MONASH University

Nutrition and Lifestyle Behaviours among Malaysian Adults with Metabolic Syndrome:

Development of a Community-based Peer Support Program

By

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MSc Molecular Medicine

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Abstract

Background: The incidence of metabolic risk factors such as impaired fasting blood glucose, high blood pressure, abdominal obesity, high level of triglyceride and low level of high-density lipoprotein-cholesterol are rising drastically in Malaysia. The clustering of these risk factors is known as metabolic syndrome (MetS). MetS increases the risk of developing type 2 diabetes and cardiovascular diseases, and is closely related to individuals' nutrition and lifestyle behaviours. Lifestyle interventions incorporating peer support approach have gained much attention in prevention and management of chronic diseases in recent years. However, there is a lack of evidence supporting the use peer support concept in MetS among Malaysians. Hence, the aim of this study was to develop and assess a community-based nutrition and lifestyle behaviour peer support program among Malaysian adults with MetS (PERSUADE).

Method: A five-step approach was used in the development and assessment of PERSUADE: i) Review of existing guidelines and published literature in MetS; ii) Focus group discussions among adults with MetS; iii) Behaviour matrix incorporating outcomes of the reviews and focus group discussions and Health Belief Model; iv) Development of a 12-week peer support intervention module; and v) Feasibility trial including a pre-post investigation into the effect and process evaluation of the program.

Results: Forty-eight adults (median age: 46 (IQR=11) years old) with MetS were randomised into 4 peer group. The peer groups underwent 12 weeks of intervention and 3 months follow-up. In term of program adherence, 81.3% of participants attended all peer sessions. All participants were satisfied with the content of the module with a median score of 93.33% (IQR=16.67). The median score for peer leadership however, was relatively lower at 70.00% (IQR=15.00). Repeated measure on pre-post feasibility trial showed significant improvement almost all anthropometric and metabolic parameters of MetS compared to baseline; systolic blood pressure (p=0.001, 95%CI -8.790--0.960), fasting blood glucose (p<0.001, 95%CI 0.843-0.971), total triglyceride (p<0.001, 95%CI 0.971-0.766), high-density lipoprotein-cholesterol (p<0.001, 95%CI -0.165-0.196), and waist circumference (p<0.001, 95%CI -0.775--0.083). Furthermore, significant change was recorded for nutrition parameters including total energy intake (p<0.001, 95%CI -389.128--75.242), carbohydrate (overall p<0.001, 95%CI 9.479-41.467), protein (p<0.047, 95%CI 2.797-11.250), fibre (p<0.001, 95%CI 16.368-3097.42), fat (p<0.001. 95%CI -11.335--0.816), and glycaemic load (p<0.001, 95%CI 13.373-28.815). Participants also showed an improvement in total physical activity level (p<0.001). Percentage of smokers reduced from 16.7% to 4.2% and improvement of sleep duration went up from 35.4% to 95.8%.

Conclusion: PERSUADE was a community-based peer support program designed for Malaysian adults with MetS. The process evaluation showed a high adherence, and satisfaction towards the content, besides a satisfactory acceptance of peer leadership. There were small but significant changes in metabolic parameters, dietary intake and physical activity. Future study with a larger sample size and with a comparable control arm is warranted to elucidate the effectiveness of PERSUADE in managing MetS.

Thesis including published works declaration

I hereby that this thesis contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

This Thesis includes 5 original papers published in peer-reviewed journals and 1 currently submitted for publication. The core theme of the thesis is the develop and assessed a community-based nutrition and lifestyle behaviours peer support program among Malaysian adults with metabolic syndrome. The ideas, development and writing up of all the papers in the thesis were the principal responsibility of myself, the student, working within the Jeffrey Cheah School of Medicine and Health Sciences, Monash University Malaysia, under the supervision of Dr Amutha Ramadas and Associate Professor Quek Kia Fatt.

The inclusion of co-authors reflects the fact that the work came from active collaboration between researchers and acknowledge input into team-based research.

In the case of the thesis chapters, my contribution to the work involved the following:

Thesis Chapter	Publication Title	Status	Nature and % of student Contribution	Co-author name(s) Nature and % of Co-author's contribution*	Co-author(s), Monash Student Y/N*
2	Metabolic Syndrome: A rising concern in Malaysia	Undergoing review	Planning for manuscript, review of literature and drafting of the manuscript; 80%	Quek Kia Fatt: Revision of overall manuscript; 10% Amutha Ramadas: Revision of overall manuscript: 10%	All co-authors are not Monash students
3	Contextualizing motivations and perceived	Undergoing review	Study concept and design, data	Quek Kia Fatt: Revision of overall	All co-authors are not

	barriers of healthy nutrition and lifestyle behaviours among Malaysian adults with metabolic syndrome		collection, data analysis and interpretation, assisting statistical analysis, drafting of the manuscript; 70%	manuscript; 5% Amutha Ramadas: Study concept and design and revision of overall manuscript; 25%	Monash students
3	Peer-based intervention for metabolic syndrome: A systematic review of literature and strategic framework for research	Undergoing review	Study concept and design, data collection, data analysis and interpretation, assisting statistical analysis, drafting of the manuscript; 70%	Quek Kia Fatt: Revision of overall manuscript; 5% Amutha Ramadas: Study concept and design and revision of overall manuscript; 25%	All co-authors are not Monash students
4	Process Evaluation of a Nutrition and Lifestyle Behavior Peer Support Program for Adults with Metabolic Syndrome	Accepted for publication	Study concept and design, data collection, data analysis and interpretation, assisting statistical analysis, drafting of the manuscript; 70%	Quek Kia Fatt: Revision of overall manuscript; 5% Amutha Ramadas: Study concept and design and revision of overall manuscript; 25%	All co-authors are not Monash students
4	Nutrition and Lifestyle Behavior Peer Support Program for Adults with	Accepted for publication	Study concept and design, data collection, data analysis and	Quek Kia Fatt: Revision of overall manuscript; 5%	All co-authors are not Monash students

Metabolic Syndrome: Outcomes and Lessons Learned of a Feasibility Trial	interpretation, assisting statistical analysis, drafting of the manuscript; 70%	Amutha Ramadas: Study concept and design and revision of overall manuscript; 25%

I have renumbered sections of submitted of published papers in order to generate a consistent presentation within the thesis.

Student signature: Date:

The undersigned hereby certify that the above declaration correctly reflects the nature and extent of the student's and co-author's contributions to the work. In instances where I am not the responsible author, I have consulted with the responsible author to agree on the respective contributions of the authors.

Main Supervisor signature: Date:

Other PhD-related publication during the PhD period

1. Nutrition and Lifestyle Behaviour Peer Support for Malaysian Adults with Metabolic Syndrome (PERSUADE); a Process Evaluation. Ann Nutr Metab. 2019;75 Suppl 3:1-424. doi: 10.1159/000501751. Epub 2019 Jul 31

2. Contextualizing Motivations and Perceived Barriers of Healthy Nutrition and Lifestyle Behaviours Among Malaysian Adults with Metabolic Syndrome. Ann Nutr Metab. 2019;75 Suppl 3:1-424. doi: 10.1159/000501751. Epub 2019 Jul 31

A preview of all PhD publications and their number of citations are available at https://orcid.org/
ORCID ID: orcid.org/0000-0003-1253-1426

PhD-related presentations during the PhD period

1. Poster: Qualitative Perspective on Nutrition and Lifestyle Behaviour among Malaysian Adults with Metabolic Syndrome: Analysis of Focus Group Discussion. 1st South East Asian Public Health Nutrition (SEA-PHN) Conference, Kuala Lumpur, Malaysia, July 2017.

2. Poster: Nutrition and Lifestyle Behaviour Peer Support for Malaysian Adults with Metabolic Syndrome (PERSUADE); a Process Evaluation. Asian Congress of Nutrition, Bali, Indonesia, August 2019.

3. Oral: Contextualizing Motivations and Perceived Barriers of Healthy Nutrition and Lifestyle Behaviours Among Malaysian Adults with Metabolic Syndrome. Asian Congress of Nutrition, Bali, Indonesia, August 2019.

4. Oral: Process Evaluation of a Nutrition and Lifestyle Behaviour Peer Support Program for Abdominally Obese Adults with Metabolic Syndrome. Research Symposium, Monash University Malaysia, January 2020.

5. PhD-related awards during the PhD period
1. Young Scientist Award, Asian Congress of Nutrition, Bali, Indonesia, August 2019.
2. Young Investigator Award, Malaysian Association for the Study of Obesity (MASO) 2019 Scientific Conference on Obesity, Kuala Lumpur, Malaysia, October 2019.

PhD-related journal reviewing during the PhD period

1. BMC Public Health, 2018 – 3 manuscripts.

Declaration

This thesis contains no material which has been accepted for the award of any other degrees or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

Signature

Print Name: MUHAMMAD DANIEL AZLAN MAHADZIR

Date:

Acknowledgement

I firstly dedicate my thesis to my life partner and my bestfriends who has been very close to me throughout this doctoral journey. Thank you for believing in me when I was too weak and exhausted to believe in myself. Thank you for pushing me, for repeating those affirmations that don't mean anything in inspirational films but mean everything when someone who cares about you says them. Thank you for not judging me when I did something really stupid, but also thanks for telling me I was an idiot and probably shouldn't have done the stupid thing. Thank you for always being honest.

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A notable mention to Dr Ann Farah Shafeera who started this journey together with me. You have been very supportive even when I have lost my own strength and faith in finishing this challenging yet meaningful doctoral journey. From official meetings to coffee chats, overnight stays in the lab and, impromptu emotional conversations, were all vital in keeping me strong. Despite the bittersweet journey, thank you for always keeping me in your thoughts and prayers.

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Thanks for all your encouragement!

CHAPTER 1

INTRODUCTION

1.1   Background

The burden of chronic diseases in the world is increasing and the effect is magnified in developing countries such as Malaysia (1). National Health and Morbidity Survey (NHMS), in 2015, reported cardiovascular diseases (CVD) and type 2 diabetes (T2DM) to be the two primary causes of mortality and reduced quality of life in Malaysia (2). Metabolic syndrome (MetS) is a clustering of risk factors that increase individuals' risk of developing T2DM and CVD (Figure 1).

Figure 1: Components of metabolic syndrome

The pathophysiology of MetS is commonly explained by the increase in insulin resistance that signifies an internal metabolic chaos (3). The proportion of Malaysian adults diagnosed with individual MetS risk factors such as impaired fasting blood glucose levels, high blood pressure, abdominal obesity, high fasting blood triglyceride levels and low fasting HDL-cholesterol levels are rising tremendously (2). However, the awareness about the effect of the clustering of these risk factors is poor, and this may be due to the absence of international consensus on MetS as a disease (4). Since MetS is treated individually based on its risk factors, many experts assumed MetS as a clustering and

not a disease (4). Consequently, there are multiple definition of MetS being used in the world and different defining criteria have been provided by World Health Organization (5, 6), National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATPIII) (7), International Diabetes Federation (IDF) (3), and Joint Interim Statement (JIS 2009) of the International Diabetes Federation Task Force on Epidemiology and Prevention (National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity) or also known as Harmonised Criteria (4). Despite the definition used, MetS prevalence is high across the world and particularly in Malaysia where the prevalence ranged in between 22.9% and 42.5% (8).

The hallmark of MetS is abdominal obesity measured by waist circumference (WC) (9). Excess of abdominal fat is most closely associated with the metabolic risk factors and most likely to be the initiating risk factor of MetS (10). There is substantial evidence to point out abdominal fat is predictive of insulin resistance and of the presence of other related metabolic abnormalities (11). However, the mechanisms by which abdominal obesity is causally related to the MetS are not fully understood. Despite that, the definitions mentioned above have different cut-off values of abdominal obesity. Ramli and colleagues reported the difference in prevalences based on various MetS definitions and found that JIS definition is the most sensitive and can detect MetS better among Malaysians (12).

1.2   Problem statement

MetS is closely related to individuals' nutrition and lifestyle behaviours (4). NCEP-ATPIII suggested that attention must firstly be given to individual modification of lifestyle behaviours alongside with pharmacological treatment for each MetS risk factor(13). A recently published review outlined poor dietary habits, sedentary lifestyle, smoking, and poor sleeping pattern as lifestyle-related factors that increase the prevalence of MetS in Malaysia (8). As the evidence on modifiable risk factors on chronic diseases grows, the government launched the National Strategic Plan on Non Communicable Diseases (13) to mobilise the entire healthcare sectors to combat NCDs including T2DM and CVD. Since, MetS is a sub-clinical precursor to these two serious and costly clinical conditions, it become an ideal target of intervention which was unfortunately neglected in the national strategic plan (8).

As mentioned earlier, lifestyle intervention is the first line in managing or preventing MetS (14). In their systematic review, Martin et al (14) described lifestyle intervention as the most important step in managing adults with MetS from developing CVD and T2DM. This is supported by Takahara et al (15) in their review where effective lifestyle intervention was described to be equally important to pharmacological treatment of MetS risk factors. However, it is always more challenging to change

one's lifestyle habits compared to initiation of pharmacological treatment. Sullivan et al describe the these challenges in the management of MetS (16). The main barrier to practical application of lifestyle changes is when it is much easier for a physician to prescribe a pill than to foster long-term lifestyle changes. The authors then explained that lifestyle and behavioural changes is initiated when physician helping their patients to make a proactive choice. Current healthcare services requires overall change in perception towards implementation of a healthful lifestyle to achieve this (16). This change must include the individual, his or her community, besides consideration of their literacy level and cultural acceptability.

Currently, existing evidence on lifestyle interventions for MetS elucidated temporary behavioural changes rather than long term or permanent changes (17) (18). Annesi et al coined the temporary changes in lifestyle behaviour as 'behavioural decay' and hypothesised that such decay happened when intervention were designed without prioritising the patients (19). The effectiveness of lifestyle intervention increases when the curriculum is harmonised to include the aspects of culture and literacy level (20) and in some cases, socioeconomic status (21).

1.3   Research question

The high prevalence of MetS in Malaysia demands a closer look on its prevention measures and line of management. Hence, as an integrative step to the respective clinical practice guideline, peer support program is seen to be a viable approach in term of lifestyle intervention on adults with MetS. The study aimed to answer this research question:

Does a community-based, peer-led, group-based, peer support program improves metabolic outcomes, nutrition and lifestyle behavioural measures in Malaysian adults with MetS?

1.4   Research hypothesis

A community-based, peer-led, group-based, peer support program improves metabolic outcomes, nutrition and lifestyle behaviour measures among Malaysian adults with MetS.

1.5   Research objectives

General Objective

To develop and assess the feasibility of a community-based peer support intervention in improving metabolic outcomes, nutrition and lifestyle behaviour measures among Malaysian adults with MetS using a systematic five-step approach.
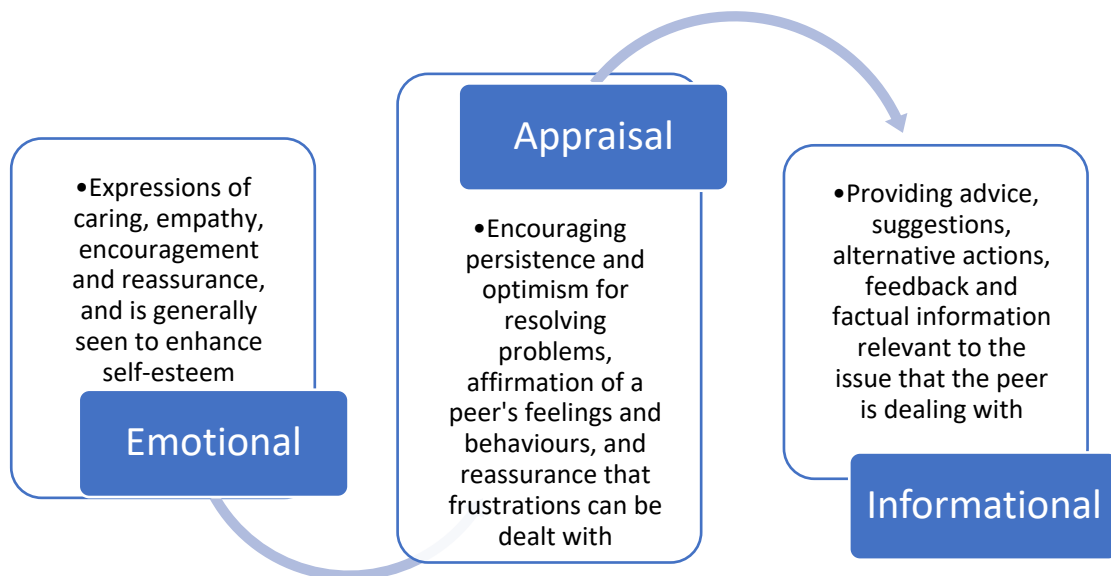
Specific Objectives

1. To conduct systematic review of literature on peer group-based lifestyle intervention on adults with MetS.
2. To determine motivation and barriers to nutrition and lifestyle changes in adults with MetS using a qualitative approach.
3. To develop a behavioural change matrix consolidating behavioural theme, behavioural change techniques and behavioural determinants as a backbone of program development.
4. To develop an evidence-based and community-specific community-based peer support program module.
5. To assess the effect of community-based peer support intervention on metabolic outcomes, nutrition and lifestyle behavioural parameters among Malaysian adults with MetS.

1.6   Significance of the study

Incorporating peer support in lifestyle intervention has gained much attention in prevention and management of chronic diseases. Peer for Progress is one of the largest and most well-known research in this aspect, where the program helped diabetic peers to achieve improvement in lifestyle behaviour and eventually a better glycaemic control (22). Dennis et al. defined peer support within a healthcare context as "the provision of emotional, appraisal and informational assistance by a created social network member who possesses experiential knowledge of a specific behaviour or stressor and similar characteristics as the target population" (23). Peers is an individual who shares common characteristics with the 'targeted' group, allowing her/him to relate to and empathize with. As a result, peers can offer three main types of support: emotional, appraisal and informational; based on experiential knowledge, rather than formalized sources (23) (Figure 2).

Incorporating peer support in management of chronic diseases such as T2DM , CVD and hypertensions has shown to improve glycaemic control, induce weight loss and increase quality of life (24). However, there are limited studies published on the effectiveness of peer support on MetS. Greer et al did a study on incorporating group medical visits among adults with MetS (25) and Shahar et al

did a study on group-based lifestyle intervention among rural people in Malaysia (26). Both studies found a significant change on WC after participating group-based lifestyle intervention. Owing to the growing evidence on peer support framework, this thesis described the development, implementation and feasibility of a new nutrition and lifestyle behaviour peer support program among Malaysian adults with MetS.

Figure 2: Supports that can be provided by peers

1.7   Ethics approval

The study has received ethics approval from Monash University Human Research Ethics Committee (CF16/56 - 2016000022).

1.8   Thesis flow

This thesis is divided into five chapters. The first chapter introduced the readers to the overall background and aim of the study. Subsequent Chapter 2 describes the current MetS status in Malaysia in term of its prevalence, associated risk factors and published interventional studies. The third chapter describes the development of fundamental elements of the peer support module which incorporated a systematic review of published evidence on peer-group based lifestyle intervention on MetS and also a qualitative analysis of focus group discussions among Malaysian adults with MetS. Chapter 4 describes the implementation and feasibility study of the newly developed program and finally the Chapter 5 provides the readers with an overall conclusion and recommendations for future research.

CHAPTER 2

LITERATURE REVIEW

2.1   Overview

This was a scoping review conducted among sixty-one peer-reviewed articles from year 2000 to 2018 related to MetS and Malaysian population. The prevalence data reported to fall in between 23% to 45% across all definitions. The high rate of MetS is consistent with the high rate of CVD and T2DM cases in the country.

The review article also described Malaysian studies on associated lifestyle-related risk factors such as high carbohydrate intake and sedentariness. These unique risk factors should be emphasised in the development of a lifestyle intervention specific to Malaysians.

It was interesting to note that only three intervention studies that targets specifically on MetS in Malaysia were available. Two of the studies focussed on functional foods while another one focussed on nutrition education. The finding of this scoping review shows a clear lack of interventional studies despite the well-known knowledge that MetS is best managed through an intensive yet relevant lifestyle intervention.

Findings from our scoping review is crucial to set the direction of the intervention development. This paper gives us a clear picture on how burdening MetS to Malaysia and what is the factors contributing to high rising of MetS prevalence.

Metabolic syndrome: A rising concern in Malaysia

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BMC Public Health

Metabolic Syndrome; A rising concern in Malaysia
--Manuscript Draft--

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Abstract:	Background

Metabolic syndrome (MetS) represents a constellation of risk factors, including hypertension, dyslipidemia, central obesity and impaired fasting glucose reflecting an underlying pathophysiology of insulin resistance and adipose tissue dysfunction. Recent research shows that MetS poorly affects developing countries such as Malaysia and poses a major burden to its modern society. The findings from the latest National Health and Morbidity Survey (NHMS 2016) suggested that the prevalence of metabolic syndrome has increased rapidly in recent years, partly as a result of rapid socioeconomic development. Method

This paper is a scoping review of the MetS research done in Malaysia from the year 2000 till 2018. A thorough search using the word 'Metabolic Syndrome' and 'Malaysia' was done in nine medical databases; Pubmed, Scopus, MEDLINE, CINAHL, AMED, Embase, Emcare, Web of Science, Cochrane. Titles and abstracts were reviewed based on inclusion and exclusion criteria.Results

61 related studies done in Malaysia highlighting the prevalence data, population-specific risk factors and the latest therapeutic study done on MetS. In short, the MetS prevalence in Malaysia is high (26.5% to 43.4%). MetS is found to worsely affects the Indian population, gender female, urban dwellers and people at older age. Related risk factors for MetS in Malaysia include being overweight and obese, having a good appetite, high intake of carbohydrate and physical inactivity. There were only four therapeutic studies done targeting MetS with a neutral and insignificant outcome. Conclusion

As a whole, this paper has generated important public health data and enough evidence to show that the prevalence of MetS and its associated risk factors is alarmingly high among the adult population in Malaysia. There is indeed an urgent need to further improve the current primary care initiative to promote better health intervention programs. |

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Metabolic Syndrome; A rising concern in Malaysia

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Abstract

Background

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Conclusion

As a whole, this paper has generated important public health data and enough evidence to show that the prevalence of MetS and its associated risk factors is alarmingly high among the adult population in Malaysia. There is indeed an urgent need to further improve the current primary care initiative to promote better health intervention programs.

Keyword

Prevalence, metabolic syndrome, cardiovascular disease, diabetes, risk factor.

Background

"Syndrome X," was first described by Reaven in his 1988 Banting Lecture (1). As the understanding deepens, in the 1998, the World Health Organization (WHO) reinstate Syndrome X as Metabolic Syndrome (MetS) and lined that insulin resistance and adipose tissue dysfunction are thought to be the primary mediators of clustering of cardiovascular diseases (CVD) risk factors (2). Metabolic syndrome (MetS) defined as a cluster of metabolic abnormal risk factors that includes hyperglycemia, obesity, atherogenic dyslipidemia, and hypertension (1, 3). MetS has a unique pathophysiologic attributes and these risk factors are prone to cluster hence increases the risk of developing Type-2 diabetes mellitus (T2DM) and CVD by 5 to 9 fold (2). The clustering risk factors has also shown to increase all-cause mortality in a wide variety of populations (4). Since then MetS has become the subject of paramount research interest and also a subject of ongoing deliberation with regard to its clinical value as a diagnostic criteria. Several criteria for MetS continued to emerge over the last few decades started by WHO itself in 1998 and followed by National Cholesterol Education Program Expert Panel III (ATPIII) in 2001, and the International Diabetes Federation (IDF) in 2006 (1). After several years of debate and discussion, in 2009, a joint interim statement joined by the IDF Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity, elucidated a 'harmonized' MetS definition (5). Irrespective of the diagnostic criteria used, epidemiological studies from various parts of the world have clearly demonstrated that MetS is an increasing global health problem, not only in the western societies, but also in the Asian populations (6). Malaysia is a rapid developing country with a multi-ethnic heterogeneous population consisting of Malays (51%), Chinese (27%), Malay-related and aboriginal groups (11%), Indians (8%) and mixed ethnic groups (3%) (7). The rapid growth and development and improved socio-economic status in Malaysia has a profound effect on the lifestyle behaviors of its population and consequently the disease patterns. The National Health and Morbidity Survey III (NHMSIII) in 2006 indicated that the prevalence of overweight and obesity, hyperlipidemia, hypertension and diabetes among

Malaysian adults has increased substantially over the last 10 years (8) A recent national survey showed that 42.5% of Malaysian adults were diagnosed with MetS and a higher prevalence was observed in women (43.7%) than men (40.2%). As the gap between rural and urban or low and high income groups is diminishing the prevalence was between areas and socioeconomics group begin to vanish hence suggesting that the exposure of MetS risk factor is similar nationwide (9). This paper aim to review the latest published research evidence of the MetS the Malaysian population as reported from the year 2000 until present. Subsequently, this review will elucidate the latest prevalence data as well as a range of risk factors specifically known to the development of MetS in Malaysia.

Methodology

Literature Search

A scoping review was done to elucidate the extent of MetS research done among Malaysian adults.

Our research question was "What is the prevalence and related lifestyle behavioural risk factors among Malaysian adults with Metabolic Syndrome?". A combination of term "metabolic syndrome" and "Malaysia" was searched in eight medical databases; Pubmed, Scopus, MEDLINE, CINAHL, AMED, Embase, Emcare, Web of Science and Cochrane on 31st March 2018.

Inclusion and exclusion criteria

After removal of duplicates, abstracts were screened by the all authors. We include studies that was done among Malaysian adults and presented findings on prevalence, specific MetS risk factors and available therapeutic approach. We exclude studies outside Malaysia, studies on paediatrics and young (< 18 years old) population and in vitro and in vivo model studies. After achieving consensus by all authors, full text articles were retrieved and included in the review.

Results

Literature Search Results

The review followed guidelines provided by Transparent Reporting of Systematic Review and Meta-analysis (PRISMA). Eight electronic databases up to March 2018 were searched using MeSH terms ("metabolic syndrome" and "Malaysia") and elucidated 718 titles. After removal of duplicates, 198 titles and abstracts were screened and 61 papers were included in the review. Figure 1 shows the PRISMA flowchart for the systematic literature search.

Prevalence

In lieu to the alarming rate of CVD and diabetes, studies has been done to elucidate the prevalence of MetS in Malaysia. Current research findings on the prevalence of MetS in Malaysia have not been consistent because of varied definitions and population difference used in different studies. Multiple nationwide cross-sectional study on MetS however have suggested that the prevalence falls in between 26.5% to 43.4% (1) depending on definitions used in the study. In 2012, Mohamed et al sampled 4341 adults and found that the prevalence is 32.1%, 34.4%, 37.1% and 42.5% according to WHO, NCEP ATPIII, IDF and Harmonized respectively (3). A year later, Ramli AS et al found that in a bigger sample size of 8836 adults, the prevalence of MetS are 26.5%, 37.4% and 43.4% according to NCEP ATPIII, IDF and Harmonized respectively (1). These two studies shows a consistent findings based on the definitions used hence suggested that despite the definition used, the prevalence of MetS in significantly high.

Table 1 MetS prevalence based on Nationawide cross-sectional studies.

Study	Sample Size	Prevalence				Remarks
		WHO (1999)	NCEP ATPIII (2001)	IDF (2006)	Harmonized (2009)	
Mahmoud, WN. (2010) (2)	4341 Mean Age (47.8±14.5) years old	32.1%	34.3%	37.1%	42.5%	MetS was higher in urban areas, was higher in females, increased with age, and was highest among India population. (3)

Ramli, AS. (2013) (1)	8836 Mean Age (53.2±10.6) years old	NA	26.5%	25.5%	43.4%	MetS was higher in female, was highest among India population, increased with age, and was highest among low education. (1)
Andrew, KG. (2011) (15)	2366 Mean Age (43.6±10.5) years old	NA	36.1%	30.1%	NA	MetS was highest among India population
Yeow, TP. (2012) (2)	4341 Mean Age (52.7±12.8) years old	NA	34.3%	NA	42.5%	MetS was higher in females, was higher in urban areas, increased with age and was higher in individuals with history of smoking
Rampai, S. (2012) (14)	17,211 Mean Age (36.9±0.2) years old	NA	NA	NA	27.5%	MetS was highest in India population, was higher in females and increased with age.

As shown in the table, Harmonized criteria was able to capture higher MetS prevalence compared to the rest of the criteria. Following its introduction, Harmonized criteria is commonly used in MetS research along with ATPIII and IDF. Moreover, on top of the usability of waist circumference as a vital predictor, due to the difficulty and impracticality to perform insulin resistance and microalbumin measurement in clinical practice and in large epidemiological studies, most reports on MetS excluded WHO criteria. Nevertheless, the table as a whole summarizes an alarming prevalence of MetS in Malaysia and it is in line with the finding of our own NHMS 2015.

Sociodemographic Risk Factor

Gender

All four nationwide study found that the prevalence of MetS is higher in female compared to male (1, 3, 2, 14). In a smaller urban Malay cohort, the prevalence of MetS among female is recorded higher compared to men using IDF (52.9% vs 47.1%) and ATPIII (54.7% vs 45.3%) criteria (,11). The same scenario also obeserved among the rural population as Jan M. et al reported a higher prevalence in female compared to male using Harmonised (42.9% vs 29.8%), IDF (36.6% vs 26.6%) and ATPIII (34.3% vs 20.2%) criteria (,10). Another study on rural community also reported a worrisome prevalence of 63.7% (IDF) among female as compared to 36.3% (IDF) in males (16). Prevalence data on elderly also elucidated a higher female MetS incidence compared to males (48.1% vs 36.3%) using IDF criteria. This findings highlight the gender gap in MetS incidence. Bentley-Lewis, Koruda, and Seely (2007) (10) speculated several reasons for a higher prevalence of MS in women. These factors included pregnancy, lactation, gestational diabetes mellitus, preeclampsia, hormonal contraceptives, menopause, and polycystic ovary syndrome. Differences in socioeconomic status, work-related activities, and cultural views of the body have also been considered contributing factors of a higher prevalence of MS among women (16).

Age

As table depicts, the mean age for the first three study is older than the recent one by Rampai, S. et al. This raised the concern that MetS prevalence is influenced by the age. Studies has reported the incidence of MetS among population is shown to increase propotionately with age (1, 3, 10). Aye, M. et al summarized an increment of risk of 1.04 fold higher for each year of age increase (17). Findings in nationwide studies (1, 3, 2, 14) has shown, regardless of gender, MetS prevalence rises as the age gets older. However, two studies found that the prevalence of MetS is highest in the age bracket of (40-49 years old) (11) and (50-59 years old) (18). Both studies agree that this finding was either attributed to the 'healthy worker effect' (11) or merely be a chance of finding (11, 18). In a small elderly cohort (mean age 66.4±5.9 years old), Johari et al studied 343 elderly and found that only 43.4% (IDF) of them are having MetS (17). Despite the conflicting findings, this trend of MetS with age

is probably due to increasing occurrence of metabolic components or risk factors with increasing age especially on abdominal obesity and triglycerides (19).

Location

Mohamud, WN. in his study found that the urban dwellers are more susceptible to MetS compared to rural community; WHO (32.8% vs 31.3%), ATPIII (36.0% vs 32.6%), IDF (39.1% vs 35.0%) and Harmonised (44.9% vs 40.0%) (3). However, a larger nationwide study a couple of years later elucidates a similar likelihood of having MetS amongst the rural and urban population (1). Hamid Jan et al reported an adverse MetS prevalence in a rural setting to be 37.5% (Harmonized), 32.4% (IDF) and 28.4% (ATPIII) (10). Besides, a rural hospital based study also found a high MetS prevalence among the outpatient; 48.7% (IDF). Furthermore, a study on rural Orang Asli (indigenous) community also have shown an increasing prevalence of MetS, 22.7% (IDF). This finding supports the hypothesis that rapid economic development leads to urbanization of rural areas resulting the population to adopt urban lifestyle hence the similar CVD and T2DM risk exposure.

Education Levels and Income Brackets

Furthermore, difference in prevalence also found among people whom received different level of education and status of employment. Urban dwellers are usually of those with occupation hence receive better education as compared to rural population. One study shows that the prevalence of MetS among housewives, unemployed and those whom earn at the lowest income bracket is high (10). The lowest prevalence of MetS was found at the extreme ends of education level; tertiary and no formal education (1). In contrast, two studies found that people with primary education has the highest prevalence of MetS (1, 10). Housewives are usually engaged in household activity and child bearing hence spent less time in leisure time physical activity, leading to a sedentary lifestyle. A study among Malaysian housewives showed that 50.4% of respondents had low physical activity (20) In extension, Samir et al. (2011) also indicated that lack of information, motivation and skills, family support, accessibility to places for physical activity, cost-effective facilities, and time are the most significant common reason for inactivity among the unemployed and low income earners (21).

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Medical History

On another point of view, the prevalence of MetS among critical population varies. In a study among T2DM patient, the prevalence soars up to 84.8%, 95.8%, 96.1% and 97.7% according to IDF, WHO, NCEP ATPIII and Harmonized criteria (4). Since insulin resistance is the hallmark of MetS it explains the peak prevalence among T2DM patients. Futhermore, The Subang Men Study has diagnosed 31.6% (IDF) of men with erectile dysfunction (ED) or testosterone deficiency syndrome (TDS) with MetS. Besides, a study among Schizophrenia patients whom receiving monotherapy antipsychotic treatment shows a staggering prevalence of 66.7% according to NCEP ATPIII (22).

As the prevalence varies across gender, race, age, location, level of education and employment status, these attributes serve as the demographical factors that influence the incidence of MetS among Malaysian population. Generally, the prevalence of MetS is comparably high across the population as the large epidemiological studies suggest. Hence, it raises the importance of population-specific risk factors identification that will aid a better MetS prevention and management program.

