Journal of
Community Medicine & Health Education

Research Article Open Access

Effectiveness of Health Education Interventions on Modifying Cardiovascular Diseases Risk Factors: Systematic Review and Meta-Analysis

Radwan NM[1]*, Al-Khashan HM[2], Alamri FA[2], Kabbash E[3], Abu-Elenin MM[3] and El-Olemy AT[4]

[1]*Department of Public Health and Community Medicine, Faculty of Medicine, Tanta University, Egypt*
[2]*Department of Family Medicine, Ministry of Health, Saudi Arabia*
[3]*Department of Public Health and Community Medicine, Tanta University, Egypt*
[4]*National Center of Complementary and Alternative Medicine, Saudi Arabia*

Abstract

Background: Cardiovascular disease is linked to certain risk behaviours and health education has become the most commonly used measure for modifying these risk behaviours.

Objectives: To determine the effectiveness of health education interventions on modifying cardiovascular disease risk factors.

Search methods: We searched the Cochrane Library, MEDLINE and EMBASE during the past twenty years.

Selection criteria: We included randomized controlled trials (RCTs) on health education interventions aimed at modifying cardiovascular diseases risk factors.

Conclusion: Wellbeing instruction intercessions could be powerful in changing frame of mind of individuals toward utilization of solid eating regimen, performing physical action and in quitting smoking. However, it is not effective in reducing body weight, blood pressure and blood sugar.

Keywords: Health education; Cardiovascular diseases risk; Meta-analysis

Introduction

Cardiovascular diseases (CVDs) represent the most common cause of non-communicable disease deaths) [1]. They account for 17.3 million deaths annually, followed by cancers (7.6 million), respiratory diseases (4.2 million) and diabetes (1.3 million) [2]. These four groups of diseases account for about 80% of all non-communicable disease deaths and they share four risk factors; tobacco use, physical inactivity, the harmful use of alcohol, and unhealthy diets [3]. CVD is also linked to other risk factors, including high blood pressure and elevated total serum cholesterol [4]. Primary health care providers represent the first contact with the patients and have an important role for health promotion and prevention of CVDs [5].

One of the most predictors for morbidity and mortality is the socioeconomic status (SES) [6-8]. SES is a complex phenomenon that is conceptualized as a combination of financial, occupational and educational variables [9-11]. Among these factors, the educational status is considered the most common one for measuring the SES [12]. Health literacy is defined as "the degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions" [13]. An inverse association is always present between health literacy and CVDs [14-17].

Multiple risk factor interventions for CVDs are defined as interventions that address more than one risk factor at the same time, in addition to, or instead of, pharmacological therapy [18]. These interventions include mainly advice for diet, smoking, alcohol, physical activity and body weight in the Isfahan Healthy Heart Program (IHHP), recorded a significant reduction in the prevalence of abdominal obesity, hypertension and hypercholesterolemia among intervention group compared to the control one after health education intervention [19,20]. Also, Jeemon, investigated a comprehensive CVDs risk reduction using a non-randomized comparison and he recorded a significant reduction in the percentage of participants with high risk factors from 10.6% to 4.7% among the intervention group compared to an increase from 13.3% to 17.8% among the control one [21].

On the other hand, Ebrahim stated that health education intervention designed to change health behaviour doesn't reduce CVDs mortality or clinical events in general population, but it may be effective among high risk hypertensive and diabetic patients [22]. However, these results should be taken with caution because of variations in settings and population. So, there is a need for evidence synthesis to evaluate the effectiveness of health education intervention on modifying CVDs risk factors.

Objectives

To determine the effectiveness of health education interventions on modifying CVDs risk factors for the primary prevention of CVDs.

Methods

Criteria for considering studies for this review

Types of studies

We included randomized controlled trials (RCTs) with health education interventions.

***Corresponding author:** Nashwa M Radwan, Department of Clinical Education, Ministry of Health, Saudi Arabia, Tel: 00966540261707; E-mail: radwan.n.m@gmail.com

Received July 03, 2019; **Accepted** October 26, 2019; **Published** November 01, 2019

Citation: Radwan NM, Al-Khashan HM, Alamri FA, Kabbash E, Abu-Elenin MM, et al. (2019) Effectiveness of Health Education Interventions on Modifying Cardiovascular Diseases Risk Factors: Systematic Review and Meta-Analysis. J Community Med Health Educ 9: 669..

Types of participants

Normal individuals or those with high risk for developing CVDs (such as hypertension, obesity, smoking, hyperlipidemia, type 2 diabetes or a combination of these). We excluded trials where there is evidence that the participants have been diagnosed with CVDs at baseline.

Types of interventions

Health education interventions which aim to alter one or more CVDs risk factors including; diet, obesity, blood pressure, smoking, total blood cholesterol or physical activity.

Outcome measures

1. Changes in CVDs risk factors (blood pressure, blood sugar, blood lipids, smoking and obesity).

2. Changes in health knowledge, attitudes and practice.

Search methods for identification of studies: We identified trials through systematic searches of Cochrane Library, EMBASE and MEDLINE. We also checked the references lists of all primary studies for additional references.

Selection of studies

The titles and then the abstracts of potentially relevant articles were read independently by (NMR and ATE). Articles was rejected only if both review authors determined from the title or abstract that the article was not a randomized controlled trial. After reviewing the full articles, the studies that were not relevant to the review were excluded. Remaining records were independently checked by the same review authors. All papers that were thought to be of relevance were obtained and read by (NMR and ATE) independently. We recorded the selection process in detail to complete a PRISMA flow diagram (Figure 1).

Data extraction and management

We used a data collection form for study characteristics and outcome data. One author (NMR) extracted study characteristics from the included studies, as follows:

1. Methods: study design, total duration of study, study setting and date of the study.

2. Participants: number, mean age, gender, diagnostic criteria, inclusion and exclusion criteria.

3. Interventions: intervention and comparison.

4. Outcomes: primary and secondary outcomes specified and collected.

5. Risk of bias.

(NMR and ATE) independently extracted outcome data from the included studies. We resolved disagreements by discussion. (NMR) transferred data into the Review Manager 5 software [23]. (ATE) checked study characteristics for accuracy against the trial report.

Assessment of risk of bias in included studies

(NMR and ATE) independently assessed risk of bias for each study using the criteria outlined in the Cochrane Hand book for Systematic Reviews of Interventions [24]. We resolved any disagreements by discussion. We graded each potential source of bias as high, low or unclear, and provided a quote from the study report together with a justification for our judgement in the "Risk of bias table". We assessed the risk of bias according to the following domains.

1. Random sequence generation (selection bias)

2. Allocation concealment (selection bias)

3. Blinding of outcome assessment (performance bias)

4. Incomplete outcome data (attrition bias)

5. Selective outcome reporting (reporting bias)

Assessment of quality of evidence

We assessed the quality of evidence of the primary outcomes using the GRADE approach [25] and presented the results in the "Summary of findings table". The GRADE system considers 'quality' to be a judgement of the extent to which we can be confident that the estimate of effect is correct. The level of 'quality' is judged on a four-point scale:

High quality: Further research is very unlikely to change our confidence in the estimate of effect.

Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Very low quality: Any estimate of effect is very uncertain.

We initially graded evidence from RCTs as high, and downgraded it by either one, two, or three levels after full consideration of: any limitations in the design of the studies, the directness (or applicability) of the evidence, the consistency and precision of the results and the possibility of publication bias.

Measures of treatment effect

We used Review Manager 5 [23] to manage the data and to conduct the analyses. We reported dichotomous outcomes as risk ratios (RRs) with 95% confidence interval (CI). For continuous outcomes, we calculated mean differences (MDs) with 95% CI when the studies used the same scale.

Dealing with heterogeneity

We used the I^2 statistic to measure heterogeneity among the trials in each analysis [26].

Subgroup analysis

We summarized and analyzed all eligible studies in Review Manager 5 [23]. (NMR and ATE) extracted the data; the first author entered all data and the second author checked all entries. We resolved disagreements by discussion. We undertook meta-analyses only where this was meaningful. We combined the data using a random-effects model.

Results

Results of search

We searched 295 potentially relevant articles, 230 were identified after removal of duplicates. Abstracts reviewed based on inclusion and exclusion criteria by (NMR and ATE) independently. Thirty-two full-text articles assessed for eligibility independently, of these, 9 met the inclusion criteria. Details of the flow of studies through the review are given in Prisma flow diagram (Figure 1).

