*, community leaders and volunteers would improve and make this initiative sustainable.

**KEYWORDS:**

Obesity, overweight, women, weight loss, successful weight loss, community-based intervention

# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

Obesity is a major public health threat worldwide and is a known risk factor for several chronic non-communicable diseases (NCD) such as cardiovascular disease, hypertension, type 2 diabetes, dyslipidemia and cancer. It is a problem in both developed and developing countries. The worldwide prevalence of obesity nearly tripled between 1975 and 2016. In 2016, more than 1.9 billion (39%) adults aged 18 years and older were overweight and 650 million (13%) were obese. The prevalence of overweight and obesity is higher among women as compared to men; 40% versus 39% and 15% versus 11% respectively (WHO, 2018).

Theoretically, obesity occurs when there is excess energy consumption (dietary intake) in relative to energy expenditure (energy loss via metabolic and physical activity). Although obesity represents an unhealthy excess in body fat mass, the current practical definition of obesity is determined by an assessment of body mass index (BMI). The BMI is calculated by dividing a person's weight (in kilograms) by height (in meters squared). Based on the World Health Organization (WHO) 1998 classification, overweight is defined as BMI of between 25.0 kg/m<sup>2</sup> until 29.9 kg/m<sup>2</sup> while obesity is defined as BMI equal to or more than 30.0 kg/m<sup>2</sup>. However, Asians have higher body fat percentage at similar BMI when compared to Caucasians or European. Evidence showed that the risk of co-morbidities in Asia begin to rise at lower BMI values. Therefore, there are another classification for Asians where

overweight is defined as BMI between 23.0 kg/m<sup>2</sup> until 27.4 kg/m<sup>2</sup> while obesity is defined as BMI equal or more than 27.5 kg/m<sup>2</sup>. Having said that, the WHO Expert Consultation in 2002 concluded that the latter classification is only to be used for public health action while the WHO 1998 classification is retained for international classification (WHO, 2004).

Overweight and obesity are associated with genetic, behavioural, physiological factors, environment, psychological, social, economic, and even political factors that interact in varying degrees to promote the development of obesity (Rusali *et al.*, 2016; Wright and Aronne, 2012). Furthermore, globalization has increases the accessibility of food, including unhealthy diet such as processed food, high fat and carbohydrate food, which are high in calories and salt content (WHO, 2013).

Besides these health issues, overweight and obesity also affects the economy as it is related with disease burden and mortality, medical expenses and production loss due to medical leave. Annual cost related to obesity is estimated to exceed \$110 billion in the United States (Appel *et al.*, 2011). It also associated with reduced quality of life and job discrimination.

Population attribution fraction (PAF) and disability-adjusted life years (DALYs) has been used to quantify years of life lost from premature death and number of years lost due to disability from obesity and overweight. According to Ng *et al.* (2014), it was estimated that overweight and obesity had caused 3.9% of years of life lost and 3.8% of DALYs globally in 2010. Study among Malaysian adults aged between 20 -59 years old revealed that overweight had attributed to the burden of disease by 1582 per 1000 persons years (PYs) for men and 1146 per 1000 PYs in

women, while obesity had attributed to the burden of disease by 2951 per 1000 PYs, led by women at 1657 per 1000 PYs (Peng *et al.*, 2018).

In response to the increased prevalence of NCD (including obesity), in May 2004, the WHO adopted a Global Strategy on Diet, Physical Activity and Health. This strategy focussed on healthy diets and regular physical activity, which are among the major risk factors of NCD (Waxman, 2004). Later, the WHO produced the Global NCD Action Plan 2013 – 2020, with nine targets to be achieved by the year 2025. Among these targets include; 1) 25% relative reduction in premature mortality, 2) 10% reduction in prevalence of insufficient physical activity and 3) to stop the rise in obesity.