Modifiable Risk Factors

Nutrition and Diet

High carbohydrate intake, defined as more than 60% total calorie intake increased the risk of MetS in men by 2.8 folds and in women by 0.6–2.7 folds (17) by significantly increasing the blood TG levels. Besides, excessing carbohydrate consumption would increase insulin resistance particularly in an aging population (17, 30). Nevertheless no study has investigated the association between types of carbohydrates and MetS, which warrants further in depth study on dietary pattern. Other than that, good appetite may lead to a higher amount of food intake leading to MetS. Previous study indicated that energy and nutrient intake were higher among individuals with good appetite as quantify using Council of Nutrition Appetite Questionnaire (CNAQ) (,17). In term of diet quality, low intake of Vitamin D is associated with increase in MetS risk (11). Approximately 41% and 87% of Malaysian males and females respectively had insufficient (< 50 nmol/L) levels of 25-hydroxyvitamin D which increase the odd of having AO hence MetS as a whole. As explained above, AO is highly associated with insulin

resistance. Another dietary risk factor that is associated among Malaysian is Food Security (32). There

is conflicting finding as studies in either low income or general populations elsewhere reported that

food insecurity is a risk factor for metabolic abnormalities (33-39), but the single study in Malaysia do

not support the claim. Despite having high diet diversity score, food secure women had the highest

prevalence of MetS (29.6%) compared to women from household food insecure (25.7%), individual

food insecure (23.4%) and child hunger (24.2%) households. Hence, this warrants a future study on

the nature of food insecurity among Malaysian; chronic, recurrent or episodic. The cycle of food

insecurity is important to determine its influence on MetS (32).

Lifestyle and Behavioral Risk Factors

In term of behavioural risk factors, studies has been done in Malaysia to elucidate low physical activity

and history of past smoking is associated to MetS. Chu, H.Y et al studied a group of 686 Malay on the

relationship between the incidence of MetS and physical activity levels found the prevalence of

metabolic syndrome among participants with low, moderate or high activity levels was 13.3%, 11.7%

and 7.0% (ATPIII) (27, 28, 29). The average Malay community has moderate physical activity levels

with total reported physical activity was 1710.5 MET-min/week (28). Domestic physical activity was

the domain in which participants were most active followed by occupational, transportation and

leisure-time. In this particular group, the average total sitting time (including transportation) was

7.6±2.4 h/day which is very long and deletrious. Hence, joint analysis of sitting time and physical

activity shows that higher sitting time and insufficient physical activity were deleteriously associated

with odds for metabolic risk factors in middle-aged Malay men and women (27). However, men

reported significantly higher total physical activity scores than women while the overall energy

expenditure of the participants was 1898.4 (1757.8, 2098.7) kcal/kg/week (29). This findings may

account to the higher MetS prevalence among women compared to men. Other than that, studies

found that low physical activity may account to the increasing prevalence in elderly (17, 30), shift

workers (16), overweight and obese (11) and indegenious tribes (14, 31). More to discover on the

status of physical activity among Malaysian and its influence of the hike of MetS. On another point of

view, besides our understanding on harmful effect of smoking, history of past smoking was associated with MetS with an odds ratio of 1.27 than the current smoking habit (2).

As a whole, the studies focussed on MetS in Malaysia results on a very scarce information on the associated population risk factors. The understanding of MetS is at its infants stage and a thorough research is in need given that the MetS prevalence is hiking tremendously in Malaysia.

Interventional Studies

From our database search, we found only 3 relevant studies that focussed on MetS intervention in Malaysia. Teng, KT studied the impact of dietary fatty acids in particular saturated fatty acid (SFA) (in the form of palmitic acid), monounsaturated fatty acid (MUFA) and n-6 polyunsaturated fatty acid (n-6 PUFA) from commonly available culinary oils on thrombogenic and inflammatory aspects (40). The study demonstrated that the amount of dietary fatty acids affects postprandial lipemia in MetS subjects. It is well recognized that postprandial lipemia is linked to endothelial function by altering thrombogenic or inflammatory state. However, low fat and high carbohydrate diet which is common in Malaysia has dampened the lipemic response especially among MetS individuals. This study found that the amount and type of fatty acids are key determinants of the magnitude of the lipemic response and the response is beneficial to MetS subjects as thrombogenic and inflammatory response are precursor in insulin resistance and atherosclerosis (41). Due to a small sample size, the results is shown to be insignificant yet a beneficial trend is found to influence blood pressure, blood HDL and TG levels in MetS individuals.

Other than that, Ibrahim et al studied a group of menopousal women with MetS on the protective effect of *Nigella sativa* supplementation (42). The casuality of *N. sativa* consumption in the form of coffee mix, oil products as a source of supplement which is believed to help to boost energy level with a little understanding on its actual benefits nor toxicity effect deemed a scientific investigation in Malaysia. The results showed significant decrease in the development of hyperlipidemia and

hyperglycemia among menopausal women in *N. sativa* treatment group compared to placebo group. The hypolidemia effect was hypothesized to be due to an up-regulation of LDL-C molecules (43) through receptor mediated endocytosis or through non-enzymatic lipid peroxidation by antioxidant properties of *N. sativa* (44) making liver cells more efficient to remove LDL-C from blood by increasing LDL-C receptor densities in liver and binding to apolipoprotein, apo B.20 (45, 46) . Besides, the hypoglycemic response was suggested to be due to Thymoquinone, the active constituent of *N. sativa* that are able attentuate oxidative stress hence preserving the integrity of pacreatic beta cells (47).

Besides pharmacological agents, a study focussing on lifestyle intervention among elderly with MetS was done by Shahar et al (48). The intervention program was conducted in four sessions over 6 months and was delivered via group counselling sessions, talks, and cooking and exercise demonstrations using the specifically developed healthy aging packages comprising a flipchart, five placemats and one booklet. The flipchart entitled "Nutrition Guide for Older People: Reducing Risk of Chronic Diseases" consists of specific nutrition and lifestyles guidelines to reduce the risk of chronic diseases. This 6 months nutrition education intervention showed significance for improving total cholesterol levels in men and waist circumference in women with MetS. Besides, it shows improving trends in MetS risk factors including body weight, blood HDL levels and FBG levels. The study showed that it is feasible, possible and desirable to conduct a suitable nutrition education intervention program in our population, provided that the program was designed to target a specific problem in the population and considers the needs of the population. Given that the degree of influence of environmental factors, particularly lifestyle behaviour and dietary habits, on the incidence of MetS, a lifestyle intervention is deemed as the most relevant approach for both management and preventative strategies for MetS.

Discussion

Regional Concern

MetS is a growing epidemic worldwide and is associated with an increased incidence of atherosclerotic CVD and T2DM. This reviews highlighted a number of studies that underlines the magnitude of cardiovascular risk factor clustering in the Malaysian population. Earlier, NHMS in 2011 and 2015 shows a similar trend of escalating cardiovascular risk factor prevalence over the last two decades (3, 49). Irrespective of the definition used, Malaysia seemed to record a much higher prevalence of MetS compared with other Asian countries, such as Singapore (50), Japan (51), India (52), Nepal (53). Hong Kong (54) and China (55), where prevalence ranged from 6.1 to 18.3%, when based on ATP III definition, and increased to 9.6–25.8%, when data were analysed using IDF criteria. Comparatively, prevalence in the non-Asian population, by NCEP ATP III, in the United States (34.0%) (56) and Iran (34.7%) (57) was much higher compared the published data in Malaysia. In the NHANES III study, the prevalence of MetS was shown to increase with age, reaching the peak at around the age of 60 years and above (58) which is the same found in Malaysia (1, 3, 14, 59). As reported in the NHMS in both 2006 (49) and 2011 (8), the prevalence of obesity, hypertension and diabetes has escalated tremendously over the last 10 years, in tandem with the country's rapid urbanization and improved socioeconomic status. Nevertheless, this is not exclusive to Malaysia, as such observations have also been reported in many other economically developing countries such as China (55) and India (52).

It is a known that Asians, in particular of South Asian origin, have an ethnic predisposition to abdominal obesity, hypertension, dyslipidemia and hyperinsulinemia and glucose intolerance and, as such, have a higher incidence of MetS, resulting in increased morbidity and mortality rates due to T2DM and CVD (60, 61). Based on the current studies, Malaysia has the highest prevalence of abdominal obesity (44.9 and 64.2% in men and women) (3, ,11) compared with other countries with similar ethnic populations, such as China (55, 63), Hong Kong (62) and India (63), where the overall prevalence is reported to be 7.7, 25.2 and 31.4%, respectively. The highest prevalence of abdominal obesity and elevated glucose

was observed in Indian subjects (1, 3) and hypertension and elevated TG were more prevalent in Malays (14) and Chinese (2, 14), respectively. In terms of location, studies shows that the likelihood of having MetS amongst the rural population was similar to their urban counterparts (1, 2), in concordance with the NHMS 2011 cohort study group whose data indicates that cardiovascular risk-factor clustering was similar in urban and rural populations (9, 49). This findings support the hypothesis that rapid economic development leads to urbanization of rural areas in Malaysia, resulting in the rural population adopting sedentary lifestyle, akin to their urban counterparts, and, therefore, exposed to similar T2DM and CVD risks. Henceforth, sociodemography and environmental factors are equally important, and are likely to be the main contributing factors to the high prevalence of MetS and CVD risk profiles as seen among Malaysians.

Definition Difference

Generally, MetS is highly prevalent in the adult population worldwide, with predisposition suggested in Asians (10). Research findings on the prevalence of MS in Malaysia have not been consistent because of varied definitions; WHO, ATPIII, IDF and Harmonized, and the population differences used in different studies. Table 2 below summarizes the clinical value used for each diagnostic criteria.

Risk Factors (RF)	World Health Organisation (WHO), 1999	National Cholesterol Education Program Expert Panel III (ATPIII), 2001	International Diabetes Federation (IDF), 2005	Joint Interim Statement (JIS) 'Harmonized', 2009
Obesity Body Mass Index (BMI)	>30kg/m^2	Not used	Not used	Not used
Obesity Waist-to-hip Ratio (WHR)	M >0.9 F >0.85	Not used	Not used	Not used
Obesity Abdominal/Waist Circumference (WC)	Not used	WC [Caucasian] M ≥102cm F ≥88cm	WC [South Asian] M ≥90cm F ≥80cm	WC [South Asian] M ≥90cm F ≥80 cm
Hypertension	Systolic ≥140mmHg	Systolic ≥130mmHg	Systolic ≥130mmHg	Systolic ≥130mmHg

	Diastolic ≥90mmHg or on antihypertensive treatment	Diastolic ≥85mmHg	Diastolic ≥85mmHg or on antihypertensive treatment	Diastolic ≥85mmHg or on antihypertensive treament
High Fasting Plasma Glucose (FPG)	DM, IGT or IR	≥6.1 mmol/L or DM	≥5.6 mmol/L or DM	≥5.6 mmol/L or DM
Microalbuminuria Urinary Albumin Excretion (UAE)	≥20 mg/min	Not used	Not used	Not used
Microalbuminuria Albumin Creatinine Ratio (ACR)	≥30 mg/g	Not used	Not used	Not used
Dyslipidemia Elevated Triglyceride (TG)	≥1.7 mmol/L	≥1.7 mmol/L	≥1.7 mmol/L	≥1.7 mmol/L
Dyslipidemia Reduced high density lipoprotein (HDL-C)	M <0.9 mmol/L F <1.0 mmol/L	M <0.9 mmol/L F <1.0 mmol/L	M <0.9 mmol/L F <1.0 mmol/L	M <0.9 mmol/L F <1.0 mmol/L
Metabolic Syndrome	DM, IGT or IR any 2 or more RF	At least 3 RF	WC 2 or more RF	At least 3 RF

M: Male; F: Female; DM: Diabetes Melitus; IGT: Impaired Glucose Tolerance; IR: Insulin Resistance

Prior to its pathological identification, WHO outlined 8 risk factors associated with MetS. WHO characterised MetS by diagnosing an individual with insulin resistance, diabetes or impaired gluocose tolerance with two more risk factors either obesity, hypertension, microalbuminuria and dyslipidemia. Later it is found that abdominal obesity observed by waist circumference is a better metabolic abnormality predictor compared to both BMI and WHR. Henceforth, ATP III criteria characterised MetS based on the presence of any 3 out of 5 risk factors which. The clinical value for abdominal obesity and fasting blood sugar level imply in ATPIII criteria however was estimated based on caucasian population. IDF, on the other hand considers abdominal obesity as a mandatory component where different cut-off points for waist circumference must be ethic specific on additional of 2 other risk factors. These three main MetS criteria elucidated a heterogenous findings on prevalence worldwide especially among Asian populations. More recently, in an effort to standardise the criteria for MetS, a

joint interim statement was made by a collaborative team consisting of the IDF Task Force on Epidemiology and Prevention, National Heart, Lung and Blood Institute, American Heart Association, World Heart Federation and the International Association for the Study of Obesity. It was proposed that abdominal obesity should no longer be a prerequisite feature of MetS, and that diagnosis should be based entirely on the presence of any 3 of the 5 risk factors (11). The waist measurement cut-off points, however, were to remain ethnic and gender specific, as previously recommended in the IDF criteria. Nonetheless, irrespective of the diagnostic criteria used, it has been clearly demonstrated that subjects with MetS are at higher risk of developing cardiovascular disease (CVD) and type 2 diabetes compared with those without the syndrome (12, 13).

Primary Care Empowerment

MetS has now become a major public health threat and clinical problem. A higher MetS prevalence would translate into higher numbers with established T2DM, CVD, and events, leading to increased utilization of healthcare services, escalating health care costs, increased premature deaths, reduced productivity, and catastrophic economic implications (64). Furthermore, CVD epidemic has already begun in Malaysia where there is a trend towards a younger age at first myocardial infarction (65) and higher cardiovascular mortality than in developed countries (66). In response to the urgent needs to address this phenomenon, the Ministry of Health, Malaysia, launched the National Strategic Plan for the Non Communicable Disease (NSPNCD) in 2010, focusing on seven strategies which include prevention and health promotion, clinical interventions, partnership with patients, public engagement, research and surveillance, capacity building, and regulatory interventions (67).

Following a worrying scenario of MetS in Malaysia, there are some recommendations for the public health level as to have more attention on the modification of lifestyle of the general public through health promotion campaigns, multisectoral collaborations, and regulatory measures (68, 69). At the primary care level, individual patients with MetS need to be identified so that their multiple risk factors can be managed early to reduce complications (68). Efforts should also be made to screen healthy individuals who are at risk of developing MetS. However, this attempt is often hampered by the

shortage of multidisciplinary primary care team personnel in Malaysia (70). Solutions therefore lie in enhancing the primary care delivery system and capacity building of primary care workforce by integrating all public and private primary care workforces under a common network of care, supported by the national health enhancing scheme to provide better coordination, continuity, and quality of care, especially to individuals with multiple MetS risk factors (67, 68, 70).

Peer Support in Metabolic Syndrome Intervention

There is emerging evidence supporting Peer Support framework in management of chronic diseases. The construct of peer support is proven to be an effective approach in health promotion design as it can deliver age-appropriate care information that addresses critical factors such as physiological function, social psychology, and emotional and health literacy (71). Studies involving peer support has found that peer may influence they group to adopt better lifestyle due to the same exposure towards a certain health condition and experience the same surroundings that may encourage better activity engagement among them (72, 73). Such programs can empower these patients to self-manage their condition and to enhance their self-care-related motivation and confidence.

Conclusion

Irrespective of the diagnostic criteria used, epidemiological studies from various parts of the world have clearly demonstrated that MetS is an increasing global health problem, not only in the western societies, but also in the Asian populations. The clustering of CVD risk factors that characterizes MetS is a powerful driving force for the emerging CVD epidemic in Asia and the prevalence of MetS in East Asia was found to range from 8% to 13% in men and from 2% to 18% in women, depending on the population and definition used. In Malaysia, epidemiological evidence describing prevalence of MetS is still scarce. Most local studies on MetS prevalence involved small sample size while a nationwide survey showed that crude prevalence of MetS using WHO, NCEP-ATP III, IDF, and Harmonized definitions was 32.1%, 34.3%, 37.1%, and 42.5%, respectively. MetS is found to clusters among female, people with higher age, urban dwellers and people with low education and low income. Despite the growing evidence, interventional studies done on MetS is very

low signifies the poor awareness among Malaysian adults. Growing evidence showing the potential of peer support construct in managing chronic diseases calls for a need to design such low-cost yet effective intervention to be delivered here.

Abbrevation

MetS   Metabolic Syndrome

WHO   World Health Organization

CVD   cardiovascular diseases

T2DM   type-2 diabetes mellitus

NCEP-ATPIII   National Cholesterol Education Program Expert Panel III

IDF   International Diabetes Federation

NSPNCD   National Strategic Plan for the Non Communicable Disease

CNAQ   Council of Nutrition Appetite Questionnaire

PRISMA   Transparent Reporting of Systematic Review and Meta-analysis

Declaration

Ethics approval and consent to participate
Not applicable

Consent for Publication
Not applicable

Availability of data and material
Results of literature search can be requested from corresponding author (md.mahadzir@monash.edu)

Authors' contributions
MDAM designed the search strategy and carried out the systematic research. MDAM drafted the manuscript in cooperation with AR. MDAM removed the duplicates and all author screened the title and abstracts of search findings. All authors reviewed and agreed on the final manuscript. Muhammad Daniel Azlan Mahadzir, Quek Kia Fatt and Amutha Ramadas contributed equally to this work.

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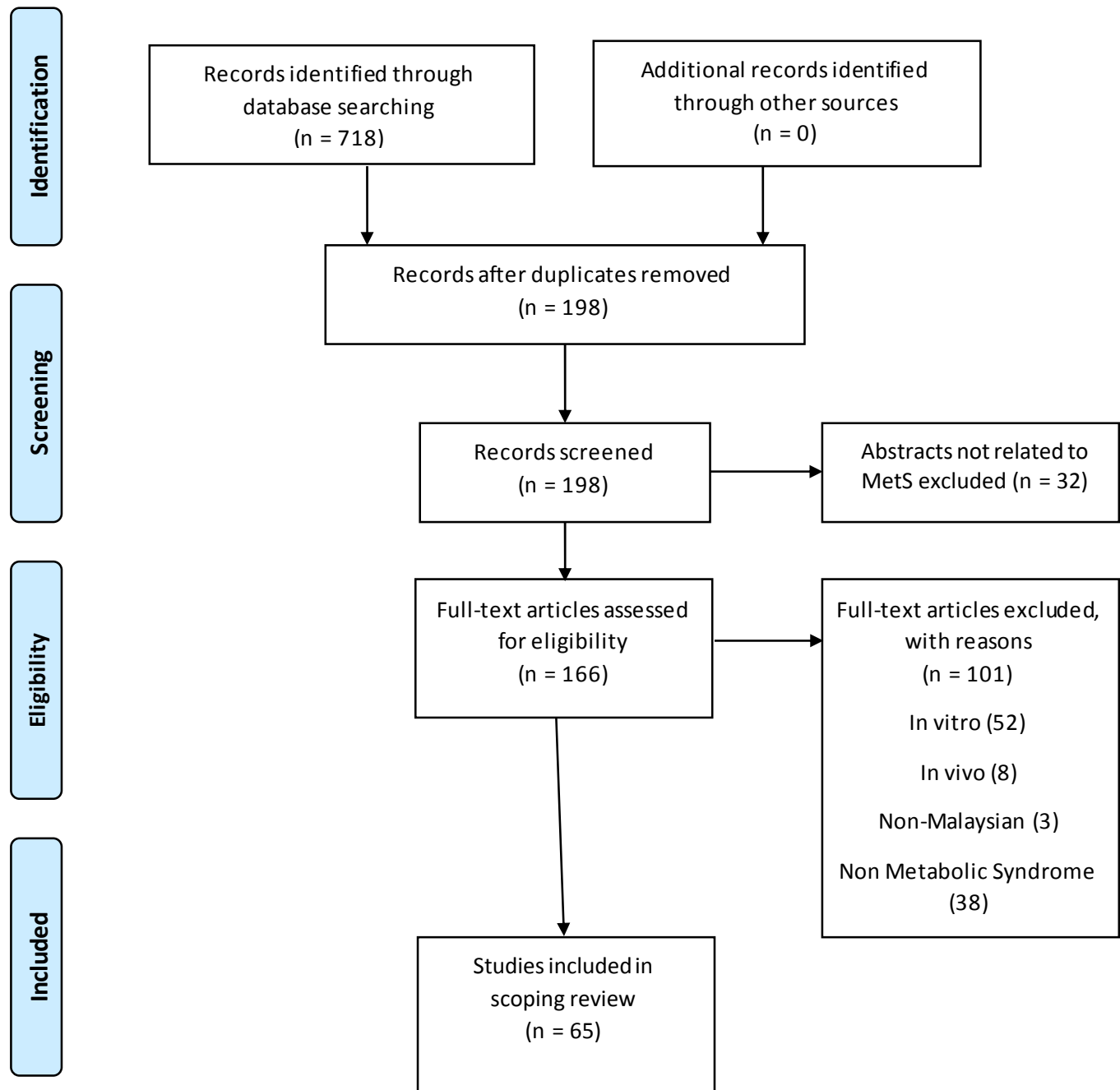
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Figure 1: PRISMA Flowchart for Literature Search

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CHAPTER 3

METHODOLOGY

3.1 Overview

A five-step development process was involved in the development and assessment of a nutrition and lifestyle behaviour peer support program for Malaysian adults with MetS. These steps namely, i) Review of evidence; ii) Focus group discussions; iii) Development of behaviour change matrix; iv) Peer module development; and v) Feasibility and process evaluation, were done to ensure that the information that it delivers is evidence-based, appropriate and community-specific. This chapter will elaborate on the Step I and 2 while the following chapter will explain Step 3-5.

An extensive review were conducted on available related guidelines and literature on lifestyle interventions in MetS among adults. Related guidelines such as the National Strategic Plan for Non-communicable Diseases (2010-2014) (13), Malaysian Dietary Guidelines 2010 (27), and clinical practice guidelines for metabolic diseases (28-31) as well as the Malaysian Medical Nutrition Therapy for diabetes, hyperlipidaemia and hypertension (32-34) we reviewed to extract relevant and evidence-based behaviour change targets. Additionally, basic knowledge on MetS and its individual components, self-management skills and prevention steps of specific risk factors outlined in these review were also listed down to inform the development process.

Following that, a systematic review were done to explore peer group-based lifestyle intervention program for MetS. Eleven medical databases (MEDLINE, Embase, Scopus, Web of Science, PUBMED, AMED, EMCARE, Proquest, PsycINFO, CINAHL and Cochrane Central Register of Controlled Trials) were searched. Peer-reviewed articles published before January 2018 and focused on individuals with MetS were included. Seven studies were selected and assessed for quality.

Article 2 summarised seven studies which incorporated peer group-based lifestyle intervention. All selected studies shows an improvement in term of abdominal obesity measured by waist circumference which is the hallmark of MetS. The review also help to elucidate the study designs and intervention types that being used and help to advise on the fundamentals of a peer support design. Besides that, it highlights a four health system challenges for future research to incorporate peer support program to be alongside clinical management of MetS.

Furthermore, the study aims to characterise and understand the lifestyle behaviours of Malaysian adults with MetS prior developing an effective community-specific lifestyle intervention. To

ensure that the peer support addresses culturally and community -appropriate information, the study needs to explore the abstract information on nutrition and lifestyle behaviours through qualitative analysis of focus group discussions (FGD) involving Malaysian adults with MetS. This FGD was done to explore their understanding of MetS and their perceived motivation and barriers of healthy nutrition and lifestyle behaviours. FGD Moderator Guide (Appendix B) was developed to assist the moderators during the session. Article 3 described a qualitative analysis of a FGD involving 21 Malaysian adults with MetS help to refine the understanding of health behaviours here. The study elucidated seven strong themes contextualising the motivation and barriers to lifestyle changes among adults in Malaysia. Interestingly, lack of knowledge on MetS is the main barrier for them to change as they do not perceived the deadly effect of the clustering of risk factors. The findings help to refine the shape a better behavioural targets and also incorporate better behavioural change techniques in a peer support program.

3.2. Article 2

Peer-based intervention for metabolic syndrome: A systematic review of literature and strategic framework for research

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Peer-based intervention for metabolic syndrome: A systematic review of literature and strategic framework for research

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Abstract

Objective: Peer support programs reap the benefits of social supports and have been implemented among individuals with the various chronic diseases. However, there is a lack of consolidated evidence on its effectiveness in Metabolic Syndrome (MetS). The aim of this systematic review is to assess the effectiveness of peer group-based lifestyle interventions on MetS among adults.

Methods: Eleven scholarly databases (MEDLINE, Embase, Scopus, Web of Science, PUBMED, AMED, EMCARE, Proquest, PsycINFO, CINAHL and Cochrane Central Register of Controlled Trials), and reference lists of included publications were systematically searched. Peer-reviewed articles published before January 2018 and focused on individuals with MetS were included. Quality of included articles was also assessed.

Results: A total of seven studies were identified, of which two focused on group counselling and three focused on group medical visits and one focused on group lifestyle program. All seven studies were graded medium to good. Four studies reported significant reductions in waist circumference (WC) while two studies reported significant changes in fasting blood glucose and systolic blood pressure. This review suggested four health system strategies for future research to contribute to facilitate integration between peer-based intervention in current management of MetS.

Conclusions: There is a growing evidence supporting group-based peer support lifestyle interventions to improve MetS-related risk factors in adults. All seven studies reported significant changes on WC which is the hallmark of MetS. Furthermore, the suggested framework can be used to guide development of future peer-based intervention development for a specific population.

Strength and Limitations of the Study

1. This is the first study systematically review the effectiveness of peer or group-based lifestyle intervention on MetS.

2. We employed a selective inclusive criteria that only selects studies with clear definition of MetS and focussed exclusively on lifestyle intervention without medication or supplementation.

3. First limitation is that there is a risk of publication bias as only published studies using the English language were considered.

4. The review only took the recent (January 2010 – January 2018) peer-reviewed publications into consideration.

5. Furthermore, literature search was systematically conducted using major databases without cross-referencing.

Introduction

Metabolic syndrome (MetS) is a clustering of symptomless biochemical and physical conditions that are highly associated with an increased risk for developing type 2 diabetes and cardiovascular diseases (1). The hallmark of MetS is abdominal obesity measured by waist circumference (WC) (2). Excess of abdominal fat is most closely associated with the metabolic risk factors most likely to be the initiating factor of risk factors clustering in MetS (3). These risk factors namely, impaired blood glucose, dyslipidaemia and raised blood pressure, are symptoms of metabolic chaos inside the body.

MetS relates proportionately to bad dietary habits and sedentariness (4). Ghee et al described the contribution of high carbohydrate diet, poor hydration, poor sleeping pattern and over nutrition as a strong modifiable risk factors for MetS (4). Hence, MetS became an ideal target of lifestyle-focused interventions. However, for a lifestyle change to be considered a viable target for remission of the MetS, it must be comprehensive and sustainable over time. Comprehensive interventions should incorporate a considerable level of health education, intensive self-management skills training, and behavioural-targeted modification, on top of the traditional clinic visit (5). This can be achieved via a supportive peer-based intervention framework.

'Peer support' is defined as 'support from a person who has experiential knowledge of a specific behaviour or stressor and similar characteristics as the target population' (5). Peer support in lifestyle interventions has been found to provide a space through which healthcare providers or trained peer leaders can deliver extensive health education and self-management instruction while also allowing for increased adoption and productivity rate (6). Peer support combines the benefits of both receiving and providing social supports which made it superiorly beneficial to be implemented among adults with similar chronic diseases whom need a lifestyle change (6).

The key benefit of peer support framework is its ability to address barriers such as lack of family support, lack of resources, financial barrier, limited contact time with health provider and

health literacy levels of patients which are less likely achieved in traditional clinic visits (7). The non-hierarchical, reciprocal relationship that is created through the sharing of similar life experiences in peer-based interventions, minimizes these barriers (8). As a result, lifestyle interventions that consolidate peer support as their delivery method have been shown to improve not only patient clinical outcomes but also quality of life indicators (9).

Owing to the growing benefit of peer support and chronic diseases, this systematic review aimed (i) to summarise evidence based on peer-reviewed peer group-based lifestyle interventions targeted for MetS; (ii) to elucidate the study design, intervention development process, intervention delivery method and intervention effect on the component of MetS; (iii) outline the challenges and limitations in peer-based intervention design and (iv) present a strategic framework of research on lifestyle intervention on MetS for future research.

Methods

This review was constructed according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for systematic reviews and meta-analyses (10). Figure 1 presents the PRISMA flow chart of the systematic review.

Patient and public involvement

There were no patients or applicable public involved in this review.

Search strategy

Eleven databases, namely, Scopus, Web of Science, Pubmed, Cochrane, PsychInfo, AMED, Medline, Embase, Emcare, Proquest and CINAHL, were searched using the keyword "peer", "lifestyle", "intervention" and "metabolic syndrome". A sample search in Medline is shown in Table 1.

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Figure 1: PRISMA flow chart

Table 1: Sample search strategy in MEDLINE

No	Keyword	Hits
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#2	"lifestyle intervention".mp. [mp=ti, ot, ab, tx, kw, ct, sh, hw, tn, dm, mf, dv, fx, dq, nm, kf, ox, px, rx, an, ui, sy, tc, id, tm]	15956
#3	"metabolic syndrome".mp. [mp=ti, ot, ab, tx, kw, ct, sh, hw, tn, dm, mf, dv, fx, dq, nm, kf, ox, px, rx, an, ui, sy, tc, id, tm]	173549
#4	#1 AND #2 AND #3	12

Eligibility criteria

To be eligible, studies had to meet the following conditions:

1. Study design: Interventions with randomized and non-randomized designs.

2. Language: Published in English.

3. Article: Full-text articles in peer-reviewed scientific journals.

4. Participants: Adult older than 18 years old with identified as MetS using a clearly defined definition.

5. Intervention: Intervention must be designed in a group setting instead of a one-to-one consultation by health providers. Studies that compared interventions with main focus on diet, lifestyle behaviour and physical activity levels with conventional dietary advice or no treatment were eligible. Multimodal interventions with combination of diet, lifestyle behaviour and physical activity were included. Studies were excluded if its incorporated supplements, functional foods or pharmacological drugs. Studies only studying postprandial effects of lifestyle intervention were excluded. No restrictions were made regarding dietary approaches or length of intervention.

6. Outcome: Studies reported comparisons of pre- and post-intervention changes in MetS parameters.

Data Extraction

MDAM and AR independently screened articles titles and abstracts retrieved after removal of duplicates. Abstracts were screened and articles that met the selection criteria were short-listed for full-text review. MDAM extracted the data using an Excel spreadsheet developed for this review. Data variables included first author, study title, year of study, study design, recruitment location, intervention target, intervention design, sample size, participant age and MetS outcome.

Assessment of Quality

Study quality was assessed by MDAM using a tool similar to another review (11). Methodological quality is assessed based on these criteria; selection bias, confounders, study design, blinding procedure, data collection methods, intervention integrity, method of analysis, withdrawals and dropouts (Appendix 1). For each section a methodological rating of strong, moderate or weak was given, which led to an overall study rating.

Results

Systematic Search

A series of systematic search in eleven scholarly databases resulted in 5129 articles (Scopus-898, Web of Science-625, Pubmed-491, Cochrane-323, PsychInfo-82, AMED-395, Medline-443, Embase-831, Emcare-251, Proquest-293 and CINAHL-498). After removal of duplicates, abstracts of 1175 articles were screened for relevance. Subsequently 156 publications were identified after removal of conference proceedings and book chapters. The titles and abstracts were again screened and after removing reviews, duplicate studies, non-interventional lifestyle studies, and non peer-based studies, 51 studies remained, of which, seven articles met the eligibility criteria and were included in the review. Characteristics of all selected studies were summarised in Table 2.

Table 2: Summary of included interventions (n=7)

Study	Design/ Country	Sample size / Duration	MetS criteria	Intervention provider	Intervention
Oh et al (2010)(12)	RCT South Korea	52 *32 intervention* *21 control* 6 months	NCEP ATPIII	Community nurse	A 6-month tailored lifestyle management intervention with 60 sessions was provided. Each 90-minute session consisted of comprehensive multi-components: (1) health monitoring, (2) counselling, (3) health education, (4) exercise, and (5) diet. Control: Standard clinic visit
Pettman *et al* (2009) (13)	RCT Australia	153 *103 intervention* *50 control* 16 weeks	IDF	Study coordinator with health science / nutrition background and a leader with expertise and experience in chronic disease self-management program facilitation and training.	A structured 16-week information and education program and group exercise was conducted for intervention group. The program, called 'Shape up for Life', ran as group sessions for 2 hours each week. Control: Usual care
Fitch et al (2006)(14)	RCT USA	28 *12 Lifestyle modification* *16 control* 7 months	NCEP ATPIII	Registered Dietician	American Association of Clinical Endocrinologists (AACE), NCEP Adult Treatment Panel III and the DPP study; healthy eating, less than or equal to 35% of total calories from fat, 25-35 g of soluble and insoluble fibre per day, 3 hours of physical activity per week at

					moderate intensity, more than 10000 steps daily measured by pedometer and self-monitoring. Control: No Intervention
Morita-Suzuki et al (2012) (15)	RCT Japan	91 *37 individual counselling* *54 group counselling* 3 months	Japanese Criteria for MetS	Physicians and public health nurses	All study participant received exercise instruction of maintaining minimal caloric expenditure of 300 kcal daily and were monitored using a step-counter. Group counselling participated in 1-hour group session on fundamental dietary advice based on Japanese Health and Dietary Guidelines. Control: Individual counselling received a tailored counselling session on diet, exercise and lifestyle.
Ma et al (2013)(16)	RCT USA	241 *79 Coach-led* *81 DVD* *81 Control* 3 months	IDF	Registered dietician certified to deliver the Group Lifestyle Balance program	Group Lifestyle Balance Program; developed by Diabetes Prevention Program investigator. The program was delivered face-to-face in 12 weekly classes to coach-led intervention participants, or via a home-based DVD. Control: Usual care
Greer et al (2010)(17)	Pre-post USA	22 10 weeks	NCEP ATP III	Physician	Group medical visit model using LEARN curriculum; an adult weight management program utilizing a therapeutic lifestyle change approach. It

| | | | | | | addresses nutrition, physical activity, lifestyle changes, goal setting, recording, and helpful devices to achieve goals in an interactive format. |
| Shahar et al (2013) (18) | RCT Malaysia | 47 *24 Intervention* *23 Control* 6 months | | NCEPT ATP III | Physician | The intervention group received nutrition education via group counselling sessions, talks, and cooking and exercise demonstrations using a specifically developed healthy aging package for 6 months. Control: Standard Care |

Study characteristics

Study design

Three studies were conducted in the United States (14, 16, 17) while one in South Korea (13), Australia, Japan (15) and Malaysia (18) respectively. Six of the selected studies were randomised-controlled trials (RCT) with similar and comparable control arms, and one pre-post trial has been included. All study recruited their participants from existing from existing patient databases but the Intervention were done in multiple settings. Three of the studies were done in primary care clinic settings (19) (17, 20) while Fitch study were done in a hospital setting (14). Morita study was done in a workplace (15) and Pettman study was done in a community setting (13, 18). The sample size for all study ranged from 22 to 241 participants and age ranged from 45 to 63 years old.