Included studies: Details of the methods, participants,

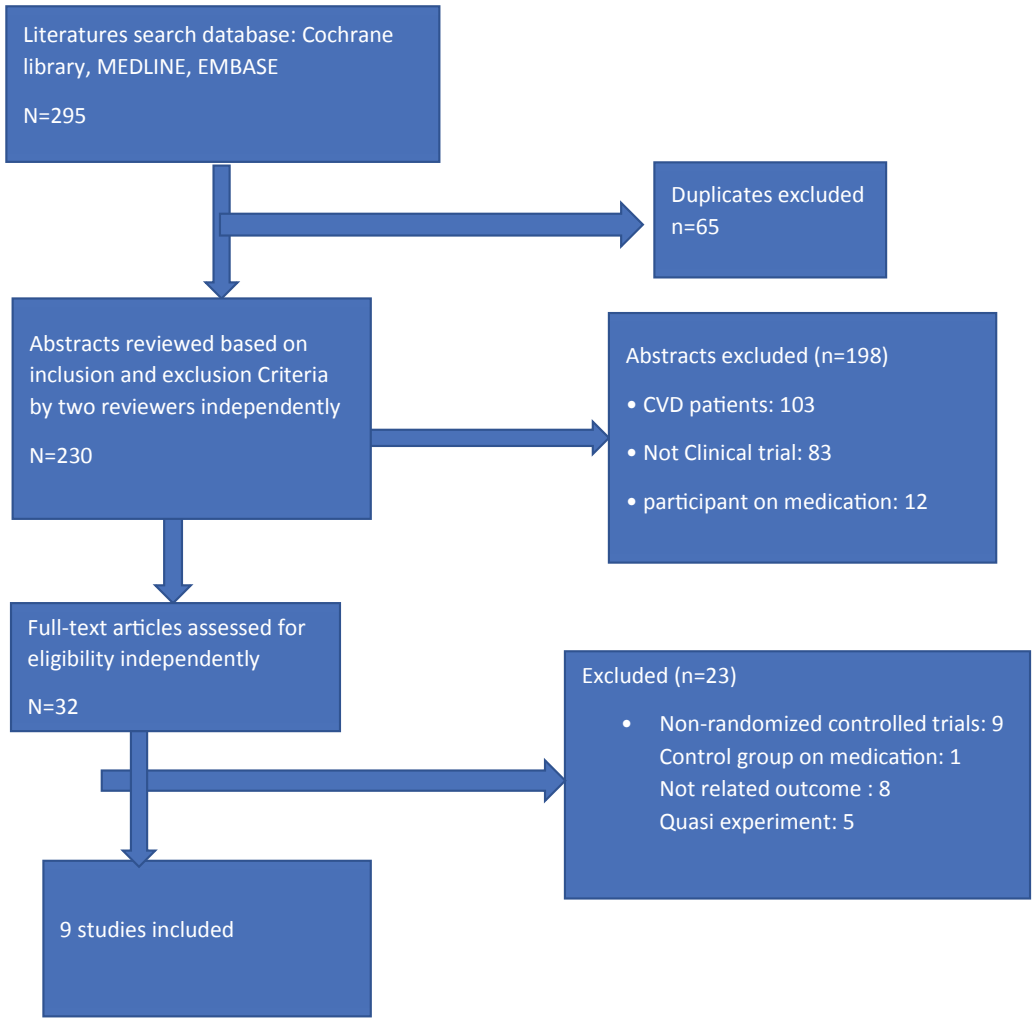

Figure 1: Study of PRISMA flow diagram.

interventions, comparison group and outcome measures for each of the nine included studies in the review are provided in the characteristics of included studies (Table 1).

Excluded studies: We present reasons for exclusion for the studies that most nearly missed the inclusion criteria in the characteristics of excluded studies (Table 2).

Trial participants: The participants of the trials were either individuals aged 30-60 years in four trials [24-28] and the remaining aged above 60 years. They were normal individuals or hypertensive individuals who were not on any treatment for hypertension [29] or obese ones or with metabolic syndrome or high risk individuals (on anti-hypertensive drug therapy and/or lipid-lowering drug therapy and/or anti-diabetes therapies).

Interventions: Details of the interventions explained in the characteristics of the included studies (Table 3). The interventions were mainly health education on life style modification including advice on diet, physical activity, weight control and tobacco cessation.

Risk of bias in included studies: We present details of risk of bias for each of the included trials in the "Risk of bias table" (Table 3) and summaries in Figure 2 and Figure 3. Overall, the studies included in this review were at some risk of bias. All studies had at least three domains with unclear risk of bias. One study was at high risk of bias for random sequence generation and other study with allocation concealment [30] respectively.

Random sequence generation (selection bias): The generation of random sequence was adequate in four studies [31] unclear in four studies and inadequate in one study (randomization by calendar date).

Allocation concealment (selection bias): Allocation concealment was adequate in four studies, unclear in three studies and inadequate in two studies.

Blinding (performance bias): Two trials masked outcome assessors to the treatment allocation (low risk) (and one trial didn't (high risk). The risk was unclear in the remaining six studies.

Incomplete outcome data (attrition bias): Attrition bias was of low risk in five trials, unclear risk in three studies and high risk in one study.

Selective reporting (reporting bias): Selective reporting bias was of low risk in seven studies unclear risk in one study and high risk in one study.

Outcome	Mean difference/OR	CI	Number of participants	Quality of evidence (GRADE)
Cardiovascular events	Not reported	Not reported	Not reported	Not reported
Systolic BP	MD=1.15	-1.07, 3.37	3851	Low
Diastolic BP	MD=0.15	-0.11, 0.41	3088	Low
BMI	MD=-0.05	-0.18, 0.07	2969	Moderate
Weight	MD=0.93	-3.39, 5.78	1435	Very low
Waist circumference	MD=-0.72	-1.59, 0.14	1126	Moderate
Fasting blood sugar	MD=19.12	-27.4, 65.65	428	Very low
HDL-C	MD=0.76	-1.13, 2.65	573	Low
Triglyceride	MD=-6.34	-18.79, 6.11	341	Low
Smoking cessation	OR=0.79	0.53, 1.16	2166	Moderate

Table 1: Summary of main results.

No	Study ID	Journal	Method	Setting	Participants	Intervention	Outcome	Notes
1	Dietary and physical activity counseling in high-risk asymptomatic patients with metabolic syndrome - A primary care intervention.	Journal of Food, Agriculture & Environment, Vol.9 (3&4), July-October 2011.	Randomized controlled 18 months trial.		253 high risk individuals (on anti-hypertensive drug therapy and/or lipid-lowering drug therapy and/or anti-diabetes therapies) under 80 years, without a history of coronary or other atherosclerotic disease intervention group (n=133) and control (n=120)	A total of approximately 90 min intervention contacts in 3 consecutive visits (every 6 months) (for 18 months) to GP offices, consisting in lifestyle habits in relation to diet, weight control and physical activity.	After 18 months of intervention, the patients in the Group I significantly reduced anthropometric measurements, fat (p=0.001), carbohydrate (p=0.054) and total caloric intake (p=0.009) and increased physical activity level compared to the controls (p=0.042).	
2	The effect of community-based health management on the health of the elderly: a randomized controlled trial from China.	BMC Health Services Research 2012; 12:449.	Randomized parallel controlled trial	Nanjing Community Health center.	2400 participants aged 60 years and more were randomly allocated 1:1 into management (1163) and control groups (1198).	education/ skills training on health self-management, telephone consultation, lectures on health, and distribution of health promoting materials.	Changes in CVD risk factors (blood pressure, lipid levels, diabetes, and obesity).	The study had obtained the approval of the Medical Ethics Committee of Southeast University.
3	Pragmatic randomized trial of home visits by a nurse to elderly people with hypertension in Mexico.	International Journal of Epidemiology 2001;30 (6):1485–91. [PUBMED: 11821367]	Randomized controlled trial		Subjects were 683 people with hypertension aged ≥60 years, who were residents of Mexico City and were registered with the Family Medicine Clinics of the Mexican Institute of Social Security (IMSS), control 338	Intervention group was offered nurse visits over 6 months with blood pressure checks and negotiated lifestyle changes.	Nurse home visits are effective in reducing blood pressure in hypertensive patients aged ≥60 years.	
4	A Randomized Controlled Trial to Assess Pharmacist Physician Collaborative Practice in the Management of Metabolic Syndrome in a University Medical Clinic in Jordan	J Manag Care Pharm. 2011;17(4):295-303	Randomized controlled clinical trial.		patients met the NCEP/ATP III criteria for metabolic syndrome Patients were randomized into 2 groups, with 110 in the intervention group and 89 in usual care (physician only)	Pharmaceutical care counseling conducted over 9 months in 6 family medicine clinics involving 13 physicians at Jordan University Hospital	Improvements in BP and triglycerides but did not have a significant effect on body weight, waist circumference, high-density lipoprotein cholesterol, or fasting blood sugar. Com	Study period: from March 15, 2009, through May 10, 2009.

