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The Effectiveness of Implementation of Healthy Living Community Movement in Overcoming Metabolic Syndrome Among Female Workers in East Kalimantan, Indonesia

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Abstract

The metabolic syndrome occurs in almost 25% of the world's adult population. A workplace is an ideal place for implementing health interventions to reduce metabolic syndrome risk factor. One of the Indonesian government's health programs to improve public health and prevent non-communicable diseases is called Healthy Living Community Movement (HLCM). This research aims to determine the effectiveness of HLCM implementation to overcome metabolic syndrome among female workers in Indonesia. This quasi-experimental study included 42 female workers with metabolic syndrome, which were divided into an intervention group and a control group. The intervention group was given an 8-weeks combination of health education and implementation of HLCM activities that consisted of fruit and vegetables provision as much as 400 grams per day and physical exercisefor at least 150 minutes per week. The intervention for control group included only health education. Subjects'parameters were measured and adherence toHLCM activities was evaluated by a questionnaire. Adherence to HLCM implementation was carried out by 52.4% of the subjects which resulted in a significant reduction in their waist circumference, systolic and diastolic blood pressure, and triglyceride levels ($p < 0.05$, respectively). After 8 weeks of interventions, 13 subjects (65%) from the intervention group were no longer included in the metabolic syndrome criteria, while in the control group only 2 subjects (10.5%) were not included. Therefore, the implementation of HLCM in the workplace is effective in overcoming the metabolic syndrome.

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Introduction

The metabolic syndrome is a combination of metabolic risk factors that include abdominal obesity, high blood sugar, abnormal cholesterol levels, and hypertension.[1] This disease is initiated with central obesity and is closely related to a higher risk of cardiovascular disease and diabetes mellitus. According to the International Diabetes Federation (IDF), the metabolic syndrome occurs in almost 25% of the world's adult population.[2] In Indonesia, the prevalence of metabolic syndrome was 17.5% in 2012.[3] However, in 2015, this value had increased to 23 %, comprising 26.6% and 18.3% in women and men, respectively.[4] Obesity, which is the main risk factor for metabolic syndrome occurs frequently in about 38.5% of female workers in the Indonesian government work environment, including civil servants, national army, police, regional-owned, and state-owned enterprises. The risk of developing metabolic syndrome is 10 times greater in obese workers than those with normal nutritional status,[5] where the health consequences include a huge loss for them and the organization. The problem of obesity among employees in Indonesia impacts high expenditures for health care estimated at IDR 56,487 billion/year and on the economic value of lost productivity due to absenteeism from work, which is estimated at IDR 20,394 billion/year.[6] The workplace environment has the potential effect on health promotion because workers spend a majority of their time at work, where a total of 68.53% labor for > 35 hours per week 7. Several studies showed that workplace health promotion impacted increasing physical activity and healthy eating behavior to reduce body weight, blood pressure, lipid profile, and depressive symptoms in workers.[8,9] Healthy Living Community Movement (HLCM) is a health promotion initiative launched by the Indonesian government. This program is a systematic and planned activity carried out by all parts of the country with the awareness, willingness, and ability to act healthily to improve quality of life.The focus of HLCM activities includes increasing physical activity, daily consumption of vegetables and fruits, as well as early detection of non-communicable diseases (NCDs). HLCM can be done anywhere, including at the workplace. Therefore, the program can be used as an approach strategy for the reduction of obesity and metabolic syndrome among workers. This study aims to determine the effectiveness of implementing HLCM to overcome metabolic syndrome in female workers.