Metabolic Syndrome Criteria

Three definition of MetS is being used in all studies respectively with NCEP ATP II being used the most. Two RCTs (12, 14) and the pre-post trial (17) recruited patients that fulfilled MetS criteria according to ATP NCEP III while another two RCTs used IDF criteria (13, 20). Finally, Morita et al study followed Japanese Criteria for MetS (15). The Japanese criteria is similar to NCEP ATP III but with ethnic specific cut-off for WC while IDF made it compulsory for abdominal obesity to be the criteria of MetS.

Intervention Providers

The interventions were mainly delivered by a trained and certified healthcare professional. Community physician and trained dietician and nutritionist are mostly involved as the lead among peer groups. However, in Pettman study, participants were engaged at baseline by study coordinator before being followed up by the peer leaders (13).

Study Duration

All six peer group-based intervention on the management of MetS ranged between 12 and 52 weeks with three study reported a follow-up of 6 and 7 months (12, 14, 18). All of these studies combined physical activity and dietary behaviour intervention, and only relatively studies longer than 12 weeks reported significant findings however not sustained during follow-ups.

Intervention Design

All studies focussed on combination of physical activity levels and good dietary practices led by healthcare professionals and peer leaders. Three of the studies used existing guidelines or diabetes prevention program curriculum in their approach; Group Lifestyle Balance (20), LEARN Curriculum (17) and standard DPP curriculum (14).

Quality Assessment

All six studies are rated medium to strong design. The MetS definition and eligibility criteria are clearly specified in all studies. All three RCTs described their method of randomisation. Generally, all studies described the groups similar at baseline in term of sociodemography and MetS risk factors.

Only half of the selected studies described the intervention however not clear enough for replication while the rest only described adherence level and follow up status of participants. Summary of quality assessment for each study is presented in Table 3.

Table 3: Methodological quality assessment

Criteria	Oh et al (2010)	Pettman et al (2008)	Fitch et al (2006)	Mrital-Suzuki et al (2012)	Ma et al (2013)	Greer et al (2010)
1	√	√	√	√	√	√
2	√	√	√	N/A	N/A	N/A
3	√	√	√	N/A	N/A	N/A
4	√	√	√	√	Not clear	Not clear
5	Not clear	√	Not clear	X	√	X
6	√	√	√	X	X	X
7	Not clear	Not clear	Not clear	Not clear	Not clear	Not clear
8	√	√	√	√	√	√
9	v	v	X	X	X	X
10	√	√	√	√	√	√
11	√	√	√	√	√	√
12	v	√	√	√	X	√
13	√	√	√	√	√	√
Total	**11**	**12**	**9**	**7**	**6**	**6**
	Good	**Good**	**Good**	**Good**	**Medium**	**Medium**

Study Outcomes

All study reported outcomes on MetS risk factors except Greer (17) which only reported changes in WC and BMI. The results elucidated by these studies ranged from 3 months to 6 months. All studies found a significant, albeit small, changes in term of WC. Shahar et al (18) found that only female participants recorded significant change on WC but not male. Pettman et al (13) on the other hand is the only study found that blood pressure has also improved significantly. Finally, Morita et al

(15) and Ma et al (20) found that their study results for fasting blood sugar were significantly changed. Although the interventions are feasible in short-term, a longer follow-up is essential to investigate the sustained lifestyle changes following a peer-based interventions. Table 4 summarizes the changes and significant P-value for all metabolic outcomes for all seven studies.

Table 4: Primary metabolic outcomes reported in the studies (n=7)

Study	FBG	BP	WC	HDL	TG
Oh et al (2010)	NS	NS	(-8.2 + -10.9) cm, P <0.001	NS	NS
Pettman *et al* (2008)	NA	>5% reduction	3 cm reduction	NA	NA
Fitch et al (2006)	NS	NS	(-2.6+1.1) cm, p=0.011	NS	NS
Morita-Suzuki et al (2012)	5.8 mg/dL P=0.004	NS	-2.2 cm P < 0.0001	NS	NS
Ma et al (2013)	(-4.2 + 1.6) mmol/L, P = 0.010*	NS	(-5.8+1.0) cm, P <0.001*	NS	NS
Greer et al (2010)	NA	NA	2.12 cm, p=0.047	NA	NA
Shahar et al (2013)	NS	NS	d=-4.1% P=0.004	NS	NS

*NS – Not Significant at P=0.05 or P=0.005; NA – Not Available

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Discussion

Peer Support in Chronic Diseases

Chronic NCDs disproportionately affect people in low- and middle-income countries. More than 85% of global NCD deaths occurs in low-resource settings (21). Despite that, the exorbitant costs of NCDs, including often lengthy and expensive treatment, poses a significant economic burden worldwide. For instance, in Malaysia, the burden of NCD is growing government outlined the economic stress to the country in its National Strategic Plan for NCDs (22). Concurrent with NCD epidemic, capacity limitations in developing countries such as Malaysia demands for a cost-effective innovations to manage and prevent NCDs including MetS. This systematic review of the published literature offers important insights on peer group-based intervention. This review highlighted 7 studies of variable design examining peer group design in MetS. Most of the study employed existing diabetes self management program and published national guidelines, and mostly focussed on clinical endpoints. There have been a number of studies shown the effectiveness of peer-based intervention for chronic diseases such as diabetes (23, 24) and CVD (25) as in improving adherence to clinic attendance, healthcare service delivery, and healthcare reach and coverage in general. These studies however focussed on clinical outcomes rather than intervention development details, and only a few of them reviewed to sustained, long-term lifestyle intervention (26, 27). Despite that, this framework is feasible for following up of patients prior to their first clinic visit and can be incorporated to a wider NCD program involving public health settings (28). So far, research is very limited but is also very much needed in order to justify wide-scale implementation of peer group-based strategies in reducing the burden of NCDs in Malaysia.

Intervention Evaluation

Despite the need to scale up lifestyle-based interventions on NCDs, there are very few interventions that meet benchmark for scale up (29) and this review is concern about the evaluation tool and absence of behavioural theory in program development. The quality of studies selected for this review was analysed using a tool developed by Ramadas et al (11). One notable limitation for this tool is that it does not evaluate the formation of peer groups in the intervention. There are chances of group to be skewed if it does not being formed randomly (7) which resulting in limitations in intervention delivery. However, it does not impact on this review as the studies included in this review are mostly preliminary and only incorporated a small number of peer groups. A more specific tool to evaluate peer support study design quality is needed as we advance into a deeper understanding of peer support in chronic diseases. This review suggested for future studies to evaluate the followings;

1. Clear and measurable goals, objectives and monitoring benchmarks.

2. Adequate level of understanding on principles and practices among peer leaders.

3. A targeted and streamlined data collection tools such as forms that do not create significant extra burdens on peers to fill in.

4. A clear flowchart on monitoring and evaluation of the process of program implementation.

5. A linkage of program inputs with program outputs, and measurement of specific short-term and intermediate outcomes such as peer leadership and content satisfaction.

6. Since there is an emphasis on cost-effectiveness for intervention in developing countries such as Malaysia, a complete guide on documentation including on expenses (costs), savings (benefits) time taken for program delivery and involvement and participation levels.

Furthermore, none of the selected studies elaborated nor incorporated behavioural theories in their intervention development. This is important as the incorporation of these theory in intervention development among MetS patients was found to be beneficial (30, 31). Several theories such as Self-efficacy Theory (32), Health Belief Model (30, 33), Transtheoretical Model (34) and Social Cognitive

Theory (35) were all found to be beneficial among adults with diabetes by improving their glycemic control and assisting weight loss. All seven studies included in this review tested an existing diabetes self-management program or existing lifestyle intervention program thus, explanation on behavioural theory is either neglected or not being incorporated. Since peer group-based intervention in MetS is very scarce, there is yet to be a conclusive evidence to point out the most suitable theory or model for clustering of risk factors or MetS as a whole (36). Alternatively, the selection of behavioural theory in an intervention should be made based on the objective of the intervention and the factor to be intervened.

Research Gap on Peer-based Intervention

There is a need for a systematic evaluation of behavioural approaches in lifestyle intervention to help researchers to learn about fundamental elements that may improve or halt any behavioural change among adults with MetS (37). This understanding can help researcher to design a better framework to intervene different populations throughout the world. In this paper, group-based peer support interventions on MetS were reviewed to understand how a published program is executed. As the information and knowledge of peer-based intervention on NCD, particularly MetS is still at infancy, research is needed on all dimensions including designing, implementing and evaluating different models of peer support to meet the needs of different populations in various settings (36, 38). This review suggests a set research direction to integrate peer-based intervention into national health system strategy for management of MetS.

Health system strategy 1: MetS prevention

Poor knowledge of preventive measures is a key contributor to the rising incidence of MetS. MetS itself is a non-consensus disease as most healthcare professional perceived it as a clustering of metabolic risk factors (39). Due to this, effort on MetS prevention is overshadowed by intervention involving pre-diabetes and overweight and obese adult albeit its being related (39). Since there is a

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mounting evidence to show peer support as more cost-effective and feasible (40), intervention among pre-MetS subjects such as those with abdominal obesity is warranted to prevent curb the rising of NCDs in Malaysia. Earlier prevention also reduce the risk clustering of more risk factors which may become harder to manage (37, 40).

Health system strategy 2: detection and diagnosis

MetS risk factors in diagnosed, managed and treated independently and decision support is needed for healthcare professional to determine the need of thorough lifestyle intervention rather than just pharmacological approach (40). Low awareness among healthcare professional of MetS is a major limiting factor linking patients to care (41). Activated and trained peer leader among health professionals have been leveraged for client health education to address risk factors for MetS in developed countries, however was shown to be inefficient (41, 42). This suggested that the dissemination of knowledge can be very limited in traditional clinic settings. An advantage of peer-based intervention is that it is modular enough whereby healthcare professionals can be provided with a solid baseline awareness that assist in diagnosis and intervention adherence (7). Peer-based intervention may increase awareness through education and behaviour change through inter-peer communication. Such systems can be tailored to provide information regarding MetS frequently to remind all about healthy lifestyle practices and medication adherences under the supervision and guidance of healthcare professionals. This has been demonstrated in developed countries and interventions with decision support for hypertension (43) and type 2 diabetes (44) where while peer are exposed to intervention, healthcare professionals were there to supervise the information delivery process.

Health system strategy 3: follow up/retention to care

One of the advantages of a peer-based intervention is incorporation of behavioural strategies in information delivery. It improves retention to provided care as inter-peer communications often deal with consistent reminders about lifestyle behaviour change, daily monitoring, medication and

upcoming peer session (36). Peer reminders can play a role in promoting a sustained lifestyle modification among adults with MetS. From a bigger perspective, peer-based intervention can also support retention to care by assisting patients with financial barriers, transportation issues, and assist follow ups with providers (8). Research on prospective peer support intervention following clinic visits should be done to elucidate the efficacy of peer support in promoting sustained lifestyle changes.

Health system strategy 4: quality of care and coordination of care

Quality and coordination of care is angled from a healthcare professional perspective. Peer-based program can support client or patient education, training, work planning, decision support and treatment adherence on top of standard clinic visits (6, 45). This enhances supports to add value to quality of care provided by healthcare professionals. Peer-based program such as weekend classes allow peer leaders to inform peers on MetS and also could improve self-monitoring skills following official clinic visits (7). However, one study discussed possible conflicting issue on coordination of care (8). Peer to peer interactions influence healthcare follow up rate at different levels of care. Despite that, It is shown to inversely affects disease surveillance as peer is perceived as more dominant than healthcare professionals in delivering information (8, 45). While the evidence of peer-based intervention points out to improve MetS control, the outcomes in coordinated care between healthcare professionals and peers is still unknown. Details of coordinated care provided by peer-based intervention on top of clinic visits is important to ensure continuity of care and informed decision making in the case of MetS.

Research in these areas are crucial to elucidate the optimal interventional strategies for MetS to be aligned with the target set by clinical standards. The urgency for high-quality evidence is stemmed from the need to inform many important decisions regarding diagnosis, prevention and treatment of MetS which facilitates the implementation of peer support alongside with clinical practice hence highlighting the need to incorporate implementation research, monitoring and evaluation in peer-based research. It may assist stakeholders and policy makers in evaluating

innovations and strategies that merit incorporation to existing health system and additional further

investment.

Study Limitation

Several limitations should be considered while interpreting the results presented in this

review. There is a risk of publication bias as only published studies using the English language were

considered. The review only took the recent (January 2010 – January 2018) peer-reviewed

publications into consideration. Furthermore, literature search was systematically conducted using

major databases, there is a possibility for some publications not to be included in the search due to

lacking of cross-referencing process and selective inclusion criteria.

Conclusion

This systematic review gathered seven studies on peer-based lifestyle intervention among

adults with MetS. Seven articles were eligible, including four randomized control trials, two

randomised trials and a pre-post study. There was considerable heterogeneity in the design of peer

group-based intervention, and the role of the peer leaders varied considerably. Three studies found

that peer-based intervention resulted in insignificant reductions in body weight and WC. Evidence on

the impact of peer-based intervention on lifestyle changes was equivocal, with only one study

demonstrating that such intervention improved self-report physical activity and diet. Evidence

regarding physical activity levels was also unclear across seven studies. Due to the small but growing

amount of evidence, we conclude that there are insufficient data to support peer-based lifestyle

intervention as effective and that a more comprehensive, systematic approach to knowledge

approach is required. We provided a list of health system strategy to point of the direction of future

research to incorporate peer group-based intervention in clinical care. Peer-based intervention shows

a promising outlook on long-term intervention prior to standard clinic visit. Among the important

factors to pay attention is the training of peer leaders and local stakeholders support on integrating

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peer support as a complement to standard care. Since MetS is a chronic lifestyle related disease that incurs economic burden to healthcare sector, an effective, cost-effective public health approach is needed to overcome the rising prevalence.

Funding

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Appendix 1: Methodological Quality Criteria

No	Criteria	Question
1	Selection Bias	Were the eligibility criteria specified?
2	Selection Bias	Was the method of randomization described?
3	Study Design, Blinding Procedure	Was the random allocation concealed? (ie, Was the assignment generated by an independent person not responsible for determining the eligibility of the patients?)
4	Confounders	Were the groups similar at baseline regarding important prognostic indicators?
5	Study Design	Were both the index and the control interventions explicitly described?
6	Data Collection Method, Intervention Integrity	Was the compliance or adherence with the interventions described?
7	Method of Analysis	Was the outcome assessor blinded to the interventions?
8	Withdrawals and Dropout	Was the dropout rate described and were the characteristics of the dropouts compared with the completers of the study?
9	Study Design, Intervention Integrity	Was a long-term follow-up measurement performed (outcomes measured ≥ 6 months after randomization)?
10	Confounders	Was the timing of the outcome measurements in both groups comparable?
11	Confounders	Was the sample size for each group described by means of a power calculation?
12	Method of Analysis	Did the analysis include an intention-to-treat analysis?
13	Method of Analysis	Were point estimates and measures of variability presented for the primary outcome measures?

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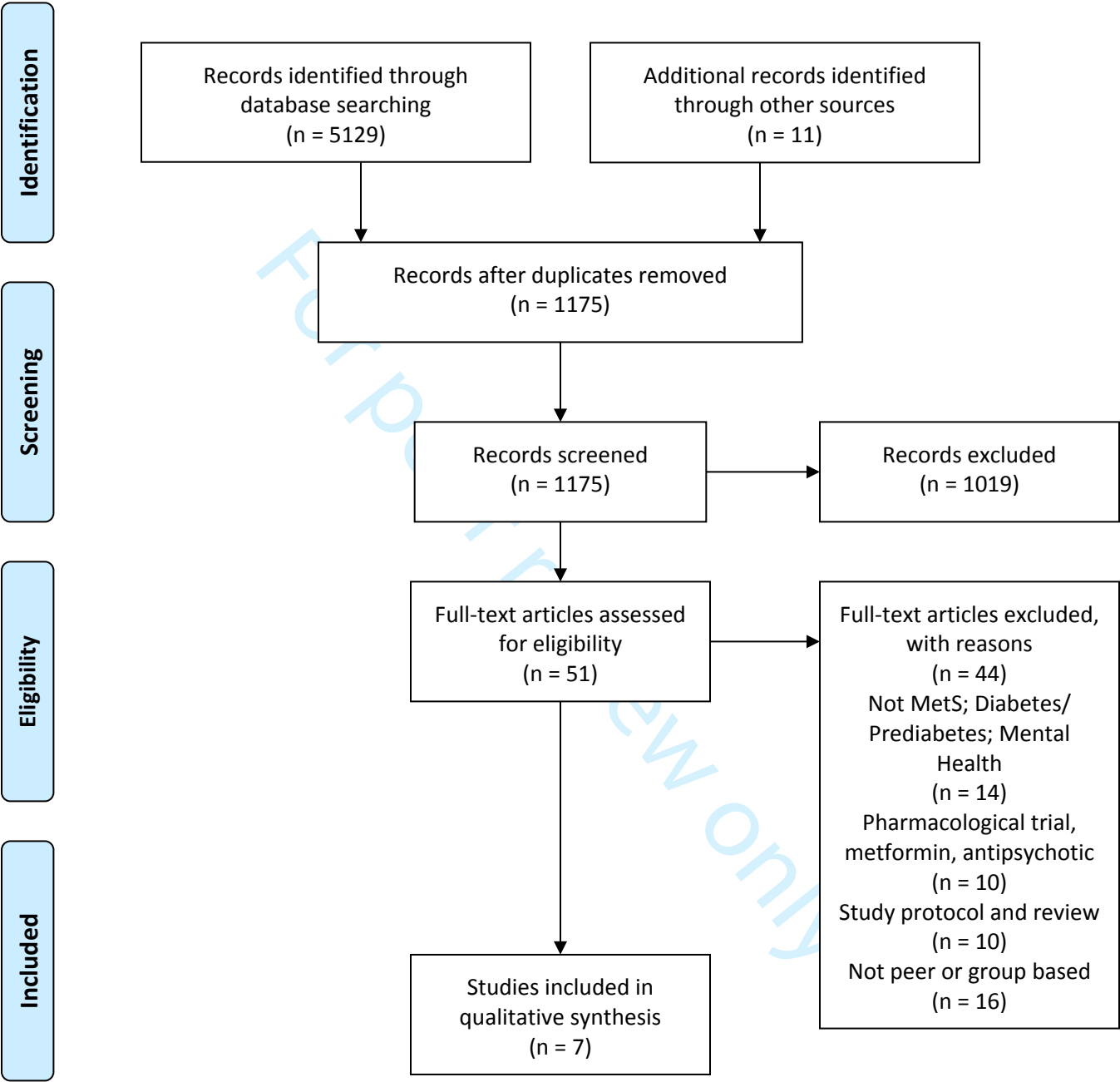
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Identification

Records identified through
database searching
(n = 5129)

Additional records identified
through other sources
(n = 11)

Screening

Records after duplicates removed
(n = 1175)

Records screened
(n = 1175)

Records excluded
(n = 1019)

Eligibility

Full-text articles assessed
for eligibility
(n = 51)

Full-text articles excluded,
with reasons
(n = 44)
Not MetS; Diabetes/
Prediabetes; Mental
Health
(n = 14)
Pharmacological trial,
metformin, antipsychotic
(n = 10)
Study protocol and review
(n = 10)
Not peer or group based
(n = 16)

Included

Studies included in
qualitative synthesis
(n = 7)

Contextualizing motivations and perceived barriers of healthy nutrition and lifestyle behaviours among Malaysian adults with metabolic syndrome

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BMC Family Practice

Contextualizing motivations and perceived barriers of healthy nutrition and lifestyle behaviours among Malaysian adults with metabolic syndrome
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Abstract:

Introduction

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A qualitative study with four focus groups (21 purposively sampled respondents) was conducted with adults diagnosed with MetS whom attending MONASH Medical Precinct in 2018. An interview protocol consolidating both responsive interviewing model and health belief model were prepared. The focus groups were audio recorded and transcribed. The data were analysed by emergent themes analysis. Data saturation was achieved in the fourth focus group.Results

Seven main themes; three motivations and three perceived barriers and one subtheme on healthy nutrition and lifestyle behaviour were identified in the analysis of FGD. Motivations for healthy nutrition and lifestyles behaviour were (i) weight gain and physical appearances; (ii)personal experience of adverse complications and (iii) good family and social support. The identified perceived barriers were (i) healthcare as a business model; (ii) healthy change is difficult and expensive and (iii) cultural influence on food intake. Inadequate knowledge on MetS as most respondents were unaware of MetS as a clustering of risk factors but were able to identify the components individually was also a strong theme identified in this study.Conclusion

Nutrition and lifestyle behaviours of adults with MetS were highly affected by the several potent motivations and perceived barriers among individuals. Information delivery and lifestyle promotion should address these aspects to increase program adoption and adherence, ensuring success of a community-based lifestyle intervention.

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Contextualizing motivations and perceived barriers of healthy nutrition and lifestyle behaviours among Malaysian adults with metabolic syndrome

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Keywords

Metabolic Syndrome, Nutrition, Lifestyle, Health Belief Model, Focus Group Discussion

Introduction

Unhealthy dietary behaviour and lifestyle factors such as sedentariness, alcohol and tobacco use, and sleep deprivation, may lead to poor health. Nutrition and lifestyle behaviour of individuals have been associated with the risk of metabolic syndrome (MetS) (1). MetS is a clustering of cardiovascular risk factors which places individuals at increased risk for cardiovascular morbidity and mortality (2, 3). The increase in MetS prevalence among Malaysian adults for the past decade (4-6) reinforces the need of an effective health promotion program with age-appropriate care information that addresses critical factors such as physiological function (6), social psychology (7), and emotional and health literacy (1). Such programs can empower these patients to self-manage their condition and to enhance their self-care-related motivation and confidence.

An exploration of models for individual motivation to participate in intervention measures is necessary to develop hypotheses regarding the influence of various factors on participation (8). For instance, theoretical frameworks such as Health Belief Model (HBM) was used to explain individual's behaviours and behavioural changes (9, 10). Furthermore, a deeper understanding on individuals' motivation and barriers to behaviour is among the key to ensure the success of lifestyle intervention measures (1). The HBM is made up of four constructs representing the perceived threat and net benefits: perceived susceptibility, perceived severity, perceived benefits, and perceived barriers, which accounted for individual's "readiness to act." (11). Besides to better fit the challenges of changing habitual unhealthy behaviours, such as being sedentary, smoking, or overeating, cues to action and self-efficacy concept are added into the construct. Cues to action would activate that readiness and stimulate overt behaviour while self-efficacy is to instil one's confidence in the ability to successfully perform an action (Figure 1) (12, 13). Overall, HBM is the best model to explain the motivation and barriers faced by individuals in order to initiate a healthy behavioural change (10).

Consequently, we have to better characterised and understand the lifestyle behaviour of Malaysian adults with MetS before developing an effective community-specific lifestyle intervention. Since our

understanding on behavioural determinants that shaped the lifestyle behaviour among Malaysian with MetS is limited, this study aimed to explore the abstract information on nutrition and lifestyle behaviours through qualitative analysis of focus group. This study will qualitatively analyse a series of focus group discussions (FGD) involving Malaysian adults with MetS to explore their understanding of MetS and their perceived motivation and barriers of healthy nutrition and lifestyle behaviour. Furthermore, HBM will be used as the conceptual model in the design of focus group question and overall script as it is the best model to chart out the awareness level and readiness of change among individuals (10).

Methodology

Respondent

This study received ethical approval from Monash University Human Research Ethics Council (MUHREC) prior to respondent recruitment; (Project ID: CF16/56 – 2016000022). Individuals attending MONASH Medical Precinct were invited for MetS screening. Respondents were recruited using purposive sampling that sought out based on the MetS status which is the focus of the study. All consented respondent whom fulfilled the Harmonised criteria (14) of MetS were invited to join the FGD led by a moderator. Sociodemographic details and MetS components were recorded for all respondents.

Focus Group Discussion

Each session was decided based on the number of consented respondents which have to make a minimum group size of three. Moderated interviews were then arranged with respective groups. Four separate FGD sessions involving a total of 21 respondents took place in a private consultation room at Monash Medical Precinct. Each session was led and recorded by a moderator accompanied by a trained assistant. Moderator will use an interview protocol written based on responsive interviewing model (15). A protocol which consisted of a list of questions was developed based on Health Belief Model (HBM) domain framework (16) was used to introduce areas for open discussion. Since this study is keen to see how respondent would interact during the focus group, group dynamic and interactions were enhanced by reassuring all respondents that any views expressed in the focus group would remain confidential and that there were no 'right' or 'wrong' answers to the questions and that constructive criticism was a valued part of the process. Overall, the group structure would be a more compelling approach in evaluating one's lifestyle behaviours. As explained in an earlier study, the group dynamics response, that is the type and range of data generated through the social interaction of the group, can be deeper and richer than those obtained from one-on-one interviews (15).
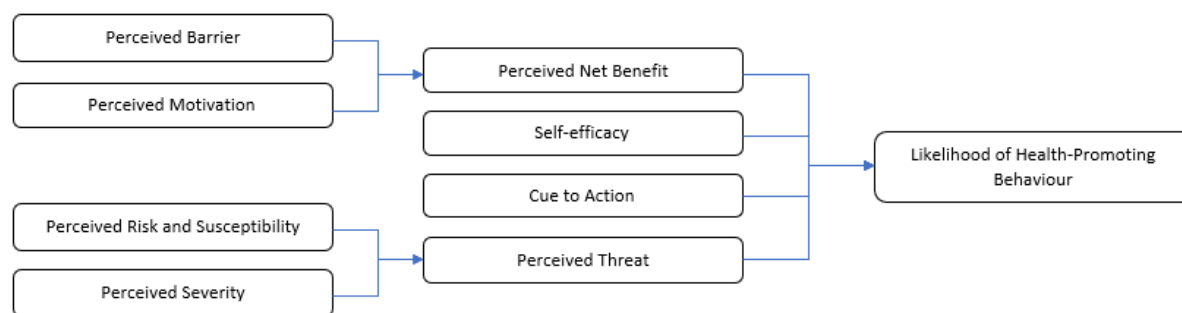
Figure 1 The Health Belief Model (HBM) (16)

Thematic Framework Analysis

All FGD session recordings were transcribed verbatim before undergoing thematic analysis. The steps of the thematic framework analysis (15, 17) were implemented using a priori issues derived from HBM constructs. Two initiation HBM components, motivation and perceived barriers towards healthy lifestyle, were used as primary domains in the thematic framework to facilitate textual, structural and composite descriptions of lifestyle behaviours among Malaysian adults with MetS; what do they know, what do they choose to do. Detection of salient phrases from the transcript followed by inductive coding was conducted line by line in each transcript. Comparison of codes was done both within and between the four transcripts with a constant reference was made to the coding framework and the study aim. Themes were developed by comparing codes within a category and by constant comparison of the codes across categories. This was done to ensure the interpretations remain grounded in the themes and its codes. In addition, to make sense of individual codes, relationship between the codes and the links between them were sought as a whole, to provide explanations for the findings and overarching themes. Hence, after an analysis of the transcripts, themes were categorized into the a priori domain as informed by the HBM concept.

Results

Sociodemographic Characteristic of Respondents

Respondents (n = 21) who fulfilled the Harmonised MetS criteria participated in the study. On average participants were 51 (SD=10.3) years old, ranging in age from 26 to 64. The majority were women (73%), married (73%) and all had equal to or more than a high school education. Slightly less than half 46% were employed full-time. All participants had abdominal obesity according to the Harmonised Criteria (14, 18).

Table 1: Sociodemographic characteristic of study respondents.

	Sociodemographic Characteristic		
No	**Item**	**n**	**%**
1	**Age (years)**	21	51 ± 10.3
2	**Gender**		
	Male	6	27
	Female	15	73
3	**Status**		
	Single	1	4
	Married	15	73
	Widow	3	14
	Divorced	2	9
4	**Ethnicity**		
	Malay	20	95
	Chinese	1	5
5	**Education**		
	Secondary	5	24
	Tertiary	16	76
6	**Occupation**		
	Employed	9	43
	Unemployed	1	5
	Business Owner	6	29
	Retired	5	23
7	**Income (MYR)**		
	0 – 999	1	5
	1000 – 1999	2	9
	2000 – 3999	5	24
	4000 – 5999	5	24
	6000 – 9999	4	19
	>10,000	4	19
8	**Metabolic Risk Factors**		
	Abdominal Obesity	21	100
	Hypertension	21	100

	Diabetes	19	91
	Dyslipidemia	7	33
	Hypertriglyceride	9	43
9	**Number of risk factors**		
	3 risks	3	14
	4 risks	15	72
	5 risks	3	14

Themes

Six strong themes emerged during the analysis of motivation and perceived barriers among adults with MetS. While one theme on perceived threat emerged on further analysis.

Motivations

Theme 1: Weight Gain and Physical Appearances

Participants expressed the changes in lifestyle is highly motivated by the gradual weight gain as they aged. The weight gain decreases their physical appearances resulted in them investing in anti-ageing products and food supplements. However, six participants extended their health monitoring by improving dietary habit and increasing physical activity. One of them said;

"You can eat all the pills but you will see the difference only once you sweat and eat better."

Weight gain is seen as a health threat as well especially among male respondents. They raised their concern on the worsening knee pain, shortness of breath and constant fatigue. Two of the participants said;

"the tummy has become large until I feel tired carrying it."

"you know your body is having problem when you have shortness of breath after climbing the stairs and feel extremely sleepy past the afternoon lunch"

While weight gain is a concern, female respondents are more concern on the skin and physical beauty. Observable changes on their skin prompted the female participants to eat better and exercise. One of the respondent said;

"I only started exercising when my dermatologist said it helps to get rid of my wrinkles."

Theme 2: Personal Experience of Adverse Complication

When being asked about what their view on MetS which accounts to increased risk of cardiovascular diseases and type 2 diabetes mellitus, participants shared their fears of being less healthy, or of being in such poor health that they could not continue in their normal roles, and how disability may affect their life. Four participants told stories of close family and relatives whom they knew who had strokes and rendered paralysed prior to it and how these had limit them. The participants expressed that they did not want their health compromised to the extent that they could not take care of themselves or their families. Hence, they are motivated to change to better. As one of the women said, when talking about all the things she still planned to do in life.

"I've made up in my mind but I'm not ready to go yet as I am not sure how to start."

The following quote is from a participant who shared how providing care for dad who got paralysed prior to stroke attack. Hence it has motivated her to make changes:

"Couple years ago, my father got stroke at 59 years old. Couldn't move, couldn't eat, couldn't do nothing and depend on us (the children) ...it really started all of us thinking and decided to change. Whatever that goes inside my husband and my children mouth is taken care of. It will be too late when we got stroke. Why want to trouble everyone around us because of our bad habits…"

Although several participants acknowledged how fear motivated them to action, two of the participants expressed opposite views indicating that fear alone was not enough to sustain lifestyle changes. One person commented that threat of poor health concerned her, but she didn't feel threatened enough to change the way she lived.

"If something destined to happen, it will happen, no matter how you take care."

Theme 3: Good Family and Social Support

The participants were asked about the environment and surrounding that may affects their life choices and habit. Eight of them voiced the need for support when making lifestyle changes. Different individuals expressed different type of support that they need or had received. Three participant talked about family members walking with her daily while another shared walking her dog daily routine. Participants gave examples of how individuals and pets had given primarily positive support. One of participant however shared that her husband prevents her to do the walking because he feels intimidated by her healthy lifestyle. Henceforth, the need to have friends or family support the person in making lifestyle changes was a strong theme. Five comments from participants were:

> *"I don't have that support, I get discouraged and then, you know, I stop. If I had somebody to walk with me, I believe I could walk a little bit."*

> *"I think that, means a lot when you got somebody else that's in the house that's take care of food and drinks and conscious about food every day."*

> *"I always join my neighbour to walk around the neighbourhood. Usually we'll do it in a group. I feel very moving to go for a walk. My wife and kids are together too. On weekends, we usually have barbeque, get together. It's that kind of support that makes me feel better about myself."*

If one does not have support it can be especially challenging as evident in this quote from a participant:

> *"Dieting is hard for a housewife like me. I have to take care of what my husband and my kids want to eat. My husband never cares about his food. I have to cook everything that he likes which is sometimes not a healthy choice. When it comes to exercise, we do it seldom. When my husband feels lazy, my kids will follow him. I usually walk with my neighbour, seldom, once a week."*

> *"My husband is a jealous type. If he don't likes it, you better not do it. Like walking and all, he can never see me doing it. Because when I do it and he's lazy, he feels intimidated."*

Barriers

Theme 4: Healthcare as a business model

There is an intricate relationship between participants and their health care providers. Most of the participants has been visiting Medical Precinct for more than two years. Trusting health care providers was important for them and most of them were told stories of doctors prescribing medications without discussing side effects, why the medications were needed. Five of the participants told that they are more interested on non- pharmacological options such as diet and exercise to reduce the risk of their diseases which however was not being provided by their previous health care providers. Most participants described relatively little or no discussion with health care providers about healthy eating and exercise, and they perceived doctors were rushed during visits.

"I always heard 'you are what you eat', but doctors are busy prescribing medications only."

