**TITLE**Public health interventions on non-communicable diseases in Malaysia: A systematic review

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# ABSTRACT

**Background.** The burden of non-communicable disease (NCD) is increasing in developing countries. The economic development of Malaysia is accompanied by a dramatic increment in NCD related mortality and morbidity in the recent decades.

**Objective.** The aim of this study was to review the interventional studies targeting the general public health to reduce the problem in Malaysia.

**Methods.** Selected studies for this research obtained through a systematic database search. The main searched databases were PubMed, Embase, and ScienceDirect. Database searches resulted in 809 studies from which 14 satisfied the inclusion criteria and quality assessment. Included articles were published since January 2000 until May 2015.

**Results.** In Malaysia, interventional studies have targeted various proxies to tackle NCDs including dietary habits improvements, physical activity encouragements, educational efforts to increase awareness, etc. To reduce diabetes 🡪 . HPT 🡪 . CHOL 🡪 . OBE 🡪 .

**Conclusion.** Increasing awareness and knowledge of dietary intakes, encouragements to increase physical activity, self-monitoring of glucose have great influence in reducing NCDs in Malaysia.

# INTRODUCTION

Non-communicable diseases (NCDs) are the number one cause of mortality and morbidities worldwide of which 80% occurred in low- and middle-income nations 1. However, these horrifying rates can be averted by proper interventional policies 1,2.

As a developing country, Malaysia is on the track of fast modernization, is urbanizing rapidly, and is in the verge of economic transition 3,4, all of which are known to cause NCDs 5-8.

Of most important risk factors causing NCDs, we can name unhealthy diet, physical inactivity or insufficient physical activity, as well as lack of knowledge and awareness of risk factors contributing to NCDs, smoking tobacco, and alcohol consumption 9-11. To tackle NCD related issues, public health interventions have been introduced WHO 1,2. These interventions are cost effective and are more rationally and economically feasible comparing to NCD related costs (i.e., productivity loss, health expenses, etc.).

Nonetheless, effectiveness of the public health interventions have been debated over the past few years 12,13. Therefore, this study struggles to summarize the existing published studies in Malaysia to identify significant and effective methods addressing NCD reduction tools in Malaysia.

# METHODS

## Guideline

We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) to systematically conduct this study 14.

## Research Strategy

We included peer-reviewed papers and Randomized Controlled Trials (RCT) published between January 2000 and May 2015. The following databases were included in our search: PubMed, ScienceDirect, and Embase. The extensive keyword search included non-communicable disease(s), intervention or interventional, diabetes (or ‘diabetes mellitus’ or ‘high blood glucose’ or ‘high blood sugar’), hypertension (or ‘high blood pressure’), hypercholesterolemia (or hypercholesterolaemia or ‘high blood cholesterol’ or ‘high cholesterol’ or hyperlipidemia), obesity, and Malaysia.

## Study selection criteria

Two independent reviewers (MA and TTS) reviewed the titles of the studies in the initial search results. Aforementioned reviewers examined the selected titles in the abstract review stage. Subsequently, the full-text of papers were assessed for relevancy, quality check, and inclusion/exclusion criteria. In the end, based on final selected studies we thoroughly checked whether there are any studies missed in the database research or not.

### Inclusion criteria

The following properties were considered as proxies to include studies: i) whether the study was original article using quantitative/qualitative methods; ii) included any interventional studies conducted in a Malaysian representative population; iii) targeted any NCDs in Malaysia.

### Exclusion criteria

If any of the following attributes was found in the study, it would be excluded from the review: i) if results related to the Malaysian participants were not specifically reported or were not obvious; ii) conference papers, protocol, or was assessed low quality study; iii) if the intervention could not be applied to the public.

## Study types

We did not discriminate between quantitative or qualitative studies to be included in this review.

## Outcome measured

Studies reporting public health interventions targeting: i) physical activity; ii) dietary habits; iii) NCD knowledge and awareness (i.e., educational interventions); iv) self-management or self-monitoring of any risk factors contributing to NCD; and, v) any feasible action resulting in reduction of NCD or risk factors causing NCDs.