Methods

Subjects for this study were female workers from 2 locations in the East Kalimantan provincial government office, Indonesia. The East Kalimantan province is one of the provinces in Indonesia with the highest number of obese people. According to Basic Health Research data, the obesity trend in East Kalimantan has increased sharply every year from 18.7% (2007), 20.6% (2013) and 28.7% (2018). Obesity is the major risk factor for metabolic syndrome, therefore the efforts are needed to prevent and reduce these risk factors. The inclusion criteria comprised of women between the ages of 30 to 55 years diagnosed with metabolic syndrome based on the IDF criteria that meet at least three of the five indicators as follows 1) waist circumference (≥ 80 cm), 2) blood pressure level (≥ 130/85 mmHg), 3) fasting blood glucose level (≥ 100 mg/dL), 4) high-density lipoprotein (≤50 mg/dL), and 5) triglyceride levels (≥ 150 mg/dL).[10] The formula for the mean of two populations was used to calculate the minimum sample size.A total of 42 subjects was required in this study with a population standard deviation of 1.1, 95 % confidence interval and a mean value difference of 0.7.[11] This research was approved by the Human Research Ethics Committee of IPB University (protocol number 451/IT3.KEPMSM-IPB/SK/2021). All participants were provided written informed consent and an explanation of the study purposed. Participants were also informed that they could withdraw at any time, and were assured of their anonymity and confidentially within the study.

Interventions

The intervention group received an 8-weeks combination of health education and implementation of HLCM activities that consisted of fruit and vegetable provision and physical exercise. Subjects were given as much as 400 grams per day of fruit and vegetables in the form of juice, salad, fresh-cut fruit, or local vegetables cooked in a variety of ways. Fruits and vegetables were delivered to subjects during working days,hence they could consume them as snacks or as a complement to meals. They were also encouraged to do physical activity of moderate-intensity sports, such as brisk walking, badminton, cycling, and aerobic exercise for up

to 150 minutes per week. The intervention for control group included only health education without further treatment.

Measurements

Subjects' characteristics including age, educational level, and marital status were collected using a questionnaire. Fruit and vegetable consumption was measured using a self-food record form. Physical activity monitoring was performed using a smartphone application (GoogleFit, Steps App, Fitpro) to find out the duration of physical activity. Application was used during the exercise and reported weekly to the researcher. Adherence toHLCM implementation was measured based on the amount of fruit and vegetable consumption and duration of physical activity. Subjects who consumedminimum 400 grams per day of fruit and vegetables and performed 150 minutes per week of physical activity are said to be obedient. The metabolic syndrome components were obtained by direct measurement. A tape measure was used to measure waist circumference, and a sphygmomanometer was used to assess blood pressure. Fasting blood glucose, HDL, and triglyceride levels were obtained from the subjects blood samples by the medical team for later analysis in the laboratory. The metabolic syndrome component data were taken twice, before and after the intervention.

Data Analysis

Data were analyzed using the SPSS Statistics Version 26 computer program. The analysis includes descriptive statistics, *a chi-squared* test and independent t tests to determine changes between pre-and post-test within each group. All statistical tests were judged significant at $p < 0.05$, and the data were presented as mean ± standard deviation.

Table 1: Subjects' characteristics and the metabolic syndrome components between intervention and control group

Variable	Intervention group		Control group		P-value
	n	%	n	%	
Age (years)	9	42.8	7	33	0.583
< 40 years	12	57.2	14	67	
≥ 40 years					
Education Level					
Graduate/Postgraduate	18	85.7	16	76.2	0.432
Diploma	3	14.3	5	23.8	
Senior high school	0	0	0	0	
Marital status					
Single	0	0	0	0	0.147
Married	19	90.5	21	100	
Divorced/Widow	2	9.5	0	0	
Metabolic syndrome components					
Central obesity	21	100	19	90.5	0.147
Hypertension	20	100	17	81	0.153
Hypertriglyceridemia	11	52.4	9	42.8	0.537
Low HDL level	15	71.4	12	57.1	0.334
Hyperglycemia	7	33.3	9	42.8	0.525

Results

Subjects' characteristics and components of the metabolic syndrome in the intervention and control groups were shown in Table 1. The intervention group's mean age was 41.9 (30-57 years), while the control group was 43.8 (30-56 years).

The intervention group had a greater educational level than the control group. Based on marital status, most of the subjects are married. More of subjects in intervention group had central obesity, hypertension, hypertriglyceridemia and low HDL level than the control group. There were no significant differences in the characteristics and components of the metabolic syndrome in the two groups ($p > 0.05$).

