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Lifestyle Modification Program for Cardiovascular Risk Patients in Indonesia

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Abstract

BACKGROUND: Unhealthy lifestyle leads to an increased risk of contracting cardiovascular disease (CVD), and there is no standard program yet applied for the people who are at high risk for CVD, since the focus is on curative care service, thus the allocation and focus for preventive area are relatively low.

AIM: This study aimed to determine the effectiveness of the LIFESTYLE modification program developed by the researcher. The program was designed in response to the needs of Indonesian patients. LIFESTYLE is an acronym for L-ose weight, I-dentify your risk, F-ood choice, E-xercise frequently, S-top smoking and alcohol, T-hink positive, Y-es to a healthy lifestyle, L-et's control regularly, and E-veryone is supporting you.

MATERIALS AND METHODS: This study employed the quasi-experimental design, specifically pretest-posttest method along with time series. Fifty-eight participants were purposively chosen and given a 12-week LIFESTYLE modification program in a community health center called Puskesmas in Indonesia. CVD risk and physiological parameters such as blood pressure, waist circumference, total blood cholesterol, and body mass index were observed before, during, and after the intervention. CVD risk was estimated using Framingham 10-year CVD risk score of non-laboratory-based test.

RESULTS: The mean for CVD risk and physiological parameters decreased after the participants underwent the LIFESTYLE modification program. The analysis of variance revealed that there was a significant difference in the participants' systolic blood pressure and total cholesterol ($p < 0.001$) before, during, and after the intervention.

CONCLUSION: The 12-week LIFESTYLE modification program is effective in increasing knowledge of cardiovascular risk and observing a healthy lifestyle. Furthermore, this program facilitates early identification of risks for CVD and improves selected physiological parameters.

Introduction

Globally, cardiovascular disease (CVD) is the leading cause of death with approximately 17.5 million people dying each year, accounting for an estimated 31% of all deaths worldwide [1]. Moreover, the World Health Organization (WHO) stated that "many of these people have been exposed to unhealthy behaviors including tobacco use, eating foods containing too much salt," and sedentary lifestyle. These poor lifestyle behaviors and lifestyle-related risk factors may increase the risk of CVD, stroke, and death worldwide.

Early detection and treatment of individuals for CVD risk are an essential strategy in preventing or delaying CVD incidents. It is expected that primary prevention in terms of risk assessment is needed to detect accurately the symptoms of the disease and determine early the necessary interventions. CVD risk assessment is applied to identify individuals who are more likely to develop CVD and, therefore, to receive more intensive interventions as soon as possible. Several tools have been developed for risk estimation, most of which are derived from the Framingham study. Majority of the risk assessment tools are applied based on laboratory value such as total cholesterol (TC), high-density lipoproteins, low-density lipoproteins (LDL), or other biomarkers. However, there are some tools developed which are non-laboratory-based where the same modeling principles and assessment techniques are applied [2].

Indonesia, like many other Southeast Asian countries, has a population burdened with CVD. "Approximately one-third of the adult population has high blood pressure and nearly 1.5 million deaths occur due to hypertension (HPN) each year" in the Southeast Asian region [3]. HPN is the sixth cause of death in Indonesia, where the incidence increased from 7.6% in 2007 to 9.5% in 2013 [4]. This phenomenon is due to unhealthy behaviors such as tobacco smoking (67% for males), alcohol consumption, raised blood pressure, and obesity that may contribute to CVD event or any non-communicable diseases [5].

A healthy lifestyle is critical for the prevention of high blood pressure, and it is an essential consideration for CVD patients, especially those with HPN. Lifestyle modification can serve as the initial intervention before starting pharmacologic therapy and can facilitate drug step-down in a highly motivated individual who achieves and sustains lifestyle changes. In addition, Appel [6] stated that a 3 mmHg reduction in systolic blood pressure (SBP) should lead to an 8% reduction in stroke mortality and a 5% reduction in mortality from coronary arterial disease.