There are many ways to achieve weight loss. It can be divided into non-pharmacological, pharmacological or surgical approach. Surgical approach (bariatric surgery) is offered for those with BMI above 35.0 kg/m<sup>2</sup> or 40.0 kg/m<sup>2</sup>, in which behavioural treatment and/or pharmacological approach do not alter their obese status. However, not everyone with the BMI above 35.0 kg/m<sup>2</sup> or 40.0 kg/m<sup>2</sup> will be offered bariatric surgery. Usually it is offered for those who develop complications of obesity such as diabetes, hypertension, dyslipidemia, sleep disorders or pulmonary dysfunction. Bariatric surgery is considered as the last resort for the patient, considering the short and long-term complications associated with the surgery (Thompson *et al.*, 2007).

Pharmacological treatment for weight loss can be either prescribed or over-the-counter drugs and supplements. Most of these prescribed drugs act by suppressing appetite or enhancing satiety, resulting in weight loss. These drugs must be taken

continuously to maintain weight loss. When discontinued, the weight will regain. Examples of prescribed drugs are orlistat and sibutramine (Thompson *et al.*, 2007).

Of all approaches, non-pharmacological approach is the mainstay in combating obesity. These include lifestyle modification on diet, physical activity and psychology. Weight loss interventions involving physical activity are found to be more effective than diet modification alone for long-term weight loss (Madjd *et al.*, 2016). However, it is not easy to lose weight and is even harder to maintain the weight loss. Therefore, a properly conducted program is important as there is risk of failure in losing weight or maintaining the weight loss.

### **1.1.1 The obesity burden in Malaysia**

The National Health and Morbidity Survey (NHMS) 2015 reported that 66.5% of Malaysian adults are physically active. Out of this, 25.4% were health-enhancing physical activity (HEPA) active and 41.1% were minimally active. Despite the relatively high prevalence of physical activity, the prevalence of overweight increased from 29.4% in 2011 to 30.0%, and obesity increased from 15.1% in 2011 to 17.7%. The prevalence of obesity was significantly higher among females [20.6% (95% CI: 19.5, 21.8)] compared to males [15.0% (95% CI: 13.9, 16.1)]. This indicated that although 41.1% of the participants met the minimum level of 600 metabolic equivalent task (MET) minutes/week (10 MET-hours/week) of total physical activity as recommended by the World Health Organization (WHO), they were still overweight

or obese. Therefore, an individual may need to do more than the minimum recommended level of physical activity in order to lose weight. However, the exact amount and intensity of physical activity needed to maintain or lose weight is not clear, since these requirements vary between different individuals and change according to the energy intake of a person (Chan *et al.*, 2017). The American College of Sports Medicine (ACSM) recommended a minimum of 150 minutes per week of moderate intensity physical activity for overweight and obese adults to improve health, whilst 250 – 300 minutes of moderate intensity physical activity per week for long term weight loss (Donnelly *et al.*, 2009).

In response to this, various action has been taken by the government of Malaysia in tackling the weight issue. In July 2009, the Malaysian government commenced ‘10,000 steps a day’ campaign, to reduce the sedentary lifestyle (Verma *et al.*, 2013). Also, the government through ministry of health (MOH) started to introduce community-based intervention programs to target the community. It is not only to change the behaviour of the community but also include community empowerment to encourage them to act as an agent of change. The program is known as NCDP 1 Malaysia, is introduced in the year 2009 in all over the country among selected district (Mustapha *et al.*, 2014). Also, Malacca state health department have make initiative to reach for the community in rural area through 1 Stop Center for Health (1SCFH). Following the benefits of this program, *Komuniti Sihat Pembina Negara* (KOSPEN) is then introduced.



### **1.1.2 Overview of KOSPEN**

KOSPEN is a community-based intervention program for NCD that was introduced by the Ministry of Health in Segamat, Johor in October 2013. The aim of program is to contain the increase in the prevalence of NCD through a comprehensive and aggressive approach to empower the community and enhance their participation in the prevention and control of NCD and its risk factors. The program establishes functional units consisting of volunteers from communities across the country that will serve as the health agent of change. The volunteers are named *Gerak Sihat 1 Malaysia* (GS1M). The main strategies for this program are to improve awareness among individuals and communities on non-communicable diseases and their risk factors, by focusing on basic preventive measures and detection of risk; transformation of health knowledge to healthy behaviour and lifestyle; and creating healthy lifestyle environment (Chung *et al.*, 2017).