5	Beneficial effects of strategies for primary prevention of diabetes on cardiovascular risk factors: results of the Indian Diabetes Prevention Program.	Diabetes & Vascular Disease Research 5(1):25-9 · March 2008	Randomised controlled trial		In the IDPP, 531 subjects (421 male and 110 female) aged 35–55 years were recruiter	advice on LSM (life style modification) a median follow-up period of 30 months,	Beneficial effects on the atherogenic phenotype of lipids but had no influence on blood pressure.	The study protocol was approved by the ethics committee of the institution. Informed consent was obtained from all subjects.
6	Beneficial effects of short-term nutritional counselling at the primary health-care level among Brazilian adults	Public Health Nutrition: 8(7), 820–825, 2005	Randomized controlled trial	Primary health-care centre in Sa˜o Jose´ do Rio Preto, Sa˜o Paulo State, Brazil.	104 adults (83 women and 21 men aged 30–65 years, body mass index 24–35 kg m , non-diabetic) into two groups: nutritional counselling (n=53) and control (n=51	Nutritional counselling	After 6 months of follow-up, body weight, waist circumference, diastolic blood pressure, fasting blood glucose, total and low-density lipoprotein cholesterol, total and saturated fat, and dietary energy and cholesterol levels showed a more significant decrease among subjects in the intervention group than in the control group (p=0.05)	
7	Cardiovascular risk management and its impact on hypertension control in primary care in low-resource settings: a cluster-randomized trial	Bull World Health Organ. 2010 Jun 1; 88(6): 412–419.	Cluster randomized controlled clinical trial		Intervention=1114, control=1042 Males and females 30–70 years of age with systolic blood pressure between 140 and 179 mmHg were selected for the study if they were not on treatment for hypertension and did not have any exclusion factor	WHO CVD risk management package. Counselling on cessation of tobacco use	atfter 12 months more than half of patients still had uncontrolled hypertension. Behavioural risk factors had improved among intervention in patients in Nigeria but not in China.	
8	Effectiveness of an Health intervention to improve the cardiometabolic profile of people with prehypertension in low-resource urban settings in Latin America: a randomised controlled trial	The Lancet Diabetes & Endocrinology · December 2015 DOI: 10.1016/S2213-8587(15)00381-2	randomised controlled trial.		individuals (aged 30–60 years) with systolic blood pressure between 120 and 139 mm Hg, diastolic blood pressure between 80 and 89 mm Hg, or both from health-care centres, workplaces, and community centres in low-resource urban settings in Argentina, Guatemala, and Peru.	either monthly motivational counselling calls and weekly personalised text messages to their mobile phones about diet quality and physical activity for 12 months, (n=316) or usual care(n=321)	The intervention did not affect change in systolic blood pressure or diastolic blood pressure compared with usual care	
9	Cardiometabolic risk reduction through lifestyle intervention programs in the Brazilian public health system	Diabetology & Metabolic Syndrome 2013, 5:21	Randomized controlled trial		Intervention=83, control=97 aged 18 and 79 years and the presence of prediabetic conditions and/or metabolic syndrome without diabetes.	9-month lifestyle intervention programs Intensive health education	Minimize cardiometabolic risk factors involved in the progression to type 2 diabetes and/or cardiovascular disease	

Table 2: Characteristics of included studies [ordered by study ID].

No	Bias											
	Random sequence generation (selection bias)		Allocation concealment (selection bias)		Blinding of outcome (detection bias)		Incomplete outcome data (attrition bias)		Selective reporting (reporting bias)		Other bias	
	Authors' judgement	Support for judgement	Authors' judgement	Support for judgement	Authors' judgement	Support for judgement	Authors' judgement	Support for judgement	Authors' judgement	Support for judgement	Authors' judgement	Support for judgement
1	High risk	Randomization by calendar date	High risk	Allocation not concealed	Low risk	Quote: "The staff members who scheduled the study visits and those who performed the measurements were blind to randomization"	Unclear risk	Insufficient information to judge	Unclear risk	Insufficient information to judge	Unclear risk	Insufficient information to judge
2	Low risk	A list of random numbers using a random numbers table	Low risk	the randomization schedule was concealed from community health service center staff until allocation	Unclear risk	Insufficient information to judge.	Low risk	Both dropout rates were not of statistical significance (p>0.05). The main reasons for dropping out were determined: moving, travelling, withdrawing and death.	Low risk	Primary and secondary outcome were clearly stated and reported.	Unclear risk	Insufficient information to judge.
3	Low risk	Randomization was carried out by computer.	Low risk	Randomization was concealed until screening and recruitment were complete	Unclear risk	Insufficient information to judge.	Low risk	The main reasons for dropping out were clear	Low risk	Primary and secondary outcome was stated and reported.	Unclear	Insufficient information to judge.
4	Low risk	Patients were randomized using a coin-toss method.	Unclear risk	Insufficient information to judge	Unclear risk	Insufficient information to judge.	Low risk	The reason for drop out was clear and missing data was balanced between both groups	Unclear risk	Insufficient information to judge.	Unclear risk	Insufficient information to judge.
5	Unclear risk	Insufficient information to judge	Unclear	Insufficient information to judge	Low risk	The ECG records were read by a cardiologist who was blinded to the study protocol	Unclear risk	Insufficient information to judge.	Low risk	Primary and secondary outcome were well defined and stated.		
6	High risk	All participants were blinded to treatment assignment for the duration of the study. However, the staff members involved in the intervention wer aware of the group assignment.	Unclear risk	Insufficient information to judge			Low risk	The drop out rate was 20%. However there were no statistical differences between participants who attended all the evaluations and those lost to follow up	Low risk	Primary and secondary outcomes were clearly stated and definded		
7	Unclear risk	Insufficient information to judge	Unclear risk	Insufficient information to judge	Unclear risk	Insufficient information to judge	Unclear risk	Insufficient information to judge	Low risk	Primary and secondary were well stated and defined	Unclear risk	Insufficient information to judge

8	Low risk	biased-coin minimisation method was used	Low risk	sonnel assessing the outcomes and data managers by generating lists of participants with masked code numbers. Electronic logs were used to monitor allocation concealment.	Unclear risk	Insufficient information to judge	Unclear risk	Insufficient information to judge	Low risk	Primary and secondary outcome well defined		
9	Unclear	Insufficient information to judge	Unclear	Insufficient information to judge	Unclear	Insufficient information to judge	Low risk	Causes for loss follow up are explained and individuals are equally distributed between both groups	Low risk	Primary and secondary outcome are well defined and		

Table 3: Risk of bias among studied trials.

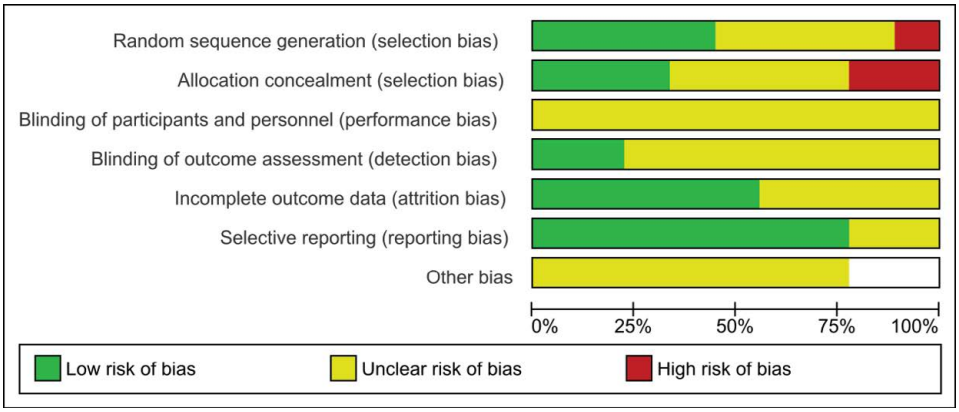

Figure 2: Risk of bias graph: Authors' judgment of risk of bias percentages along included studies.