When asked about nurse or diet counselling, none participants shared experiences either positive or negative impact of the counselling from within the private or public practice offices. They are more interested on the information provided by their medical doctors than other health personnel. Public has to be educated on what roles of each health personnel are playing. Dependency on medical doctor only will result to a long queue in health practices and delayed treatment.

"I don't think these people (nurse and dietician) understands what is happening inside me. They only speak based on their working manual. That's why I think it is crucial for doctor to explain more to us."

Moreover, several participants voiced concerns that some illnesses were being used to financially benefit companies. This led to distrust for most participants, and communication and trust with their health care providers was a concern. One participant commented;

"…sometimes when the doctors prescribed too many medications, they act like they work for the pharmacy."

Two others commented:

> *"Doctors will tell all Indian people over 40 or 50 will high blood pressure. I think that is an easy statement for all (vague generalisation)."*

> *"I think doctors give too much medication until five or six different medicines something's going to cancel out something."*

Some of these statements portrayed a lack of understanding among participants on the diseases and its clinical management. For an instance, MetS itself has five different cardiometabolic risk factors that may require different medications on each case. Henceforth, health care providers should work to build trust and clearly explain their reasons for treatment recommendations as well as the role played by nurse and dietician. All participants viewed good communication and personal contact as building blocks to establish trust in the patient-provider relationship. One gentleman shared about the relationship he had with his former physician;

> *"...I had a good Chinese doctor friend in a clinic in Sunway...... But he passed away last year. All of my family consult with him before. That kind of doctor is hard to find. He will sit with you and tell you one by one why you need to take your medications. He will tell you to go jogging every morning. He never rushes like a normal doctor especially those in the public government practice."*

Theme 5: Healthy change is hard and expensive

Besides, participants were aware about the details of good dietary habit including food pyramid, food timing and calorie counts but they found it hard to apply it in real life due to the cost of healthier food options, lack of support to practice healthy diet and daily exercise and finally the availability of food may influence participant food choices. Participant however ignored the habit of reading nutrition panel in all processed food that they consumed. 70% of participants reported previous participation

in lifestyle intervention focussing on weight loss. Despite that, they suffered decay in healthy habits after six months of the end of intervention due to lack of support from the close surroundings. Besides, the healthy habits are seen as hard and unrealistic to be applied in Malaysia due to availability and affordability of healthier food options, the tedious process of calorie counting, lack of surrounding support on healthy lifestyle behaviour and inadequate knowledge on healthy lifestyle.

One of common comment when participants were asked to rate their healthy life;

> *"This one is hard to talk about, but I found it's hard to keep being healthy every day."*

Many participants had made lifestyle changes for a while, but then went back to previous habits. Four participants have previous subscribed for an expensive weight loss program and failed to maintain their weight after 7 months. While, the others commented that the changes introduce into their life is too hard and drastic. They do not know how to manipulate the change to keep it more exciting.

> *"It's boring to weight food every day. It feels like a fishmonger in a market."*

> *"I bought all the weight loss vitamins (supplements) for nearly 10,000 (MYR), it feels slimmer for a while but after a year I feel my body expands."*

For many, it was hard to continue to make life style changes related to healthy eating and increased exercise. The participants really viewed changing eating and physical activity for the long term as a "battle" and something they had to control. One participant pointed out that

> *"Once you have been off a diet and go back, it's just harder to go back."*

> *"Once you started dieting and you fry a piece of chicken, you're going to fry some chicken every day for a week, and your diet just gone."*

This process of beginning to make changes "getting on track" was viewed as very difficult. Likewise, if participants returned to old habits, it was hard to get "back on track," eating healthy foods and

increasing physical activity. The feelings of discouragement of relapse came through very clearly in all sessions. One participant described getting off track as:

> "My problem is common for everyone, I'm going to get up for exercise every morning, which I did initially and after that God knows. And then when I try to schedule it for afternoons and do it for a while, but I always feel tired so I don't go jogging that day."

Another participant shared her way of making sure that she gets her exercise:

> "I'm always home until lunch, if I'm watching TV then I will cycle, If I can watch TV, I can exercise."

Participants were asked what it takes to be healthy and most of them answered that they do not know. They see as being healthy is to eat proper food which is more expensive than the easy local food and to be involved in active lifestyle which has the most people gave up. However, two participants give new perspectives on healthy lifestyle;

> "Buy a weighing scale and a long mirror. Put it at your bedside. Every day, if you are fat, you can see you are fat."

> "Health lifestyle needs discipline. That's why a lot of successfully people has a healthy life. They have the discipline to be healthy."

Theme 6: Cultural influence on food intake

All respondent assume healthy diet is a plate filled with vegetable, organic food and drizzled with olive oils. Most respondent recognised 'Mediterranean Diet' as the perfect healthy diet. Thus, most of them feels like they are 'cheating' when they eat local foods. Several respondent gave up eating healthily at all because they were told to avoid rice;

> "We as Malaysian can never stop eating rice. Make rice healthy and then only tell us to diet."

A Chinese female respondent claimed her diet to be different than other race. She said;

> *"We are told what to eat since we are kids. If you are Chinese, you will eat more soup and not eating at night. It's different than Indian, Malay and any other race in Malaysia."*

However, one respondent said that despite the cultural influence in food choice, the current availability of foods in Malaysia has made choice is the only thing to blame. He mentioned;

> *"Now you can find most of the food you want to eat, Chinese, Indian, Malay, Italian, French, Japanese, Korean and all. You just need to know which to choose."*

Perceived Threat

Theme 7: Inadequate knowledge on Metabolic Syndrome

In terms of perceived threat and susceptibility, participants were able to identify the components of MetS individually and relate it to the bad lifestyle and dietary habit. For example, high carbohydrate diet towards progression of diabetes and high salt intake that is responsible to cause hypertension. In general, participants were unfamiliar with MetS as a diagnosis. Most were unaware of the term and had not been told by their doctors that their combination of health problems was referred to as "Metabolic Syndrome".

> *"we only know about diabetes, high blood pressure and high blood cholesterol. We were only told to eat properly, exercise and eat our medication. Metabolic syndrome is new. If you said it's the big tummy problem, that's what I call fat."*

Based on their individual risk factors, participants were aware of the need to make lifestyle behaviour changes to improve their health. In addition, they had knowledge of appropriate behaviours in which they should be engaged. For example, several were aware that the appropriate healthy serving plate concept; Quarter, Quarter and Half (19). However, they expressed a need for skill building to successfully make behaviour changes.

Discussion

HBM is the earliest theory developed to explain the process of lifestyle adoption and individual's behavioural choice. In the theory, three domains are suggested as the initiator in lifestyle and behaviour choices; motivations, perceived barriers and perceived threat (16). This study adopted HBM as the fundamental framework to understand nutrition and lifestyle behaviour of Malaysian adults with MetS. Findings from focus group analysis suggested three themes in each motivation and perceived barrier domains. Interestingly, in further analysis of themes, inadequate knowledge of MetS was found to be repeated which explains the perceived threat that underlies HBM concept and it is made as the seventh theme found in this study.

Weight gain and appearance is found to be one of the best motivation to adopt healthy lifestyle in our study. Gradual weight increase and localised fat distribution around central region among middle-aged respondents are hypothesised due to aging (20). This gradual weight gain increase the risk of fracture and disability (21, 22). Furthermore, weight gain also has been found to reduce quality of life resulting in increased concern of adopting healthy lifestyle (20, 21). Abdominal obesity is also raising a concern among respondents. Despite poor physical appearances due to large tummy, abdominal obesity also increases the risk of multitude metabolic complications (23). Consequently, targeted interventions may exploit this concern by addressing the benefit of weight loss in term of physical appearances and healthy ageing. This is also suggested that intervention that target physical changes such as weight loss are more favourable as compared to blood parameters thus will increase interest and hopefully adherences among adults with concerning lifestyle-related condition such as MetS.

Besides, our respondents whom experienced adverse health complications are also highly motivated to adopt healthier lifestyle. A few qualitative studies done on stroke patients (24, 25) and dialysis patient (26) also found relationship between experiences on health complications tend to make patients to more vigilant about their life choices. Moreover, respondent with family members whom affected by complications were also tend to become healthier. Earlier study has also found the same

theme and conclude that they take by the lesson of observing poor quality of life affecting their family members (27, 28). During the analysis of this theme, an overarching theme were sought; limited knowledge on MetS among respondents. Most respondents were unaware of MetS as a clustering of risk factors but were able to identify the components individually. As a result, lifestyle changes come later in life which is supposedly may act as an effective prevention step from MetS (2, 29, 30).

Another motivation of healthy lifestyle is to have good family and social support. Individuals residing in a neighbourhood with active community body tend to engage in weekly physical activity. Surroundings with public parks, safe pedestrian walkway and gymnasium likely to increase the physical activity levels of adults. Community engagement however is only limited on physical activity as nutrition and dietary behaviour is more likely to be influenced by family members (31). Thus supportive family members are found to be as the biggest motivator in adopting healthy or bad lifestyle behaviour (25). Besides, a few respondents reported supportive peers are among the reason why they adopt better diet and lifestyle daily especially among pensioner. Studies involving peer support has found that peer may influence they group to adopt better lifestyle due to the same exposure towards a certain health condition and experience the same surroundings that may encourage better activity engagement among them (32-34).

In term of barriers, respondents assumed healthcare, especially preventative and primary care is a business model. This finding raised a red flag on general misunderstanding that aid the inaccessibility of primary care to reach the population. Patients argued that preventative medicine and primary care intentionally create the need to seek early but unnecessary medical attention. Hence, the perceived risk and threat are believed to be exploited in pharmaceuticals and nutraceuticals industry. Studies from India (35) and Singapore (36) elucidate an unnecessary fear of regular check-ups among healthy elderly because of conflicting fear of spending more on expensive healthcare. Thus, intervention needs to emphasise on the benefit of healthy lifestyle in term of disease prevention as well as improvement in individual's quality of life.

There is a perception that healthy lifestyle is tedious and expensive. Respondents were concern that tedious step in healthy meal preparation, healthy food choices and gradual increase in physical activity is hard and unsustainable. A study found out that a major barrier in integrating a lifelong healthy habit is the limitation to understand and translate available health information into easy and practical steps in daily life (37). Besides, another study found out that easy and realistic health goal setting plays a crucial role in sustainable lifestyle changes (38). Similar to this study, a respondent mentioned that to translate Malaysian Food Pyramid (19) onto a plate is confusing and hard. Furthermore, respondent understood healthy food as green choices, organic products and non-GMO products instead of food groups and food variety. Some studies explained that this has impacted on their food choices as they assumed healthy food as more expensive than their normal diet (38, 39).

As Malaysia is a multiracial country, different race in Malaysia has different preferences in their food choices and lifestyle behaviour. Population based studies has found that Malays, the majority race in Malaysia, tend to have high fat and high carbohydrate diet daily (5, 40). These studies found that cultural background tend to influence food choices of individuals. This racial discretion were found in other study as well; Chinese population has been found to be more perceptive towards healthy lifestyle as compared to Malays and Indians (5, 6). Accessibility to healthcare and predisposing literacy were argued as most important factors that influence better health among Chinese in Malaysia (6). However, given that MetS is very prevalent among Malay and Indian in Malaysia (5, 6, 40), similar study involving Indian is warranted to obtain a better picture on their unique behavioural determinants.

Upon further analysis, inadequate knowledge on MetS is often repeated by the respondents, suggesting it as a strong theme to be addressed. This is in line with HBM as it is suggested that three main initiators of healthy lifestyle choices are motivation to change, perceived barriers of changes and perceived threat on diseases (13). Respondent were uninformed about MetS as a threat, thus they view these components individually instead of being concerned with its 'clustering'. Even though the

management of MetS will target each component individually, informed perceived threat on clustering risk factors may improve perception of change among individuals as found in a study in Japan (41).

Collectively, targeting MetS, a lifestyle-related disease, warranted a holistic point of view. The intervention has to be specifically designed to the need of change by delivering a basic understanding of diseases, its severity and individual's susceptibility of acquiring it. Besides, the adoption of healthy lifestyle is usually limited by behavioural determinants such as motivation and perceived barriers. In this study, we found that motivation such as gradual weight gain, physical appearances, adverse health complication experiences and good social support will increase the adoption of healthy lifestyle. While several perceived barriers such as perception of healthcare as business model, difficult and expensive lifestyle changes and cultural influences on food choices hindered the adoption of better nutrition and lifestyle behaviour. Finally, inadequate of knowledge on MetS abolished the need to change among individuals. Since the prevalence of MetS among Malaysian adults has increased tremendously for the past decades, an effective community-based lifestyle intervention is demanded to manage and further prevent MetS to affect the country.

Study Limitation

The qualitative approach, the selectness of the population under study and the sample size are clear limitations of this study. As opposed to studies taking a phenomenological or grounded theory approach, qualitative descriptive studies that involves focus group may be less interpretive, however, they are superior than quantitative studies (15). Despite, in the development of community-based lifestyle intervention, there is no one-size-fits-all solution. Thus addressing the qualitative components of a community that are often missed out in quantitative observation, may increase the acceptability of any lifestyle intervention among the community members (17). As the consent was sought and the confidentiality of all respondent is protected, the study poses no serious ethical question.

Conclusion

The qualitative insight informed by a thematic qualitative analysis of FGDs In this study has generated an perception of change in Malaysian adults towards healthy lifestyle. Individual perceptions on disease threat, physical appearances, adverse health effect, functionality of healthcare system and benefit of changes will significantly modulate the need to change in them. Besides, supportive environment will increase the degree of adoption and sustainability of healthy lifestyle among individuals. In conclusion, the results support the practicability and value of the study in informing a better lifestyle intervention development targeting Malaysian adults with MetS.

Acknowledgement

Abbrevation

MetS   Metabolic syndrome

FGD   Focus group discussion

SD   Standard deviation

MYR   Malaysian Ringgit

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

MDAM designed the study and carried out the interviews and analysis. MDAM drafted the manuscript in cooperation with AR. MDAM and AR participated in the design of the study and helped to draft the manuscript. All authors reviewed and agreed on the final manuscript. The study adheres to the RATS guidelines on qualitative research. All authors read and approved the final manuscript. Muhammad Daniel Azlan Mahadzir, Quek Kia Fatt and Amutha Ramadas contributed equally to this work.

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Table 1

Table 1: Sociodemographic characteristic of study respondents

No	Item	n		%
	Sociodemographic Characteristic			
No	**Item**	**n**		**%**
1	**Age (years)**	21	51 ± 10.3	
2	**Gender**			
	Male	6		27
	Female	15		73
3	**Status**			
	Single	1		4
	Married	15		73
	Widow	3		14
	Divorced	2		9
4	**Ethnicity**			
	Malay	20		95
	Chinese	1		5
5	**Education**			
	Secondary	5		24
	Tertiary	16		76
6	**Occupation**			
	Employed	9		43
	Unemployed	1		5
	Business Owner	6		29
	Retired	5		23
7	**Income (MYR)**			
	0 – 999	1		5
	1000 – 1999	2		9
	2000 – 3999	5		24
	4000 – 5999	5		24
	6000 – 9999	4		19
	>10,000	4		19
8	**Metabolic Risk Factors**			
	Abdominal Obesity	21		100
	Hypertension	21		100
	Diabetes	19		91
	Dyslipidemia	7		33
	Hypertriglyceride	9		43
9	**Number of risk factors**			
	3 risks	3		14
	4 risks	15		72
	5 risks	3		14

CHAPTER 4

RESULTS

4.1   Overview

Since the prevalence of MetS is growing proportionately with the economic burden of healthcare in Malaysia, there is an urgent need for an effective lifestyle intervention strategy. This chapter will describe the development, implementation and evaluation of nutrition and lifestyle behaviour "PEeR SUpport program for ADults with mEtabolic syndrome" (PERSUADE). This first part of this chapter described in detail the development, implementation and evaluation of PERSUADE starting from the development of Behavioural Change Matrix (BCM), content development and feasibility and process evaluation.

PERSUADE is developed by consolidating the findings from the first two steps; review of evidence and focus group discussion with a behavioural theory. Health Belief Model (HBM) (35) is selected to be the backbone of the development. HBM is one of the earliest behavioural theory that describe the tendency of an individual to adopt healthy lifestyle. The theory is further expanded in a paper by Rosenstock et al that described self-efficacy and cue to action is an important factors alongside with one's motivations and perceived barriers (36).This theory has been used extensively to study behavioural changes among obese youth (37) and diabetic patients (38, 39). Furthermore, an earlier study by Lo et al, has elucidated factors for health-promoting behaviour among adults with MetS using HBM concept (40). This findings were then used to develop and intervention program for MetS (41). Another study in Japan incorporated HBM is their intervention development and has been shown to improve metabolic outcomes of participants (42).

A behavioural change matrix (BCM) (Appendix C) was developed to consolidate the findings and concepts of HDM. BCM outlined the behavioural theme, behavioural objectives and behavioural determinants that served as the backbone of PERSUADE module development. The behavioural themes and objectives are mainly appropriate behavioural targets outlined in established guidelines. Peer Module content was developed to inform changes in these aspects by providing peers with basic knowledge of MetS, self-efficacy skills and self-monitoring skills. PERSUADE Peer Module (Appendix D) were developed using simple Malay language and was presented as a booklet of posters. These colourful posters were used as a facilitating tool for peer leaders to prompt discussion among their peer group.

Article 4 elaborated the development, implementation and evaluation of PERSUADE. Implementation of the PERSUADE involved two separate neighbourhood in Johor Bahru. The process evaluation elucidated indices on program adherence, content satisfaction and peer leadership score from the participants following 12 weeks of peer support. Despite high adherence rate and high content satisfaction score, the peer leadership score is moderate. This signifies a need to enhance and emphasis more on peer leader training apart from the peer support itself. Peer whom are selected from the member of public needs to be trained adequately before leading a group (43). Limitations such as knowledge level, language barrier and communication skills should be sought before selecting peer leaders.

Following process evaluation, Article 5 described the outcome of a pre-post feasibility trial of PERSUADE. The trial were designed to see the effect of PERSUADE on metabolic outcomes and behaviour after 6 months of follow up. PERSUADE aimed to educate adults with MetS with the knowledge of MetS, its risk factors, and the importance of preventative measures such as increased physical activities and improved diet quality. The questionnaire used for the measurement of outcomes is appended as Appendix D. The feasibility of PERSUADE is high as there is a significant change in metabolic parameters and also a few nutrition and lifestyle behaviour parameters. Despite some degree of behavioural decay observed from Month 3 to Month 6, changes in all metabolic parameters remain the same signifying a good behavioural retention rate among peers. Furthermore, we appended a table describing the results of feasibility trial in Appendix F. The effectiveness of PERSUADE should be studied using a randomised controlled trial with a comparable control arm in future.

Process Evaluation of a Nutrition and Lifestyle Behavior Peer Support Program for Adults with Metabolic Syndrome

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Article

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Abstract: Metabolic Syndrome (MetS) is a cluster of risk factors that increases the risk for diabetes and cardiovascular diseases. Lifestyle intervention is the gold standard of MetS management and prevention. Despite the growing positive influence of peer support-based interventions on management of various chronic diseases, its potential among adults with MetS has not been elucidated. We describe the development and process evaluation of a nutrition and lifestyle behavior "*PEeR SUpport program for ADults with mEtabolic syndrome*" (PERSUADE) using a systematic five-step approach—(i) review of evidence; (ii) focus group discussions; (iii) behavioral matrix development; (iv) module development; and (v) feasibility and process evaluation. High program adherence was recorded with 81.3% of participants attending all peer sessions. Participants' content satisfaction score was high (93.3%) while peer leadership score was satisfactory (70.0%). There were significant reductions in all anthropometric and metabolic parameters assessed post intervention, except for diastolic blood pressure. Significant correlations were found between reductions in body fat and triglyceride, and content satisfaction. Peer leadership was only significantly correlated with reduction in triglyceride. Future studies can explore aspects of module interactivity, use of social media, and other means to stimulate consistent engagement of participants, as well as extending the implementations to other lifestyle-related diseases.

Keywords: metabolic syndrome; peer support intervention; nutrition; lifestyle; feasibility; process evaluation

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1. Introduction

Metabolic syndrome (MetS) represents a clustering of metabolic risk factors, which reflects an underlying insulin resistance and adipose tissue dysfunction [1]. The risk factors include large waist circumference, high blood pressure, high fasting blood glucose levels, and dyslipidemia. The urgency to manage this clustering is due to mounting evidence that linked MetS with an increased risk of type 2 diabetes and cardiovascular diseases in later years [1] especially in low-middle income countries, such as Malaysia. The findings from the latest National Health and Morbidity Survey (NHMS 2016) suggested that the prevalence of MetS risk factors has increased rapidly in recent years [2], while a few studies showed a remarkably high prevalence of MetS clustering among Malaysians [3]. This is partly a result of rapid socio-economic development, which comes at the expense of healthy diet and active lifestyle [4,5].

Literature suggests strong relationships between various lifestyle habits and risk for MetS [6,7]. For example, a Western or unhealthy dietary pattern with limited variety and low quality have been

shown to be one of the main nutritional risk factors for MetS [6]. Physical inactivity and longer screen time have been associated with MetS risk [7,8]. In addition to poor nutrition and physical inactivity, meta-analysis of observational studies showed a poor sleeping pattern to increase the risk for MetS in adults [9], where short sleep duration (less than 6 h) and long sleep duration (more than 8 h) both tend to increase the risk. Hence, it is not surprising that lifestyle behaviors tend to be the first line approach towards prevention and management of MetS and interventions likely to focus on these aspects. However, the number of such interventions in Malaysia is limited, where only one community-based intervention focusing on the improvement of physical activity levels among those with MetS has been reported [10].

As chronic conditions such as MetS often persist long term, there is a need to explore more cost-effective and sustainable interventions for long-term self-management. Lifestyle modifications have been shown to be a better option than medications for long-term prevention of metabolic disorders such as diabetes [11]. However, instilling sustainable and effective lifestyle changes among individuals with MetS is challenging, and this issue has been previously discussed by Pritchett and colleagues [12]. Often, long-term management also tends to not be addressed in published guidelines on chronic disease management, which rather focus on generic dietary and lifestyle changes. In addition to this, patients' motivation and barriers to change are often overlooked and only have been documented in limited scenarios [13–15].

On the other hand, an integration of a peer support framework in lifestyle interventions is showing growing evidence to improve the outcome in chronic diseases [16]. Peer support, consisting of non-hierarchical, mutually beneficial relationships with similar others who face the same health problem, has been leveraged in group-based lifestyle interventions evaluated in the general population [17]. The effectiveness of peer support interventions has been previously reported in the case of obesity [18], diabetes and hypertension [19,20], and cancer [21]. Since peer support promotes activation of public members to have the same health goals by promoting collective behavioral changes, the framework is seen to substantiate lifestyle intervention better than a stand-alone lifestyle intervention [16].

Growing prevalence of MetS in Malaysia sparks the need of a wholesome and cost-effective lifestyle intervention. Hence, a community-based nutrition and lifestyle behavior "*PEeR SU*pport program for *AD*ults with m*E*tabolic syndrome" (PERSUADE) was developed. Here, we describe the five-step development and process evaluation of PERSUADE.

2. Materials and Methods

PERSUADE is a peer-based behavioral intervention aimed at Malaysian adults with MetS located in the state of Johor, Malaysia. PERSUADE is designed as a 12-weeks peer support program with the assistance of a peer module that was built using a five-step development process (Figure 1) to ensure that the information that it delivers is evidence-based, appropriate, and community-specific.
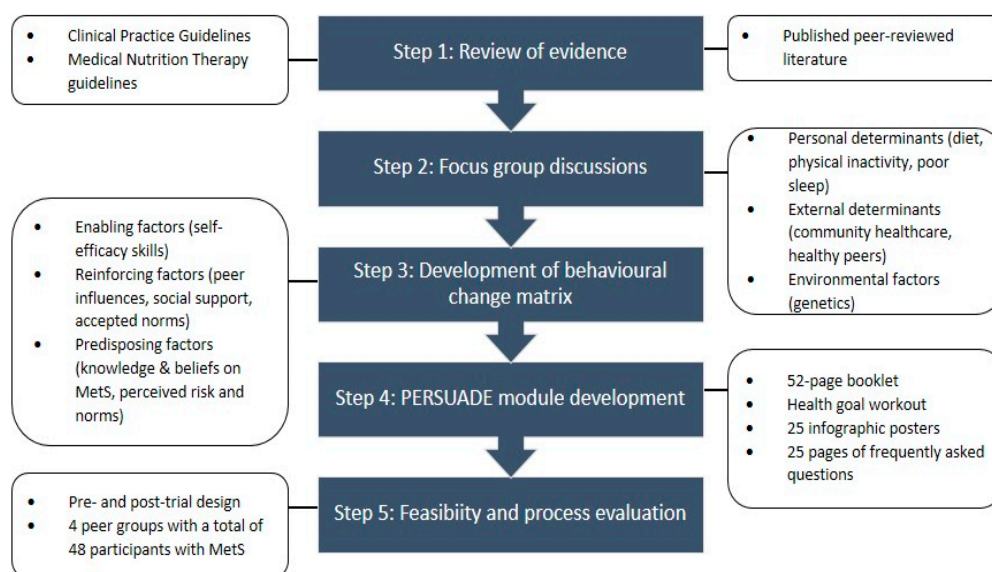
2.1. Step 1: Review of Evidence

As the first step, we conducted extensive reviews of available established guidelines and literature on lifestyle interventions in MetS among adults. Established guidelines that were reviewed included the National Strategic Plan for Non-communicable Diseases (2010–2014) [22], Malaysian Dietary Guidelines 2010 [23], and clinical practice guidelines for metabolic diseases [24–28], as well as the Malaysian Medical Nutrition Therapy for diabetes, hyperlipidemia, and hypertension [29–31]. Specifically, we reviewed objectives related to behavior changes, basic knowledge on MetS components and risk factors, self-management skills, and prevention steps of specific risk factors. In addition, we also researched the guidelines on specific improvement in dietary habits and physical activity.

A literature review of published lifestyle intervention among adults with MetS was conducted to elucidate design approaches and strategies of the interventions. Each intervention was designed closely to the need of the targeted community, and there was no one-size fits all intervention design [32]. Some of the studies however, described the decay of healthy behavior among the participants at

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post-intervention follow-up. It is worth noting that peer support design has shown to be one of the most resilient approach in terms of healthy behavioral decay and has shown promising evidence in management and prevention of chronic diseases [33].

Figure 1. PERSUADE (PEeR SUpport program for ADults with mEtabolic syndrome) Module Development Flowchart.

2.2. Step 2: Focus Group Discussions

A qualitative study with a total of 21 purposively sampled respondents was conducted with adults diagnosed with MetS who attended MONASH Medical Precinct. We studied the motivation and barriers of healthy living among adults with MetS via a qualitative study with four focus group discussions. An interview protocol consolidating both responsive interviewing model and Health Belief Model (HBM) [34] was prepared. The focus group discussions were audio recorded and transcribed. Data saturation was achieved in the fourth focus group, and the study was halted.

Thematic analysis was performed on the data. Owing to the explorative nature of the HBM [34] in the qualitative assessment, seven main themes including three motivations and four perceived barriers on healthy nutrition and lifestyle behavior were identified. Motivations identified in the thematic analysis include: (i) weight gain and physical appearances; (ii) personal experience of adverse complications; (iii) good family and social support. The thematic analysis also revealed the following barriers to change: (i) perception that healthcare as a business model; (ii) healthy change is difficult and expensive; (iii) cultural influence on food intake; (iv) inadequate knowledge on MetS. We addressed the factors associated with motivations and barriers elucidated from Step 2 in the development of PERSUADE content in which certain aspects, such as self-sustaining skills, are emphasized more as compared to the others. By doing so, information is designed to be user-friendly, easy to follow, and allowing long-term changes.

2.3. Step 3: Development of Behavioral Change Matrix

The PERSUADE behavioral change matrix was then developed using the information gathered from Steps 1 and 2. The matrix served as the backbone of PERSUADE content development, with an aim to combine each specific change objective with specific intervention strategies and delivery methods. Domains of the HBM were used as an adhesive between these three aspects to strengthen the matrix. As the HBM was used as an explanatory framework to study the degree of healthy lifestyle adoption [35], this matrix became a functional template for the module development in Step 4. A part of the behavioral change matrix (focusing on dietary modification) is shown in Table 1.

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Table 1. A sample of behavioral change matrix for dietary modification.

Behavioral Objectives	Behavioral Determinants		
	Knowledge	Perceived Benefit	Self-Efficacy Skills
• Use Malaysian Food Pyramid and 'Suku Suku Separuh' plate to ensure balance, variety, and moderation in amount of consumed food. • Use Nutrition Information Panel to understand food contents. • Monitor food portions, daily food intake, and food variety.	• Describe food classes and food variety using Malaysian Food Pyramid. • Describe food portions using 'Suku Suku Separuh' representation. • Understand what health claims on food products are. • Use Nutrition Information Panel to classify healthy foods. • Use food diary to track intake.	• Ensure balance, variety, and moderation in amount of consumed food is important in balance diet. • Know what is in a food product to ensure all ingredients are healthy. • Using food records to keep track of calorie intake.	• Identify food classes using the food pyramid. • Build a healthy plate using 'Suku Suku Separuh' concept. • Consume a wide variety of foods. • Portion food intake to ensure diet is in moderation. • Key—"Balance, Colorful, and Moderation". • Identify healthy foods using nutrition information panel. • Read health claims in food packaging. • Record all food consumed using a food diary.

Note: *Suku suku separuh* ("quarter quarter half") is a campaign by Malaysian Ministry of Health to encourage adoption of healthy plate.

2.4. Step 4: PERSUADE Module Development

PERSUADE aimed to deliver evidence-based, factual, and current health information that will help peers to improve their nutrition and lifestyle behaviors. Hence, we carefully designed each point of information by expanding the matrix with information provided in national guidelines and published literature. Motivations and barriers associated with behavioral change in adults with MetS identified in the qualitative study (Step 2) were incorporated in design of information delivery. As a result, the content of PERSUADE was developed to be community-specific and relevant to the participants.

The PERSUADE Module was designed to be a 12-week peer support program involving adults with MetS. The peers actively interacted with each other with the guidance of the PERSUADE Module on a weekly basis. The lesson plans included a 52-page booklet which comprises of a weekly program schedule, one page of health goal workout, 25 infographic posters, and 25 pages of frequently asked questions given out at the start of the intervention period. Each lesson plan was made available in a simple, understandable form in English and Malay languages. Relevant photographs and illustrations were added to enhance the understanding of the lesson plans. The presentation of information and layout of the posters were kept simple, with session objectives clearly stated in each new section.

The weekly peer module was arranged according to each section to address three main objectives: knowledge of metabolic syndrome, nutrition and dietary target, and healthy lifestyle aims. Each recommendation was also designed to address all related barriers and motivate the participants to change accordingly. A footnote containing various links to websites with related information on MetS, healthy lifestyle, and diet was provided where appropriate.

Sample pages of the module are available as a Supplementary file (S1).

2.5. Step 5: Feasibility and Process Evaluation
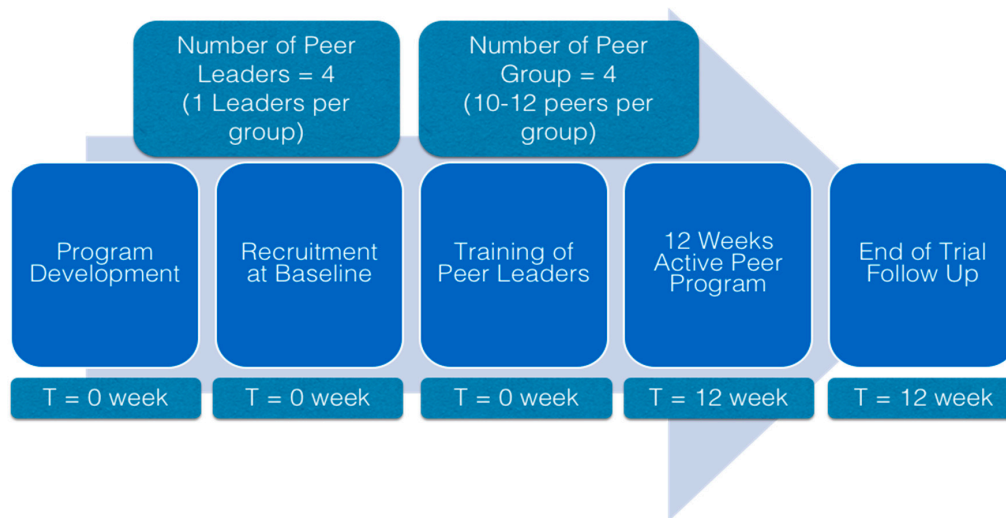
2.5.1. Feasibility Trial

A pre- and post-trial design was used to assess the feasibility and to conduct the process evaluation of PERSUADE (Figure 2). Recruitment drive was done in two neighborhoods in the state of Johor through health screening events organized by respective neighborhood committees. In order to be eligible, volunteer participants had to be Malaysian and have MetS according to the Harmonized Criteria [36]. In addition, participants had to be willing and able to commit to 12 weeks of intervention. Participants were excluded if they were reported to have cardiovascular diseases, chronic liver or kidney disease, thyroid problems, or advanced cancer. Ethical approval was obtained from Monash University Human Research Ethics Committee, (CF16/56-2016000022) before commencement of the study.

A total of 48 eligible participants were enrolled into the feasibility trial. Forty-four of them were enrolled as peers and divided into four peer groups based on their location. The remaining four participants were trained as peer leaders. A two-day session was planned to inform the leader on the overall peer support framework, essential information on metabolic syndrome, good dietary habits and healthy lifestyle, and behavioral change objectives. Each group was then introduced to their peer leader by the study nutritionist.