The KOSPEN program consists of five main components; 1) healthy eating, 2) active lifestyle, 3) no smoking, 4) weight management and 5) NCD detection through health screening. The whole concept is voluntary, hence the volunteers; whom are local villagers, are neither paid nor given any incentives or allowances. They will undergo a course of health training and will be provided with job aid tools such as blood glucose monitoring kits, weighing scales and measuring tapes for the routine health screening.

### **1.1.3 Overview of Weight Management Program in KOSPEN**

The Weight Management Program in KOSPEN is a six-month intervention program for selected KOSPEN localities. It began in 2016 with one locality per district. It comprises three interventions which are healthy eating, active living and motivational talks (to maintain retention rate of participants). The participants underwent a minimum of three training sessions with healthcare professionals (doctor, nutritionist and paramedics); at the start of the program, at three months into the program and at the end of the program (sixth month). For healthy eating, they were taught healthy food choices through talks and cooking demonstration. They were also given advice on controlling food portion and to consume between 1500 – 1800 kcal/day for males and 1300 – 1500 kcal/day for females to lose weight. Meanwhile, in active living, they were encouraged to do daily physical activities and participate in weekly sessions of 50-60 minutes of moderate-to-high intensity group physical activities. The participants were also given a journal to record their daily food intakes and physical activities.

The monthly evaluation session is carried out to check for the participants' BMI, blood pressure (BP) and blood glucose level. The session is carried out at a local venue, such as the *Balairaya*. The assessment is done by GSIM under the supervision of health staffs from nearby health clinics.

The selection criteria for this program are residents aged  $\geq 18$  years old with BMI  $> 25\text{kg/m}^2$  with no comorbidity (those with comorbidity may also participate in the program pending doctor's clearance), no permanent disability and non-pregnant.

There are three key performance index (KPI) for this program which are;

- 1) 60% of retention rate after six months into the program
- 2) 30% participants have weight reduction after six months into the program
- 3) No weight gain among participants within six months duration.

## **1.2 Rationale of study**

KOSPEN program has started since 2014 and a lot of money has been spent on its implementation. The Malaysia Institute of Public Health report on KOSPEN in 2016 only presented the general outcome of the program, based on the three program KPIs. While KOSPEN Weight Management Program has been running since 2016, less is known about its outcome and value to the community. Apart from the program KPIs, other available data on changes in anthropometric measurement (weight and waist circumference) and biochemical (blood pressure and blood glucose) has not been formally analysed and published. Therefore, our findings will provide the data on the outcome of the program for future improvement of the program. In addition, this study provides a deeper depth into the measurement of successful weight loss as compared to the current program KPIs.

### **1.3 Research questions**

1.3.1 What is the proportion of successful weight loss after six months among female participants in Terengganu?

1.3.2 Are there significant differences in weight, blood glucose and blood pressure measurements before and after six months program among female participants in Terengganu?

1.3.3 What is the association between weight loss, blood pressure and blood glucose among participants in Terengganu?

### **1.4 Objectives**

#### **1.4.1 General objectives**

To measure the outcome of KOSPEN Weight Management Program and the association between weight loss with blood pressure and weight loss with blood glucose among female participants in Terengganu.

## **1.4.2 Specific objectives**

1.4.2.1 To determine the proportion of successful weight loss after the completion of the six-month program among female participants in Terengganu.

1.4.2.2 To compare weight, blood pressure and blood glucose level before and after the six-month program among female participants in Terengganu.

1.4.2.3 To determine the association between weight loss, blood pressure and blood glucose among female participants in Terengganu.

## **1.5 Research hypotheses**

1.5.1 There are significant differences in weight, blood glucose and blood pressure measurements before and after six months program among female participants in Terengganu.