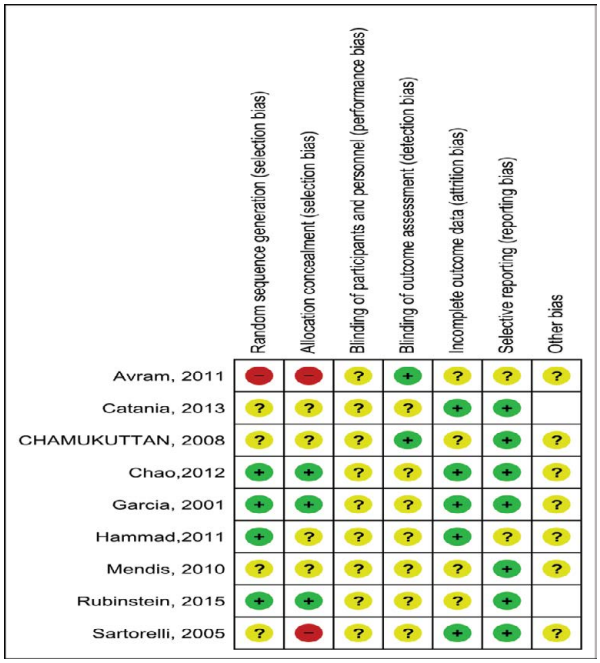

Figure 3: Risk of bias summary according to authors judgment along included studies.

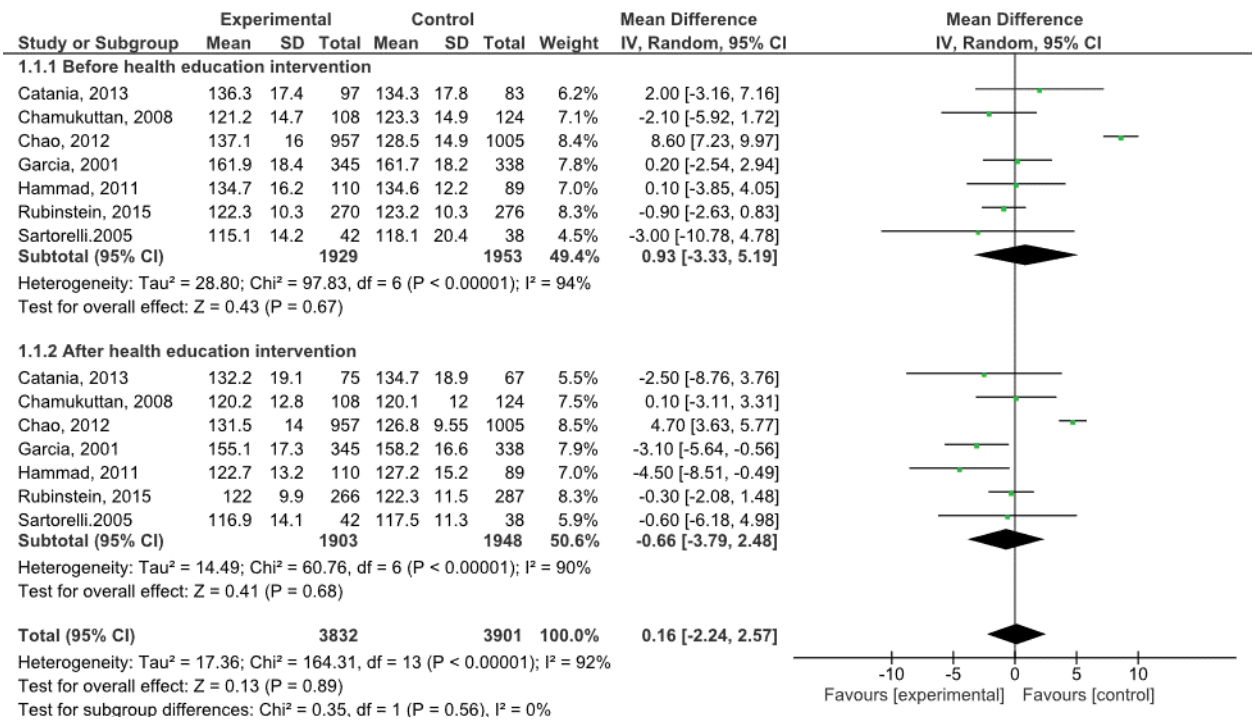

Figure 4: Forest plot for comparison of systolic blood pressure among included studies.

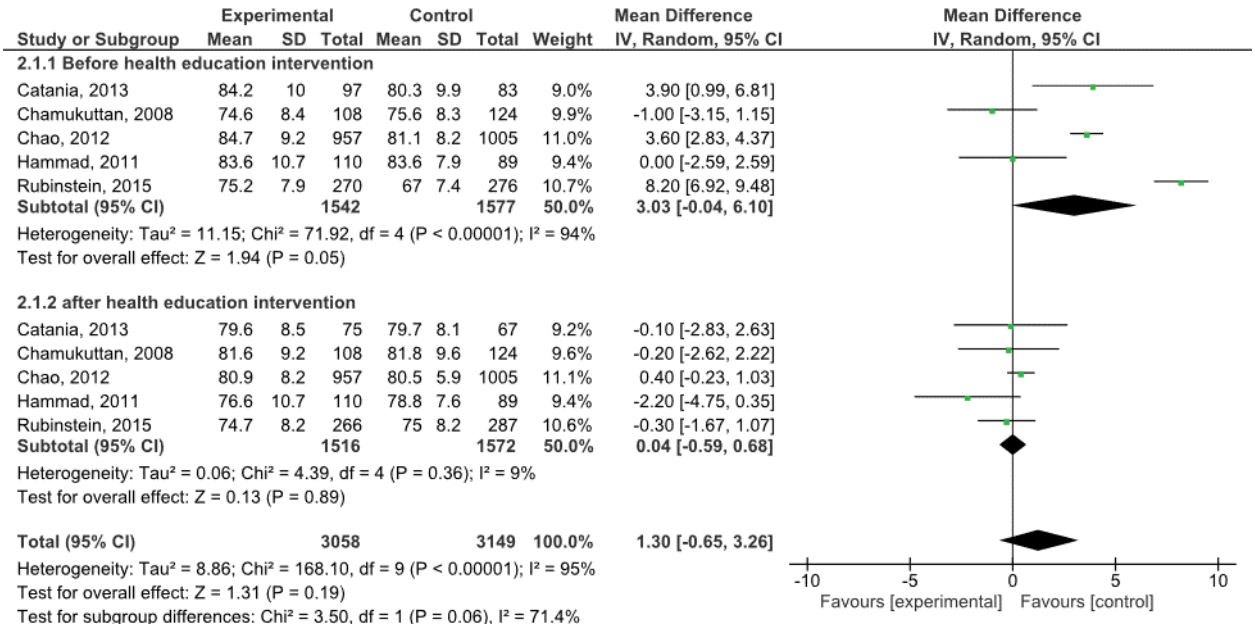

Figure 5: Forest plot for comparison of diastolic blood pressure among included studies.

Other potential source of bias

There was insufficient information to judge about other risk of bias.

1. Effects of interventions
2. Outcome measures

Changes in CVDs risk factors

Systolic blood pressure: Systolic blood pressure was reported in 7 studies with 3851 participants randomized. The pooled effect (Figure 4) showed no statistically significant difference of systolic blood pressure before and after health education interventions (Mean difference=0.16, 95% CI=-2.24, 2.57) with evidence of statistically

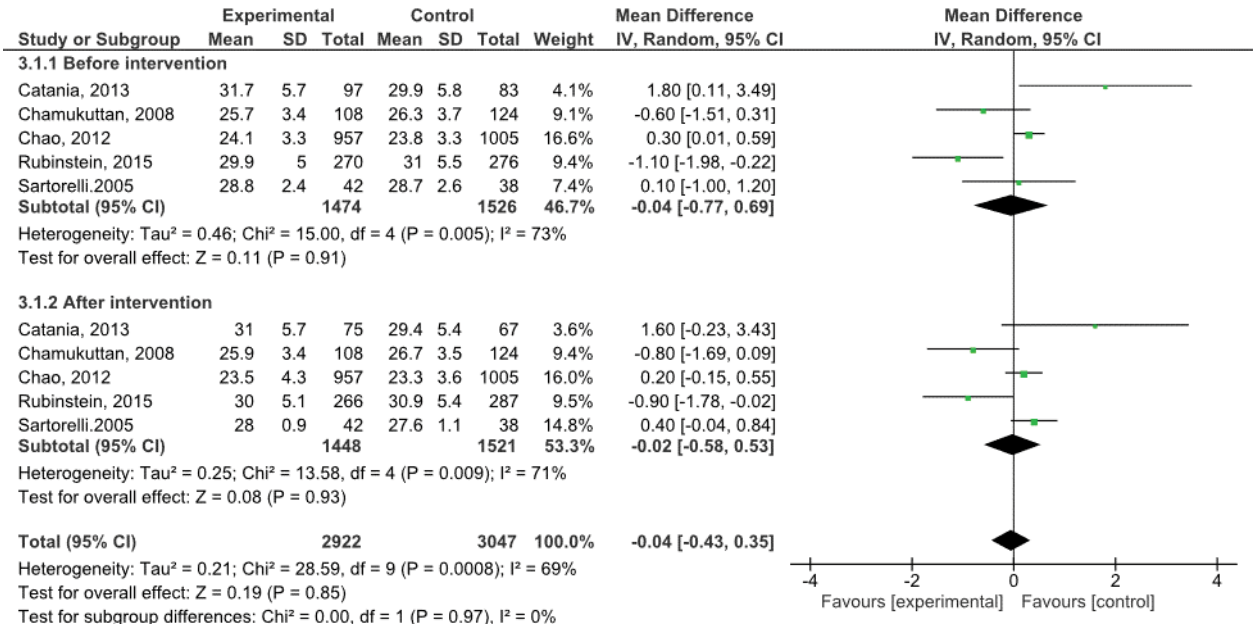

Figure 6: Forest plot for comparison of body mass index (BMI) among included studies.