Changes in anthropometric measures and metabolic biomarkers were recorded at baseline and 12 weeks post intervention. Height and waist circumference (WC) were measured according to World Health Organization protocol [37] using SECA stadiometer and SECA measuring tape, respectively. Weight and body fat percentage were measured using InBody 120 Body Composition Analyzer. Body Mass Index (BMI) was calculated as weight in kilograms divided by the square of height in meters. Blood pressure (BP) was assessed using OMRON HEM-907XL automated blood pressure monitor. Finger-prick method was used to measure fasting blood glucose (FBG) (B Braun Omnitest 3 Glucometer) as well as triglyceride (TG) and high-density lipoprotein (HDL) (Cardiochek PA Blood Meter).

of PERSUADE (Figure 2). Recruitment drive was done in two neighborhoods in the state of Johor through health screening events organized by respective neighborhood committees. In order to be eligible, volunteer participants had to be Malaysian and have MetS according to the Harmonized Criteria [36]. In addition, participants had to be willing and able to commit to 12 weeks of intervention. Participants were excluded if they were reported to have cardiovascular diseases, chronic liver or kidney disease, thyroid problems, or advanced cancer. Ethical approval was obtained from Monash University Human Research Ethics Committee, (CF16/56-2016000022) before commencement of the study.

Figure 2. Flowchart of feasibility and process evaluation of PERSUADE.

2.5.2. Process Evaluation

This process evaluation was conducted to assess participants' adherence to the intervention and satisfaction towards content and peer leadership. The adherence to the intervention was assessed by the peer attendance to each peer session. All participants were required to record their weight before each peer session to ensure validity of the attendance. The program feedback was recorded in a self-administered questionnaire post intervention, assessing the participants' satisfaction towards the content satisfaction and peer leaders.

Five factors were used to determine the content satisfaction: time and place for peer session, module objective, module content, module structure, and module relevance. Furthermore, peer leadership scores incorporated a few aspects of the program delivery; peer interactions, peer leader readiness, and peer leader knowledge. The responses were recorded using a Likert scale with scores ranging from 1 (strongly disagree) to 5 (strongly agree). Internal consistency of the items was determined using Cronbach Alpha (α), where $\alpha > 0.70$ denoted good internal consistency. Both content satisfaction and peer leadership components scored excellent in terms of internal consistency with $\alpha = 0.921$ and 0.898, respectively.

The sum of the responses for each domain (content and peer leadership) reflects the satisfaction of the participants, with higher scores indicating a higher level of satisfaction (Table 2). The sum was then converted into percentage by dividing with maximum score.

Table 2. Components of the process evaluation.

Components	Scoring Statement	Maximum Score [a]	Cronbach Alpha (α)
Program adherence	• Attendance	12	n/a
Content satisfaction	• One hour is enough to learn a topic. • Place was conducive and comfortable. • Module was easy to understand. • All information was related to my lifestyle and dietary habits. • Each module is systematic and easy to follow. • I can use the module to improve my lifestyle and nutrition behaviors.	30	0.921
Peer leadership	• Leader had enough time and interactions to achieve module objectives. • Leader was prepared to run each peer session. • Leader had enough knowledge to run the modules and answer my questions. • I can interact with my leader and peers to learn and understand healthy nutrition and lifestyle behaviors.	20	0.898

[a] Maximum score shows the maximum possible points obtainable within a component, which is equivalent to 100%.

2.5.3. Statistical Analysis

Descriptive statistics were used to describe the participants' demographic characteristics. Normality of all continuous variables was determined using the Shapiro–Wilk test, and data were found not normally distributed. Hence, a Wilcoxon signed-rank test was performed to compare the changes in anthropometric measures and metabolic parameters between baseline and post intervention. Spearman's rho (ρ) was used to assess the correlation between satisfaction towards content and peer leadership and towards changes in anthropometric measures and metabolic parameters. All statistical analyses were performed using IBM SPSS Statistics 25.0, and statistical significance was set at $p < 0.05$.

3. Results

3.1. Study Participants

Forty-eight adults with MetS with a mean age of 44.17 years (SD = 7.45) were enrolled in the study, of which 52.1% were females. The majority of the participants were Malay (85.4%) followed by Indian (8.3%), and Chinese (6.3%). Almost all (97.7%) participants were working with an average monthly income of MYR3122.92 (SD = MYR1814.98) (approximately USD737.45 (SD = USD428.72)). The participants were locals and had been a resident of the state of Johor for an average of 26.35 years (SD = 17.52 years).

3.2. Changes in Anthropometric Measures and Metabolic Parameters

Of the three anthropometric measures assessed in this study, small but significant reductions in median BMI and WC were seen post intervention as compared to baseline (both $p < 0.001$) (Table 3). Median systolic BP was also significantly lower post intervention compared to baseline ($p = 0.001$). Similar reductions were noted in median FBG, TG, and HDL post intervention (all $p < 0.001$).

Table 3. Changes in metabolic markers of study participants (N = 48).

	Baseline	Post-Intervention	*P*
	Median (IQR)	Median (IQR)	
Body mass index (kg/m^2)	25.62 (5.16)	24.99 (4.75)	<0.001 **
Waist circumference (cm)	91.75 (11.40)	91.25 (11.80)	<0.001 **
Body fat (%)	28.75 (7.80)	28.00 (8.40)	0.060
Systolic blood pressure (mmHg)	134.5 (23.00)	128.5 (22.00)	0.001 *
Diastolic blood pressure (mmHg)	80.0 (17.00)	81.0 (15.00)	0.188
Fasting blood glucose (mmol/L)	8.15 (3.00)	7.50 (2.80)	<0.001 **
Triglyceride (mmol/L)	2.71 (0.52)	1.81 (0.51)	<0.001 **
High-density lipoprotein cholesterol (mmol/L)	1.11 (0.48)	1.45 (0.54)	<0.001 **

IQR = interquartile range; * significant at $p < 0.05$; ** significant at $p < 0.001$.
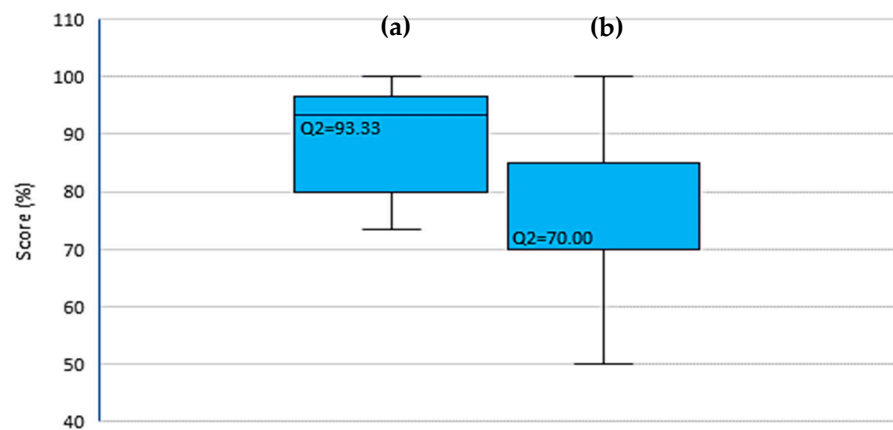
3.3. Process Evaluation

More than 81% of participants attended all peer sessions while 6.3% and 12.5% attended 10 and 11 peer sessions, respectively. Most of the absences were due to work commitments and family issues. There were no dropouts throughout the program. To ensure the validity of each attendance, participants measured their weight during each peer session, which eventually factored into the high program adherences. An individual weight chart was printed and given to each participant to see changes in their weight weekly.

All participants satisfied with the content of the module with a median score of 93.33% (IQR = 16.67) (Figure 3). The median score for peer leadership was lower at 70.00% (IQR = 15.00) with two participants disagreeing on each aspect of peer leadership except on peer interaction.

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Figure 3. Distribution of study participants according to (a) content satisfaction and (b) satisfaction towards peer leadership.

3.4. Correlation between Satisfaction and Study Outcomes

There was a small but significant correlation between satisfaction towards intervention content and reduction in body fat content ($\rho = 0.348$, $p = 0.015$) and triglyceride ($\rho = 0.431$, $p = 0.002$). Peer leadership, however, was only correlated with reduction in triglyceride ($\rho = 0.363$, $p = 0.011$). Table 4 presents the correlation analyses.

Table 4. Correlation between satisfaction towards content and peer leadership, and changes in study outcomes.

Changes in Measures (Baseline to Post-Intervention)	Content ρ	Peer Leadership ρ
Body mass index (kg/m²)	−0.187	−0.047
Waist circumference (cm)	−0.255	−0.181
Body fat (%)	0.348 *	−0.251
Systolic blood pressure (mmHg)	0.098	0.224
Diastolic blood pressure (mmHg)	0.029	0.034
Fasting blood glucose (mmol/L)	0.026	0.011
Triglyceride (mmol/L)	0.431 *	0.363 *
High-density lipoprotein cholesterol (mmol/L)	0.004	0.073

* significant at $p < 0.05$.

4. Discussion

Interventions that can successfully change diet and lifestyle of individuals with MetS may result in desirable effects by improving their anthropometric and clinical biomarkers. PERSUADE was developed to address the intricate behavioural aspects of Malaysian adults with MetS and their readiness to change in a comprehensive evidence-based, community-specific peer support program.

4.1. Outcome of the Feasibility Trial and Process Evaluation

As abdominal obesity is one of the most important components of MetS, many interventions focus on reduction in WC as well the BMI [38]. We noted our patients had significant change in WC and BMI post-intervention in our study. We had small but significant change in WC and BMI post-intervention in our study. We had participants weigh themselves and record their body weight on a weekly basis, and close monitoring of body weight has been shown as one of the factors that could aid with weight loss [39]. Although we found a significant reduction in SBP, such difference was not seen in DBP. In addition to this, the magnitude of change of FBG, TG, and HDL, though significant, was rather

small. Past studies have also noted similar issues and suggested a longer period of intervention for us to observe a bigger margin of reductions [40,41].

Satisfaction towards the module content was also observed to be high, signifying a comprehensive five-step approach in module development. The fundamental aspects incorporated in the module development were informed by an extensive review of evidence and guidelines, supplemented by earlier findings from focus group discussions. Hence, the module was tailored to be community-specific. Guenther and colleagues [42] have previously discussed the positive impact of community-specific information in intervention material to increase the participatory rate. In terms of peer support, the study evaluated peer leadership to evaluate interactivity and proactivity of peer leaders in running their individual peer groups. The satisfaction towards peer leadership was relatively low compared to the satisfaction towards PERSUADE's content. This seems to be a recurring issue with a well-conducted review on peer support, suggesting readiness of peer leaders was often less emphasized, and this factor tends to contribute towards poor delivery and less engagement [43].

We noted a high participatory rate (90%) in PERSUADE. This signifies a high level of motivation in this community to attend and participate in peer-related programs. It has also been shown in multiple peer-based studies that it has been found to be promising in addressing chronic health problems, especially those that are closely related to lifestyle [43]. The design of PERSUADE included an emphasis on empowerment and self-efficacy, making it a person-centered approach. It extended the directive clinical issues with an additional construct that reflects individuals' values, interests, and problems. This, in return, when harmonized with HBM, reflected the wide variety of social, economic, and community stressors that influence lifestyle-related disease management.

We deduced that several of the following factors could have improved the participation rate in PERSUADE:

4.1.1. Attention to Emotions

People considering peer support often express interest only in information and answers to their questions, not emotional support [43]. Owing to this, PERSUADE was designed as a systematic approach over a period of time. This gives the room for a peer leader to make a gradual evolution of emotional support as trust evolved in the course of instrumental support, such as providing information or help with specific tasks. With the increase trust, peers are giving each other implicit support, such as shared activities; emotional support may be conveyed without explicit discussion of emotions. Implicit support and trust will promote collective changes within the peer group.

4.1.2. Use of Theoretical Model

We used the HBM as the foundation in developing content structure, content, and program delivery. By doing this, we addressed one's motivation and barrier to change in our content and approach. This increases relevance of this module among the participants and subsequently increases the acceptance rate.

4.1.3. Assistance in Daily Health Management

All peer groups were followed up by their leader and discussed collectively on the planned topics which included MetS as a clustering of risk factors, heart diseases and diabetes, blood sugar levels, blood pressure, healthy eating, and exercise and medication adherences. However, since the aim of PERSUADE is to motivate self-management, this process evaluation noted that an effective creation of individualized behavioral change management plans goes beyond the concept of peer support. The peer discussion appears to have paid little attention to the individualized plans for behavioral change and progress in achieving them that are generally viewed as central to self-management. This is reflected in the understanding of the module content (content satisfaction).

4.1.4. Ongoing Proactive Contact

Our trained peer leaders met the peers every week, and the ongoing process motivated the peer to change and be present for the follow-up. Besides delivering the program, peer leaders were also instilling the sense of collective change and healthy competition among peers in their respective groups.

4.2. Limitation

While the program had its strengths, we have identified several limitations or shortcoming that served as lessons learned from the feasibility trial.

Based on verbal feedback received, there were instances where peer leaders unknowingly shared inaccurate information which was noted by peers who have done extensive 'homework' in that topic. The satisfaction towards the peer leaders may have been affected if the peers had doubt on the depth of knowledge possessed by their respective leaders. Besides, some peer supporters who tended to be too directive, prescriptive, or bossy in their advice needed to be transferred to other responsibilities. Similar issues were noted in the Peer for Progress project, as they suggested an ongoing supervision for peer leaders in the future construct for peer support [44].

In some instances, extensive focus on the module alone could have discouraged exchange of emotions among peers. At the same time, peer leaders' communication skills were not emphasized in their training but instead were covered along with several other issues in only one of two days of training sessions. Inclusion of deeper concepts of health psychology could have assisted in these aspects.

PERSUADE was designed to be a community-specific peer-led program. Hence, there may be an issue of generalizability of the program content to other parts of the world. Adaptation of the module to other settings or countries should consider the societal norms and cultural needs of the particular community.

4.3. Recommendation for Future Research

Future studies can be designed to be implemented in the real-world setting, incorporating different modes of behavioral change delivery and making a comprehensive integration on emotional and social aspects of program implementation. Moreover, a comparison in terms of cost effectiveness of various modes of interventions can be done.

We would like to highlight several key recommendations for future studies:

1. Emphasis on modifiable nutrition and lifestyle behavior (dietary pattern, dietary timing, diet variety, diet quality, sleeping pattern, smoking cessation, and physical activity programs).
2. Increase the study period from 3 months to a year to promote permanent lifestyle changes.
3. Incorporate technology in monitoring behavioral changes. Improve the rate of acceptance and adherence by including visually possible changes and a tracking system.
4. Improve peer leader training to ensure they are ready and inspiring.
5. Develop a stratified community-based sampling strategy in improve collective changes.
6. Ensure that each peer group is made up of peers with similar socioeconomic background to ensure their timely and relevant discussion throughout the period.
7. Conduct a needs assessment to gauge the societal or cultural needs of a community before adapting PERSUADE.

5. Conclusions

Lifestyle changes with the respective risk factor pharmacological management is the common treatment administered to individuals with MetS. Improvement on MetS requires life-long dietary and lifestyle changes supported by a healthy environment. Despite the challenges in delivering lifestyle interventions, the peer support framework has shown to be increasingly evident in promoting lifestyle changes among adults with chronic diseases. In addition to this, peer support programs may address

the insufficiency of the current one-off counselling session offered in most public hospital settings for people with MetS-related risk factors.

Process evaluation of PERSUADE shows a high acceptance and adherence rate among participants. Although peer leadership satisfaction can be improved with a more concise training program, the satisfaction towards the module content was high. While the feasibility trial and process evaluation supported the use of peer-based nutrition and lifestyle behavior intervention in this group, the identified limitations, issues, and recommendations can be considered before such program is proposed to a larger population.

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Nutrition and Lifestyle Behavior Peer Support Program for Adults with Metabolic Syndrome: Outcomes and Lessons Learned of a Feasibility Trial

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Abstract: Background: While peer support interventions have shown to benefit adults with certain chronic conditions, there is limited evidence on its feasibility and effectiveness among people with metabolic syndrome (MetS). This paper describes the outcomes of a pre-post feasibility trial of "*PE*eR *SU*pport program for *AD*ults with m*E*tabolic syndrome" (PERSUADE), an evidence-based and community-specific nutrition and lifestyle behavior peer support program for Malaysian adults with MetS. Methods: We recruited 48 peers (median age: 46 (IQR = 11) years old) into four peer groups, who underwent 3 months of PERSUADE, followed by 3 months of follow-up period. Statistical analyses were conducted at post-intervention and post-follow-up to assess the changes in nutrition intake, anthropometry, and metabolic parameters. Results: Although there were significant overall increases in total carbohydrate intake and glycemic load (both $p < 0.001$), we noted significant reductions in the intakes of total energy and fat (both $p < 0.001$). Physical activity (total METS/week) also showed a significant improvement ($p < 0.001$). Overall, significant but marginal improvements in anthropometric and vital metabolic parameters were also observed. Conclusions: The feasibility trial supported the adoption of PERSUADE, though there is a need to assess the long-term impact of the peer support program in local community settings.

Keywords: metabolic syndrome; peer support; diet; lifestyle; intervention; feasibility

1. Introduction

Metabolic syndrome (MetS) is a clustering of metabolic risk factors that includes abdominal obesity, elevated serum levels of triglyceride (TG), fasting blood glucose (FBG), raised blood pressure (BP), but a reduced level of high-density lipoprotein (HDL). These changes may increase the risk of developing type 2 diabetes mellitus (T2DM) and cardiovascular diseases (CVD) [1]. Multiple nationwide cross-sectional studies on MetS in Malaysia have suggested that the prevalence falls between 26.5% to 43.4% depending on definitions used in the study [2]. This alarming prevalence may be due to changes in economic development, modernization, and urbanization in developing countries such as Malaysia [3].

Similar to other lifestyle-related chronic diseases, MetS is closely related to poor nutrition and dietary profiles, as well as sedentary lifestyle [2]. It is important for MetS to be identified early, not only because of the associated risks but also to put forward lifestyle as the initial focus of therapy. Components of MetS have been shown to improve with positive changes in diet and physical activity levels [4]. The National Cholesterol Education Panel Adult Treatment Panel III (NCEP-ATP) [5] recommended lifestyle modification as the first strategy in MetS management, which is also in line with

Malaysian National Non-communicable Diseases Planning 2010–2015 [6]. Furthermore, short-term and intensive lifestyle intervention targeting weight loss among adults with MetS is effective at improving the clinical outcomes [7]. However, the literature suggests a high possibility of relapse over time, where participants regained weight loss or exhibit worse markers of MetS [8].

Peer-led intervention programs have been suggested to address lifestyle-associated non-communicable diseases in other parts of the world [9]. The effectiveness of peer intervention has also been previously assessed among female factory workers with MetS in the past [10]. Several studies assessed the effectiveness of lifestyle interventions to modify the health behaviors of the group affected by components of metabolic disorders in Malaysia, such as T2DM [11], gestational diabetes [12], and dyslipidemia [13], but not the clustering effect as in MetS. Under the National Strategic Plan for Non-Communicable Diseases in Malaysia, the Ministry of Health mobilized existing healthcare facilities to actively promote public health awareness and advocates a national policy on healthy diets and physical activity [6]. However, because there is no consensus for the MetS disease status, the strategic plan only targets metabolic diseases individually regardless of clustering.

To the best of our knowledge, no published experimental peer-led intervention related to MetS has been reported in Malaysia. The intervention conducted in Malaysia primarily incorporates functional foods as supplements in addition to lifestyle changes to manage MetS [2]. Besides, reported lifestyle interventions on non-communicable diseases in Malaysia put little emphasis on peer support components except for mental health-related studies. PERSUADE (nutrition and lifestyle behavior *PEeR SUp*port program for *AD*ults with m*E*tabolic syndrome) was developed as a result of the growing evidence on the peer-led framework on chronic diseases [9]. The development of PERSUADE incorporated systematic steps to ensure it was relevant, community-specific, and evidence-based. PERSUADE aimed to educate adults with MetS with the knowledge of MetS, its risk factors, and the importance of preventative measures such as increased physical activity and improved diet quality. Here, we provide a brief description of PERSUADE and report the effect of the program on dietary and lifestyle behaviors, as well as the anthropometric and metabolic parameters.

2. Materials and Methods

2.1. Development of PERSUADE Peer Support Module

PERSUADE was developed and tested for effectiveness based on a 5-step approach; (1) review of published MetS literature; (2) focus group discussion (FGD) among adults with MetS; (3) behavior change matrix incorporating findings from the review, FGD, and Health Belief Model (HBM); (4) program modules development; and (5) feasibility trial.

In the 1st step, evidence synthesis was conducted on available literature on peer-based lifestyle intervention on the metabolic syndrome to systematically assess published peer group-based lifestyle intervention targeted for MetS. Subsequently, in the 2nd step, a series of focus group discussions were conducted among a group of Malaysian adults with MetS (n=21) to qualitatively explore their understanding of MetS and their perceived motivation and barriers to healthy nutrition and lifestyle behavior.

In the 3rd step, a behavioral change matrix was prepared to incorporate both findings from the qualitative synthesis (Step 2) and the behavioral recommendations obtained from evidence synthesis (Step 1). This matrix was enhanced using the theoretical constructs of the HBM [14] and became the backbone framework of peer module content development. A 12-weeks module, including training modules for peer leaders and peers, was designed based on the behavioral change matrix in the 4th step.

A detailed description of the development and process evaluation of PERSUADE has previously been published [15]. The final step, which was a feasibility trial of PERSUADE, is explained in Section 2.2.

2.2. Feasibility Trial

The effect and feasibility of PERSUADE were assessed via a pre-post trial conducted between February and September 2019. The feasibility trial consisted of 2 parts: The 1st part involved peer leader training for 2 days, and the 2nd part involved a series of peer sessions implemented by peer leaders over a period of 3 months. The peers were then followed-up for another 3 months after completion of the intervention. During follow-up periods, no intervention was provided to the participants.

The trial took place in 2 separate neighborhoods in the district of Kulai, Taman Skudai and Taman Johor Jaya, in the state of Johor. In both neighborhoods, a recruitment drive was done to screen adults with MetS based on the harmonized criteria for MetS [3]. Ethical approval was obtained from the Monash University Human Research Ethics Committee (MUHREC) (CF16/56—2016000022) before the commencement of the study. Figure 1 presents the feasibility study flow chart.

Figure 1. Study flow chart.

2.2.1. Study Participants

Recruitment drives were done in 2 neighborhoods through health screening programs organized by the respective neighborhood committees. The committees also helped spread the word on the health screenings among their communities. All interested community members who attended the health screening were also screened according to the study's eligibility criteria, and eligible participants were invited to join the study. In order to be eligible, volunteer participants had to be Malaysian and fulfilled MetS according to the harmonized criteria [3]: 1) Waist circumference (WC) (female ≥ 80 cm; male ≥ 90 cm), 2) raised triglyceride (TG) levels (≥1.7 mmol/L), 3) reduced HDL cholesterol (female < 1.0 mmol/L; male < 0.9 mmol/L), 4) raised blood pressure (BP) (systolic ≥130 mmHg, or diastolic ≥85 mmHg), or 5) raised fasting plasma glucose (FBG) (≥5.6 mmol/L).

In addition, participants had to be willing and able to commit to a 12-week peer module. Participants were ineligible to participate if they were reported to have cardiovascular diseases, chronic liver or kidney disease, thyroid problems, and advanced cancer.

An audit of pilot studies reported a median of 36 participants in feasibility trials [16]. Hence, we aimed to recruit at least 44 participants after adding an additional 20% to account for potential dropouts to the reported median sample size. We successfully enrolled 48 participants into the study at the end of the recruitment process.

2.2.2. Peer Leader Training Program

The 48 participants were divided into 4 groups of 5 to 8 members according to the location of their neighborhoods to maximize participation. Each group was led by 1 volunteer peer leader. Peer leaders had to fulfill the following criteria; ability to communicate verbally, available for all 12 weeks of study, and willing to attend 2 days of peer leader training. Four peer leaders were appointed and were responsible for all participants in 4 peer groups, respectively. The training course for peer leaders involved; (1) brainstorming and discussion on motivation and barriers on behavioral change; (2) introduction to the PERSUADE peer module; and (3) self-efficacy skills workshop. The total training course was 16 hours long and comprised of 4 knowledge sessions on MetS, good dietary habits, physical activity, and healthy lifestyle behaviors (sleeping pattern, smoking, hydration, medication adherence, and supplement intake). The training also involved 4 workshops on self-efficacy skills (body weight, blood pressure and waist circumference measurement, dietary record, physical activity record, and reading food labels).

2.2.3. Peer Session by Peer Leaders

As a part of the 3-months peer-led intervention, each participant was provided with a PERSUADE peer handbook that consisted of posters and peer activity guide on MetS, physical activity, healthy diet, and lifestyle behavior. The handbook also allowed participants to monitor and record their weight, physical activity, and dietary intake, as shown by peer leaders at respective group sessions. The intervention for week 1 started with a large group activity where 4 peer leaders, together with the research team, conducted a 2-hours introduction and peer support session. All participants had activities for their own group to set their knowledge and understanding goals and health goals for the rest of the program.

The large group activity was followed by a 2nd peer session led by the 4 peer leaders individually in small-groups, and this format was sustained until the end of the program. The weekly small-group peer sessions of 60 minutes duration were organized by each group's peer leader to strategize steps on achieving significant changes in lifestyle behavior, dietary intake, physical activity levels, and weekly body weight. Each support session was designed to improve peer social support through facilitated group discussion and learning by sharing experiences and problem-solving strategies with each other. At the start of each peer session, participants measured their body weight in order to set goals to be achieved at their next meeting. Each time, a target goal was set with participants relating to their body weight, dietary intake, and physical activity levels. At the end of the 12th week, the research team identified the most successful group who lost the most weight to discuss and share experiences with all peer groups, particularly on their challenges and how they overcame barriers faced throughout the study period.

2.2.4. Data Collection and Measurements

Data were collected from participants at recruitment (baseline), at the end of the feasibility trial (3 months post-enrollment), and again after 3 months follow-up (6 months post-enrollment) during face-to-face sessions with the study nutritionist, to assess the changes in nutritional, lifestyle, anthropometry and metabolic parameters across the 3 time points. Anthropometry measures, including height and waist circumference, were measured according to the World Health Organization protocol [17] using the SECA stadiometer. Weight and body fat percentage (BF) were measured using InBody 120 Body Composition Analyzer. Body Mass Index (BMI) was calculated as weight in kilograms divided by height in meters squared. BP was assessed using OMRON HEM-907XL automated BP monitor. Furthermore, FBG and TG and HDL-cholesterol were measured via the finger-prick method. Both B Braun Omnitest 3 Glucometer (FBG) and Cardiochek PA Blood Meter (TG and HDL) were calibrated and validated for screening.

Dietary data were collected using a 24-hour dietary recall at all 3 time points described above. The dietary recall included probing for information on the mealtime of the day, food preparation methods, and portion size of each food and beverage. We used a validated visual aid [18] to help participants report accurate portion sizes. Nutritional data were analyzed using DietPLUS Version 3 [19,20]. A short questionnaire was used to gather information on dietary and lifestyle behaviors, including the number of meals consumed, eating speed, late-night eating, breakfast-skipping, dining out, supplement intake, smoking habits, and sleeping duration. Physical activity levels were measured using the validated short-form International Physical Activity Questionnaires (IPAQ) [21], and data were converted to metabolic equivalent task minutes per week (MET-minute/week).

2.2.5. Data Analysis

The study population was described using the median, interquartile range (IQR), mean, standard deviation (SD), frequency, and percentage. Characteristics of peers were compared across the peer groups using Kruskal Wallis or Fisher's Exact test to ensure that there were no statistical differences in demographic characteristics between the peer groups. The normality of continuous variables was determined using the Shapiro Wilk test. Total fiber intakes, DBP, FBG, BF, and TG, were not normally distributed, and natural log transformations were performed. Repeated measures were used to compare the changes in nutritional, anthropometric, and metabolic parameters. If there was an overall statistically significant difference between the time points, Bonferroni pairwise comparisons were performed. Magnitudes of change in continuous variables (d) were calculated to demonstrate the immediate and sustained effects of the intervention. Categorical variables were compared between similar time points using the McNemar test. All statistical analyses were performed with IBM SPSS Statistics 25.0, and the statistical significance was set at $p < 0.05$.

3. Results

The characteristics of participants are presented in Table 1 according to their peer groups. None of the characteristics differed according to the groups they were assigned. The total number of participants was 48; 23 (47.9%) males and 25 (52.1%) females. All participants successfully completed the trial. The level of adherence was high, as most (81.3%) of the participants attended the peer group session. While 6.3% and 12.5% attended 10 and 11 peer sessions, respectively, and most of the absences were due to work commitments and family issues.

Table 1. Characteristics of study participants (N = 48).

Characteristics		All (N = 48)	PG1 (n = 14)	PG2 (n = 10)	PG3 (n = 15)	PG4 (n = 9)	p
Age (Years)	Median (IQR)	46 (11)	43.5 (11)	47 (6)	44 (17)	46 (7)	0.563
Gender	Female	25 (52.1)	6 (42.9)	6 (60.0)	6 (40.0)	7 (77.8)	0.292
	Male	23 (47.9)	8 (57.1)	4 (40.0)	9 (60.0)	2 (22.2)	
Ethnicity	Malay	41 (85.4)	12 (85.7)	9 (90.0)	13 (86.7)	7 (77.8)	0.515
	Chinese	3 (6.3)	1 (7.1)	0 (0.0)	2 (13.3)	0 (0.0)	
	Indian	4 (8.3)	1 (7.1)	1 (10.0)	0 (0.0)	2 (22.2)	
Marital status	Single	2 (4.2)	1 (7.1)	0 (0.0)	1 (6.7)	0 (0.0)	0.967
	Married	44 (91.7)	13 (92.9)	9 (90.0)	13 (86.7)	9 (100.0)	
	Widowed	2 (4.2)	0 (0.0)	1 (10.0)	1 (6.7)	0 (0.0)	
Education	Primary	5 (10.4)	1 (7.1)	1 (10.0)	1 (6.7)	2 (22.2)	0.658
	Lower secondary	13 (27.1)	2 (14.3)	4 (40.0)	3 (20.0)	4 (44.4)	
	Upper secondary	16 (33.3)	6 (42.9)	3 (30.0)	5 (33.3)	2 (22.2)	
	Tertiary	14 (29.2)	5 (35.7)	2 (20.0)	6 (40.0)	1 (11.1)	
Occupation	Working	47 (97.9)	13 (92.9)	10 (100.0)	15 (100.0)	9 (100.0)	0.687
	Not working	1 (2.1)	1 (7.1)	0 (0.0)	0 (0.0)	0 (0.0)	

PG = peer group. Age is presented as median (IQR) and analyzed with the Kruskal Wallis test. Categorical variables are presented as *n* (%) and were analyzed with Fisher's Exact test.

3.1. Dietary Behaviors

Table 2 presents the changes in nutritional parameters assessed in the feasibility study. We found reductions in total energy intake at post-intervention (d = −4.15%, *p* = 0.045) and at post follow-up (d = −9.90%, *p* = 0.015). We hypothesized the overall reduction of total fat intake (*p* = 0.001) to contribute towards the decrease in total energy and masked the changes in carbohydrate and protein intakes. Interestingly, we also found a significant increase in energy-adjusted total fiber intake at post follow-up (d = +30.36%, *p* < 0.001) and almost equal percentage of increase in total sugar per 1000 kcal (d = +39.06%, *p* = 0.002). The glycemic load showed an increase at post-intervention (d = +14.93, *p* < 0.001), but the increase stabilized over the follow-up period. The unexpected changes in total sugar and glycemic load were very likely due to an increased intake of fruits, as recommended in the PERSUADE program module.
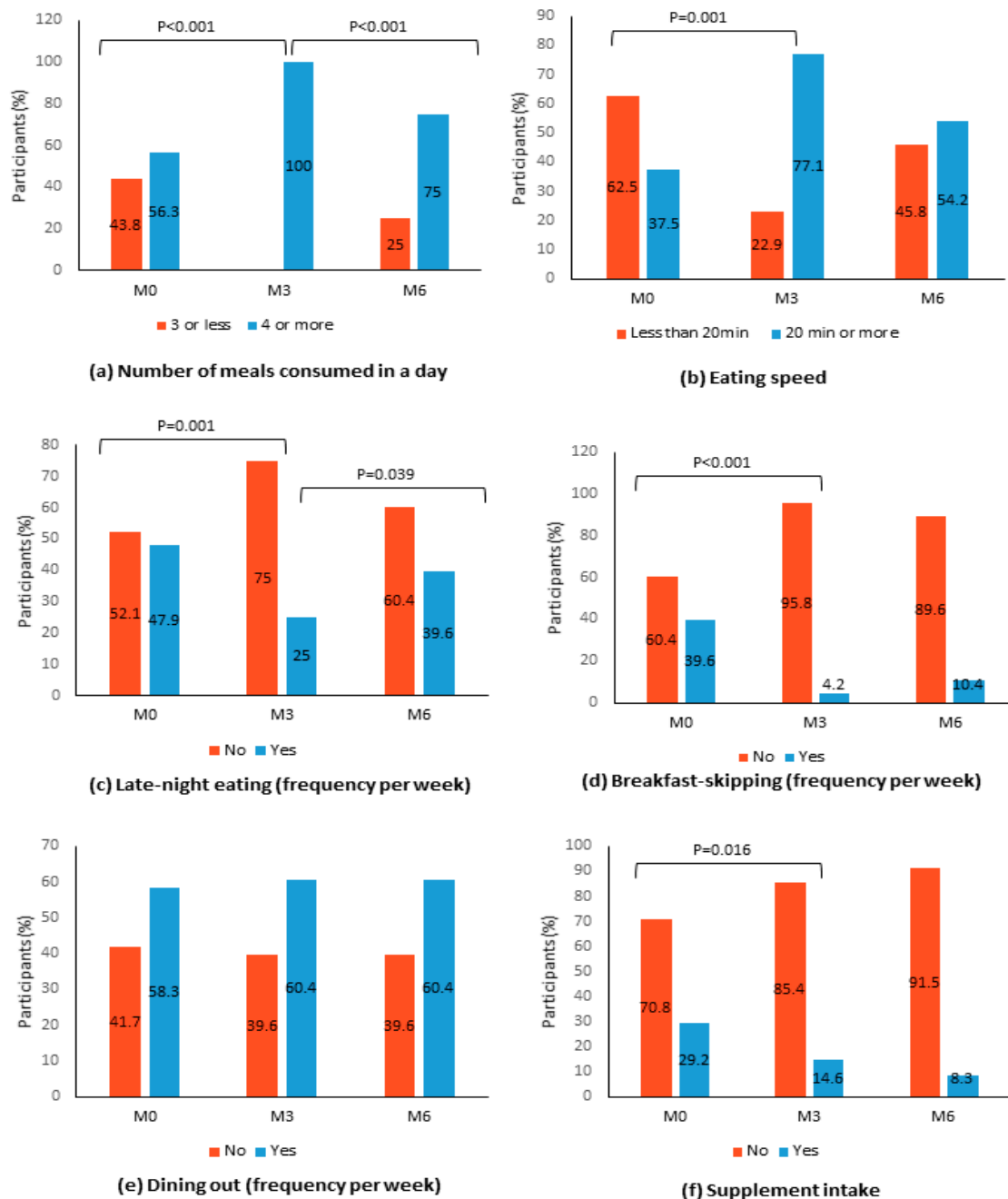
Table 2. Changes in nutrient intake of study participants (N = 48).