Adherence toHLCM implementation was measured to determine the amount of fruit and vegetable consumed as well as the duration of physical activity. Table 2 shows that a majority (80.9%) of subjects consumed all the fruit and vegetables provided and 57.1% did sufficient physical activity. Overall, 52.4% of subjectsadhered to performing both of HLCM activities.

Table 2: Adherence toHealthy Living Community Movement (HLCM)Activities

HLCM Activities	N	(%)
Consumption of fruit and vegetables		
Enough (400 g/day)	17	80.9
Less (< 400 g/day)	4	19.1
Physical activity		
Enough (150 minutes/week)	12	57.1
Less (< 150 minutes/week)	9	42.9
Consumption of fruit and vegetables + physical activity		
Adhere (as recommended)	11	52.4
Not Adhere (not as recommended)	10	47.6

The implementation of HLCM in the intervention group was effective in improving several components of the disease. These improvements included a significant reduction in waist circumference, blood pressure, and both systolic and diastolic and triglycerides levels. A mean reduction of 3.95 cm on the waist circumference, 13.1 mmHg on the systolic blood pressure, 7.45 mmHg on the diastolic blood pressure, and 33.6 mg/dL on triglyceride levels ($p < 0.05$, respectively) as shown in the intervention group after completing the 8-weeks intervention. The control group had a significant reduction in triglyceride levels (27.78 mg/dL, $p < 0.05$) while waist circumference, systolic and diastolic blood pressure were not significantly reduced (0.21 cm, 0.68 mmHg, and 1.26 mmHg, $p > 0.05$). Table 3 depicts the changes in metabolic syndrome components after 8-weeks of implementing HLCM between the two groups pre-and post-intervention.

Table 3: Changes in metabolic syndrome components after 8-weeks of HLCM implementation for intervention and control group

Variable		Intervention group(n=20) mean ± SD	Control group (n=19) mean ± SD	P-value
Waist circumference (cm)	Pre-	94.9±8.30	94.18±8.55	
	Post-	90.95±7.14	94.39±9.03	
	Δ WC	-3.95±2.83	0.21±1.43	0.000†
	P value	0.001*	0.514	
Systolic BP (mmHg)	Pre-	146.6±16.04	146.36±12.28	
	Post-	133.5±18.45	143.26±19.99	
	Δ SBP	-13.1±8.56	-0.68±6.28	0.000†
	P value	0.000*	0.359	

Diastolic BP (mmHg)	Pre-	90.45±6.25	92.63±11.41	
	Post-	83±7.37	88.94±4.42	
	Δ DBP	-7.45±6.02	-1.26±3.36	0.001†
	P value	0.000*	0.082	
TG (mg/dL)	Pre-	165.15±68.96	189±81.76	
	Post-	131.55±45.59	161.21±46	
	Δ TG	-33.6±47.61	-27.78±53.09	0.574
	P value	0.005*	0.038*	
FBG (mg/dL)	Pre-	108.3±68.06	108.57±45.23	
	Post-	92.9±16.33	100.05±23.29	
	Δ GDP	-15.4±60.32	-8.2±35.88	0.888
	P value	0.970	0.872	
HDL (mg/dL)	Pre-	47±8,93	51.31±15.29	
	Post-	48.5±9.85	48.89±10.22	
	Δ HDL	1.5±4.69	-2.42±8.50	0.013†
	P value	0.072	0.117	

Description: *($p<0.05$) significant difference before and after,† ($P<0.05$) significant difference in the two groups mean changes, SD = standard deviation, Δ difference post-and pre-test, WC = waist circumference, BP = blood pressure; TG = triglycerides, FBG = fasting blood glucose, HDL = high density lipoprotein.