1.5.2 There are significant association between weight loss, blood glucose and blood pressure among female participants in Terengganu.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Recommendation on weight loss

The recommendation on the ideal weight loss is currently inconclusive. According to the Guidelines of the National Heart, Lung and Blood Institute (NHLBI) of America, a minimum of 10% reduction in weight is required in order for it to be associated with the reduction in health risk (Donnelly *et al.*, 2009). However, there were some studies that showed beneficial improvement in cardiovascular risk factors even when the weight loss is less than 10% (ADA, 2005; Esposito *et al.*, 2003). The consensus view of leading health authorities recommended that weight loss of 5-10% is associated with reduction in health risk, regardless of age or sex. WHO (1998) and Canadian Obesity Guidelines (2006) recommended weight loss goal of 5-10% in 24 weeks and six months interval, respectively among those with BMI  $\geq 25.0$  kg/m<sup>2</sup> (Ross and Bradshaw, 2009). According to Byrne *et al.* (2012), losing weight as little as 5% of body weight leads to significant reduction in health risk. Similarly, Stevens *et al.* (2006) recommended that weight change of  $\geq 5\%$  is considered clinically relevant. Some other studies also reported that weight loss of between 2 – 3% from the baseline weight also resulted in beneficial improvement in chronic risk factors (Lalonde *et al.*, 2002).

### **2.1.1 Proportion of successful weight loss**

There have been numerous studies that report on the proportion of successful weight loss among overweight and obese women. Jiandani *et al.* (2016) showed that 40.6% women achieved successful weight loss of  $\geq 5\%$  from the initial body weight at six months into a weight loss program in Canada. Another study in the United States (U.S) showed 14.2% of female participants achieved successful weight loss in the control group, 52.7% in the group receiving in-person support, and 46.0% in the group receiving only remote support. However, the weight loss was not statistically significant between the two intervention groups (Appel *et al.*, 2011). While another study in the U.S revealed 11.9% of the respondents had achieved weight loss of  $< 10\%$ , 40.3% lost between 10-20% and 47.8% achieved weight loss  $> 20\%$  after a 6-month intervention among overweight and obese women (LeCheminant *et al.*, 2007).

## **2.2 Outcome of KOSPEN Weight Management Program**

### **2.2.1 Weight**

There were various findings with regards to assessment of weight loss among participants. A study in Canada found that among participants who enrolled in a weight loss program for  $\geq 6$  months, the average weight change was -0.23kg (4.2) for those with weight loss  $< 5\%$  and -12.8kg (9.1) for those with weight loss  $\geq 5\%$  ( $p < 0.05$ ) (Jiandani *et al.*, 2016). Madjd *et al.* (2016) revealed that there was a significant weight reduction among participants of the low-frequency physical activity and high-

frequency physical activity group after 24 weeks of study ( $p < 0.01$ ). Similar result was also observed between groups ( $p = 0.028$ ) of overweight and obese women on multidisciplinary weight loss program in Iran. Another finding in the United States (U.S) by Appel *et al.* (2011) showed that the percentage of weight loss in the control group was 66.4%, compared with 85.3% in the group receiving in-person support and 84.7% in the group receiving only remote support.

### **2.2.2 Blood pressure**

Ibrahim *et al.* (2016) revealed that among weight management participants in Negeri Sembilan, there were significant differences of  $-2.63$  mmHg ( $-3.79$  to  $-1.48$ ) ( $p < 0.01$ ) in the diastolic blood pressure between the intervention and usual care groups. The intervention group had an average reduction in the diastolic blood pressure by  $-1.78$  mmHg at six months ( $p < 0.01$ ). In contrast, the usual care group showed an insignificant increase in diastolic blood pressure by  $+0.59$  mmHg at six months follow-up ( $p > 0.05$ ). A study in Australia showed that by 12 months, blood pressure had reduced in both groups (Low Carbohydrate, High Fat diet  $-14 \pm 2 / -6 \pm 2$  mmHg, and Isocaloric High Carbohydrate, Low Fat Diet  $-15 \pm 3 / -8 \pm 2$  mmHg;  $p < 0.001$  for time) (Wycherley *et al.*, 2010).