	Baseline (M0) Mean (SD)	Post-Intervention (M3) Mean (SD)	Post-Follow-Up (M6) Mean (SD)	*p* [a]	Pairwise Comparison	Change (%)	*p* [b]
Energy (kcal)	1685.42 (421.04)	1613.82 (331.50)	1453.24 (296.61)	0.001	M0 vs. M3 / M3 vs. M6	−4.25 / −9.90	0.045 / 0.015
Carbohydrate (g/1000 kcal)	139.71 (32.35)	149.04 (42.91)	165.19 (33.21)	0.001	M0 vs. M3 / M3 vs. M6	−6.68 / 10.84	0.483 / 0.049
Protein (g/1000 kcal)	32.91 (9.53)	33.33 (14.54)	39.93 (13.71)	0.004	M0 vs. M3 / M3 vs. M6	−1.19 / +19.80	1.000 / 0.041
Fat (g/1000 kcal)	29.03 (11.89)	21.89 (12.44)	22.96 (9.81)	0.001	M0 vs. M3 / M3 vs. M6	−24.60 / +4.89	<0.001 / 1.000
Total fiber [c] (g/1000 kcal)	6.71 (2.05)	6.95 (6.60)	9.06 (3.41)	<0.001	M0 vs. M3 / M3 vs. M6	+3.58 / +30.36	0.508 / <0.001
Total sugar (g/1000 kcal)	40.02 (18.64)	32.05 (17.00)	44.57 (20.42)	0.001	M0 vs. M3 / M3 vs. M6	−24.87 / +39.06	0.056 / 0.002
Glycemic load (g/%)	135.34 (30.05)	157.54 (47.22)	156.43 (44.16)	<0.001	M0 vs. M3 / M3 vs. M6	+14.93 / −0.70	<0.001 / 1.000

[a] Repeated measures; [b] Bonferroni pairwise post hoc; [c] Natural log transformation was performed.

Changes in the distribution of the peers according to other dietary behaviors were also observed (Figure 2). PERSUADE encouraged participants to consume smaller but more frequent meals to contain hunger. Although the post-intervention finding found all participants adhered to that suggestion (56.3% vs. 100%, *p* < 0.001), the effect was not sustained over the follow-up period. Overall, more peers took longer than 20 minutes to eat their main meals at post-intervention compared to baseline (77.1% vs. 37.5%, *p* = 0.001), though a decline was observed at post-follow-up. Proportions of late-night dining (after 10 pm) and dining out also showed decreases. Although it was initially difficult to discourage late-night food consumption among our participants (52.1% vs. 75%, *p* = 0.001), the proportion of late-night eaters reduced at post follow-up (75% vs. 60.4%, *p* = 0.039). While no statistically significant changes can be observed in dining out behavior, the proportion of participants who skipped breakfast decreased at post-intervention (4.2% vs. 39.6%, *p* < 0.001). As PERSUADE encouraged consumption of real foods compared to supplements, the proportion of peers consuming supplements also reduced from 29.2% to 4.2% at post-intervention (*p* < 0.001).

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Figure 2. Distribution of study participants according to dietary behaviors at baseline (M0), 3-months post-intervention (M3), and 6-months post-intervention (M6) (N = 48). Note: The McNemar test was performed between baseline (M0) and post-intervention (M3) and between post-intervention (M3) and post-follow-up (M6). Only statistically significant *p* values (*p* < 0.05) are shown.

3.2. Lifestyle Behaviors

A significant increase in the number of physically active peers was reported after 3 months of intervention as compared to baseline (85.4% vs. 60.4%, *p* < 0.001) (Figure 3). Interestingly, we found the proportion of smokers to decline from 16.7% to 4.2% at post-intervention (*p* = 0.031) and remained low at post-follow-up. In addition to this, all participants reportedly had at least 6 hours of sleep per day at post-intervention (*p* < 0.001) and over the follow-up period.

A significant increase in the number of physically active peers was reported after 3 months of intervention as compared to baseline (85.4% vs. 60.4%, $p < 0.001$) (Figure 3). Interestingly, we found the proportion of smokers to decline from 16.7% to 4.2% at post-intervention ($p = 0.031$) and remained low at post-follow-up. In addition to this, all participants reportedly had at least 6 hours of sleep per day at post-intervention ($p < 0.001$) and over the follow-up period.

(a) Physical activity

(b) Smoking

(c) Duration of sleeping (hours/day)

Figure 3. Distribution of study participants according to (**a**) physical activity, (**b**) smoking and (**c**) sleeping pattern at baseline (M0), 3-months post-intervention (M3), and 6-months post-intervention (M6) (N = 48). Note: The McNemar test was performed between baseline (M0) and post-intervention (M3) and between post-intervention (M3) and post-follow-up (M6). Only statistically significant *p* values ($p < 0.05$) are shown.

3.3. Anthropometry and Metabolic Parameters

Overall, there were significant changes found in all anthropometry and metabolic parameters, except DBP and BF (Table 3). Pairwise comparisons showed significant differences in SBP, FBG, BMI, and TG between baseline and post-intervention, but not between post-intervention and post-follow-up. A decrease in WC at post-intervention (d = −0.71%, $p < 0.001$) suggested abdominal obesity to be one of the most challenging parameters to be intervened. It was also disappointing to note an increase in WC at post follow-up (d = +0.24, $p = 0.018$). A significant increase observed in HDL at the end of intervention (d = +25.89%, $p = 0.001$) was not retained over the follow-up (d = −19.86%, $p < 0.001$).

Table 4. Changes in anthropometry and metabolic parameters of study participants (N = 48).

Table 3. Changes in anthropometry and metabolic parameters of study participants (N = 48).

	Baseline (M0)	Post-Intervention (M3)	Post Follow-Up (M6)	p [a]	Pairwise Comparison	Change (%)	p [b]
	Mean (SD)	Mean (SD)	Mean (SD)				
SBP (mmHg)	135.29 (19.65)	130.50 (17.36)	130.42 (18.36)	0.001	M0 vs. M3 M3 vs. M6	−3.54 −0.06	0.001 1.000
DBP (mmHg)	82.58 (11.67)	81.00 (9.28)	81.75 (9.67)	0.566			
FBG (mmol/L)	8.60 (3.48)	7.57 (1.98)	7.57 (2.16)	<0.001	M0 vs. M3 M3 vs. M6	−11.98 0	<0.001 1.000
BMI (kg/m^2)	25.84 (3.91)	25.42 (3.93)	25.50 (4.07)	0.001	M0 vs. M3 M3 vs. M6	−1.63 +0.31	<0.001 1.000
WC (cm)	91.72 (11.53)	91.07 (11.36)	91.29 (11.43)	<0.001	M0 vs. M3 M3 vs. M6	−0.71 +0.24	<0.001 0.018
BF (%)	29.88 (6.57)	29.42 (6.43)	29.37 (6.36)	0.060			
TG (mmol/L)	2.89 (1.73)	2.19 (2.06)	2.19 (2.09)	<0.001	M0 vs. M3 M3 vs. M6	−24.22 0	<0.001 1.000
HDL (mmol/L)	1.12 (0.35)	1.41 (0.32)	1.13 (0.33)	<0.001	M0 vs. M3 M3 vs. M6	25.89 −19.86	0.001 <0.001

SBP = systolic blood pressure; DBP = diastolic blood pressure; FBG = fasting blood glucose; BMI= body mass index; WC = waist circumference; BF = body fat; TG = triglyceride; HDL= high-density lipoprotein cholesterol. [a] Repeated measures; [b] Bonferroni pairwise post hoc.

4. Discussion

There is growing evidence supporting the adoption of peer support frameworks for the management of chronic non-communicable diseases such as hypertension and T2DM [22–24]. The effect of peer support-based lifestyle interventions can be extended to MetS as the clustering of metabolic risk factors predisposes patients to similar metabolic complications in later years. Peer support established a supportive social construct that aims for collective changes to practice a better lifestyle [25]. The effectiveness of peer support is reflected well in the long-term lifestyle changes following continuous social support received by peers [26]. PERSUADE was designed using a systematic approach, taking into consideration the potential for long-term continuous peer support.

PERSUADE resulted in an overall decrease in the fat intake but increased consumption of carbohydrates and protein. The inverse relationship in consumption suggested that participants reduced their intake of fat and re-compensated it with the intake of carbohydrates and protein. However, the overall macronutrient intake was reduced, as reflected by the reduction in total energy intake. Similarly, the PREVENT-DM trial reported significant improvement in dietary habits in a peer-led lifestyle behavior intervention when calorie counting was taught to the peers [27]. PERSUADE demonstrated success in improving dietary behaviors such as late-night eating, slower eating speed, and skipping breakfast. This is an important finding for our peer support program as individual interventions have shown difficulties in achieving notable changes in these aspects and often reported to be successful when social support is included as one of the key intervention features [28]

Although significant changes were observed among critical anthropometric and metabolic parameters, the changes were small in magnitude. Larger magnitudes of change in body weight, for example, were seen in a 24-week peer-led intervention [29], which advises us that there is a need for a longer intervention period in the future. Similarly, PERSUADE had a significant effect on SBP but not DBP, a finding that is consistent with the results from prior studies of peer-led groups where longer periods of intervention may be required to observe changes in DBP [30,31].

4.1. Lessons Learned from PERSUADE

The success of peer support appears to be due in part to the non-hierarchical, reciprocal relationship that is created through the sharing of similar life experiences [32]. Despite the benefits for patients with

chronic diseases from peer support programs in improving psychosocial outcomes for patients [33], the study outlined a few key lessons on what can be improved for a peer support program for MetS.

Peer support provides adults with MetS with better social support. These adults felt more empowered to make collective changes in behavior, which ultimately leads to everyone in peer groups achieving target goals in health and fitness [21]. This is enhanced by a better understanding of MetS acquired by all peers in the early part of PERSUADE. This finding is similar to a previous study reporting that participants' individual knowledge and attitudes toward MetS risks will significantly improve peer group changes in terms of dietary habits and physical activity [24].

The intervention period of PERSUADE lasted 12 weeks, and we allocated another 12 weeks for follow-up. Feasibility trials with similar duration, small sample size, and study design have been reported in MetS and other conditions [34–36]. Greer and Hill [34], for instance, utilized a pre-post study design over a period of 10 weeks to assess healthy lifestyle changes in the individual with MetS (*n* = 22) after interactive group sessions. The study did not find significant statistical changes in weight or BMI but found a slight reduction in WC at week 10.

Consistent and continuous support of peers is essential to ensure significant changes in lifestyle behaviors within a shorter period of intervention (less than 12 weeks) [37]. PERSUADE encouraged the peers to share experiences with one another and learn more about the barriers faced by peers to practice healthy eating and regular physical activity during the 12-weeks intervention period. As a result, the peers learned food portioning and the exact duration of time that can be allocated for their own meal preparations according to their daily activities. Peers were also more engaged in weekly exercise sessions and became proactive enough to initiate group exercise sessions with their peer leaders.

4.2. Strengths and Limitations

We expected an increase in the glycemic load as there has been an increase in an overall carbohydrate intake. We hypothesized that the decrease in fat intake was compensated with an increase in carbohydrates and protein. This paradox has been documented in previous literature [38] and happens as the individuals try to compensate for the lower energy intake from reduced fat consumption. Higher intake of carbohydrates is also regarded to be more satiating [39]. In addition, the total sugar intake saw a reduction at post-intervention but increased again at follow-up. The lesson learned here is that a greater emphasis must be given to complex carbohydrate consumption as wholegrain consumption is not the norm in Malaysia. Future studies should also focus on strategies to increase low energy-dense but satiating food options for participants as they are encouraged to lower their fat consumption.

As this study was focused on the development and test of the feasibility of a peer-led program, two key features lacking in PERSUADE were a control arm and cost-effectiveness analysis. Future studies should include a comparative arm using a randomized-controlled design with a measurement on cost-effectiveness analyses to provide a more in-depth evaluation of a peer support program such as PERSUADE. Since the cost of managing chronic diseases is continuously increasing, it is relevant to determine the cost-effectiveness of the peer support framework as compared to the current standard treatment.

Peer-led interventions in the future should also incorporate local community stakeholders to increase the participation rate and crucial continuous support such as regular health check programs, regular exercise events, and events with community healthcare clinics. Peer support approaches such as face-to-face, telephone contact, or web-based/email can also be incorporated into the intervention model to improve the outcomes.

5. Conclusions

PERSUADE is a peer-led intervention program for individuals with a risk of MetS that shows a positive result in its pre-post feasibility trial. In PERSUADE pre-post trial, 12 weeks of intervention

resulted in significant improvements in vital nutrition and lifestyle behaviors, as well as small yet promising improvements in anthropometric and metabolic parameters.

Future work entails implementation in a larger sample and a control group, with low energy-dense, satiating foods or wholegrain alternatives, the involvement of other stakeholders in program development and delivery, as well as the use of various intervention modalities to improve the nutritional and metabolic outcomes.

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CHAPTER 5

CONCLUSION AND FUTURE DIRECTIONS

5.1   Conclusion

As MetS is closely related with nutrition and lifestyle behaviours of an individual, peer support framework offers a good platform to initiate behavioural changes. This thesis described the development, implementation and evaluation of a peer support program for adults with MetS in Malaysia (PERSUADE).

PERSUADE was developed using a five-step approach to ensure it is evidence-based and community-specific. A systematic review reviewing seven studies on peer group-based lifestyle intervention advised the fundamentals of PERSUADE development. A qualitative analysis of focus group involving 21 Malaysian adults contextualised the motivations and barriers to adopt lifestyle changes among Malaysia with MetS. The findings were consolidated into a BCM that serves as the backbone of PERSUADE module and content development.

Both Peer Leader Module and Peer Module were presented a booklet form containing colourful posters to facilitate discussion among peers. A process evaluation on the 12 weeks PERSUADE elucidated high program adherence (81.3%), high content satisfaction score (93.3%) and satisfactory peer leadership score (70%).

Further evaluation in a pre-post feasibility trial involving 48 Malaysian adults with MetS elucidated significant changes dietary intakes and physical activity levels compared to baseline and 6 months follow up: reduction in energy intake ($p<0.001$), reduction in protein intake ($p=0.047$), increase in carbohydrate intake ($p<0.001$), reduction in fibre intake ($p<0.001$), reduction in fat intake ($p<0.001$) and, increase in physical activity levels ($p<0.001$). Significant changes is observed in all anthropometric and metabolic parameters except diastolic blood pressure; systolic blood pressure was reduced ($p=0.001$), fasting blood glucose was reduced ($p<0.001$), total triglyceride levels was reduced ($p<0.001$), increase in HDL cholesterol levels ($P<0.001$), and reduction in waist circumference ($p<0.001$).

Overall, peer support program shows benefit in managing MetS among Malaysian adults. PERSUADE feasibility shows promising results. However, future study with a larger sample size and a comparable arm is needed to show the effectiveness of it compared to standard usual care.

5.2   Study strengths and limitations

PERSUADE evaluation yields a good feasibility result. There are a few notable strengths for this study:

1. MetS is a clustering of risk factors that increases the risk of T2DM and CVD. Hence intervention on the population affected by MetS is ideal to curb the growing prevalence of non-communicable diseases in Malaysia.
2. Integration of a theoretical model (Health Belief Model) in the study resulted in a systematic and objective development of the peer support module.
3. The qualitative study (focus group discussion) provided more details to explain complex motivation and barriers to change issues among MetS patients.
4. The recruitment process of PERSUADE feasibility trial was well-designed and sample is representative of study population thus allowing findings to be generalised.

However, there were some limitations in PERSUADE study:

1. Sample size was not large enough to evaluate the effectiveness of PERSUADE.
2. The duration of PERSUADE is too short as the study is subjected to a fixed doctoral graduate timeline.
3. There was no comparable arm to evaluate the effectiveness of PERSUADE against standard usual care.
4. Currently, there is no matrix to evaluate the robustness of peer support program as the essence of such program lies in the process of it not just on its outcomes.

5.3   Future directions

There are several gaps in MetS research in Malaysia presented in Publication 1 and 2. Publication 1 urges more research on lifestyle intervention since MetS is closely related to lifestyle and behaviours of individuals. In Publication 2, a list of health system strategies is given to include future studies around prevention of MetS, detection and diagnosis, follow-up care, and finally coordination of care. Since MetS is a chronic non-communicable diseases, a holistic approach from prevention to treatment is crucial.

This thesis advocate for peer support framework in future lifestyle-based intervention. Peer support programs that is well-designed and community-specific may increase the reach and retention of behavioural and lifestyle changes among adults with MetS. To address gaps in knowledge and clinical concerns on MetS, future peer support interventions need to emphasize on peer leader training

particularly on the principles of behavioural counselling and communication skills in addition to the expected content on information load and peer session approaches.

Future studies should also first determine the most effective behavioural approaches and content for peer counselling and peer-led group and individual self-management training sessions to elucidate the optimal mix of modalities in peer support interventions such as face-to-face, telephone contact, or web-based and email modalities. The choice of behavioural approach is highly dependent of the need of targeted community. Thus, to address this, future study needs to be initiated with a comprehensive need assessment to contextualise their targeted community lifestyle and behaviour.

To initiate a collective and comprehensive approach to MetS, peer-led interventions in the future should also incorporate local community stakeholders such as neighbourhood committee, local businesses and municipal office to ensure crucial continuous support and to enhance community interactions. By including important stakeholders, a more relevant and community-centric content can be developed hence increasing program adoption and retention after the study ends.

Alternatively, a framework to combine peer support interventions as a complement and extend other clinical services and outreach is needed including structured self-management training and education. Peer supports offers physician or healthcare provider controls over their patient or client and to ensure this coordination of care is crucial to facilitate hospitals or clinic to integrate peer support as a part of chronic diseases management.

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Appendix A
MUHREC Ethical Clearance Statement

Monash University Human Research Ethics Committee (MUHREC)
Research Office

Human Ethics Certificate of Approval

This is to certify that the project below was considered by the Monash University Human Research Ethics Committee. The Committee was satisfied that the proposal meets the requirements of the *National Statement on Ethical Conduct in Human Research* and has granted approval.

Project Number:	CF16/56 - 2016000022
Project Title:	Nutrition and lifestyle behaviours in cardiometabolic syndrome: development of a community-specific peer-support programme
Chief Investigator:	Ms Amutha Ramadas
Approved:	**From:** 15 March 2016 **To:** 15 March 2021

Terms of approval - *Failure to comply with the terms below is in breach of your approval and the Australian Code for the Responsible Conduct of Research.*

1. The Chief investigator is responsible for ensuring that permission letters are obtained, <u>if relevant</u>, before any data collection can occur at the specified organisation.
2. Approval is only valid whilst you hold a position at Monash University.
3. It is the responsibility of the Chief Investigator to ensure that all investigators are aware of the terms of approval and to ensure the project is conducted as approved by MUHREC.
4. You should notify MUHREC immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.
5. The Explanatory Statement must be on Monash University letterhead and the Monash University complaints clause must include your project number.
6. **Amendments to the approved project (including changes in personnel):** Require the submission of a Request for Amendment form to MUHREC and must not begin without written approval from MUHREC. Substantial variations may require a new application.
7. **Future correspondence:** Please quote the project number and project title above in any further correspondence.
8. **Annual reports:** Continued approval of this project is dependent on the submission of an Annual Report. This is determined by the date of your letter of approval.
9. **Final report:** A Final Report should be provided at the conclusion of the project. MUHREC should be notified if the project is discontinued before the expected date of completion.
10. **Monitoring:** Projects may be subject to an audit or any other form of monitoring by MUHREC at any time.
11. **Retention and storage of data:** The Chief Investigator is responsible for the storage and retention of original data pertaining to a project for a minimum period of five years.

Professor Nip Thomson
Chair, MUHREC

cc: Assoc Prof Kia Fatt Quek, Prof Khalid Abdul Kadir, Dr Saleem Perwaiz Iqbal

Appendix B

PERSUADE Focus Group Discussion Moderator Guide

NUTRITION AND LIFESTYLE BEHAVIOURS PEER SUPPORT PROGRAM AMONG MALAYSIAN ADULTS WITH METABOLIC SYNDROME

SITE	
DATE	

	NAME	I/C	PHONE
MODERATOR			
ASISSTANT			

FOCUS GROUP DISCUSSION
MODERATOR MODULE

Consent Process

Moderator need to initiate the discussion with a consent statement and provide all participants a clear view of the research objectives and their rights in this study.

Below is a summary of the information that moderator should explain to make sure participants understand the study.

Thank you for agreeing to participate. We are very interested to hear your valuable input on your daily diet and lifestyle pattern.

- *The purpose of this study is to identify all dietary and lifestyle behaviors that contributes to progression of cardiometabolic syndrome. We hope to learn things that come from your daily basis, something ordinary but in return harm your body in a long run.*

- *The information you give us is completely confidential, and we will not associate your name with anything you say in the focus group.*

- *We would like to tape the focus groups so that we can make sure to capture the thoughts, opinions, and ideas we hear from the group. No names will be attached to the focus groups and the tapes will be destroyed as soon as they are transcribed.*

- *You may refuse to answer any question or withdraw from the study at anytime.*

- *We understand how important it is that this information is kept private and confidential. We will ask participants to respect each other's confidentiality.*

- *If you have any questions now or after you have completed the questionnaire, you can always contact a study team member like me, or you can call the project team leaders whose names and phone numbers are on the previous form.*

Scripted Question

No	Question	Probe
1	What do you understand about healthy diet? Do you think you are consuming healthy diet?	Aware about the importance?
		Do you think food that makes you become sick?
		What is the hardest thing to achieve in healthy diet?
2	How many times do you eat everyday? If you can skip, which meal you skip the most?	How about breakfast, is it important?
		Would you skip lunch or breakfast?
		What do you usually eat everyday? Dinner?
		When is your dinner?
		Do you usually eat kuih or munchies? Watching TV?
3	How to get enough nutrients for healthy diet?	Do you prioritize on food and vegetables?
		Limit on carbohydrate, starch, rice?
		Food supplements?
4	What kind of exercise you like the most?	Do you exercise everyday? How long?
		You do it alone or with the family?
		Is there a park or ground near your house or you prefer to go to the gym? Why?
		Football or futsal? Jogging or cycling?
5	Any of your family smoke in the house?	Do you smoke?
		Did your parents smoke? You follow them?
		How is your workplace look like? Do you smoke with friends?
		When do you usually smoke the most? Afternoon or after meal?

6	Any of you drinking alcohol before?	Regular?
		Describe to me the best liquor in the market.
		Do you usually get drunk?
		Do you prefer wine or beer?
7	Are you happy with your sleep?	Do you wake up fresh the next day? Nightmare?
		Do you snore? Since when do you snore? Disturbed?
		Do you usually feel sleepy after meal? Sleep?
		How long do you think the best sleep?
8	How do you describe your neighbour? Are you close with them?	How many family members they have?
		What is their occupation?
		Is there any neighbourhood community in your area?
		Do you usually do activities?
		What main thing you want to improve around you?
9	Do you have relatives close by?	Frequent visit to their house?
		They always come to help you?
10	With the size of the family, is it a nice house to live now?	Do you like your current address now? Any intention to move?
		Is there closeby hospitals, clinics, mall to you?
		Do you always go for medical check-up, Why?
		Do you wish your family stays with you?

MONASH University

Borang Kehadiran
(Sign in Sheet)

Nama	
I/C	
Alamat	
No Telefon	
Tandatangan	

Sila isikan borang di bawah untuk tujuan rekod kajian.

1. Umur:
   Age:
   _____tahun / *years*

2. Jantina: ⬜ (1) Lelaki / *Male*
   Sex: ⬜ (2)Perempuan   /
              Female

3. Status   (1) Bujang / *Single*
   perkahwinan: (2) Berkahwin / *Married*
   Marital   (5) Bercerai / *Divorced*
   status: (6) Berpisah / *Separated*

4. Etnik: ⬜ (1) Melayu / *Malay*
   Ethnicity: ⬜ (2) Cina / *Chinese*
              ⬜ (3) India / *India*
              ⬜ (4) Lain-lain/ *Others*
              _____

5. Pendidikan: ⬜ (1) Rendah / *Primary*
   Education: ⬜ (2) Menengah rendah
                   /
                Lower secondary
              ⬜ (3) Menengah tinggi /
                Higher secondary
              ⬜ (4) Tertiari/tinggi /
                Tertiary

6. Pekerjaan: ⬜ (1) Pelajar / *Student*
   Occupation: ⬜ (2) Bekerja / *Employed*
              ⬜ (3) Tidak bekerja /
                Unemployed
              ⬜ (4) Bersara / *Retired*

7. Pendapatan   _____
   individu (RM):
   Personal income
   (RM):

8. Pendapatan   _____
   isirumah (RM):
   Household income
   (RM):

9. Bilangan orang
   dalam isirumah: _____
   Number of people in
   the household:

10. Bilangan tahun
    bermastautin: _____tahun /
    Number of years of *years*
    residence:

MONASH University

Feedback Form

Perihal	
1. Adakah anda berpuas hati dengan perbincangan hari ini?	▬ (1) Ya / *Yes* ▬ (2) Tidak / *No*
2. Adakah anda memahami tujuan kajian dan hala tuju kajian ini?	▬ (1) Ya / *Yes* ▬ (2) Tidak / *No*
3. Adakah moderator dan pembantunya membantu anda untuk menjawab soalan?	▬ (1) Ya / *Yes* ▬ (2) Tidak / *No*
4. Adakah anda ingin mengetahui lebih lanjut tentang sindrom kardiometabolik?	▬ (1) Ya / *Yes* ▬ (2) Tidak / *No*
5. Adakah anda berpuas hati dengan tempat perbincangan ini diadakan?	▬ (1) Ya / *Yes* ▬ (2) Tidak / *No*
6. Adakah anda selesa dengan susunan perbincangan ini?	▬ (1) Ya / *Yes* ▬ (2) Tidak / *No*
Sila nyatakan cadangan dan pertanyaan anda (jika ada)	

Appendix C
PERSUADE Behavioural Change Matrix

Behavioural Theme	Behavioural Objectives	Behavioural Determinants		
		Knowledge	Perceived Benefit	Self-efficacy Skills
Community Peer Support	1. Connect with peers with same exposure	1. Identify Peers 2. Recognise Support System	1. Temporary health change brings no benefit	1. Identify individuals with the same health problems
	2. Break stigma on having health problems	1. Understand the disease and risk factors. 2. Understand role of lifestyle in disease progression	1. Stigma deter healthy lifestyle progress. 2. Change in lifestyle is not expensive.	1. Discuss with peers on key challenges. 2. Discuss with peers on how to overcome.
	3. Set a collective health goal	1. Identify individual strengths 2. Identify individuals limitations	1. Motivation is an important factor in long-term lifestyle changes.	1. Understand what is optimal wellbeing. 2. Understand what is a short-term health goals. 3. Understand what is long-term health goals. 4. To be able to set short-term and long-term practical health goals (SMART Concept).
Metabolic Syndrome and Clustering of Risk Factors	1. To understand metabolic risk factors 2. To understand the clustering of risk factors and its relationship to cardiovascular diseases and type 2 diabetes 3. To describe the relationship between lifestyle and diseases	1. Understand what is fasting blood glucose levels. 2. Understand blood pressure 3. Understand lipid profile particularly HDL Cholesterol and Triglyceride 4. Understand obesity and abdominal obesity 5. Define what is metabolic syndrome 6. Define Lifestyle-related chronic diseases.	1. Being unaware about the threat cause people do not react to clustering of risk factors. 2. Monitoring all risk factors will give a better representation of internal health. 3. Lifestyle is an important risk factors in chronic diseases.	1. Understand the healthy range of fasting blood glucose levels and how to measure them daily. 2. Understand the healthy range of systolic and diastolic blood pressure and how to measure them daily. 3. Understand the healthy range of blood lipid profile and how to measure them periodically, 4. Understand the healthy range of BMI and waist circumference and how to measure them. 5. Describe what is metabolic syndrome and what is the relationship with

			cardiovascular diseases and type 2 diabetes. 6. Present the risk of premature death among people with metabolic syndrome.
Good and Balance Dietary Habit	1. Use Malaysian Food Pyramid and "Suku Suku Separuh" Plate to ensure balance, variety and moderation in amount of consumed food. 2. Use NIP (Nutrition Information Panel) to understand food content. 3. Monitor Food Portion, Daily Food Intake and Food Variety.	1. Describe food class and food variety using Malaysian Food Pyramid. 2. Describe food portion using 'Suku Suku Separuh' representation. 3. Understand what is health claims on food products. 4. Use Nutrition Information Panel to classify healthy food. 5. Use food diary to track intake.	1. Ensure balance, variety and moderation in amount of consumed food is important in balance diet. 2. Know what is in a food products to ensure all ingredients are healthy. 3. Using food records to keep track with calorie intake.	1. Identify what is food class using food pyramid. 2. Built a healthy plate using 'Suku Suku Separuh Concept' 3. Consume a wide variety of foods 4. Portion food intake to ensures diet is in moderation 5. Key – "Balance, Colourful and Moderation" 6. Identifiy healthy food using nutrition information panel. 7. Read health claims in food packaging. 8. Record all food using a food diary.
Sedentariness Prevention and Daily Physical Activity	1. Understand and incorporate basic movements in daily activity thus preventing sedentariness 2. Use Physical Activity Pyramid in Weekly Physical Activity Planning 3. Promote practical exercise that can be integrated in a busy working day	1. Describe what is sedentariness 2. Use physical activity pyramid 3. Use simple movement to break sedentariness. 4. Plan a good diet plan to provide energy. 5. Achieve adequate rest to recover.	1. Physical activity is important to healthy lifestyle. 2. Physical activity helps the weight loss process. 3. Sedentariness is as bad as smoking. 4. Healthy diet fuel physical activity energy demand. 5. Good hydration is important after physical activity levels. 6. Rest is an important part of recovery	1. Understand the important of physical activity. 2. Break sedentariness every 30 minutes. 3. Plan achievable physical activity level target using daily steps. 4. Plan the physical activity plan using physical activity pyramid to make exercise more interesting. 5. Keep in track with tangible outcome such as weight daily.

	4. Understand good dietary habit is important for energy production. 5. Promote enough rest after physical activity.			6. Motivate each peer to exercise daily and make exercise an interesting social event.
Self-monitoring on Health and Wellbeing	1. To understand the importance of anthropometry measurement such as BMI and waist circumference. 2. To understand the importance of daily blood pressure monitoring 3. To understand the need of monthly blood screening for metabolic syndrome components and health risk management 4. To be able to effectively plan healthy diet weekly using the correct portion and high variety. 5. To be able to avoid sedentariness by incorporating basic movements in daily life frequently.	1. Understand measurable health indicators; body weight, height, BMI, waist circumference, blood pressure and body fat percentage. 2. Understand the important of waist circumference measurement. 3. Understand the importance of daily blood pressure monitoring. 4. Plan a routine health screening session with doctors. 5. Record dietary intake and plan effective dietary plan. 6. Plan an achievable physical activity levels. 7. Understand the health risk of smoking and alcohol intake. 8. Understand the important of sleep and rest.	1. Easy anthropometry measures such as weight Is a good motivator to keep healthy lifestyle habit. 2. Blood pressure monitoring is important to keep track on cardiovascular health. 3. Waist circumference is more important change than BMI 4. Routine health screening motivates you to keep healthy habit. 5. Tracking dietary intake will make you more aware of food intake. 6. Physical activity can be contributed in daily activity and sedentariness is as bad as smoking. 7. Smoking increase risk of multiple diseases. 8. Irresponsible alcohol intake is bad for health. 9. Sleep deprivation may increase the risk of metabolic diseases	1. Plan your diet, physical activity, hydration and sleep everyday. 2. Measure and record your blood pressure daily. 3. Measure and record your waist circumference and weight every week. 4. Plan your doctors appointment every 6 weeks. 5. Plan meals using food pyramid and suku suku separuh plate. 6. Measure daily steps to avoid sedentariness. 7. Understand the risk of alcohol intake and smoking on health. 8. Understand the importance of sleep to recover.

	6. To monitor sleep quality, energy levels and manage stress effectively by promoting social engagement through peers. 7. To be able to initiate cessation on alcohol and tobacco product intakes by understanding the health risk imposed by its consumption.			

Appendix D
PERSUADE Module

PERSUADE

A Community-based Nutrition and Lifestyle Peer Support Program for Malaysian Adults with Metabolic Syndrome

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List of Contents

How to use this module?

1. Your peer leader will provide you this module as a tool to facilitate weekly discussion.
2. Every week, you need to record you body weight at the start of peer program.
3. This module contain a series of colourful posters and use it to remember details on metabolic syndrome and lifestyle change.
4. There is a list of frequently asked question each week. Discuss with you peer group to answer each question.
5. Organise a weekly workout with your peer group before or after discussion.