## Results extraction and quality assessment

Results obtained from papers by first reviewer (MA) were double-checked for accuracy and appropriateness by the second reviewer (TTS). Unanimous agreement solved disagreements in results extraction. For the quality assessment of studies, we used ‘quality assessment tool for quantitative studies’ 15 and ‘Assessing the quality of reports of randomized clinical trials: is blinding necessary?’ 16 for RCTs. A detailed performance comparison of ‘quality assessment tool for quantitative studies’ 15 and ‘Cochrane Collaboration Risk of Bias Tool’ 17 is presented elsewhere 18.

To assess the quality of studies, we followed the procedure which is presented by Thomas 15. First, studies’ following sections were graded by MA and TTS: ‘Selection Bias,’ ‘Study Design,’ ‘Confounders,’ ‘Blinding,’ ‘Data Collection Methods,’ and ‘Withdrawals and Drop-outs’. If no discrepancy in ratings of the studies’ elements were achieved, the study’s quality would be graded from weak to high 15.

## Data extraction

The following details were extracted from final selected articles: i) authorship; ii) year and journal title; iii) study design; iv) sample population; v) NCD(s) type; vi) intervention method; and, vii) effectiveness of the intervention.

# RESULTS

The database research resulted in 809 studies. After duplicate articles’ removal (n = 130), titles/abstracts were reviewed. In this stage, 649 were excluded. The final retrieved articles were thirty (n = 30). However, after thorough full-text reviews we excluded 17 articles due to content unsatisfactory leading to final number of thirteen (n = 13) studies for this study. Figure 1 shows the in detail procedure to obtain the final studies for this review.



Figure . Study selection procedure

In Table 1, we illustrated the details of the studies included in this review. The design of the studies were quasi-experimental, or randomized trials. The sample size of the studies ranged from 8 to 607. Various intervention methods were included in the studies such as dietary habits modification, physical activity encouragement, increasing education on NCDs, self-monitoring of blood pressure or glucose level. Studies that were included in this review reported one intervention method and desirable outcome of the NCDs intervened. Overall, studies included in this review scored moderate 15, which is considered as the acceptable quality for the systematic reviews (studies scored less were excluded).