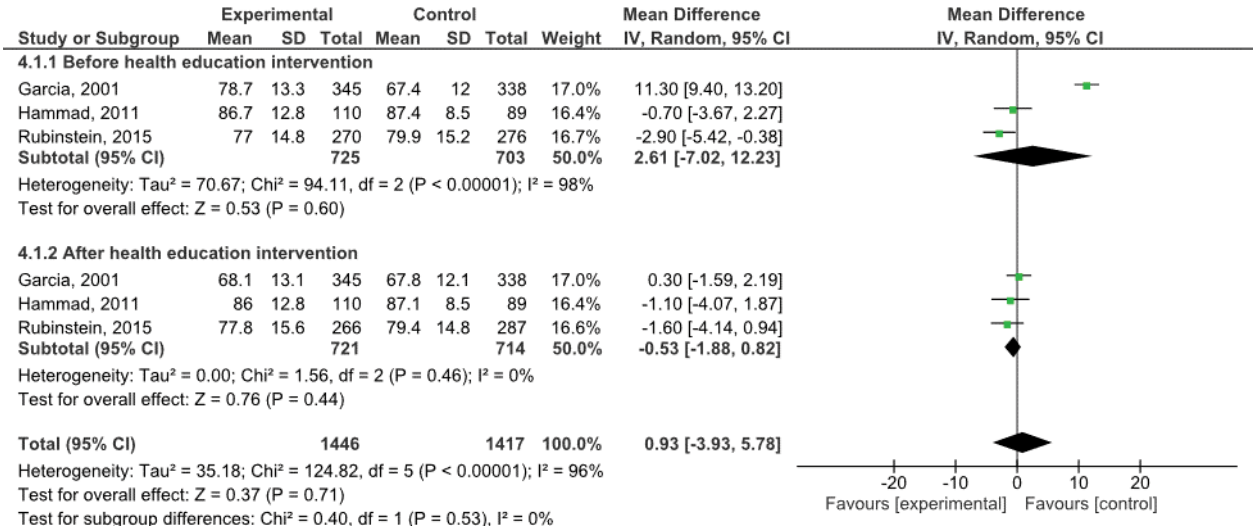

Figure 7: Forest plot for comparison of weight before and after health education intervention.

significant considerable heterogeneity (I^2=92%, P=0.00001). Tests for funnel plot asymmetry was not used because the included studies in the meta-analysis was less than 10 studies [32].

Diastolic Blood Pressure (DBP): Similarly, diastolic blood pressure was reported in 5 studies with randomized 3088 participants. The pooled effect (Figure 5) showed no statistically significant difference of DBP among studied participants after health education interventions (MD=1.30, 95 % CI=-0.65, 3.26) with evidence of statistically significant considerable heterogeneity (I^2=95%, p=0.00001).

Body Mass Index (BMI)

Body mass index was reported in 5 studies among 2969 participants. The pooled effect (Figure 6) revealed no statistically significant change in BMI after health education interventions (MD=-0.04 95% CI=- 0.43, 0.35) with evidence of statistically significant substantial between-trial heterogeneity (I^2=69%, p=0.0008). However, Mendis et al. [26] recorded the mean change of BMI in two regions and they recorded a statically significant reduction in BMI after 12 months of follow up in Nigeria region (MD=-0.22 ± 1.56 in intervention group compared to MD=0.92 ± 1.28 in control ones, p=0.0001). But they recorded no statistically significant reduction in BMI in the second studied region (China).

Weight

Weight was recorded in 3 studies with 1435 participants (Figure 7). No statistically significant reduction in weight was reported among participants after health education interventions (MD=0.93, 95% CI=-3.93, 5.78, I2=96%, p=0.00001). However, Satrorelli recorded a statistically significant difference between intervention and control

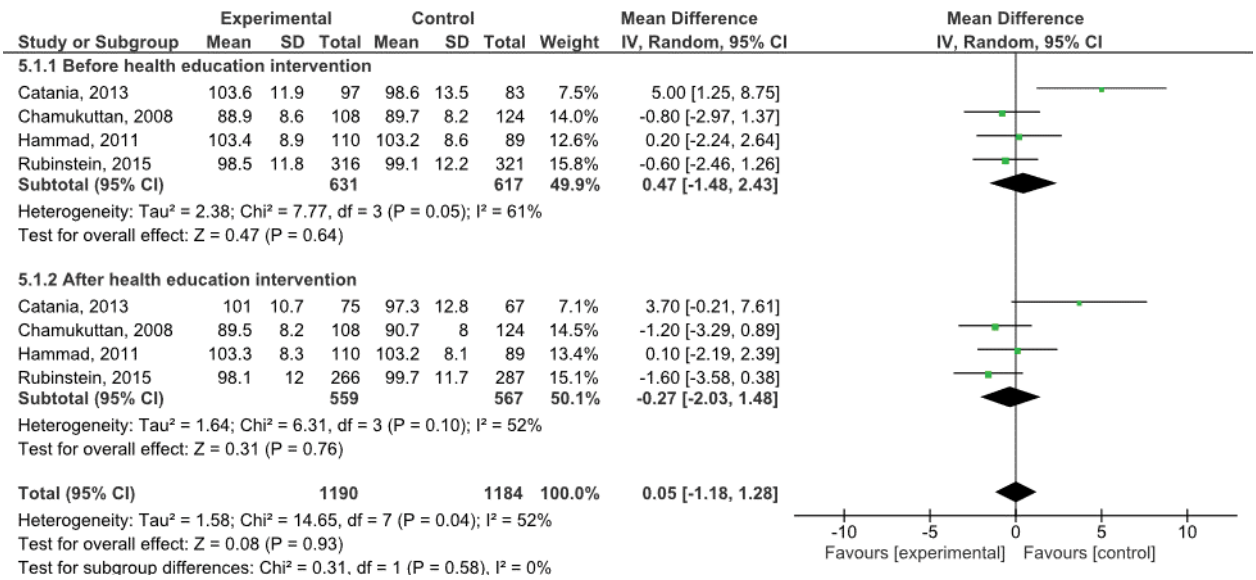

Figure 8: Forest plot for comparison of waist circumference in subgroup analysis.

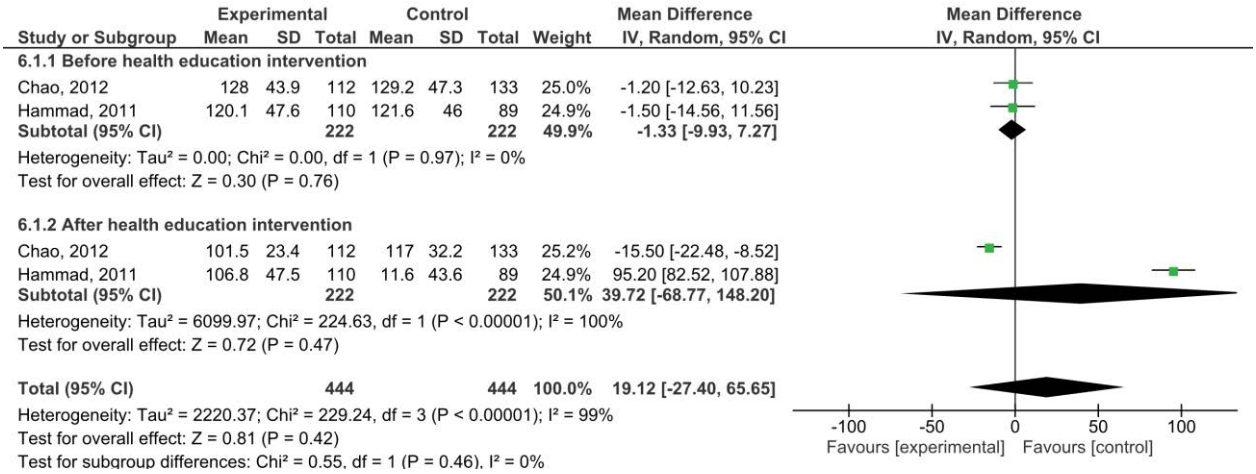

Figure 9: Forest plot for comparison of Fasting blood sugar before and after health education interventions.

groups regarding body weight after 12 months of health education interventions (MD=-2.3 ± 3.3, CI=-3.4, -1.3 in intervention group compared to MD=-0.3 ± 2.9, CI=-1.4, 0.8 in control one, p=0.001).