Summary of PERSUADE Development

The latest report of Global Burden of Diseases in Malaysia outlined cardiovascular diseases and cancer as the nation largest cause of mortality. Besides, the National Health and Morbidity Survey (NHMS) has shown that non-communicable diseases (NCDs) to be among the highest morbidity in the country; diabetes, hypertension, obesity and dyslipidemia. Multiple studies also reported NCDs complications to be affecting national health-related quality of life. Metabolic Syndrome (MetS) is a clustering of metabolic risk factors that increases the risk of developing type 2 diabetes and cardiovascular diseases. PERSUADE is a 6 months Community-based Peer Support Program designed for Malaysian Adults with Metabolic Syndrome (MetS). The program aimed to improve nutrition and lifestyle behaviour through an active participation in a peer support program. The development of PERSUADE involved an extensive stepwise formative research which included community-population need assessment, building up of matrix of behavioural change and eventually evidence-based content development. PERSUADE comprises of a 12-week Active Peer Support Program in which all participants will be followed up closely by appointed Peer Leaders weekly. Research team comprises of clinical nutritionists will be monitoring changes from the baseline, end of active peer support period and the following three months to ensure healthy behaviour improvement and to provide personalised guidance throughout the program. The program is in line with the National Plan for Non-Communicable Diseases 2010-2025 and National Action on Nutrition Plan.

The development of PERSUADE involved a stepwise formative research. To form an effective and relevant program, quantitative and qualitative assessment of need initiated the framework and content development. The summary of PERSUADE development is shown in the figure below.

- **Program Obejctive**
  - The relvance of Lifestyle Intervention on Metabolic Syndrome

- **Need Assessment**
  - Study of associated nutrition and lifestyle behaviour among Malaysian adults.
  - Study motivation and behaviour on healthy behaviour

- **Matrix of Behavior Change**
  - Determination of behaviour change objective and behaviour change techniques

- **Framework Development**
  - Determination of PERSUADE Peer Program program structure, active program duration and information load method.

- **Content Development**
  - Development of evidence-based content.

Peer Support Schedule

Summary of 12-weeks Active Intervention and frequently asked questions.

Week	Activity	Poster	Evaluation
	Introduction to Peer Group	1	Peer Booklet
	Introduction to Peer Support Program	-	24H Diet Recall
	BMI and Anthropometry Measure	-	IPAQ
	Health Goal Settings	-	
	Peer Activity 1. Gather for a morning walk 2. Introduce and exchange contacts 3. Explain the role of peer support and why 4. Introduce the Program 5. Measures height, body weight and body fat 6. Explain health goal and set		
2	What is Premature Death	2	Insecurity
	Metabolic Syndrome and Control	3	24H Diet Recall
	Abdominal Obesity and BMI	4	
	Peer Activity 1. Gather for Morning Walk 2. Discuss what is Premature Death 3. Discuss experiences on Premature Death or Disability 4. Measure waist circumference 5. Discuss on metabolic syndrome 6. Elucidate the risk profile		
3	Blood Biochemistry	5	Complications
	Diabetes and Complications	6	24H Diet Recall
	Dyslipidemia and Stroke	7	
	High-carbohdyrate and High-fat Diet	8	
	Peer Activity 1. Gather for a morning walk 2. Tell them about important blood tests 3. Discuss on fasting blood glucose and diabetes 4. Discuss on diabetic complications; neuropathy, retinopathy, nephropathy 5. Discuss on lipid profile and hypertension 6. Discuss the risk of stroke and disability		
4	Undiagnosed Hypertension	9	Sleeping
	Cardiovascular Disease	10	24H Diet Recall
	Inadequate Rest	-	
	Peer Activity 1. Gather for a morning walk 2. Discuss on the importance of blood pressure monitor 3. Discuss the risk of heart diseases with hypertension 4. Explain heart attack as a silent killer 5. Discuss on the topic 'Shorter Sleep Shorter Life.' 6. Discuss on quality sleeping and sleeping hygiene		
5	Morning Walk Session	Booklet	Peer Booklet
	BMI and Anthropometry Measure	-	24H Diet Recall
	Health Goal Settings	-	HRQOL
	Peer Activity		

	1. Gather for morning walk 2. Check blood biochemistry parameters 3. Measure blood pressure 4. Measure body fat analysis 5. Measure waist circumference		
6	Good Dietary Habits	11	FFQ
	Malaysian Food Pyramid	12	24H Diet Recall
	Healthy Plate	13	
	Peer Activity 1. Gather for morning walk 2. Discuss on Good Dietary Habit 3. Explain on food class 4. Discuss on portion sizing 5. Design 4 plates		
7	Nutrition Information Panel	14	Obesity
	Carbohydrate Selection	15	24H Diet Recall
	Good Fat	16	
	Peer Activity 1. Gather for morning walk 2. Discuss on processed food 3. Discuss on NIP relevance and how to read 4. Explain on good carbohydrate and high-fibre food 5. Explain on Glycemix Index and show example 6. Discuss on polyunsaturated, saturated, trans fat 7. Explain on good fat and brain health		
8	Stress and Sleep	17	Sleeping
	Depression and Anxiety	18	24H Diet Recall
	Sleeping Hygiene	19	
	Peer Activity 1. Gather for morning walk 2. Discuss on good sleep and fatigue 3. Discuss on sleep hygiene 4. Set minimum hours to sleep		
9	Physical Activity Pyramid	20	IPAQ
	Avoid Sedentariness	21	24H Diet Recall
	Hydration	22	
	Peer Activity 1. Gather for morning walk 2. Explain physical activity pyramid 3. Discuss on sedentariness 4. Plan a week of workout 5. Discuss on dehydration and plan on hydration		
10	Morning Walk Session	Booklet	Peer Booklet
	BMI and Anthropometry Measure	-	24H Diet Recall
	Health Goal Settings	-	HRQOL and Insecurity
	Peer Activity 1. Gather for morning walk 2. Check blood biochemistry parameters 3. Measure blood pressure 4. Measure body fat analysis 5. Measure waist circumference		

	6. Compare with previous parameters			
11	Regular Health Check-up and Medication Adherences	23	Complications	
	Smoking Cessation	24	24H Diet Recall	
	Alcohol Intake Control	25		
	Peer Activity 1. Gather for a morning walk 2. Discuss on smoking and history of smoking 3. Discuss on the health risk from smoking 4. Refer expert if someone intend for cessation			
12	Morning Walk Session	Booklet	Peer Booklet	
	BMI and Anthropometry Measure	-	24H Diet Recall	
	Healthy Lifestyle Planning	-	FFQ	
	Follow up Dates	-		
	Peer Activity 1. Gather for a morning walk 2. Check blood biochemistry parameters 3. Measure blood pressure 4. Measure body fat analysis 5. Measure waist circumference 6. Compare with previous parameters 7. Set follow-up dates.			

Frequently Asked Question (FAQ) to accompany Poster

The table provided a list of frequently asked question to accompany PERSUADE Poster. Peer Leaders are expected to be able to answer the question is asked.

Week	Activity	Index
1	Introduction to Peer Group 1. What is a Peer? 2. How do you choose a Leader? 3. Where to gather every week? 4. How long does a Peer Support Program will be? 5. Why Peer Support? 6. Can I bring my family member to each session? 7. How can Peer Support help my health?	1
2	What is Premature Death 1. What age do we consider Premature Death? 2. Does Premature Death only due to heart attack and stroke? 3. How to know if we have high risk of premature death? 4. What is the best way to avoid premature death? 5. Do you have medication or supplements to prevent Premature Death?	2
	Metabolic Syndrome and Control 1. What is Metabolic Syndrome? 2. Why my doctor never mentions anything about metabolic syndrome? 3. Can you explain what is Insulin? And why it become resistant? 4. If I have Diabetes, does that means I already have Metabolic Syndrome? 5. How to cure metabolic syndrome? 6. How to prevent metabolic syndrome? 7. Does metabolic Syndrome inherited?	3
	Abdominal Obesity and BMI 1. Why waist circumference is more important than body weight? 2. How to differentiate bloating and real waist? 3. Tummy fat is hard to get rid of. What to do? 4. Since BMI is inaccurate, does that means it is not important? 5. Is the body fat analyser correct? Can we trust it? 6. What is visceral fat? And why it is dangerous?	4
3	Blood Biochemistry 1. How frequent should we check our blood? 2. Is it enough to know just fasting blood sugar? 3. What else can we know from the blood? 4. Why do we check blood and urine? 5. How do we replace the blood after taking a tube full of it?	5
	Diabetes and Complications 1. Why diabetes is so common in Malaysia? 2. How to know if we have diabetes? 3. Most of my family have diabetes, should I be worried? 4. What is the most common complication among Malaysian? 5. What is diabetes foot? 6. How diabetes caused heart problem? 7. Does the diabetes medication cause kidney problem? 8. Why do we develop eye problem with diabetes?	6
	Dyslipidemia and Stroke 1. What is cholesterol?	7

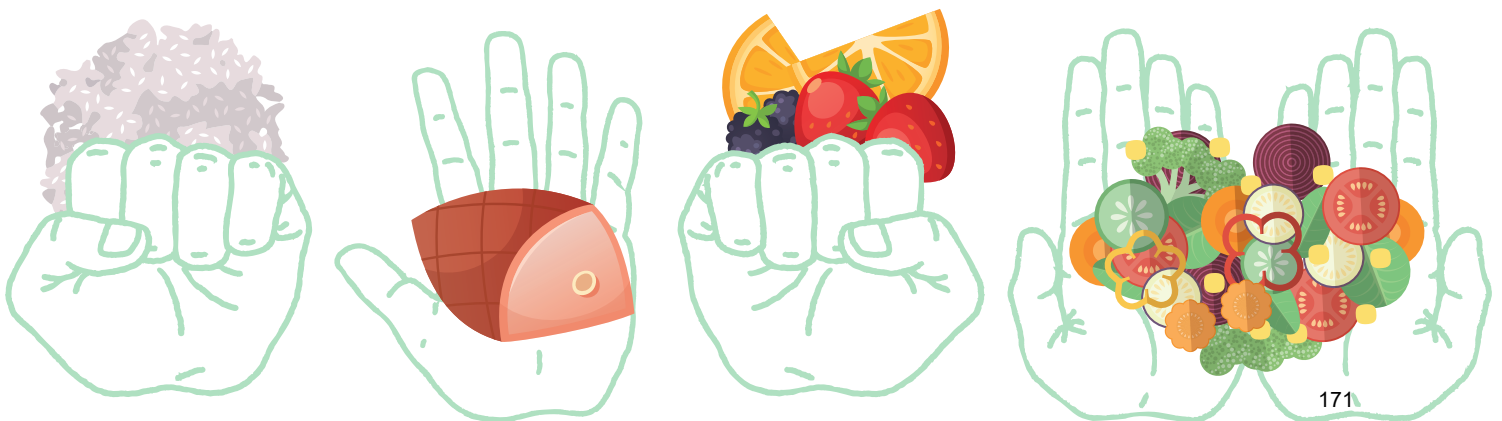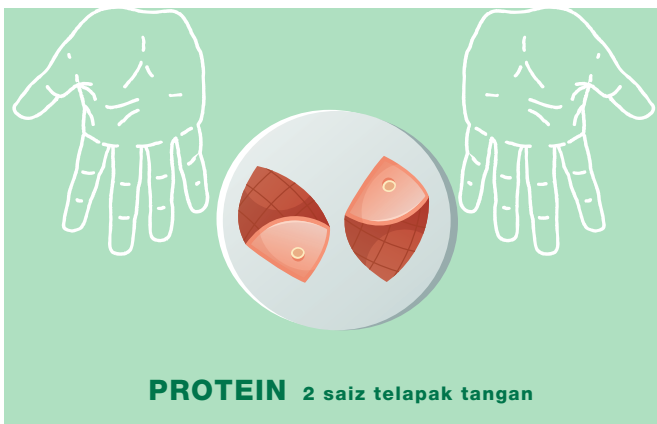|		
	2. What is the difference between fat and cholesterol? 3. What is good cholesterol and bad cholesterol? 4. What food has the highest amount of bad fat? 5. What is good fat? 6. Will I get high cholesterol by cooking with plant oil? 7. Can virgin coconut oil helps with cholesterol levels? 8. Does exercise helps to reduce cholesterol?	
	High Carbohydrate and High Fat Diet	8
4	Undiagnosed Hypertension 1. What is high blood pressure? 2. Can I rely on home blood pressure machine to check my blood pressure? 3. What is the difference between systolic and dystolic blood pressure? 4. When is the best time to check blood pressure? 5. How to know if we have abnormal pulse? 6. If I have chest pain, do I have high blood pressure? 7. I develop frequent migraine, is that high blood pressure? 8. What food can cause high blood pressure? 9. How to replace salt in food?	9
	Cardiovascular Disease 1. Is there any other heart problem other than heart attack? 2. What is the worst type of heart problem? 3. Where is the heart? 4. How to differentiate heart attack with chest pain? 5. Why do I feel sore on my shoulder down? 6. Can we recover after first heart attack? 7. How cardiac patients may exercise? 8. What other cause of heart attack besides food and inactivity? 9. How cholesterol clog our heart blood vessels?	10
6	Good Dietary Habits 1. How to know if we eat good food? 2. How many times should we eat in a day? 3. Is it expensive to eat healthily? 4. Do we need to take food supplements? 5. How much fruits and vegetables to eat in a day? 6. Is vegetarian healthy? 7. How to eat safe food? Do we need to wash our fruits and vegetables? 8. GMO food is it safe?	11
	Malaysian Food Pyramid 1. How to portion food? 2. Fruits and vegetables are expensive, we cannot eat everyday. 3. How many types of vegetables to eat in a day? 4. What is the easiest way to portion up food? 5. What is the required calories per day?	12
	Healthy Plate 1. How many plates should we eat in a day? 2. How large is the plate? 3. Is meat, chicken and fish give you the same amount of protein? 4. Does gravy in food counts in healthy food? Like Kuah Kari? 5. Can we add two plates in one meal setting?	13
7	Nutrition Information Panel 1. Where do you find the information panel?	14

	2. How to know the information if the food is at the market? 3. Why does NIP important? 4. Can the company report wrong information on the panel? 5. What is the most important information to look at to avoid or eat more the food? 6. Do I need to know the basic mathematics? 7. What is health claims and benefits?	
	Carbohydrate Selection 1. How to choose good carbohydrate? 2. What is wholegrain? 3. Why do we need fibre? 4. Does potato good substitute for rice? 5. Is rice all bad? 6. What is glycemic index? 7. Is good carbohydrate expensive now?	15
	Good Fat 1. Is there good fat? 2. What is saturated fat? 3. What is trans fat? 4. Butter or margarine? 5. Can we cook or fry using olive oil? 6. How to know Omega 3, 6 and 9? 7. What is EPA and DHA? 8. Is there fat in food? 9. How to limit fat in food when most Malaysian food are fried?	16
8	Stress and Sleep 1. What is stress? 2. Career and occupation give us stress, how to handle? 3. Where to seek help? 4. How many hours of sleep we need in a night? 5. What is a quality sleeping? 6. Am I okay to have nightmares?	17
	Depression and Anxiety 1. Does stress lead to depression? 2. Am I lonely or depressed? 3. I always feel anxious because there's something incomplete. 4. How do I manage depression?	18
	Sleeping Hygiene 1. What is sleeping hygiene? 2. How to improve my sleeping quality? 3. Can I bathe in the middle of the night? 4. I always wake up in the middle of night to go to toilet.	19
9	Physical Activity Pyramid 1. I am old, what is the best exercise? 2. How much exercise in a week is enough? 3. What is exercise? 4. What is the minimum daily exercise? 5. There is no park near my house, what to do? 6. I have history of heart attack, can I exercise?	20
	Avoid Sedentariness 1. What is sedentariness and what caused it?	21

	2. Is this the main problem with abdominal obesity?	
	Hydration 　1. How much water is enough in a day? 　2. How large is the glass to use for 8 glasses per day? 　3. I always go to toilet after drinking water, should I be worried? 　4. How many water should I drink after workout? 　5. Is there water in food? 　6. How to avoid water retention?	22
11	Regular Health Check-up and Medication Adherences 　1. I don't know why I have to eat too many medications 　2. Can I skip my medication? 　3. Does medication cause kidney failure? 　4. Pharmaceuticals are a business model, I think eating better should be better? 　5. How long should I take my medications? 　6. I only get my blood test results one month after the test, is it still valid? 　7. How many times should I do health check-up? 　8. Does health check-up covered by insurance? 　9. Where can I get my complete health screening? 　10. Can I do health checks with dietician, nutritionist or pharmacist?	23
	Smoking Cessation 　1. Why is it hard to stop smoking? 　2. My friend said, stop smoking will bring more harm to me, is it true? 　3. Is it true that I will gain weight when I stop smoking? 　4. How to substitute smoking? Is vape good? 　5. What is the true benefit of stop smoking? 　6. Can I get help to stop smoking?	24
	Alcohol Intake Control 　1. Last time I drink alcohol was 10 years ago, is it ok? 　2. Is it okay to still drink alcohol? 　3. Alcohol was found to be protective in some study, why?	25

PIRAMID MAKANAN SIHAT

DAGING, MANISAN, KEJU DAN MAKANAN DIPROSES

Jarang

TELUR, IKAN DAN PRODUK TENUSU

1-3 sajian sehari 10% dari kalori harian

BIJIRIN PENUH

2 sajian sehari 20% kalori seharian

PELBAGAI UBI DAN AKAR

2 sajian sehari 20% kalori seharian

BUAH BUAHAN

3 sajian sehari 30% kalori seharian

KEKACANG

3 sajian sehari 30% kalori seharian

SAYUR SAYURAN PELBAGAI WARNA

4-5 sajian sehari 40%-50% kalori seharian

AIR MINUMAN

Sekurang-kurangnya 8 gelas sehari

SAIZ SIHAT HIDANGAN

PROTEIN 2 saiz telapak tangan

SAYUR SAYURAN 2 penumbuk tangan tertutup

KARBOHIDRAT 2 segenggam tangan

LEMAK 2 bahagian saiz ibu jari

LABEL NUTRISI

CALORIES
The energy that is supplied in food, if it is not burned up during the day, it will be stored in the body as fat. Try to limit calories from fat.

CARBOHYDRATES
Aim for 300g Total Carbohydrates each day. Aim for at least 25g of fiber each day. Fiber helps digest food and helps people feel full longer.

NUTRIENTS
Aim for a total of 100% in all nutrients and vitamins throughout the whole day. The food item is a good source of a vitamin or mineral if % Daily Value is 10% or greater

INDIVIDUAL NEEDS
The average person needs 2000 calories a day. An active person (exercising at least 1 hour a day) will need closer to 2500 calories. To lose weight, reduce daily calorie intake by 500 calories, but no less than 1500 total.

NUTRITION FACTS

Serving Size 1 cup (228g)
Serving Per Container 2

Amount Per Serving

Calories 90	Calories from Fat 30

	% Daily Value
Total Fat 3g	**5%**
Saturated Fat 0g	0%
Trans Fat	
Cholestrol 0mg	0%
Sodium 300mg	13%
Total Carbohydrate 13g	**4%**
Dietary Fiber 3g	12%
Sugar 3g	
Protein 3g	
Vitamin A	80%
Vitamin C	60%
Calcium	4%
Iron	4%

• Percent Daily Values (DV) are based on a 2000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

Calories		2000	2500
Total Fat	Less Than	65g	80g
Sat Fat	Less Than	20g	25g
Cholesterol	Less Than	300mg	300mg
Sodium	Less Than	2400mg	2400mg
Total Carbohydrate		300g	375g
Fiber		25g	30g

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

SERVING SIZE
All values on the label are based on 1 serving size. If you eat 2 servings, multiply all values by 2. If eating 1/2 the serving, cut all values in half

FAT & SODIUM
Aim for less than 65g of Total Fat a day Aim for less than 300mg of Cholestrol a day. Aim for less than 2400mg of sodium daily. Use fresh/frozen vegetables instead of canned

PROTEIN
Aim for 20g per meal, 50-60g total each day. Eat small servings of lean meat, fish and poultry. Try to find proteins besides meat, such as beans.

% DAILY VALUES (DV)
Based on your individual needs, the daily values are used as a general guide for the total amount needed each day. Listed are suggestions for the average or active individual.

KURANGKAN MAKANAN PROSES LEBIHKAN YANG SEGAR

PELAN DIET SEHARIAN

50 KCAL

600KCAL

50 KCAL	6.30 PAGI - 7.00 PAGI
600 KCAL	7.00 PAGI - 8.30 PAGI
50 KCAL	10.00 PAGI - 10.30 PAGI
600 KCAL	12.00 TENGAH HARI - 2.00 PETANG
50 KCAL	4.30 PETANG - 5.30 PETANG
600 KCAL	6.30 PETANG - 8.30 MALAM
50 KCAL	8.30 MALAM - 9.00 MALAM

PINGGAN SIHAT MALAYSIA

BROWN RICE & WHOLEMEAL BREAD

FRUIT & VEGETABLES

MEAT & OTHERS

CHOOSE WATER | USE HEALTHIER OILS | BE ACTIVE

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SINDROM METABOLIK

TEKANAN DARAH TINGGI

KOLESTEROL BAIK (HDL) RENDAH
KOLESTEROL JAHAT (LDL) TINGGI

GULA DALAM DARAH TINGGI

BUNCIT & KEGEMUKKAN

KEMATIAN AWAL

GERAKKAN BADAN

SETIAP 30 MINIT

PIRAMID AKTIVITI FIZIKAL

- **KURANG KAN MENONTON TV**
- **DUDUK TERLALU KERAP**
- **BERMAIN PERMAINAN VIDEO**

AF = TIDAK KERAP
I = INTENSITI RENDAH
T = TIDAK MELEBIHI 30 MINIT

SENAMAN UNTUK FLESIBILITI REGANGAN -

F = 3-5 HARI / MINGGU
I = HINGGA KE TAHAP TIDAH SELESA TETAPI BUKAN SAKIT
T = 20 + MINIT

SENAMAN UNTUK KEKUATAN & DAYA TAHAN OTOT
- **SENAMAN MENGUNAKAN BERAT BADAN (TEKAN TUBI BANGKIT TUBI)**
- **SENAMAN MENGGUNAKAN 'RESISTANT BAND'**
- **MENGANGKAT BEBAN DI GIMNASIUM / RUMAH**

AF = 3-5 HARI / MINGGU
I = HINGGA MEMBERI BEBANAN PADA OTOT
T = 45 + MINIT

AKTIVITI KARDIO
JOGING / BERBASIKAL / BERENANG -

F = 3-6 HARI / MINGGU
I = INTENSITI SEDERHANA - TINGGI
T = 20 + MINIT

SUKAN & REAKREASI
- **FUTSAL / BADMINTON / MENDAKI BUKIT**

F = 3-6 HARI / MINGGU
I = INTENSITI SEDERHANA - TINGGI
T = 20 + MINIT

- **BERJALAN**
- **NAIK TURUN TANGGA**
- **BUAT KERJA RUMAH**

AF = SETIAP HARI / MINGGU
I = INTENSITI SEDERHANA
T = 30 MINIT

UKUR BERAT BADAN

PERIKSA UKURLILIT PINGGANG SETIAP MINGGU

600 KCAL	
KURANG BERAT BADAN	Kurang dari 18.5
NORMAL	18.5 ke 22.9
BERAT BADAN BERLEBIHAN	23 ke 24.9
OBES	Lebih dari 25
UKURLILIT PINGGANG	
SIHAT	Kurang dari 80 untuk perempuan Kurang dari 90 untuk lelaki

PERIKSA DARAH

SETIAP 6 MINGGU

	UNIT	OPTIMAL	INTERMEDIATE	HIGH
HDL	mg/dL	> 60	40 - 60	< 40
	mmol/L	> 1.55	1.03 - 1.55	< 1.03
LDL	mg/dL	<130	130 - 159	> 159
	mmol/L	< 3.36	3.36 - 4.11	> 4.11
TRIGLYCERIDES	mg/dL	< 150	150 - 199	> 199
	mmol/dL	< 1.69	1.69 - 2.25	> 2.25

Legend:
- HDL
- LDL
- TRIGLYCERIDES
- TOTAL CHOLESTEROL

NORMAL	PREDIABETES	DIABETES
FPG <5.5	FPG 5.5-7.0	FPG > 7.0
OGTT < 7.8	OGTT 7.8-11.1	OGTT > 11.1
HBA1C <42	HBA1C 42-47	HBA1C > 47
HBA1C <6.0	HBA1C 6.0-6.4	HBA1C > 6.4

PERIKSA TEKANAN DARAH

SETIAP PAGI

BLOOD PRESSURE CATEGORY	SYSTOLIC mm Hg (upper number)		DIASTOLIC mm Hg (lower number)
NORMAL	Less than 120	and	Less than 80
ELEVATED	120 - 129	and	Less than 80
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 1	130 - 139	or	80 - 89
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 2	140 OR HIGHER	or	90 or Higher
HYPERTENSIVE CRISIS (CONSULT DOCTOR IMMEDIATELY)	HIGHER THAN 180	and / or	Higher than 120

140
90
69

REKOD MAKANAN

SETIAP HARI

	ISNIN	SELASA	RABU	KHAMIS	JUMAAT	SABTU	AHAD
SARAPAN PAGI							
SNEK							
MAKAN TENGAHARI							
SNEK							
MAKAN MALAM							
SNEK							

TANDA HARI YANG SIHAT

DALAM KALENDAR

SEPTEMBER

		1	2	3	4	5	6
7	8	9	10	11	12	13	14
15	16	17	18	19	20	21	22
	24	25	26	27	28 ♥	29	30

NILAI KECERGASAN ANDA SETIAP PAGI

1   2   3

NILAI KUALITI TIDUR

BERDASARKAN TENAGA DI PAGI HARI

1   2   3

SKOR TIDUR BULANAN

71 - 90 POOR SLEEP

30 - 40 GOOD SLEEP

41 - 70 MODERATE SLEEP

LEMAK BADAN

UKURLILIT PINGGANG

600 KCAL	WOMEN	MEN
LOW RISK	Below 3.15 inches	Below 37 inches
MODERATE RISK	31.5 to 35 inches	37 to 40 inches
HIGH RISK	35 inches or more	40.2 inches or more

BODY MASS INDEX

UNDERWEIGHT HEALTHY RANGE OVER WEIGHT OBESE

LDL

HDL TRIGLYCERIDES

TOTAL CHOLESTEROL

	UNIT	OPTIMAL	INTERMEDIATE	HIGH
TOTAL CHOLESTEROL	mg/dL	< 200	200 - 239	> 239
	mmol/L	< 5.2	5.3 - 6.2	> 6.2
LDL CHOLESTEROL (CALCULATED)	mg/dL	< 130	130 - 159	> 159
	mmol/L	< 3.36	3.36 - 4.11	> 4.11
HDL CHOLESTEROL	mg/dL	> 60	40 - 60	< 40
	mmol/dL	> 1.55	1.03 - 1.55	< 1.03
TRIGLYCERIDES	mg/dL	< 150	150 - 199	> 199
	mmol/dL	< 1.69	1.69 - 2.25	> 2.25
NON-HDL-C (CALCULATED)	mg/dL	< 130	130 - 159	> 159
	mmol/dL	< 3.3	3.4 - 4.1	> 4.1
TG TO HDL RATIO (CALCULATED)	mg/dL	< 3	3.1 - 3.8	> 3.8
	mmol/dL	< 1.33	1.34 - 1.68	> 1.68

DIABETES

KENCING MANIS

NORMAL	PREDIABETES	DIABETES
FPG <5.5	FPG 5.5-7.0	FPG > 7.0
OGTT < 7.8	OGTT 7.8-11.1	OGTT > 11.1
HBA1C <42	HBA1C 42-47	HBA1C > 47
HBA1C <6.0	HBA1C 6.0-6.4	HBA1C > 6.4

PENYAKIT SARAF

PENYAKIT JANTUNG

PENYAKIT MATA & BUTA

PENYAKIT BUAH PINGGANG

TEKANAN DARAH TINGGI

PENYAKIT BUAH PINGGANG

STROKE

PENYAKIT JANTUNG

BLOOD PRESSURE CATEGORY	SYSTOLIC mm Hg (upper number)		DIASTOLIC mm Hg (lower number)
NORMAL	Less than 120	and	Less than 80
ELEVATED	120 - 129	and	Less than 80
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 1	130 - 139	or	80 - 89
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 2	140 OR HIGHER	or	90 or Higher
HYPERTENSIVE CRISIS (CONSULT DOCTOR IMMEDIATELY)	HIGHER THAN 180	and / or	Higher than 120

Appendix E
PERSUADE Questionnaire

MONASH University

Date:

Location:

Tabiat Permakanan dan Gaya Hidup dalam Sindrom Metabolik:
Perangkaan Program Sokongan Kesihatan Komuniti
Nutrition and Lifestyle Behaviours in Metabolic Syndrome: Development of a Community-Specific Peer-Support Programme

Arahan *Instructions*

- Semua bahagian soal selidik ini hendaklah dilengkapkan.
  All parts of the questionnaire should be completed.

- Sila tandakan (√) atau (X) jawapan anda, melainkan jika dinyatakan sebaliknya.
  Please put a tick (√) or a cross (X) against your response, unless it is indicated otherwise.

- Ruang yang disediakan untuk anda untuk menulis pandangan anda. Sekiranya anda memerlukan lebih banyak ruang untuk menulis, sila sertakan kertas tambahan.
  Spaces are provided for you to write your views on the subject. Should you need more space to write, please feel free to attach additional sheets.

Sila berikan pendapat yang jujur dan butir-butir yang anda mampu.
Hanya para penyelidik projek ini akan mempunyai akses kepada data anda.
Semua maklumat yang anda berikan di sini adalah sulit.
Please provide honest opinions and as much details as you can.
Only the Investigators of the project will have access to the data.
All information you provide here will remain confidential.

Terima kasih kerana bersetuju untuk mengambil bahagian dalam kajian ini.
Thank you for agreeing to take part in this study

CHECKLIST		
-	Consent form & Screening	
A	Personal info & sociodemography	
B	Dietary behaviour & lifestyle habits	
C	Physical activity (IPAQ)	
D	QOL	
E	Health screening	
F	24-hour dietary recall	
G	FFQ	

Tajuk Kajian: **Tabiat Pemakanan dan Gaya Hidup dalam Sindrom Kardiometabolik: Perangkaan Program Sokongan Kesihatan Komuniti**

Ketua Penyelidik: **Dr Amutha Ramadas**

Saya bersetuju untuk mengambil bahagian dalam kajian Monash University seperti di atas. Perihal dan butiran kajian telah diterangkan kepada saya. Saya telah membaca borang penjelasan kajian yang akan saya simpan sebagai rekod.

Saya juga bersetuju untuk:	Ya	Tidak
1. *Membenarkan sampel darah diambil*	☐	☐
2. *Membenarkan tekanan darah, tinggi, berat, pinggang dan ukuran lemak dalam badan diambil*	☐	☐
3. *Ditemuramah untuk maklumat berkaitan butir-butir diri, pemakanan, gaya hidup dan kesihatan*	☐	☐
4. *Dihubungi semula untuk Fasa 2 dan 3*	☐	☐
5. *Dihubungi semula untuk kajian-kajian seterusnya*	☐	☐

Saya akui bahawa penglibatan saya adalah secara sukarela, dan saya boleh memilih untuk tidak melibatkan diri ataupun boleh menarik diri dari sebarang tahap pengajian tanpa sebarang masalah.

Saya faham bahawa sebarang maklumat yang diperoleh daripada temuduga ini untuk laporan tidak mengandungi sebarang nama atau ciri-ciri peserta.

Saya faham maklumat yang saya berikan adalah peribadi dan tidak akan dibocorkan dalam laporan atau kepada pihak ketiga.

Laporan dan maklumat yang direkod dalam temuduga akan disimpan dengan selamat dan hanya akan diakses oleh pihak penyelidik kajian dan akan dimusnahkan selepas tamat kajian.

Tandatangan	
Nama Penuh	
MyKad	
Alamat	
No Telefon	
Tarikh	

CONSENT FORM (PHASE 1)

Project: **Nutrition and Lifestyle Behaviours in Cardiometabolic Syndrome: Development of a Community-Specific Peer-Support Programme**

Chief Investigator: **Dr Amutha Ramadas**

I agree to take part in the Monash University research project specified above. I have had the project explained to me, and I have read the Explanatory Statement, which I keep for my records.

I consent to the following:	Yes	No
1. *Taking my blood sample*	☐	☐
2. *Taking my blood pressure, height, weight, waist and body fat measurements*	☐	☐
3. *Asking questions regarding my basic details, nutrition, lifestyle and quality of life*	☐	☐
4. *To be recontacted for Phase 2 and Phase 3*	☐	☐
5. *To be recontacted for future research*	☐	☐

I understand that my participation is voluntary, that I can choose not to participate in part or all of the project, and that I can withdraw at any stage of the project without being penalised or disadvantaged in any way.

I understand that any data from the interview for use in reports will not, under any circumstances, contain names or identifying characteristics.

I understand that any information I provide is confidential, and that no information that could lead to the identification of any individual will be disclosed in any reports on the project, or to any other party.

 I understand that reports based on the interview(s) will be kept in a secure storage and accessible only to the research team. I also understand that the collected data will be destroyed after the stipulated period.