Table Interventional studies on non-communicable diseases conducted in Malaysia

| AUTHOR (YEAR) | INTERVENTION TYPE | STUDY DESIGN | SAMPLE | PRIMARY OUTCOME VARIABLES | FINDINGS | QUALITY |
| --- | --- | --- | --- | --- | --- | --- |
| Karupaiah (2014) 19 | Lifestyle education | Multicenter quasi experimental controlled trial (Community-based Cardiovascular Risk Factors Intervention Strategies: CORFIS) | Two hundred and nine (n = 209) respondents were non-randomly selected from 486 hypertensive adults | Adherence to sodium reduction, regular exercise, and increasing fruit and vegetables intake were quantified against weight, waist circumference (WC), systolic blood pressure (SBP), and diastolic blood pressure (DBP) among three groups: Non-adherent/N-A; Newly adherent/NA; Totally adherent/TA. | Sodium intake reduction was adherent with SBP reduction in NA (p < .001) and TA (p < .001). Marginally increasing fruit and vegetable consumption (Δ = .41 serving) resulted in sizeable reductions in weight for NA (p < .001) > TA (p < .001) > N-A (p > .05) and in WC for NA (d = .68, p < .001) > TA (d = .53, p < .001) > N-A (d = .52, p > .05). Exercise behavior was least successful as pedometer counting was below 10,000 steps but sizeable weight and WC reductions were largest for NA (d = .71 and .79, respectively) > TA (d = .60 and .53, respectively) > N-A (d = .33 and .35, respectively). | Moderate |
| Low (2013) 20 | Lifestyle education | Multicenter quasi experimental controlled trial (CORFIS) | Four hundred and eighty six hypertensive patients (n = 486); Intervention group (n = 309) and control group (n = 177) | I) Proportion of patients who achieved targeted BP (140/90mmHg: for those without diabetes mellitus; <130/80mmHg: for those with diabetes mellitus). II) Change in the mean/median BP at 6-month as compared to baseline. | In the CORFIS arm, 69.6% of patients achieved BP goal as compared to the control arm (57.6%), p = .008. In addition, in the intervention group 56.6% of those who had uncontrolled BP at baseline achieved the targeted BP at 6-month compared to the control arm (34.1%), p < .001. There were significant reductions in SBP in the CORFIS arm (median -9.0mmHg; -60 to 50) versus control (median -2mmHg; -50 to 48), p = .003; as well as in DBP (CORFIS arm: median -6.0mmHg; ranged from -53 to 30 versus control arm: median .0mmHg; ranged from -42 to 30), p < .001. | Moderate |
| Supa'at (2013) 21 | Lifestyle education | RCT: measuring effects of whole body Swedish Massage Therapy (SMT) an hour weekly for four weeks on hypertensive women against resting | Eight respondents were allocated in the massage group (n = 8) | BP and heart rate (HR); Vascular endothelial adhesion molecules 1 (VCAM-1); Intracellular adhesion molecules 1 (ICAM-1). | Massage group showed significant SBP reduction of 12 mmHg (p = .01) and DBP reduction of 5 mmHg (p = .01).  HR was also reduced in massage group: after 1, 3, and 4 sessions. VCAM-1 showed significant reduction after four sessions: the massage group showed reduction of 998.05 ng/mL (p = .03) and the control group of 375.70 ng/mL (p = .01) with no significant differences between groups. There were no changes inICAM-1. | Moderate |
| Barakatun (2013) 22 | Lifestyle education | prospective, single-group, pre-post design trial for 12 weeks | One hundred and four (n=104) diabetic patients (age=56.4 ±9.9 years; 37% male) were included; Years of diabetes diagnosis was 6.3 ±4.9 | Effect of individualized Medical Nutrition Therapy (MNT) in T2DM patients on glycemic control, metabolic parameters and dietary intake. Advice were given to subjects treated with diet and on a stabile dose of oral anti-diabetic agents by a dietitian for 12 weeks. Dietary advice was based on Malaysian MNT for adults with T2DM. I) Glycemic control (fructosamine and HbA1c level); and, II) Measures of anthropometry, BP, lipid profile, insulin levels dietary intake and knowledge on nutrition. | The post-MNT results showed a significant reduction of fructosamine (311.5 ±50 to 297 ±44 umol/L; p< .001) and HbA1c (7.6 ±1.2 to 7.2 ±1.1 %, p<.001) with pronounced reduction for subjects who had very high HbA1c levels of >9.3% at baseline. Waist circumference (9.7 ±1.2 to 89.1 ±9.8 cm, p<.05), HDL-cholesterol (1.1 ±.3 to 1.2 ±.3 mmol/L, p<.05), dietary intake and nutrition knowledge score (42 ±19 vs. 75 ±17%; p< .001) were significantly improved from the baseline. | Moderate |