Waist circumference

Waist circumference was compared before and after health education interventions in subgroup analysis in four studies with 1126 participants (Figure 8). No statistically significant reduction was recorded in waist circumference before and after health education interventions (MD=-0.05, 95% CI=-1.18, 1.28 with I2=52 %, P=0.04).

Fasting blood sugar was evaluated in two studies with 428 participants. No statistically significant reduction in the mean fasting blood sugar was detected after health education interventions (MD=19.12, CI=-27.40, 65.65 I2=99%, P<00001). However, the analysis showed some imprecision with wide CI as the analysis included only two trials (Figure 9).

High density lipoprotein-cholesterol (HDL-C)

High density lipoprotein-cholesterol was evaluated in three studies) with 573 participants. No statistically significant change was recorded in HDL-C among studied participants after health education interventions (MD=0.70, 95% CI=-0.86, 2.25, I2=77%, P=0.0006) (Figure 10).

Triglyceride

The mean triglyceride before and after health education interventions was evaluated among 341 participants in two studies (Figure 11). No statistically significant change in the mean triglyceride was detected after health education interventions (MD=-11.72, 95% CI=-24.84, 1.40, I2=26%, P=0.26). The wide CI may be explained by the few numbers of participants included in the analysis.

Changes in knowledge, attitude and practice

Changes in Knowledge, attitude and practice after health education interventions regarding eating habits and physical activity were

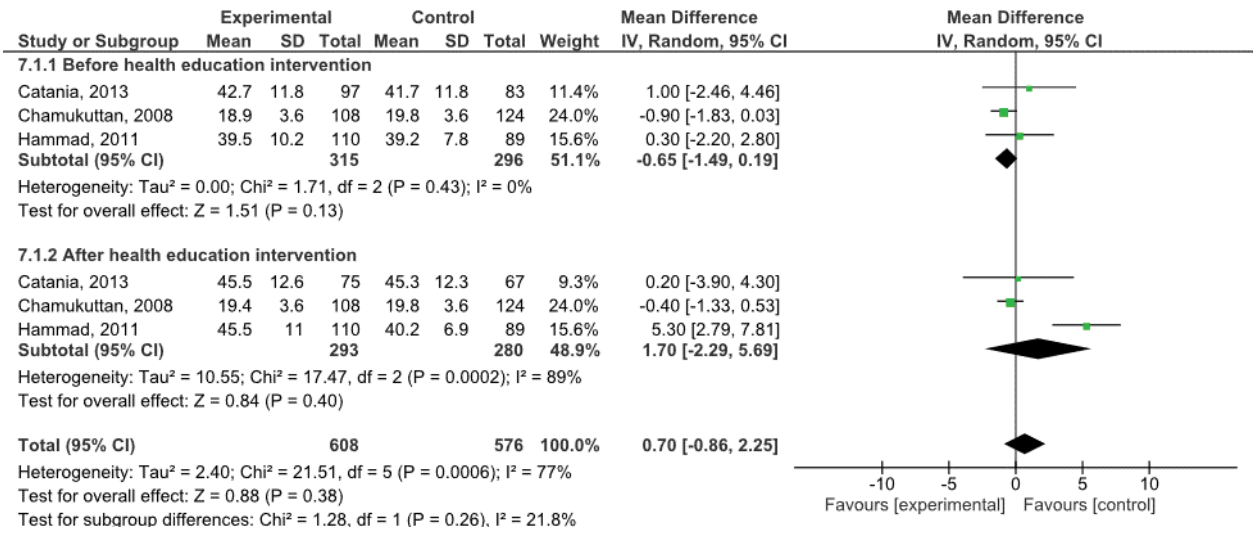

Figure 10: Forest plot for comparison of high-density lipoprotein before and after health education interventions.

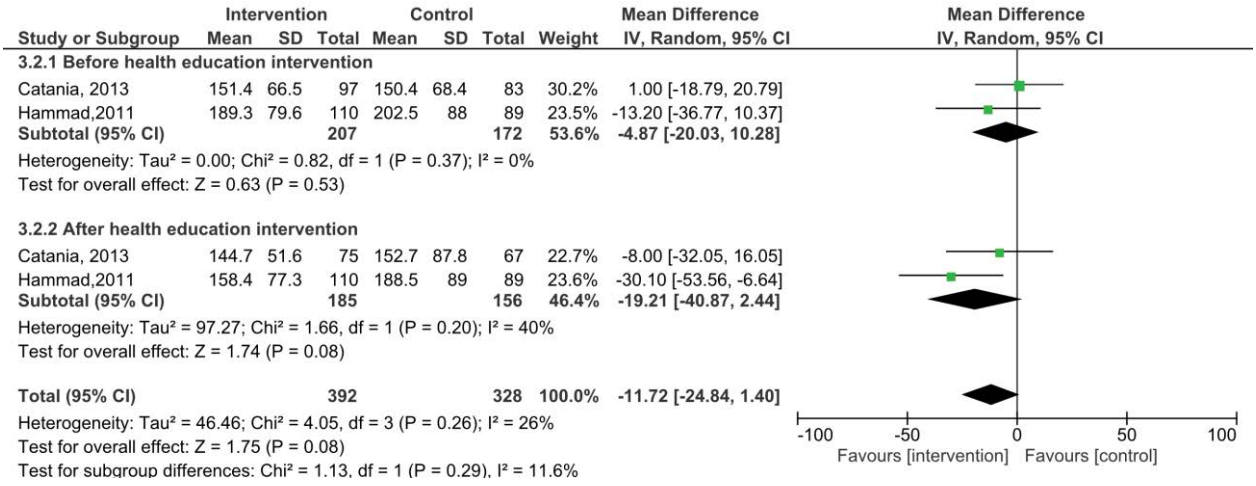

Figure 11: Forest plot for comparison of the mean triglyceride before and after health education interventions.

studied in only one study among 253 participants (133 intervention and 120 control). A statistically significant difference was recorded between intervention and control groups regarding reduced caloric intake, reduced fat intake, and increased physical activity after health education interventions (P<0.05). However, no statistically significant difference was recorded between the two groups regarding reduced salt intake, sugar intake, increased fresh fruits and vegetables, nor reduced alcohol consumption.

Smoking cessation

Smoking cessation was reported in one trial with 2166 participants in two regions. The pooled effect of the two regions showed a statistically significant difference after health education interventions (OR=0.79, CI=0.53, 1.16, I2=72%, p=0.01) (Figure 12).

Discussion

The summary of the main results of this review is explained in Table 2. This review studied the effectiveness of health education interventions on modifying cardiovascular risk factors. It included 6506 participants from 9 controlled randomized trials published during the last twenty years in different countries. We found that health education interventions have no statistically significant effect on Blood pressure, anthropometric measurements, blood sugar nor blood lipids. However, we found a statistically significant effect of health education interventions on changing attitude of participants regarding reduced caloric intake, reduced fat intake, increased physical activity and smoking cessation. It is important to explain that these results should be interpreted with caution because of considerable heterogeneity and imprecision due to many factors including; variation of the intervention (method of health education and duration of follow up), variation of the participants (normal, hypertensive and/ or with metabolic syndrome) and the small number of participants in analysis for measuring some outcomes.