Discussion

The risk of metabolic syndrome varies based on the socio-demographic characteristic, where it increased by 1.73 times for women aged.[12] In older women, menopause that occurs can increase the risk of metabolic syndrome. The pattern of hormone secretion alters with menopause, and estrogen secretion decreases. In post menopausal women, alteration in lipid metabolism and estrogen insufficiency is thought to play a significant role in cardiovascular disease risk.[13] The loss of estrogen can lead to fat accumulation in abdominal visceral tissue, impaired insulin action, decreased elasticity of the arterial wall, and fibrinolysis that caused an increase in metabolic syndrome components including the development of abdominal obesity, hypertension and dyslipidemia.[14] The education level among female workers in this study was high, which is contrary to the results of several studies, where the risk was greater in those with low education levels.[15,16] Based on marital status, the risk of metabolic syndrome in the widow strata was 2.53 times greater than in the unmarried while the incidence of the disease was 0.81 times higher in the married than in the unmarried strata.[3] Furthermore, the disease risk tends to be greater in divorced female workers than in those satisfied in marriage. Meanwhile, the widowed group also had a higher risk of metabolic syndrome than those married, possibly due to the cumulative effects of grief and stress associated with the loss of a spouse.[17] Central obesity is a major component of metabolic syndrome in female workers. Increased metabolic risk factors are always associated with a high accumulation of visceral fat tissue.[18] Fat cell expansion stimulates the production of metabolic products such as proinflammatory cytokines, procoagulants, inflammatory peptides, and angiotensinogen. Diabetes, heart disease, hyperlipidemia, gout, and hypertension are all caused by fat cells and free fatty acid plasma products.[19] Adherence with HLCM implementation was still not fully executed by female workers due to busy work, assignments outside the office, or field visits. Therefore, the subjects do not consume the fruit and vegetables provided. They usually buy food from the nearby food stall or fast food restaurant which contains high calories and fat but is low in fiber.[20] The female workers also do not exercise, they prefer to use their time to relax or sit with family because of being tired after work. This is in line with a study by Han and Fox,[21] where busy work among the female workers was associated with stress, feeling tired, lack of sleep and exercise time, as well as not implementing a healthy diet. The HLCM implementation is a form of healthy lifestyle used to prevent and overcome the onset of metabolic syndrome. A cohort study of more than

6 years showed that a healthy lifestyle, such as regular moderate to high levels of physical activity, a Mediterranean diet (rich in fruit and vegetables, low intake of saturated fat), not smoking, getting enough rest, and working less than 40 hours weekly significantly lowered the risk of metabolic syndrome among workers.[22] Fruit and vegetable consumption can help minimize the risk of metabolic syndrome through a combination of antioxidants, fiber, potassium, magnesium and other phytochemicals. Several studies report that the DASH (Dietary Approaches to Stop Hypertension) diet which is a diet that focuses on consuming a higher intake of fruits, vegetables, whole grains, nuts and beans, moderate intake of dairy products, low intake of red or processed meat and sweetened beverages has a protective effect against the metabolic syndrome.[23-25] Furthermore, various other studies have also shown that fruits and vegetables consumption help to normalize the blood pressure, blood sugar, and cholesterol levels.[26,27] hence preventing chronic non-communicable diseases and reducing the risk of metabolic syndrome.[28] Regular and consistent physical activity is also beneficial for preventing and managing metabolic syndrome.[29] These results are in line with the theory about the relationship between physical activity and metabolic syndrome incidents. The metabolic syndrome is related to a lack of physical activity and a sedentary lifestyle. On the other hand, through adequate physical activity, several risk factors for metabolic syndrome can be changed, including reduced LDL levels, triglyceride levels, increased HDL levels, insulin sensitivity, lowering blood pressure, and other risk factors for cardiovascular disease and other chronic diseases.[30] In this study we did not assess the factors that influencethe adherence of HLCM implementation. Another limitations is the small number of subjects due to purposive sampling technique that we adopted.

Conclusion

The implementation of HLCM in the intervention group was effective in improving several components of the disease. These improvements included a significant reduction in waist circumference, both systolic and diastolic blood pressure and triglycerides levels. After 8 weeks of interventions, 13 subjects (65%) from the intervention group were no longer included in the metabolic syndrome criteria, while in the control group only 2 subjects (10.5%) were not included. Future research should examine the long-term effects of HLCM implementation to create healthy lifestyle and improve all the components of metabolic syndrome among workers.

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Conflict of Interest

All authors declare that they have no conflict of interest.

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