| Butt (2015) 23 | Drug therapy | RCT: Patients in the intervention group received an intervention from a pharmacist during the enrolment, after 3 and 6 months of the enrolment. | Seventy-three (n = 73) patients randomized to intervention group (n = 37) and control (n = 36). | To evaluate the impact of a pharmacist led intervention on HbA1c, medication adherence, quality of life among T2DM. Outcome measures such as HbA1c, BMI, lipid profile, Morisky scores and quality of life (QoL) scores were assessed at the enrolment and after 6 months of the study in both groups. | HbA1c (9.66% to 8.47%; p = .001), BMI (29.34–28.92 kg/m2; p = .03) values reduced significantly from in the intervention group. However, lipid profiles were unchanged in both groups. Morisky adherence scores significantly increased from 5.83 to 6.77 (p = .02) in the intervention group; however, no significant change was observed in the control group (5.95–5.98, p = .85). QoL profiles produced mixed results. | Moderate |
| Ismail (2013) 24 | Self-monitoring | Open-label RCT; Patients with T2DM were selected from five public primary care clinics (age range 35–65 years). Patients were not performing SMBG at the time of the study. | One hundred and five (n = 105) T2DM patients were enrolled. Of these, 58 and 47 were randomized to intervention and control groups, respectively. | To assess the feasibility of introducing SMBG in primary care clinics in Malaysia. | After six months, the HbA1c level in the intervention group showed a statistically significant improvement of 1.3% (p = .001), relative to the control group that underwent usual care. The percentages of patients that reached the HbA1c treatment target of ≤ 7% were 14.0% and 32.1% in the control and intervention groups (p = .036), respectively. | Moderate |
| Tan (2011) 25 | Self-monitoring | Single blinded RCT | One hundred and sixty four (n = 164) participants with poorly controlled diabetes from two settings were randomized into control (n = 82) and intervention (n = 82) groups, of which 151 completed the study. | Effectiveness of a brief structured diabetes education programme addressed the self-care practices of diet, PA, medication adherence and SMBG. These self-care practices were assessed at Weeks 0 and 12 using pre- and post-questionnaires in both groups together with HbA1c and diabetes knowledge. | In the intention-to-treat analysis (n = 164), the intervention group improved their SMBG (p < .001), PA (p = .001), HbA1c (p = .03), diabetes knowledge (p < .001) and medication adherence. At Week 12, HbA1c difference adjusted for SMBG frequency, medication adherence and weight change remained significant (p = .03) compared with control group. For within group comparisons, diabetes knowledge (p < .001), HbA1c level (p < .001), SMBG (p < .001) and medication adherence (p = .008) improved from baseline in the intervention group. In the control group, only diabetes knowledge improved (p < .001). | Moderate |
| Yusof (2009) 26 | Lifestyle prescription | Randomly assigned to either a low glycemic index (GI) vs. conventional carbohydrate exchange (CCE) dietary advice over a 12-week period | One hundred and four T2DM patients | Assessing two dietary interventions on T2DM patients: low GI or CCE. The glycemic control, BP, lipid profile and insulin levels were assessed. However, antidiabetic medications consumptions by patients were unchanged throughout the study. | At week 4, a GI diet was associated with significant changes in the fructosamine level (ΔGI = -.20 ± .03; ΔCCE = -.08 ± .03 mmol/l, p < .01) and waist circumference (ΔGI group = -1.88 ± .30 cm; ΔCCE group: -.36 ± .4 cm, p < .05). At week 12, the changes in fasting glucose (ΔGI = -.03 ± .3; ΔCCE = .7 ± .3 mmol/l; p < .05) and waist circumference (ΔGI = -2.35 ± .47 cm; ΔCCE group = -.66 ± .46 cm; p < .05) in the GI group was significantly lower than the CCE group. With the low-GI diet, the changes in postprandial glycaemia at time 0, 60, 150 and 180 min after consuming the standard test meal was lower than with the CCE diet (p < .05). | Moderate |
| Al-Mahmood (2007) 27 | Therapeutic lifestyle change (TLC) | RCT: From a cross-sectional study patients were either randomly assigned to intervention or control group. | Sixteen (n = 16) non-obese normoglycemic hyperlipidemic patients were assigned to intervention and 16 normolipidemic (n = 16) were assigned to control group. | Assessing lipid-lowering effects by TLC on insulin sensitivity and secretory status of non-obese normoglycemic hyperlipidemic subjects. | Insulin resistance was significantly reduced in intervention group (HOMA-IR reduced from 3.8 to 1.4, p < .001) and improvement of insulin sensitivity (HOMA%S increased from 5.1% to 121.2%, p=.004) in hyperlipidemic subjects with associated reductions in lipid levels. | Moderate |