### **2.2.3 Blood glucose level**

A study among healthy overweight and obese women in Iran revealed that fasting plasma glucose declined over the 24 weeks of study in both high frequency physical activity and low frequency physical activity groups ( $p < 0.001$ ) (Madjd *et al.*, 2016). Recent community-based study by Ibrahim *et al.* (2016) who conducted lifestyle intervention among pre-diabetes patients in Negeri Sembilan found that the intervention group had greater decrease in the fasting plasma glucose of  $-0.31$  mmol/l ( $-0.39$  to  $-0.24$ ) as compared to the non-intervention group ( $p < 0.001$ ). However, a study among Petronas worker in Malaysia showed there was no significant changes in the fasting blood glucose throughout the three months weight management program at the workplace (Rusali *et al.*, 2016).

## **2.3 Association of weight loss**

### **2.3.1 Blood pressure**

A meta-analysis of 25 randomized control trials involving 4874 participants showed systolic blood pressure reductions were  $1.05$  mm Hg (95% CI,  $1.43$  to  $0.66$ ) and diastolic blood pressure reductions were  $0.92$  mm Hg (95% CI,  $1.28$  to  $0.55$ ) for every kilogram of weight loss (Neter *et al.*, 2003). A study in Slovakia found that a reduction of the BMI by at least  $1 \text{ kg/m}^2$  among obese men and women was inversely associated with uncontrolled hypertension at the end of the follow-up. The odds ratio for uncontrolled hypertension was lower in obese men than in obese women (Sabaka

*et al.*, 2017). Increasing weight loss >10% of the initial body weight may provide added improvements in blood pressure compared to <10% in overweight or obese women (SBP,  $p=0.005$  and DBP,  $p=0.003$ ) (LeCheminant *et al.*, 2007). Winnicki *et al.* (2006) in their study among hypertension patients noted that patient had a decrease of about 0.7 mmHg for systolic blood pressure and 0.3 mmHg for diastolic blood pressure with 1 kg weight lost. However, this relationship is not true if the weight loss is more than 13% from the initial weight.

### **2.3.2 Blood glucose**

A study in Canada found that weight loss had no effect on blood glucose level ( $p=0.1$ ). However, this result could be due to the relatively normal glucose levels for most participants before the intervention program (Janssen *et al.*, 2002). Dow *et al.* (2013) in the study among 446 overweight and obese women in U.S showed there is significant relationship between weight loss and blood glucose ( $r^2 = 0.26$ ,  $p$ -value <0.001). The study found that for every 10%-point reduction in body weight, there was an estimated 4-point reduction in blood glucose level. A study among cardiovascular disease patient in New Orlean, Los Angeles found that among overweight and obese patients who had mean weight reduction of -2%, there was no significant improvement in fasting glucose. However, there is significant improvement in fasting blood glucose -4% ( $p<0.03$ ) when the mean weight reduction is 5% (Lavie *et al.*, 2009).