In Indonesia, most of the hypertensive patients check their blood pressure at the community health center called Puskesmas. Puskesmas offers community health services such as checking blood pressure and conducting health education to prevent complications of CVDs. Nurses provide the health-care services to the community members. However, there is no special program offered for patients with HPN to prevent further occurrence of CVD.

Many studies show that lifestyle modification has become an important aspect of preventing CVDs. In this study, the researcher was inspired to develop the LIFESTYLE modification program. LIFESTYLE is an acronym for L-ose weight, I-dentify your risk, F-ood choice, E-xercise frequently, S-top smoking and alcohol, T-hink positive, Y-es to a healthy lifestyle, L-et's control regularly, and E-veryone is supporting you. This LIFESTYLE modification program is a 12-week community-based lifestyle intervention which is expected to decrease the 10-year risk for CVDs measured by Framingham along: Increased knowledge on cardiovascular risk and improved physiological parameters such as blood pressure, waist circumference (WC), TC, body mass index (BMI), fasting glucose, and increased self-efficacy to perform physical exercise.

Objective study

This study aimed to determine the effectiveness of the LIFESTYLE modification program for cardiovascular risk patients including the degree of knowledge, physiological parameters, self-efficacy for exercise, and the 10-year risk CVDs for patients who are at risk of CVD in Jakarta, Indonesia.

Materials and Methods

Study design

This study used the quasi-experimental design and pre-post-test non-control group with time series, where the independent variables were measured before intervention (week 1), during intervention (week 7), and after intervention (week 12) through the LIFESTYLE modification program.

Setting and sample

The study was conducted in a community health center called Puskesmas in Central Jakarta, Indonesia, from August 2018 to October 2018. In this study, the nonprobability method particularly purposive sampling was applied, and a total of 58 patients met the inclusion and exclusion criteria. The inclusion criteria for the study were: Indonesian, between the ages of 30 and 65 years, has a 10-year risk of developing CVD as measured by Framingham non-laboratory based on score ≥6%, BMI of 23–30, and has a history of smoking and high blood pressure (systolic pressure >130 mmHg and diastolic pressure >90 mmHg). The exclusion criteria were pregnant woman, diagnosed with any CVDs, using weight loss medicine, and taking medications for severe heart disease such as blood-thinning medicines, statins, nitrates, or heparin.

Ethical consideration

Before the study was conducted, the researcher secured the approval of the Ethics Review Committee, including that of the Institutional Review Board of the associated universities (approval no. 2018-02-DNS-34 and 005/KEPPKSTIKSC/III/2018). Before collecting the data, the researcher also obtained the participants' consent through an informed consent form.

Instruments

The research data were collected over twelve weeks using datasheets for the participants' profile, blood pressure, TC, BMI, and Framingham 10-year risk of CVD. Another tool, the non-laboratory-based Framingham [2], was used to measure and predict the 10-year risk of general and individual CVD. The variables used to predict 10-year risk of CVD were age, gender, smoking, SBP, treatment of HPN, BMI, and history of diabetes. Cigarette smoking status and antihypertensive medication use were ascertained through self-report; diabetes was determined based on insulin use or oral hypoglycemic medications and self-report.

Blood pressure was measured on the left arm of the participants, using an appropriately sized cuff and a standard automatic digital blood pressure sphygmomanometer (OMRON HEM-7120), after the participants had been seated for 15 min, with feet on the floor and arm supported.

The measurement of TC level was as follows: Blood specimen was drawn from the finger peripheral after completing 6–12 h of fasting overnight. Calibrated home cholesterol meter test of family Dr. (SN 16000048), with stick strips, was used to measure cholesterol level.

BMI was calculated as weight (in kilograms) divided by height (in meters) squared. The instruments used included a standard stature meter (general care) to measure the participants' height and calibrated scale

(OMRON digital personal scale HN 289) to measure their weight. Weight and height were obtained before a session started; the participants were instructed to remove their shoes, take off heavy clothing (e.g., jacket), and discard items from their pocket (e.g., key, wallet, and the like). For weight, the participants were asked to look straight ahead and stay still on the scales; for height, the participants were asked to stand with their back on the wall and look directly forward.