Quality of evidence

We assessed the quality of evidence in this review using GRADE

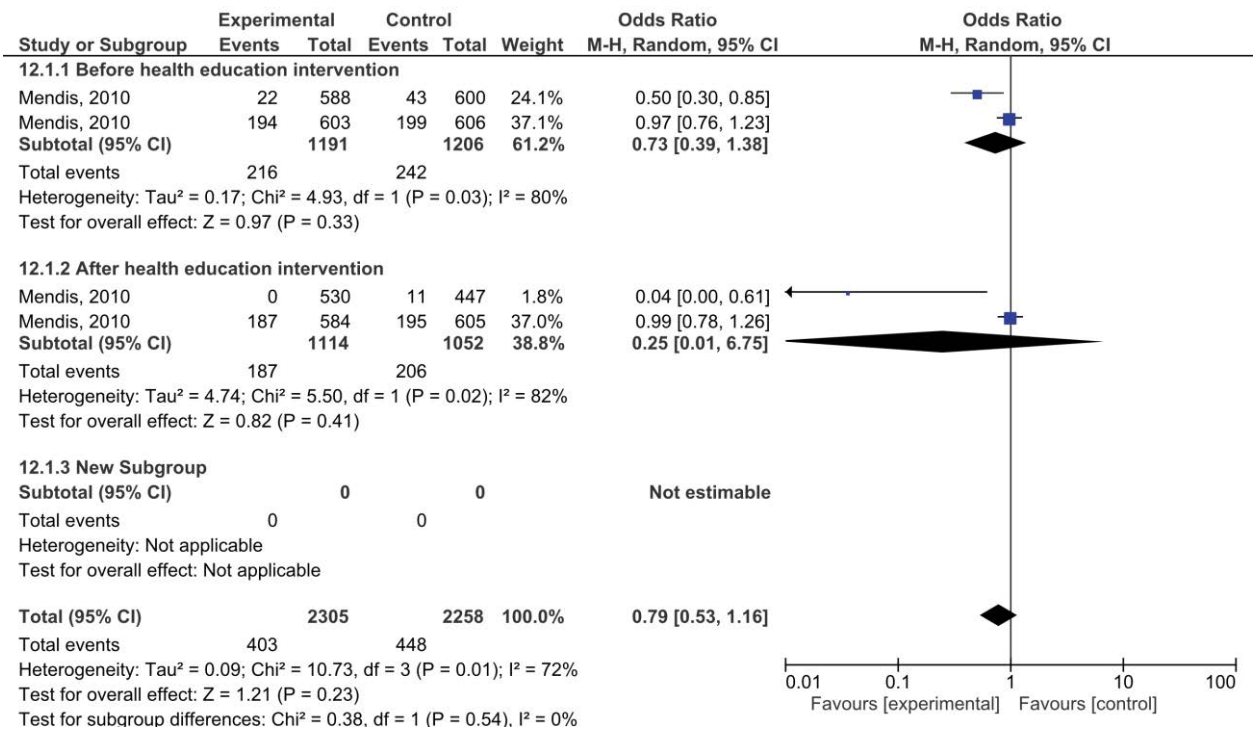

Figure 12: Forest plot for comparison of smokers before and after health education interventions.

approach. We considered the four recommended domains affecting study limitations including; risk of bias in the included studies, directness of the evidence, consistency across studies, and precision of the pooled estimate or the individual study estimates [32]. Overall the trials included in this review recorded some degree of risk of bias. Indirectness of the evidence did not represent a considerable risk in the review as all the included studies reported health education interventions. However, we detected statistically significant inconsistency in between trials in most of the analysis of the outcome variables, thus suggesting that the percentage of the variability in effect estimates is important as it is due to true heterogeneity rather than sampling error (chance). The considerable heterogeneity included in the review may be explained by differences in study participants, geographical location, methods and duration of follow-up, in addition to the variations in the methods of evaluation across the studies. Concerning the estimate effect of BMI, waist circumference and smoking cessation, we judged the quality of evidence to be moderate, indicating that further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate. We downgraded the evidence by one level due to substantial in between trials heterogeneity (I2=69%, 52% and 72% respectively). Regarding the estimate effect of SBP, DBP and HDL-C, we judged the quality of evidence to be low, indicating that further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate. We downgraded the evidence by two levels because of considerable heterogeneity among included trials (I2=92%, 95% and 77% respectively). Also, we judged the estimate effect of triglyceride to be low because of serious imprecision indicating by wide CI (-24.84, 1.40). Concerning weight and FBS we judged the quality of evidence to be very low, indicating that the estimate effect is very uncertain. We downgrade the evidence by three levels because of considerable heterogeneity (I2=96% and I2=99% respectively) and some imprecision (IC=-3.93, 5.78 and CI=-27.40, 65.65 respectively).

Agreements and disagreements with other studies or reviews

In this review we recorded no statistically significant reduction in the pooled estimate of mean blood pressure after health education interventions. This evidence agreed with Ramser et al. [32], but disagreed with Uthman et al. [33], who recorded the pooled effect to be significant reduction in systolic, diastolic blood pressure, BMI and waist circumference (MD=-6.72 mmHg, 95% CI-9.82 to -3.61, 4868 participants, MD=-4.40 mmHg, 95% CI -6.47 to -2.34, 4701 participants, MD -0.76 kg/m^2, 95% CI -1.29 to -0.22, 2984 participants and MD -3.31, 95% CI-4.77 to -1.86, I^2=55%, four trials, 393 participants respectively). Also, Baena et al. [34] found that the studies combining physical activity and diet, or behavioral counselling interventions significantly reduced systolic and diastolic blood pressure (pooled MD -6.1 mmHg, 95% CI -8.9 to-3.3 for systolic blood pressure and pooled MD=-2.4 mmHg, 95% CI -3.7 to -1.1 for diastolic blood pressure) [29]. At the same time, Carter et al. [35] recorded greater mean reduction in SBP over a 6-month follow-up among intervention group versus control one (BP was controlled in 63.9% of intervention group patients compared with 29.9% of patients in the control group). Also, McLean et al. [36] found a mean reduction of 5.4 mm Hg in SBP in intervention than control group patients after 6 months of follow-up [37]. This disagreement with our results may be explained by the variation of the participants of the trials in many factors including the baseline value of systolic and diastolic blood pressure. Also, it is evident that treatment of hypertension required to be controlled first by medication then maintained by life style modification and the effectiveness of pharmacist- physician collaboration in the treatment of hypertension is consistent with previous published studies [36]

In the current review, the pooled effect of health education interventions recorded no statistically significant effect on anthropometric measurements among the intervention group. This was in accordance with Ramachandran et al. [37] and disagreed with Wing

et al. [38], Uthman et al. [33] and Lin et al. [39]. The latter recorded -3.4 kg weight loss among the intervention group. However, the intervention in their study was more intense with in-person visits with face to face health education and daily, rather than weekly, tailored text messages for 6 months. It is also clear that the variation in the method and the period of follow up affect the outcome of anthropometric measurements as these measures required long period to detect considerable change and perhaps a longer follow up may be required to observe more reduction in weight.

Concerning lipid profile, we agreed with Uthman et al. [33] who recorded no statistically significant difference in the mean base line of blood lipids after health education intervention. In contrast, Ramser et al. [32] found that triglycerides were reduced by from 150.7 mg/dL to 107.5 mg/dL, in diabetic patients who were resistant to usual care and received a collaborative pharmacist-physician intervention. This disagreement may be explained by variation in the base line blood lipids among the participants as the included participants in the later trial were diabetic patients. Even more, lifestyle interventions in primary care proved to be more effective in improving quality of life compared to standard care. However, it may have limited impact when delivered to low risk patients [36].

Also, our results were compatible with Mendis et al. [26] who recorded significant change in participants' attitude towards reduced caloric intake and increased physical activity after health education interventions [37-41]. The positive impact of health education interventions observed in our review on smoking cessation was also supported by Uthman et al. [33] and Suissa et al. [42] who stated that increasing the intensity of the behavioral intervention was positively associated with increasing smoking abstinence. However, Fagerstrom [43] limited this impact among moderate to light smokers, which is not surprising, given the difficulty of altering smoking-cessation behavior among heavy smokers in the absence of nicotine replacement therapy.

Limitations

Limitations of this review include low or insufficient strength evidence for some outcomes across the various included studies. These low grades were driven by high or unclear risk of bias within individual studies and lack of precision among outcomes included in subgroup analysis with few trials and small number of participants with wide confidence intervals. Also, there was a considerable heterogeneity about the base line of most risk factors (blood pressure, body weight, and lipid profile) among included participants. Besides variability of the method and duration of intervention.

Conclusion

We can conclude that health education interventions could be effective in altering attitude of people toward consumption of healthy diet, performing physical activity and smoking cessation but not effective in reducing body weight, blood pressure, blood sugar or blood lipids. However, the evidence comes from studies at some risk of bias and there was statistical significant variation between the results of the studies.