## 2.4 Conceptual framework

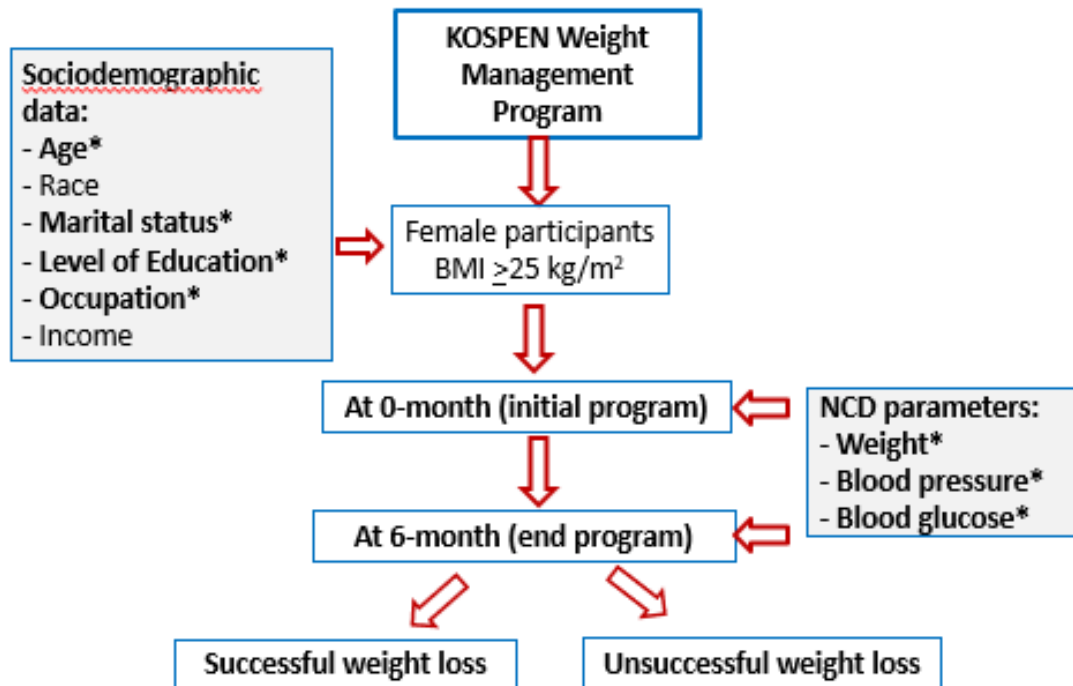


Figure 2.1: Conceptual framework of study

Parameters with bold font and asterisk (\*) were included in this study.

## **CHAPTER 3**

### **METHODOLOGY**

#### **3.1 Study design**

This was a cross sectional study using secondary data.

#### **3.2 Study duration**

This study was conducted from 15th January 2018 until 30th April 2018.

#### **3.3 Study location**

This study was conducted in Terengganu. Terengganu has eight districts in total namely Kuala Terengganu, Kuala Nerus, Marang, Hulu Terengganu, Setiu, Besut, Dungun and Kemaman. This study involved data from seven KOSPEN localities in Terengganu; one locality for each district, except Kuala Nerus. The localities involved are Kg Lorong Haji Da (Kuala Terengganu), Kg Merchang (Marang), Kg Kuala Por (Hulu Terengganu), Kg Bukit Mundok (Setiu), Kg Padang Cili (Besut), Kg Tepus (Dungun) and Kg Pasir Gajah (Kemaman).

### **3.4 Reference population**

The reference population in this study were all female participants of KOSPEN in Terengganu.

### **3.5 Source population**

The source population in this study were female participants of KOSPEN Weight Management Program in Terengganu 2017.

### **3.6 Sampling frame**

The sampling frame for this study were female participants with BMI  $\geq 25\text{kg/m}^2$  who completed the six-months program in 2017.

### **3.7 Subject criteria**

Inclusion criteria:

1. Female participants with BMI  $\geq 25\text{kg/m}^2$  and completed the six-month KOSPEN Weight Management Program in Terengganu for the year 2017.

Exclusion criteria:

1. Incomplete data either at baseline or at six months into the program.

### 3.8 Sample size determination

**Objective 1:** To determine the proportion of successful weight loss after the completion of the six-month program among female participants in Terengganu.

Using Single Proportion Formula:

$$n = \left( \frac{Z_{\alpha}}{\Delta} \right)^2 * P(1 - P)$$

$$n = (1.96/0.1)^2 \times (0.41)(0.59)$$

$$= 92.9$$

$P = 0.41$  (proportion of female with weight loss  $\geq 5\%$ ) (Jiandani *et al.*, 2016)

$$\Delta = 0.1$$

$$Z_{\alpha} = 1.96$$

Consider 10% addition to sample size due to possibility of data entry error, therefore a total of 101 participants were required in this study.