To measure their WC, the researcher utilized a tape measure which was placed snugly (parallel to the floor without skin compression) on a horizontal plane around the abdomen at the level of the iliac crest, at the end of respiration.

Procedures

The researcher attended the regular meetings at the community health service and assessed the participants with a risk of CVDs by running Framingham non-laboratory-based risk score to identify eligible participants based on the identified inclusion and exclusion criteria. Through an informed consent form, the participants agreed to participate in the study.

The LIFESTYLE modification program was conducted for 12 weeks, for 60–90 min per week. The activities conducted were health education classes to identify CVD risk and emphasize the importance of consuming healthy food and having physical activity. The sessions also demonstrated cooking healthy food, taught reading and understanding food labels, and explained stress management strategies. The participants performed aerobic exercises before the weekly sessions. Each participant was given a pedometer to stimulate them to walk or perform an activity, including a program workbook designed by the researcher. The workbook outlined the 12-week program; it also contained information regarding CVD risk factors, healthy food based on DASH and low-salt diet, stress management using positive affirmation expressions, and weight monitoring. Aside from monitoring their weight, the participants also recorded in their workbook the number of steps they took daily using the pedometer, their blood TC, and their WC.

Data analysis

Data analysis was performed using SPSS (version 21.0) for Windows. The participants' profile was analyzed using frequency count and percentage distribution. Before running statistical analysis, the researcher performed the outlier test. Outliers are observations or measures that are suspicious and may distort the group results. In this study, Z-scores were applied to detect outliers. Checking normality was conducted in the second step. In a parametric test, the researcher ensured that the data were reliable and approximately normally distributed.

The one-way analysis of variance (ANOVA) was run to determine the significant difference in the participants' Framingham 10-year risk of CVD and physiological parameters (blood pressure, WC, TC, and BMI) before, during, and after the 12-week LIFESTYLE intervention program. When ANOVA results showed significant differences between the means, the researcher used Scheffe for multiple group comparison.

Results

Table 1 presents the participants' profile along variables needed to run the Framingham 10-year risk of CVD, such as age, gender, status of cigarette smoking, medication, and history of diabetes. Most of the participants were in the middle age (45–59 years old). Of the participants, 53.5% were male and 68.9% were female. Age and gender are non-modifiable risk factors for developing CVD, and older age, as assessed by the Framingham risk score, was associated with higher risk of CVD. Moreover, most of the participants (79.3%) were non-smokers, consumed antihypertension drug, and some have not taken any medication (43.1%). There were 11 participants (19.0%) who had high blood sugar. Framingham study [7] stated that the risk score was lowest for people who were not smoking, not on blood pressure or lipid-lowering medication, and for people without diabetes.

Table 1: Participants' profile (n = 58)

Variables	Frequency	Percentage
Age		
<45	5	8.6
45–59	31	53.5
≥60	22	37.9
Gender		
Male	18	31.1
Female	40	68.9
Cigarette smoking		
Yes	12	20.7
No	46	79.3
Medication currently taken		
None	25	43.1
Antihypertension	25	43.1
Other medication	8	13.8
History of diabetes		
Diabetes	11	19.0
Non-diabetes	47	81.0

Table 2 shows the mean score of Framingham CVD risk and physiological parameters. For CVD risk, the mean risk score decreased during and after the intervention, where the difference in the risk scores between week 1 and week 7 is 1.28, and between week 7 and week 12 is 1.37. However, the classification remained as moderate even after the 12 weeks of intervention. SBP was dominating with HPN Stage 1 classification [8] and decreased to pre-HPN during and after the intervention. For diastolic blood pressure (DBP), WC, and BMI, the mean scores decreased before, during, and after the intervention; however, the classification remained the same [9]. The mean for TC decreased after the intervention through the LIFESTYLE modification program [10].