| Hsu (2013) 28 | TLC | Data from a longitudinal, retrospective observational study were collected from the medical records of patients aged ≥35 years in whom LMT was initiated between January 2004 and December 2006. | Overall, six hundred and seven (n = 607; mean [SD] age was 57.1 [10.0]; 60% women) eligible patients had records of full lipid panels 12 months before and after the start of therapy. | Evaluating normal lipid level attainment after LMT. A subgroup of patients at high risk for CHD events (established CHD, diabetes but no CHD, or a 10-year history of Framingham risk score ≥20%) was also studied. | Before therapy, 89% had elevated LDL-C level, 37% had lower HDL-C, 56% had elevated TG, and 62% had ≥2 abnormal lipid levels before LMT. After LMT (87% statins only), 60% had elevated LDL-C, 37% had low HDL-C, 40% had elevated TG, and 44% continued to have ≥2 abnormal lipid levels. | Moderate |
| Moy (2006) 29 | Lifestyle education | Non-randomized pre-test-post-test quasi-experimental study design among Malay-Muslim males and were followed up after 2 years. | Security guards from a public university were assigned to intervention (n = 102) and control group (n = 84) | The intervention group received intensive individual and group counselling on diet, PA and smoking cessation. The control group was given minimal education on the same lifestyle changes through mail and group counselling. | Mean TC levels in the intervention group significantly reduced as compared to the comparison group, with an intervention effect of –.38 (–.63, –.14) mmol/l. | Weak |
| Moy (2008) 30 | Lifestyle education | Non-randomized pre-test-post-test quasi-experimental study design among Malay-Muslim males and were followed up after 2 years. | Security guards from a public university were assigned to intervention (n = 102) and control group (n = 84) | The intervention group received intensive individual and group counselling on diet, PA and quitting smoking. The comparison group was given minimal education on the same lifestyle changes through mail and group counselling. | Following the intervention, both groups reduced their total fat intake through a replacement in carbohydrate intake. The saturated fat and cholesterol intake were also reduced with a larger magnitude in the intervention group. Fruits and vegetable consumption was increased within the intervention group. | Weak |
| Ariffin (2011) 31 | Lifestyle education | Non-random, interventional study with no control | Twenty-five (n = 25) generally healthy overweight and obese subjects completed a 9-month education program on modified lifestyle intervention | Assessing the effect of education on lifestyle modification on arterial stiffness, metabolic and inflammatory markers. Dietary modification and PA increment advices were given to subjects. Arterial stiffness was measured noninvasively using PWV a and PWA b. Anthropometric measurements, body fat percentage and visceral fat, central and brachial BP, lipid profile, hsCRP c and insulin sensitivity were recorded. | After intervention, weight, waist and hip circumference, SBP, serum fasting insulin, insulin resistance, and hsCRP levels were reduced. Insulin sensitivity was increased, while body fat and visceral fat percentages were marginally reduced (p = .058 and p = .059). | Weak |

a. carotid femoral pulse wave velocity; b. pulse wave analysis; c. inflammatory marker high sensitivity C-reactive protein

For Results Section:

## General summary of types of interventions, prevalence of each type, etc. Also summarize major study designs.

## Overall intervention effectiveness

Summarize general findings regarding intervention effectiveness for NCDs, different outcomes (diet, physical activity, laboratory measures, blood pressure, anthropometric measures). Might use subheadings for the different outcomes, or just use separate paragraphs.

## Effectiveness by intervention type, length and setting

Summarize findings related to effectiveness of general education/health promotion versus clinical trial with specific dietary or physical activity advice with expectation for adherence. Also mention any findings related to length of intervention.

## Intervention effectiveness for prevention versus management of NCDs

Not sure, but may have enough information to include this kind of summary.

# CONCLUSION

As noted for the abstract:

Building on which interventions were most effective for specific outcomes, we will want to suggest which have most promise for application in the public health setting to produce change at the population level. Discuss how such interventions could be delivered given current infrastructure for public health interventions in Malaysia. Focus on community-based approach.

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Figure 2

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