**Objective 2:** Using PS software to calculate sample size to compare 2 paired means:

Table 3.1: Sample size calculation to compare weight loss, blood pressure and blood glucose level before and after the six months KOSPEN intervention

Variables	$\sigma^*$	$\delta$	m	n	N (n+10%)	Literature*
Blood glucose (mmol/L)	0.53	0.3	1	26	30	(Madjd <i>et al.</i> , 2016)
Systolic blood pressure (mmHg)	11	5	1	40	44	(LeCheminant <i>et al.</i> , 2007)
Diastolic blood pressure (mmHg)	11	3	1	107	117	(LeCheminant <i>et al.</i> , 2007)

Power of study = 80%,  $\alpha = 0.05$

$\sigma$  = SD of blood glucose/blood pressure among female participants from the literature review

$\delta$  = detectable difference (blood glucose/blood pressure) among female participants

Therefore, the highest sample here were 117.

**Objective 3:** Using G Power software (version 3.1.9.2) to calculate sample size for association between weight loss, blood pressure and blood glucose among female participants in Terengganu:

Test family - F test

Statistical test - Linear multiple regression: Fixed model

Effect size  $f^2 = 0.15$  (medium)

$\alpha = 0.05$

$\beta = 0.8$

Number of predictors = 4

Total sample size = 85

Consider 10% addition to the sample size due to the possibility of data entry error, a total of 93 participants were required in this study.

Objective 2 has the highest sample size estimation, therefore 117 was selected as the sample size for this study.



### **3.9 Sampling method**

From the records, there were 125 female participants in the Terengganu KOSPEN Weight Management Program in 2017. Since the sample size required for this study was 117, and with the probability of incomplete data, therefore, no sampling method was applied, and all 125 subjects were selected. However, after the data cleaning, two subjects were excluded from the study as the data was not complete. Therefore, a total of 123 subjects were included in this study.

### **3.10 Research tools**

#### **3.10.1 Terengganu State Health Department KOSPEN Weight Management Program 2017 Database.**

Data from district was collected and kept in a database at the NCD unit in Terengganu Health State Department. Variables available in the database were age, height, weight at initial and six months after the program and BMI at initial and six months after the program.

#### **3.10.2 Participants log book**

Variables collected from the log book were sociodemographic data such as race, religious, educational level, occupation, marital status and past medical history. Clinical variables on blood pressure and blood glucose

level at initial and at sixth month into the program were also obtained from the participants' log book.

3.10.3 A proforma was used to collect data from participants' log book. These data were then keyed-in the SPSS.

### **3.11 Operational definition**

#### **3.11.1 Overweight**

Overweight is defined as BMI between  $25.0 \text{ kg/m}^2$  to  $29.9 \text{ kg/m}^2$  using the WHO 1998 classification for BMI and following the cut-off point classification as stated in the *Buku Modul Pengurusan Berat Badan KOSPEN (KKM, 2014)*.

#### **3.11.2 Obesity**

Obesity is defined as BMI equal or more than  $30 \text{ kg/m}^2$  using WHO 1998 classification for BMI and following the cut-off point classification as stated in the *Buku Modul Pengurusan Berat Badan KOSPEN (KKM, 2014)*.

### **3.11.3 Successful weight loss**

Successful weight loss is defined as having weight reduction equal or more than five percent from the initial weight at the start of program (Byrne *et al.*, 2012; Stevens *et al.*, 2006).

### **3.11.4 Blood glucose**

Capillary blood glucose reading (in mmol/L) at initial and six months into the program.

### **3.11.5 Blood pressure**

Blood pressure reading that was measured using automated blood pressure device at initial and six months into the program.

### **3.11.6 Category of occupation**

The operational definition for occupation is divided into three groups.

- a) Housewife
- b) White collar worker
  - This includes teacher at kindergarten, preschool, primary or secondary school, accountant and clerk.