Table 2: Mean score and level of parameter risk on Framingham CVD risk and physiological parameters before, during, and after the intervention (n = 58)

Variables	Before intervention		During intervention		After intervention	
	Mean score	Classification	Mean score	Classification	Mean score	Classification
CVD risk	16.16	Moderate	14.88	Moderate	13.51	Moderate
Systolic BP	147.71	HPN stage I	139.45	Pre-HPN	134.55	Pre-HPN
Diastolic BP	88.83	Pre-HPN	84.71	Pre-HPN	84.43	Pre-HPN
WC (F)	97.40	High risk	94.85	High risk	94.15	High risk
WC (M)	95.94	High risk	93.39	High risk	92.50	High risk
BMI	27.81	Obese	27.65	Obese	27.47	Obese
Total cholesterol	207.62	Intermediate	170.64	Ideal	170.38	Ideal

BMI: Body mass index, BP: Blood pressure, F: Female, HPN: Hypertension, M: Male, WC: Waist circumference.

In Table 3, the result of the one-way ANOVA reveals that there is a significant difference in the participants' SBP and TC ($p < 0.05$); however, there is no significant difference in their Framingham CVD risk, DBP, WC, and BMI before, during, and after the 12-week LIFESTYLE modification program ($p > 0.05$).

Table 3: Test of significant difference on Framingham CVD risk and physiological parameters before, during, and after the intervention (n = 58)

Parameter	Mean score			SD	F	p	Remarks
	Week 1st	Week 7th	Week 12th				
CVD risk	16.16	14.88	13.51	8.15	1.538	0.218	Not significant
Systolic BP	147.71	139.45	134.55	22.40	5.370	0.005	significant
Diastolic BP	88.83	84.71	84.43	13.59	1.926	0.149	Not significant
WC (F)	97.40	94.85	94.15	11.27	0.921	0.401	Not significant
WC (M)	95.94	93.39	92.50	12.30	0.371	0.692	Not significant
BMI	27.81	27.65	27.47	5.53	0.054	0.948	Not significant
Total cholesterol	207.62	170.64	170.38	46.21	14.405	<0.001	significant

BMI: Body mass index, BP: Blood pressure, F: Female, M: Male, WC: Waist circumference.

On the other hand, in Table 4, the Scheffe multiple comparison of SBP shows that there is a significant difference between week 1 and week 12; however, there is no significant difference between week 1 and week 7, as well as between week 7 and week 12. This means that 12 weeks are an essential duration for the intervention to have an effect on blood pressure. Furthermore, a significant difference was observed on the TC between week 1 and week 7, as well as between week 1 and week 12. However, there is no significant difference between week 7 and week 12.

Table 4: Test of Scheffe multiple comparison on SBP and TC before, during, and after the intervention

	Time (I)	Time (J)	Mean difference (I-J)	p	Remarks
SBP	Week 1st	Week 7th	8.26	0.129	Not significant
		Week 12th	13.16	0.006	Significant
	Week 7th	Week 1st	–8.26	0.129	Not significant
		Week 12th	4.90	0.484	Not significant
	Week 12th	Week 1st	–13.16	0.006	Significant
		Week 7th	–4.90	0.484	Not significant
TC	Week 1st	Week 7th	36.98	<0.001	Significant
		Week 12th	37.24	<0.001	Significant
	Week 7th	Week 1st	–36.98	<0.001	Significant
		Week 12th	0.26	>0.999	Not significant
	Week 12th	Week 1st	–37.24	<0.001	Significant
		Week 7th	–0.26	0.999	Not significant

SBP: Systolic blood pressure, TC: Total cholesterol.

Discussion

In terms of age, most of the participants (31 or 53.5%) are in middle age (45–59 years old). Age is one of the non-modifiable risk factors for developing CVD; older age, as assessed with Framingham risk score, was associated with higher risk of CVD. This implies that as age increases, the amount of collagen and elastin decreases. This change affects the contractility and distensible properties of myocardium. Arterial blood vessels thicken and become less elastic [11].