Signature	
Full name	
MyKad	
Address	
Tel no.	
Date	

SCREENING QUESTIONNAIRE

Note: To be administered by the study researcher at Registration Counter

Tick (√) all characteristics that describe the individual

	Inclusion criteria	
1	Age ≥ 18 years at the time of the study	☐
2	Malaysian citizen	☐

	Exclusion criteria	
1	Pregnant women	☐
2	Psychiatric illness	☐
3	Subject with malignancy	☐
4	Drug/alcohol abuser	☐
5	End stage renal failure	☐
6	Chronic liver diseases including hepatoma	☐
7	Immuno-compromised subject such as HIV	☐
8	Cognitive impairment	☐
9	Speech difficulty	☐
10	Hearing difficulty	☐
11	Non-ambulatory	☐

A. MAKLUMAT SOSIO-DEMOGRAFI / *SOCIO-DEMOGRAPHIC INFORMATION*

1. Umur:
   Age: _____tahun / *years*

2. Jantina:
   Sex:
   ☐ (1) Lelaki / *Male*
   ☐ (2) Perempuan / *Female*

3. Status perkahwinan:
   Marital status:
   ☐ (1) Bujang / *Single*
   ☐ (2) Berkahwin / *Married*
   ☐ (3) Bersekedudukan / *Living with partner*
   ☐ (4) Janda/duda / *Widowed*
   ☐ (5) Bercerai / *Divorced*
   ☐ (6) Berpisah / *Separated*

4. Etnik:
   Ethnicity:
   ☐ (1) Melayu / *Malay*
   ☐ (2) Cina / *Chinese*
   ☐ (3) India / *India*
   ☐ (4) Lain-lain/ *Others*
   _____

5. Pendidikan:
   Education:
   ☐ (1) Rendah / *Primary*
   ☐ (2) Menengah rendah / *Lower secondary*
   ☐ (3) Menengah tinggi / *Higher secondary*
   ☐ (4) Tertiari/tinggi / *Tertiary*

6. Pekerjaan:
   Occupation:
   ☐ (1) Pelajar / *Student*
   ☐ (2) Bekerja / *Employed*
   ☐ (3) Tidak bekerja / *Unemployed*
   ☐ (4) Bersara / *Retired*

7. Pendapatan individu (RM): _____
   Personal income (RM):

8. Pendapatan isirumah (RM): _____
   Household income (RM):

9. Bilangan orang dalam isirumah: _____
   Number of people in the household:

10. Bilangan tahun bermastautin:
    Number of years of residence: _____tahun / *years*

B. TABIAT PEMAKANAN & GAYA HIDUP / *DIETARY BEHAVIOUR & LIFESTYLE HABITS*

1. Adakah anda seorang vegetarian?
   Are you a vegetarian?
   ☐ (1) Ya / *Yes*
   Jenis / *Type:*_____
   ☐ (2) Tidak / *No*

2. Berapa cepat anda habiskan makanan anda?
   How fast do you finish your meals?
   ☐ (1) 40 minit atau lebih / *40 minutes or more*
   ☐ (2) 20-39 minit / *20-39 minutes*
   ☐ (3) kurang dari 20 minit / *less than 20 minutes*

3. Berapa kerap anda makan selepas 10 malam?
   How frequent do you eat after 10pm?
   ☐ (1) Setiap hari / *Every day*
   ☐ (2) 3 – 6 kali seminggu / *3-6 times a week*
   ☐ (3) 1 – 3 kali seminggu / *1-3 times a week*
   ☐ (4) Kurang dari sekali seminggu / *Less than once a week*
   ☐ (5) Tidak pernah atau jarang / *Never or rare*

4. Berapa kerap anda mengelakkan makan sarapan?
   How frequent do you skip your breakfast?
   ☐ (1) Setiap hari / *Every day*
   ☐ (2) 3 – 6 kali seminggu / *3-6 times a week*
   ☐ (3) 1 – 3 kali seminggu / *1-3 times a week*
   ☐ (4) Kurang dari sekali seminggu / *Less than once a week*
   ☐ (5) Tidak pernah atau jarang / *Never or rare*

5.	Berapa kerap anda makan di luar? *How frequent do you dine out?*	☐ (1) Setiap hari / *Every day* ☐ (2) 3 – 6 kali seminggu / *3-6 times a week* ☐ (3) 1 – 3 kali seminggu / *1-3 times a week* ☐ (4) Kurang dari sekali seminggu / *Less than once a week* ☐ (5) Tidak pernah atau jarang / *Never or rare*

6.	Pernahkah anda merokok? *Do/did you smoke?*	☐ (1) Tidak merokok / *non-smoker* **(Sila ke S9 / skip to Q9)** ☐ (2) Pernah merokok / *past-smoker* ☐ (3) Masih merokok / *current smoker*

7. Berapa lama anda telah merokok?
   How long have you been smoking? _____ tahun / *years*

8. Berapa batang rokok anda hisap sehari?
   How many cigarettes do/did you smoke per day? _____ batang / *sticks*

9.	Pernahkah anda minum arak? *Do/did you drink alcohol?*	☐ (1) Tidak minum / *non-drinker* **(sila ke S11 /skip to Q11)** ☐ (2) Pernah minum / *past-drinker* ☐ (3) Masih minum / *current drinker*

10. Berapa lama anda minum arak?
    How long have you been consuming alcohol? _____ tahun / *years*

11.	Berapa lama anda tidur dalam sehari? *How many hours do you sleep in a day?*	☐ (1) kurang dari 6 jam / *less than 6 hours* ☐ (2) 6-8 jam / *6-8 hours* ☐ (3) lebih dari 8 jam / *more than 8 hours*

C. AKTIVITI FIZIKAL / *PHYSICAL ACTIVITY*

Soalan-soalan berikut akan menyoal anda tentang jumlah masa yang anda gunakan untuk berada dalam keadaan aktif secara fizikal dalam tempoh **7 hari yang lepas ini**.
The questions will ask you about the time you spent being physically active in the __last 7 days__.

Fikirkan tentang semua aktiviti fizikal **berat** yang anda telah lakukan dalam tempoh **7 hari yang lepas ini**. Aktiviti fizikal **berat** adalah aktiviti yang menggunakan daya tenaga fizikal yang kuat dan membuat anda bernafas jauh lebih kuat daripada biasa. Fikirkan hanya tentang aktiviti-aktiviti fizikal yang anda telah lakukan selama sekurang-kurangnya 10 minit pada sesuatu masa.

*Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.*

1.	Dalam tempoh 7 hari yang lepas ini, berapa harikah anda telah melakukan aktiviti fizikal berat, contohnya mengangkat barang berat, mencangkul, senaman aerobik atau berbasikal laju? *During the last 7 days, how many days did you do vigorous physical activities such as heavy lifting, digging, aerobics, or fast bicycling, or outdoor games (in days/week)?*	☐ _____ hari/seminggu *days/week* ☐ (0) Tiada **(sila ke S3)** *None **(skip to Q3)***	*METs Factor- 8.0
2.	Berapakah masa yang anda biasa gunakan untuk melakukan aktiviti fizikal **berat** pada salah satu daripada hari berkenaan? *How much time did you spend doing vigorous physical activities on one of those days (in minutes/day)?*	☐ _____ minit/sehari *minutes/day* ☐ (0) Tidak tahu / tidak pasti *Don't know / not sure*	

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

*Fikirkan tentang semua aktiviti fizikal **sederhana** yang anda telah lakukan dalam tempoh **7 hari yang lepas ini**. Aktiviti fizikal **sederhana** adalah aktiviti yang menggunakan daya tenaga fizikal yang sederhana dan membuatkan anda bernafas agak lebih kuat daripada biasa. Fikirkan hanya tentang aktiviti-aktiviti fizikal yang anda telah lakukan selama sekurang-kurangnya 10 minit pada sesuatu masa.*

3.	Dalam tempoh 7 hari yang lepas ini, berapa harikah anda telah melakukan aktiviti fizikal sederhana, contohnya mengangkat muatan ringan, mengelap lantai, berbasikal pada kelajuan biasa, atau bermain badminton beregu? Ini	☐ _____ hari/seminggu *days/week* ☐ (0) Tiada **(sila ke S5)**	*METs Factor- 4.0

	tidak termasuk berjalan kaki. *During the last 7 days, on how many days did you do* **moderate** *physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? (Do not include walking).*	*None (skip to Q5)*	
4.	Berapakah masa yang anda biasa gunakan untuk melakukan aktiviti fizikal sederhana pada salah satu daripada hari berkenaan? *How much time did you spend doing moderate physical activities on one of those days (in minutes/day)?*	☐ _____minit/sehari *minutes/day* ☐ (0) Tidak tahu / tidak pasti *Don't know / not sure*	

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

Fikirkan tentang masa yang anda telah gunakan untuk **berjalan kaki** *dalam tempoh 7 hari yang lepas ini. Masa ini merangkumi berjalan kaki di tempat kerja dan di rumah, berjalan kaki dari satu tempat ke tempat yang lain, dan berjalan kaki semata-mata untuk rekreasi, bersukan, bersenam atau pada masa lapang.*

5.	Dalam tempoh 7 hari yang lepas ini, berapa harikah anda telah berjalan kaki selama sekurang-kurangnya 10 minit pada sesuatu masa? *During the last 7 days, on how many days did you* **walk** *for at least 10 minutes at a time?*	☐ _____hari/seminggu *days/week* ☐ (0) Tiada *(sila ke S7)* *None (skip to Q7)*	*METs Factor- 3.3
6.	Berapakah masa yang anda biasa gunakan untuk **berjalan kaki** pada salah satu daripada hari berkenaan? *How much time did you usually spend* **walking** *on one of those days (in minutes/day)?*	☐ _____minit/sehari *minutes/day* ☐ (0) Tidak tahu / tidak pasti *Don't know / not sure*	

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

Soalan terakhir ini adalah berkaitan masa yang anda telah gunakan untuk **duduk** *pada hari-hari bekerja dalam tempoh 7 hari yang lepas ini. Masukkan masa yang di habiskan duduk di tempat kerja, di rumah, sewaktu belajar dan di masa lapang. Masa ini juga merangkumi waktu yang di habiskan duduk di meja, menziarahi kawan-kawan, membaca, atau duduk atau baring sambil menonton televisyen.*

7.	Dalam tempoh 7 hari yang lepas ini, berapakah masa yang anda telah gunakan untuk **duduk** pada sesuatu hari bekerja. *During the last 7 days, how much time did you spend* **sitting** *on a week day (in minutes/day)?*	☐ _____minit/sehari *minutes/day* ☐ (0) Tidak tahu / tidak pasti *Don't know / not sure*	
		METs	

Tahap aktiviti fizikal
Level of physical activity

☐ aktif (≥3000)
active

☐ sederhana (700-2900)
moderately active

☐ tidak aktif (<600)
not active

D. KUALITI HIDUP / *QUALITY OF LIFE*

Soalan-soalan berikut bertanyakan pandangan anda tentang kualiti hidup, kesihatan atau aspek-aspek kehidupan yang lain. Pilih jawapan yang anda rasa paling bersesuaian. Sila ambil perhatian terhadap standad, harapan, keseronokan dan kebimbangan anda. Fikirkan tentang kehidupan anda dalam tempoh **empat minggu** lepas.

*The following questions ask how you feel about your quality of life, health, or other areas of your life. I will read out each question to you, along with the response options. Please choose the answer that appears most appropriate. If you are unsure about which response to give to a question, the first response you think of is often the best one. Please keep in mind your standards, hopes, pleasures and concerns. We ask that you think about your life in the last **four weeks.***

	Sangat tidak baik *Very poor*	**Tidak baik** *Poor*	**Sederhana** *Neither poor nor good*	**Baik** *Good*	**Sangat baik** *Very good*
1. Bagaimanakah anda menilai kualiti kehidupan anda? *How would you rate your quality of life?*	1	2	3	4	5
	Sangat tidak berpuas hati *Very dissatisfied*	**Tidak berpuas hati** *Dissatisfied*	**Sederhana** *Neither satisfied nor dissatisfied*	**Berpuas hati** *Satisfied*	**Sangat berpuas hati** *Very satisfied*
2. Setakat manakah anda berpuas hati dengan kesihatan anda? *How satisfied are you with your health?*	1	2	3	4	5

Soalan-soalan berikutnya bertanyakan setakat mana anda telah mengalami sesuatu perkara dalam 4 minggu yang lepas.
The following questions ask about how much you have experienced certain things in the last four weeks.

	Tiada langsung *Not at all*	**Sedikit sahaja** *A little*	**Sederhana** *A moderate amount*	**Sangat banyak** *Very much*	**Teramat** *An extreme amount*
3. Setakat manakah anda berasa kesakitan (fizikal) menghalang anda dari melakukan apa yang anda perlu lakukan? *To what extent do you feel that physical pain prevents you from doing what you need to do?*	5	4	3	2	1
	Tiada langsung *Not at all*	**Sedikit sahaja** *A little*	**Sederhana** *A moderate amount*	**Sangat banyak** *Very much*	**Teramat** *An extreme amount*
4. Berapa banyakkah rawatan perubatan yang anda perlu untuk berfungsi dalam kehidupan harian anda? *How much do you need any medical treatment to function in your daily life?*	5	4	3	2	1
5. Berapa banyakkah anda menikmati keseronokan dalam hidup anda? *How much do you enjoy life?*	1	2	3	4	5
6. Setakat manakah anda rasa hidup anda bermakna? *To what extent do you feel your life to be meaningful?*	1	2	3	4	5
7. Berapa baikkah anda dapat memberi tumpuan? *How well are you able to concentrate?*	1	2	3	4	5
8. Berapa selamatkah anda rasa dalam kehidupan seharian anda? *How safe do you feel in your daily life?*	1	2	3	4	5
9. Berapa sihatkah persekitaran fizikal anda? *How healthy is your physical environment?*	1	2	3	4	5

Soalan-soalan berikut bertanyakan bagaimana sempurnanya anda mengalami atau berupaya melakukan sesuatu perkara dalam 4 minggu yang lepas.
The following questions ask about how completely you experience or were able to do certain things in the last four weeks.

	Tiada langsung *Not at all*	Sedikit sahaja *A little*	Sederhana *Moderately*	Kebanyakkannya *Mostly*	Sepenuhnya *Completely*
10. Adakah anda mempunyai cukup tenaga untuk kehidupan harian anda? *Do you have enough energy for everyday life?*	1	2	3	4	5
11. Adakah anda dapat menerima rupa dan betuk tubuh anda? *Are you able to accept your bodily appearance?*	1	2	3	4	5
12. Adakah anda mempunyai wang yang cukup untuk memenuhi keperluan anda? *Have you enough money to meet your needs?*	1	2	3	4	5
13. Setakat manakah kemudahan bagi anda untuk mendapatkan maklumat yang diperlukan dalam kehidupan harian? *How available to you is the information that you need in your day-to-day life?*	1	2	3	4	5
14. Setakat manakah anda mendapat peluang untuk aktiviti fizikal? *To what extent do you have the opportunity for leisure activities?*	1	2	3	4	5
15. Sebaik manakah keupayaan anda bergerak dari satu tempat ke satu tempat yang lain? *How well are you able to get around?*	1	2	3	4	5

	Sangat tidak berpuas hati *Very dissatisified*	Tidak berpuas hati *Dissatisfied*	Sederhana *Neither satisfied nor dissatisfied*	Berpuas hati *Satisfied*	Sangat berpuas hati *Very satisfied*
16. Adakah anda berpuas hati dengan tidur anda? *How satisfied are you with your sleep?*	1	2	3	4	5
17. Adakah anda berpuas hati dengan keupayaan anda melaksanakan aktiviti kehidupan harian anda? *How satisfied are you with your ability to perform your daily living activities?*	1	2	3	4	5
18. Adakah anda berpuas hati dengan keupayaan anda bekerja? *How satisfied are you with your capacity for work?*	1	2	3	4	5
19. Adakah anda berpuas hati dengan diri anda? *How satisfied are you with yourself?*	1	2	3	4	5
20. Adakah anda berpuas hati dengan perhubungan peribadi anda? *How satisfied are you with your personal relationships?*	1	2	3	4	5
21. Adakah anda berpuas hati dengan kehidupan seks anda? *How satisfied are you with your sex life?*	1	2	3	4	5
22. Adakah anda berpuas hati dengan sokongan yang anda dapati dari kawan-kawan anda? *How satisfied are you with the support you get from your friends?*	1	2	3	4	5
23. Adakah anda berpuas hati dengan keadaan tempat tinggal anda?	1	2	3	4	5

	How satisfied are you with the conditions of your living place?					
24.	Adakah anda berpuas hati dengan kemudahan mendapatkan perkhidmatan kesihatan? *How satisfied are you with your access to health services?*	1	2	3	4	5
25.	Adakah anda berpuas hati dengan pengangkutan anda? *How satisfied are you with your transport?*	1	2	3	4	5

Soalan berikut merujuk kepada kekerapan anda merasa atau mengalami sesuatu emosi sepanjang 4 minggu yang lepas.
The following question refers to how often you have felt or experienced certain things in the last four weeks.

	Tidak pernah *Never*	**Jarang-jarang** *Seldom*	**Kerap** *Quite often*	**Sangat kerap** *Very often*	**Sentiasa** *Always*
26. Berapa kerapkah anda mempunyai perasaan-perasaan negative, seperti susah hati, kecewa, kegelisahan atau kemurungan? *How often do you have negative feelings such as blue mood, despair, anxiety, depression?*	5	4	3	2	1

E. SARINGAN KESIHATAN / *HEALTH SCREENING*

Puasa (8-12 jam) ☐ Ya / *Yes*
Fasting (8-12 hours) ☐ Tidak / *No*

Laporan Perubatan/ Medical History		
1.	Adakah anda pernah dilaporkan sebagai penghidap penyakit kencing manis atau darah tinggi? *Have you been reported to have diabetes or hypertension?*	☐ Ya / *Yes* ☐ Tidak / *No*
2.	Adakah mana-mana ahli keluarga anda (ibubapa, adik beradik, anak-anak) mempunyai sebarang sejarah penyakit? *Has/had any of your family members (parents, siblings, children) a history of any disease?*	☐ Ya / *Yes* ☐ Tidak / *No*

3.	Apakah penyakit-peyakit yang mereka ada/pernah ada?
	 What diseases your family members has/had?
		☐ Kencing manis
		    Diabetes
		 ☐ Darah tinggi
		    Hypertension
		 ☐ Kolesterol
		    Cholesterol
		 ☐ Jantung
		    Heart
		 ☐ Lain-lain (others)
		 _____

4.	**(Perempuan sahaja/ Female only)** Pernah ada kencing manis atau darah tinggi ketika mengandung? *Any history of diabetes or hypertension reported during your pregnancy?*	☐ Ya / *Yes* ☐ Tidak / *No*

Parameter Kesihatan / *Health parameter*	Bacaan / *Reading*	CMS Criteria / Kriteria CMS
1. Tekanan darah sistolik (mmHg) *Systolic blood pressure (mmHg)*		
2. Tekanan darah diastolik (mmHg) *Diastolic blood pressure (mmHg)*		
3. Tahap gula dalam darah (puasa) (mmol/L) *Fasting blood glucose (mmol/L)*		
4. Tinggi (m) *Height (m)*		
5. Berat (kg) *Weight (kg)*		
6. BMI (kg/m^2) *BMI (kg/m^2)*		
7. Ukurlilit pinggang (cm) *Waist circumference (cm)*		
8. Peratusan lemak badan (%) *Body fat percentage (%)*		
9. Serum triglyceride (mmol/L) *Serum triglyceride (mmol/L)*		
10. Serum HDL cholesterol (mmol/L) *Serum HDL cholesterol (mmol/L)*		

Medical history	✓ Diagnosed with Diabetes/Hypertension
	✓ Family history of Diabetes/Hypertension
	✓ History of gestational Diabetes/Hypertension
Abdominal obesity (elevated waist circumference)	>102 cm for men and >88 cm for women

Raised blood pressure	$\geq$130 mm Hg systolic blood pressure or
	$\geq$85 mm Hg diastolic blood pressure
Raised fasting glucose	$\geq$5.5mmol/L
Raised serum triglyseride	$\geq$8.3 mmol/L OR 15 mg/dL
Low serum HDL cholesterol	Men <2.2 mmol/L OR <40 mg/dL
	Women <2.8 mmol/L OR <50 mg/dL

* A diagnosis of CMS can be made when 3 of 5 of the listed characteristics are present

F. REKOD DIET 24-JAM / *24-HOUR DIETARY RECALL*

Saiz Hidangan:

Sudu Teh =5 gm	Sudu =15 gm	Cawan = 120 gm
Mangkuk = 240 gm	Gelas = 240 gm	

Serving sizes:

Teaspoon =5 gm	Table spoon =15 gm	1 soup cup = 120 gm
1 cup = 240 gm	1 glass = 240 gm	

Hari 1 / *Day 1*: _____

SAJIAN *MEAL TIME*	MAKANAN *FOOD*	SAIZ HIDANGAN *SERVING SIZES*	BERAT *WEIGHT*
Sarapan *Breakfast*			
Minum Pagi *Mid-morning snacks*			
Makan Tengahari *Lunch*			
Minum Petang *Tea-time*			
Makan Malam *Dinner*			
Snek Malam *Supper*			

G. SOAL-SELIDIK KEKERAPAN MAKANAN / *SEMI-FOOD FREQUENCY QUESTIONNAIRE*

Berapa kerap anda makan makanan-makanan di bawah?
How often do you eat foods from each of the following categories?

1. BIJIRIN & PRODUK BERASASKAN BIJIRIN *CEREAL & CEREAL-BASED PRODUCTS*	Kali/hari *Times/day*	Kali/minggu *Times/week*	Kali/bulan *Times/month*	Tak Pernah *Never*	Saiz hidangan *Serving size*
1.1 Nasi Putih *White rice*					
1.2 Nasi Putih (Beras Rebus) *Parboiled rice*					
1.3 Nasi perang / multibijirin / merah / liar *Brown / multigrain / red / wild rice*					
1.4 Bubur Nasi *Rice porridge*					
1.5 Nasi goreng *Fried rice*					
1.6 Nasi Lemak *Nasi lemak*					
1.7 Nasi ayam /nasi minyak / nasi biryani *Chicken rice / oily rice / biryani rice*					
1.8 Bihun goreng *Fried meehoon*					
1.9 Bihun / Laksa sup *Meehoon / laksa soup*					
1.10 Thosai *Thosai*					
1.11 Idli / Putu mayam *Idli / putu mayam*					
1.12 Mee goreng *Fried noodles*					
1.13 Mee sup *Noodle soup*					
1.14 Pasta / Spageti *Pasta / Spaghetti*					
1.15 Capati *Capati*					
1.16 Roti canai *Roti canai*					
1.17 Mee segera *Instant noodles*					
1.18 Bijirin sarapan sedia makan (eg. cornflakes) *Ready-to-eat-cereals (eg. cornflakes)*					
1.19 Oat/ muesli *Oats/muesli*					
1.20 Kentang *Potaoes*					
1.21 Ubi keledek *Sweet potatoes*					
1.22 Keladi *Yam*					
Bijirin lain: **Other cereals:**					

2. SAYUR-SAYURAN _VEGETABLES_	**Kali/hari** _Times/day_	**Kali/minggu** _Times/week_	**Kali/bulan** _Times/month_	**Tak Pernah** _Never_	**Saiz hidangan** _Serving size_
2.1	Sayuran hijau _Green leafy vegetables_					
2.2	Sayur buahan (eg. tomato, terung, labu) _Fruits vegetables (eg. tomato, eggplant, pumpkin)_					
2.3	Sayuran kobis (eg.kobis bunga, brokoli) _Cruciferous (cauliflower, broccoli)_					
2.4	Sayuran berkacang (eg. kacang panjang, kacang buncis) _Leguminous vegetables (long beans, French beans)_					
2.5	Akar/ubi (eg ubi bit, sengkuang, lobak merah) _Roots (beetroot, sengkuang, carrot)_					
2.6	Sayuran mentah (salad, ulam) _Uncooked vegetables (salad, ulam)_					
	Sayur-sayuran lain: **_Other vegetables:_**					

3. BUAH-BUAHAN _FRUITS_	**Kali/hari** _Times/day_	**Kali/minggu** _Times/week_	**Kali/bulan** _Times/month_	**Tak Pernah** _Never_	**Saiz hidangan** _Serving size_
3.1	Buah buahan tempatan (eg. betik, pisang, tembikai) _Local fruits (eg. papaya, banana, watermelon)_					
3.2	Buah-buahan import (eg. epal, oren, kiwi, strawberi) _Imported fruits (eg. apple, orange, kiwi, strawberry)_					
3.3	Buah buahan kering (eg. kismis, kurma, prun) _Dried fruits (eg. raisins, dates, prunes)_					
3.4	Buah dalam tin _Canned fruits in syrup_					
3.5	Jus Buah-buahan segar _Fresh fruit juices_					
	Buah- buahan lain: **_Other fruits:_**					

4. DAGING & PRODUK DAGING, KEKACANG & BIJIAN _FRUITS_	**Kali/hari** _Times/day_	**Kali/minggu** _Times/week_	**Kali/bulan** _Times/month_	**Tak Pernah** _Never_	**Saiz hidangan** _Serving size_
4.1	Daging merah (lembu, kambing, babi) _Red meat (beef, mutton, pork)_					
4.2	Daging putih (ayam, itik, arnab) _White meat (chicken, duck, rabbit)_					
4.3	Ikan _Fish_					
4.4	Makanan laut (udang, kerang) _Seafood (prawns, clams)_					
4.5	Ikan masin kering / makanan laut (termasuk ikan bilis) _Dried salted fish / seafood (including anchovies)_					

4.6	Telur (ayam, itik, puyuh) *Eggs (hen, duck, quill)*					
4.7	Sosej/nugets *Sausages / nuggets*					
4.8	Kepingan bakon / ham *Bacon / ham / slices*					
4.9	Susu segar *Fresh milk*					
4.10	Susu tepung /UHT penuh krim *Milk, full cream, powdered/UHT*					
4.11	Susu tepung /UHT skim *Milk, skim/low fat, powdered/UHT*					
4.12	Susu pekat manis *Condensed milk*					
4.13	Krim bukan susu *Non-dairy creamer*					
4.14	Keju *Cheese*					
4.15	Yogurt / tairu / mooru / dadih *Yogurt / tairu / mooru / dadih*					
4.16	Susu soya *Soy milk*					
4.17	Tofu / tofu Jepun / tempeh *Tofu / Japanese tofu / tempeh*					
4.18	Kacang (eg kacang tanah, almond, pistachio, badam) *Nuts (eg peanuts, almonds, pistachios, walnuts)*					
4.19	Bijian (kuaci) *Seeds (kuaci)*					
	Makanan berasaskan protein lain:					

5. LEMAK & MINYAK *FATS & OILS*		**Kali/hari** *Times/day*	**Kali/minggu** *Times/week*	**Kali/bulan** *Times/month*	**Tak Pernah** *Never*	**Saiz hidangan** *Serving size*
5.1	Minyak kelapa sawit *Palm oil*					
5.2	Minyak bunga matahari / zaitun *Sunflower / olive oil*					
5.3	Minyak campuran *Blended oil*					
5.4	Jenis lain minyak sayur-sayuran: *Other type of vegetable oil:* _____					
5.5	Minyak sapi *Ghee*					
5.6	Vanaspati *Vanaspati*					
5.7	Marjerin *Margerine*					
5.8	Lemak babi / haiwan *Lard / animal fat*					
	Lemak dan minyak yang lain: **Other type of fats & oils**					

6. MINUMAN *BEVERAGES & DRINKS*	**Kali/hari** *Times/day*	**Kali/minggu** *Times/week*	**Kali/bulan** *Times/month*	**Tak Pernah** *Never*	**Saiz hidangan** *Serving size*
6.1	Kopi *Coffee*					
6.2	Teh Tarik *Teh Tarik*					
6.3	Teh (eg. O, Cina, hijau) *Tea (eg. Black, Chinese, Green)*					
6.4	Minuman bertenaga (eg. Milo, Horlicks) *Malt drink (eg. Milo, Horlicks)*					
6.5	Minuman beralkohol – wain *Alcoholic drink – wine*					
6.6	Minuman beralkohol – bir *Alcoholic drink – beer*					
6.7	Minuman beralkohol – likur *Alcoholic drink - liquor*					
6.8	Kordial *Cordials*					
6.9	Minuman berkarbonat *Carbonated / soft drinks*					
	Minuman lain: **Other beverages / drinks:**					

7. LAIN-LAIN *MISCELLANEOUS*	**Kali/hari** *Times/day*	**Kali/minggu** *Times/week*	**Kali/bulan** *Times/month*	**Tak Pernah** *Never*	**Saiz hidangan** *Serving size*
7.1	Makanan segera *Fast foods*					
7.2	Coklat *Chocolates*					
7.3	Biskut *Cookies / biscuits*					
7.4	Kuih tempatan *Local kuih*					
7.5	Kek *Cake*					
7.6	Ais krim *Ice cream*					
7.7	Gula *Sugar*					
7.8	Madu *Honey*					
	Lain-lain: **Others:**					

8. SUPLEMEN
  SUPPLEMENTS

Jenis Type	Kekerapan *Frequency*				Dos *Dosage*	Tujuan pengambilan *Reason for consumption*
	Setiap hari *Every day*	**>sekali / seminggu** *> Once / week*	**Sekali seminggu** *Once a week*	**1 – 3 kali / sebulan** *1 – 3 times/month*		
8.1 Multivitamin *Multivitamin*						
8.2 Vitamin B kompleks *B Complex*						
8.3 Vitamin C *Vitamin C*						
8.4 Kalsium *Calcium*						
8.5 Zat besi *Iron*						
8.6 Minyak ikan *Fish oil*						
8.7 Minyak evening primrose *Evening primrose oil*						
8.8 Herba Cina / ginseng *Chinese herbs/ginseng*						
Others:						

INDEKS – sebab anda mengambil suplemen:
A. Memberi tenaga
B. Meningkatkan prestasi
C. Meningkatkan pemulihan
D. Melegakan kesakitan
E. Meningkatkan kekuatan otot
F. Membina otot
G. Tidak tahu
H. Lain (sila nyatakan dalam ruang di atas)

INDEX on reason for consuming the supplement:
A.   Provide energy
B.   Enhance performance
C.   Enhance recovery
E.   Enhance muscle strength
F.   Build muscle
G.   Don't know
H.   Others (please state in the space above)
D.   Relieve pain

Peer Module Evaluation Form
for partcipants of PERSUADE Peer Support

Date: _____

Title and location of module: _____

Peer Leader : _____

Instructions: Please indicate your level of agreement with the statements listed below in #1-11.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. The objectives of the training were clearly defined.	O	O	O	O	O
2. Participation and interaction were encouraged.	O	O	O	O	O
3. The topics covered were relevant to me.	O	O	O	O	O
4. The content was organized and easy to follow.	O	O	O	O	O
5. The materials distributed were helpful.	O	O	O	O	O
6. This training experience will be useful in my work.	O	O	O	O	O
7. The trainer was knowledgeable about the training topics.	O	O	O	O	O
8. The trainer was well prepared.	O	O	O	O	O
9. The training objectives were met.	O	O	O	O	O
10. The time allotted for the training was sufficient.	O	O	O	O	O
11. The meeting room and facilities were adequate and comfortable.	O	O	O	O	O

Appendix F

Feasibility Trial Result

Table 1: Feasibility trial results on nutrition and clinical outcomes

Parameter	Baseline (M0) Mean (SD)	Post-Intervention (M3) Mean (SD)	Post-Follow-Up (M6) Mean (SD)	p [a]	95% CI Upper Limit	95% CI Lower Limit	Pairwise Comparison	Change (%)	p [b]	95% CI Upper Limit	95% CI Lower Limit
Energy (kcal)	1685.42 (421.04)	1613.82 (331.50)	1453.24 (296.61)	0.001	-389.128	-75.242	M0 vs. M3	−4.25	0.045	1.155	142.054
							M3 vs. M6	−9.90	0.015	25.551	295.61
Carbohydrate (g/1000 kcal)	139.71 (32.35)	149.04 (42.91)	165.19 (33.21)	0.001	9.479	41.467	M0 vs. M3	−6.68	0.483	-25.573	6.928
							M3 vs. M6	10.84	0.049	-34.033	-1.733
Protein (g/1000 kcal)	32.91 (9.53)	33.33 (14.54)	39.93 (13.71)	0.004	2.797	11.250	M0 vs. M3	−1.19	1.000	-5.069	4.228
							M3 vs. M6	+19.80	0.041	-13.231	-0.23
Fat (g/1000 kcal)	29.03 (11.89)	21.89 (12.44)	22.96 (9.81)	0.001	-11.335	-0.816	M0 vs. M3	−24.60	<0.001	3.609	10.683
							M3 vs. M6	+4.89	1.000	-6.084	3.942
Total fiber [c] (g/1000 kcal)	6.71 (2.05)	6.95 (6.60)	9.06 (3.41)	<0.001	16.368	3097.42	M0 vs. M3	+3.58	0.508	0.222	1.524
							M3 vs. M6	+30.36	<0.001	0.001	0.099
Total sugar (g/1000 kcal)	40.02 (18.64)	32.05 (17.00)	44.57 (20.42)	0.001	-2.784	11.892	M0 vs. M3	−24.87	0.056	-0.139	16.077
							M3 vs. M6	+39.06	0.002	-21.043	-4.002
Glycemic load (g/%)	135.34 (30.05)	157.54 (47.22)	156.43 (44.16)	<0.001	13.373	28.815	M0 vs. M3	+14.93	<0.001	-30.690	-13.713
							M3 vs. M6	−0.70	1.000	-8.129	10.344
SBP (mmHg)	135.29 (19.65)	130.50 (17.36)	130.42 (18.36)	0.001	-8.790	-0.960	M0 vs M3	−3.54	0.001	1.778	7.805
							M3 vs M6	−0.06	1.000	-2.779	2.946
DBP (mmHg)	82.58 (11.67)	81.00 (9.28)	81.75 (9.67)	0.566	0.975	1.012					
FBG (mmol/L)	8.60 (3.48)	7.57 (1.98)	7.57 (2.16)	<0.001	0.843	0.971	M0 vs M3	−11.98	<0.001	1.042	1.164
							M3 vs M6	0	1.000	0.951	1.059
BMI (kg/m^2)	25.84 (3.91)	25.42 (3.93)	25.50 (4.07)	0.001	-0.659	-0.015	M0 vs M3	−1.63	<0.001	0.180	0.661
							M3 vs M6	+0.31	1.000	-0.300	0.133
WC (cm)		91.07		<0.001	-0.775	-0.083	M0 vs M3	−0.71	<0.001	0.340	0.952

	91.72 (11.53)	(11.36)	91.29 (11.43)				M3 vs M6	+0.24	0.018	-0.403	-0.030
BF (%)	29.88 (6.57)	29.42 (6.43)	29.37 (6.36)	0.060	0.968	0.984					
TG (mmol/L)	2.89 (1.73)	2.19 (2.06)	2.19 (2.09)	<0.001	0.621	0.766	M0 vs M3	−24.22	<0.001	1.306	1.581
							M3 vs M6	0	1.000	0.973	1.045
HDL (mmol/L)	1.12 (0.35)	1.41 (0.32)	1.13 (0.33)	<0.001	-0.165	0.196	M0 vs M3	25.89	0.001	-0.473	-0.116
							M3 vs M6	−19.86	<0.001	0.145	0.413