References

1. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, et al. (2010) A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: A systematic analysis for the Global Burden of Disease Study 2010. Lancet 380: 2224-2260.
2. Ezzati M, Riboli E (2013) Behavioral and dietary risk factors for non-communicable diseases. N Engl J Med 369: 954-964.
3. Hunter DJ, Reddy KS (2013) Non-communicable diseases. N Engl J Med 369: 1336-1343.
4. WHO (2018) Non-communicable diseases. Geneva.
5. Loubeyre, M, Claude M, Thierry Le, Piéchaud JF, Louvard Y, et al. (2002) A randomized comparison of direct stenting with conventional stent implantation in selected patients with acute myocardial infarction. J Am Coll Cardiol 39: 15-21.
6. Blaxter M (1987) Evidence on inequality in health from a national survey. Lancet 2: 30-33.
7. Haan M, Kalan G, Camacho T (1987) Poverty and health: prospective evidence from the Alameda Country Study. Am J Epidemiol 125: 989-998.
8. Mattthews KA, Kelsey SF, Meilahn EN, Kuller LH, Wing RR (1989) Educational attainment and behavioral and biological risk factors for coronary heart diseases in middle aged women. Am J Epidemiol 129: 1132-1144.
9. Mueller CW, Parcel TL (1981) Measures of socioeconomic status: Alternatives and reccommendations. Chil Dev 52: 13-20.
10. Hollingshead AB (1971) The indiscriminate state of social class measurement. Soc Forces 49: 563-567.
11. Duncan OD (2018) A socioeconomic index for all occupations. New York: The Free Press of Glencoe.
12. Liberatos P, Link BG, Kelsey JL (1988) The measurement of social class in epidemiology. Epidemiol Rev 10: 87-121.
13. Institute of Medicine (2004) Health literacy: A prescription to end confusion. Washington. DC: National Academics Press.
14. Rodriguez A, Bernardi V, Fernandez M, Mauvecín C, Ayala F, et al. (1998) In-hospital and late results of coronary stents versus conventional balloon angioplasty in acute myocardial infarction (GRAMI trial). Am J Cardiol 81: 1286-1291.
15. Neumann FJ, Blasini R, Schmitt C, Alt E, Dirschinger J, et al. (1998) Effect of glycoprotein IIb/IIIa receptor blockade on recovery of coronary flow and left ventricular function after the placement of coronary-artery stents in acute myocardial infarction. Circulation 98: 2695-2701.
16. Krumholz HM, Parent EM, Tu N, Vaccarino V, Wang Y, et al. (1997) Readmission after hospitalization for congestive heart failure among Medicare beneficiaries. Arch Intern Med 157:99-104.
17. Rich MW, Beckham V, Wittenberg C, Leven CL, Freedland KE, et al. (1995) A multidisciplinary intervention to prevent the readmission of elderly patients with congestive heart failure. N Engl J Med 333: 1190-1195.
18. Davey Smith G, Bracha Y, Svendsen KH, Neaton JD, Haffner SM, et al. (2005) Incidence of type 2 diabetes in the randomized multiple risk factor intervention trial. Ann Intern Med 142: 313-322.
19. Kornitzer M, Rose G (1985) WHO European collaborative trial of multifactorial prevention of coronary heart disease. Prevent Med 14: 272-278.
20. Sarraf-Zadegan N, Sadri G, Malek Afzali H, Baghaei M, Mohammadi Fard N, et al. (2003) Isfahan healthy heart programme: A comprehensive integrated community based programme for cardiovascular disease prevention and control. Design, methods and initial experience. Acta Cardiol 58: 309-320.
21. Jeemon P, Prabhakaran D, Goenka S, Ramakrishnan L, Padmanabhan S, et al. (2012) Impact of comprehensive cardiovascular risk reduction programme on risk factor clustering associated with elevated blood pressure in an Indian industrial population. Indian J Med Res 135: 485-493.
22. Ebrahim S, Taylor F, Ward K, Beswick A, Burke M, et al. (2011) Multiple risk factor interventions for primary prevention of coronary heart disease. Cochrane Database Syst Rev. 1: CD001561.
23. Higgins JPT, Green S (2011) Cochrane handbook for systematic reviews of interventions. The Cochrane Collaboration.
24. Snehalatha C, Mary S, Joshi VV, Ramachandran A (2008) Beneficial effects of strategies for primary prevention of diabetes on cardiovascular risk factors: Results of the Indian Diabetes Prevention Program. Diab Vasc Dis Res 5: 25-29.
25. Sartorelli DS, Sciarra EC, Franci JL and Cardosol MA (2005) Beneficial effects of short-term nutritional counselling at the primary health-care level among Brazilian adults. Public Health Nutr 8: 820-825.

26. Mendis S, Johnston SC, Fan W, Oladapo O, Cameron A, et al. (2010) Cardiovascular risk management and its impact on hypertension control in primary care in low-resource settings: A cluster-randomized trial. Bull World Health Organ 88: 412-419.

27. Rubinstein A, Beratarrechea A, Miranda JJ, Canseco FD (2015) Effectiveness of a Health intervention to improve the cardiometabolic profile of people with pre hypertension in low-resource urban settings in Latin America: A randomized controlled trial. Lancet Diabetes Endocrinol 4: 52-63.

28. Catania AS, Cezaretto A, DeBarros CR, Salvador EP, Santos TC, et al. (2013) Cardiometabolic risk reduction through lifestyle intervention programs in the Brazilian public health system. Diabetol Metab Syndr 5:21.

29. Hammad EA, Yasein N, Tahaineh L, Albsoul-Younes AM (2011) A randomized controlled trial to assess pharmacist physician collaborative practice in the management of metabolic syndrome in a university medical clinic in Jordan. J Manag Care Pharm 17: 295-303.

30. Chao J, Wang Y, Xu H, Yu Q, Jiang L, et al. (2012) The effect of community-based health management on the health of the elderly: A randomized controlled trial from China. BMC Health Serv Res 12: 449.

31. Garcia-Peña C, Thorogood M, Armstrong B, Reyes-Frausto S, Muñoz O (2001) Pragmatic randomized trial of home visits by a nurse to elderly people with hypertension in Mexico. Int J Epidemiol 30: 1485-1491.

32. Ramser KL, Sprabery LR, George CM, Hamann GL, Vallejo VA, et al. (2008) Physician-pharmacist collaboration in the management of patients with diabetes resistant to usual care. Diabetes Spectrum 21: 209-214.

33. Uthman OA, Hartley L, Rees K, Taylor F, Ebrahim S, et al. (2015) Multiple risk factor interventions for primary prevention of cardiovascular disease in low- and middle-income countries. Cochrane Database Syst Rev 4: CD011163.

34. Baena CP, Olandoski M, Younge JO, Buitrago-Lopez A, Darweesh SK, et al. (2014) Effects of lifestyle-related interventions on blood pressure in low and middle-income countries: systematic review and meta-analysis. J Hypertens 32: 961-973.

35. Carter BL, Ardery G, Dawson JD, James PA, Bergus GR, et al. (2009) Physician and pharmacist collaboration to improve blood pressure control. Arch Intern Med 169: 1996-2002.

36. McLean DL, McAlister FA, Johnson JA, King KM, Makowsky MJ, et al. (2008) A randomized trial of the effect of community pharmacist and nurse care on improving blood pressure management in patients with diabetes mellitus: Study of cardiovascular risk intervention by pharmacists-hypertension (SCRIP-HTN). Arch Intern Med 168: 2355-2361.

37. Ramachandran A, Snehalatha C, Mary S, Mukesh B, Bhaskar AD, et al. (2006) The Indian Diabetes Prevention Programme shows that lifestyle modification and metformin prevent type 2 diabetes in Asian Indian subjects with impaired glucose tolerance (IDPP-1). Diabetologia 49: 289-297.

38. Wing RR, Venditti E, Jakicic JM, Polley BA, Lang W (1998) Lifestyle intervention in overweight individual with a family history of diabetes. Diabetes Care 21: 350-359.

39. Lin M, Mahmooth Z, Dedhia N, Frutchey R, Mercado CE, et al. (2015) Tailored, interactive text messages for enhancing weight loss among African American adults: The TRIMM randomized controlled trial. Am J Med 128: 896-904.

40. Eriksson MK, Hagberg L, Lindholm L, Malmgren-Olsson EB, Osterlind J, et al. (2010) Quality of life and cost- effectiveness of a 3-year trial of lifestyle intervention in primary health care. Arch Intern Med 170: 1470-1479.

41. Fleming P, Godwin M (2008) Lifestyle interventions in primary care systematic review of randomized controlled trials. Can Fam Physician 54: 1706-1713.

42. Suissa K, Larivière J, Eisenberg MJ, Eberg M, Gore GC, et al. (2017) Efficacy and safety of smoking cessation interventions in patients with cardiovascular disease: A network meta-analysis of randomized controlled trials. Circ Cardiovasc Qual Outcomes 10: e002458.

43. Fagerstrom KO (1991) Towards better diagnoses and more individual treatment of tobacco dependence. Br J Addict 86: 543-547.