As regards sex, most of the participants were female, who tend to have substantially more total adipose tissue than men, and these whole body sex differences are complemented by major differences in tissue distribution [12]. Although men tend to develop CVD earlier in life, after age 65, the risk of CVD in women is almost the same as in men due to protective effects of sex hormones. However, studies have shown that women may develop CVD earlier due to stress, high blood pressure, cigarette smoking habit, high cholesterol, and the use of birth control pills [11].

The Framingham study [7] unveiled that the risk score was lowest for people who were not on blood pressure or lipid-lowering medication. Some of the participants consumed antihypertension drugs such as amlodipine and captopril and they also had a history of HPN. Some participants also consumed antihypertension drugs in combination with other medications such as anti-cholesterol and antihyperglycemic (diabetes) drugs. Some of them disclosed that they used the medication irregularly because there were no symptoms observed and they sometimes forgot to take the medication.

The American Heart Association and American College of Cardiology guidelines [13] declared that lifestyle management to reduce blood pressure and CVD should include diet recommendation and physical activity modification. Moreover, the European Guidelines for CVD Prevention [14] declared that cognitive behavioral methods are effective in supporting people in adopting a healthy lifestyle. For high-risk CVD, physical activity, stress management, and counseling are recommended. These recommendations were included in the 12-week LIFESTYLE modification program, which was designed in response to the needs of Indonesians. The intervention program involved nurse educators, health-care providers, hypertensive patients, family members, and other health professionals such as dieticians, physicians, and psychologists.

In terms of the CVD risk score, Table 2 shows that the mean score decreased from week 1 to weeks 7 and 12. Gaziano *et al*. [15], [16] used BMI as one of the CVD risks scores where the percentage of body fat was associated with a given BMI which differed between populations. Population in Asia has a higher percentage of body fat at lower BMI than do European or North American populations; therefore, this risk score was useful to screen for CVD risk and others such as metabolic syndrome and diabetes in Asia [12]. During the study, most of the participants experienced a decrease in blood pressure and weight, which were used as predictors in running the Framingham risk score. They put less salt during cooking, lessened their high-salt snacks, and performed walking exercise regularly using a pedometer to record their steps after attending the session.

The one-way ANOVA revealed no significant difference in CVD risk scores (p = 0.218), as shown in Table 4. CVD risk was measured using Framingham 10-year risk of CVD non-laboratory-based test tool that can predict all CVDs such as coronary heart disease (CHD), stroke, peripheral vascular disease, and heart failure, where BMI was used instead of cholesterol level. There were seven variables necessary to run the software: These included gender, treatment for HPN, smoking, and history of diabetes (with two categories, i.e., yes or no). On the other hand, for variables of age, SBP, and BMI, the researcher inputted the numbers/scores. Thus, in the study, in week 12, the variables age, sex, treatment for HPN, smoking, and diabetes remained the same, and only the SBP and BMI changed. Moreover, most of the participants were female who tend to have substantially more total adipose tissue than men and these whole body sex differences were complemented by significant differences in tissue distribution [12]. This makes CVD risk less sensitive to identify small changes in lifestyle. Relative to this, the study of Siren *et al*. [17] aimed to examine the impact of health counseling on traditional CVD risk factors compared to Framingham risk score and follow-up session after 2 years. They revealed that Framingham risk score did not improve; on the contrary, even higher risk scores were seen after the intervention. Furthermore, in using traditional CVD risk score, there were significant differences between the groups at baseline and follow-up. They assumed that the Framingham risk score did not include physical activity and had only two categories for smoking; thus, it made the CVD risk score more sensitive to identify even small changes in lifestyle.

The predictor of the Framingham risk score is SBP, and there is impressive evidence to bring attention to the importance of SBP as a significant risk factor for CVDs. The Joint National Committee VII [18] declared that "the rise in SBP continues throughout life in contrast to DBP, which rises until approximately age 50, and [tends] to level off over the next decade [which] may remain the same or fall later in life. Diastolic HPN predominates before age 50, either alone or in combination with SBP elevation. The prevalence of systolic HPN increases with age, and above 50 years of age, systolic HPN represents the most common form of HPN."

The result of the study showed a decrease in SBP of 13.155 over the 12-week LIFESTYLE modification program, in addition to being statistically significant. A 10 mmHg decrease in SBP can change the diagnostic category, and the decrease of SBP could redirect therapy for blood pressure control or could eliminate the need for blood pressure medication [19]. Another study argued that when SBP was reduced by at least 20 mmHg and to <160 or 150 mmHg, there was a 35–40% reduction in stroke, a 50% reduction in heart failure, a 16% reduction in coronary events, and a 10–15% reduction in mortality occurrence [20].

"Obesity is associated with numerous comorbidities such as CVD, type 2 diabetes, HPN, certain cancers, and sleep apnea" [21]. "Besides an altered metabolic profile, a variety of adaptations/alterations in cardiac structure and function occurs in the individual as adipose tissue accumulates in excess amounts. Hence, obesity may affect the heart through its influence on known risk factors such as dyslipidemia, HPN, glucose intolerance, and the prothrombotic state" [21].

Weight loss in obese patients can improve or prevent many of the obesity-related risk factors for CHD. The WHO [9] revealed that "weight loss is more likely to be achieved and maintained by behavior modification techniques that focus on lifestyle and attitude." The Asia-Pacific region unveiled a general procedure which should be followed to manage obesity where behavior modification program should be followed up 3–6 months. In the present study, the program developed focused on how to effect some change in the participants' behavior; on the other hand, it gave less emphasis on the development of attitude. During the study, weight was measured in a minimum time of 12 weeks. In addition, most of the participants wore thick clothes and pants, long skirt and hijab, even jeans that may affect weight measurement. All of these exerted an influence which might be the reason that the participants experienced less decrease in body weight and BMI.

BMI has become a chosen indicator to measure body size and its composition; however, alternative measures that reflect abdominal adiposity such as WC and waist-hip ration have been suggested as being superior to BMI in predicting CVD risk [22]. Asians appear to have an increased metabolic risk at lower WC and waist-hip ratio than Europeans due to higher levels of body fat and abdominal adipose tissue. Increase in visceral adipose tissue is associated with metabolic abnormalities, including decreased glucose tolerance, reduced sensitivity of insulin, and increased lipoprotein.

For weight reduction, an "appropriate balance of physical activity, caloric intake, and formal behavioral programs" [23] is recommended. The present study conducted the LIFESTYLE modification program for 12 weeks by facilitating education on healthy diet and exercise. In the walking exercise, the participants were given a workbook in which to record their daily steps, but some of them were unable to record them regularly. A few participants stated that they were busy with their family or their job; therefore, they could not perform the walking exercise as recommended.

TC level is often used as an indicator of CVD risk and, as a general rule, the lower the TC, the better. Many earlier studies measured only serum TC, although most of the TC is contained in LDL and a good surrogate for LDL [24]. The prevalence of higher cholesterol levels tends to have more atherosclerosis and CHD.

In this study, a drop in TC value of –37,241 mg/dl beyond the statistically significant value noted and has a clinical significance. As cholesterol levels decrease, the medical treatment of high cholesterol can also change from high-cost medications to lifestyle modification through diet and physical activity. Moreover, there can also be a reduced risk for other CVDs such as CHD which has a close relation with increased lipid level. Earlier clinical trials found that a 1% reduction in serum TC level reduced the risk of CHD by about 2% [24].

Conclusion

The LIFESTYLE modification program is effective in improving physiological parameters, that is, in reducing SBP and TC. This program also brings impact by increasing the level of knowledge on CVD risk and increasing self-efficacy for exercise level. However, this program is less effective in predicting 10-year CVD risk score, in decreasing DBP, WC, and BMI.

The 12-week LIFESTYLE modification program is a useful program that can improve health by raising the awareness of CVD risk patients toward adopting a healthy lifestyle. Furthermore, this program brings advantage in early intervention to decrease the risk of CVD patients.

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