CHAPTER 4

RESULTS AND DISCUSSION

The purpose of this study is to examine the effects of a self-management support program on eating behaviors, physical activity, and metabolic control among people with metabolic syndrome. Participants were recruited into this study between March 2011 and January 2012 (Figure 1). In total, 92 eligible people were invited to participate from three community hospitals in Chiang Mai province. Of those people who were enrolled, 86 participants completed the study protocol (93.48% retention) (44 to the experimental group and 42 to the comparison group) and 6 participants dropped out (6.52%) (2 in the experimental group and 4 in the comparison group). Reasons given for dropping out included migration to other provinces, no need for additional health checks, and lack of time due to work. The research findings are presented as following:

Part I Demographic characteristics of all participants

Part II The Comparison of Eating Behaviors, Physical Activity, and Metabolic Control Between Baseline and Post-test of the Experiment and Comparison Groups

Part III The Comparison of Eating Behaviors, Physical Activity, and Metabolic Control Between the Experimental and Comparison Groups

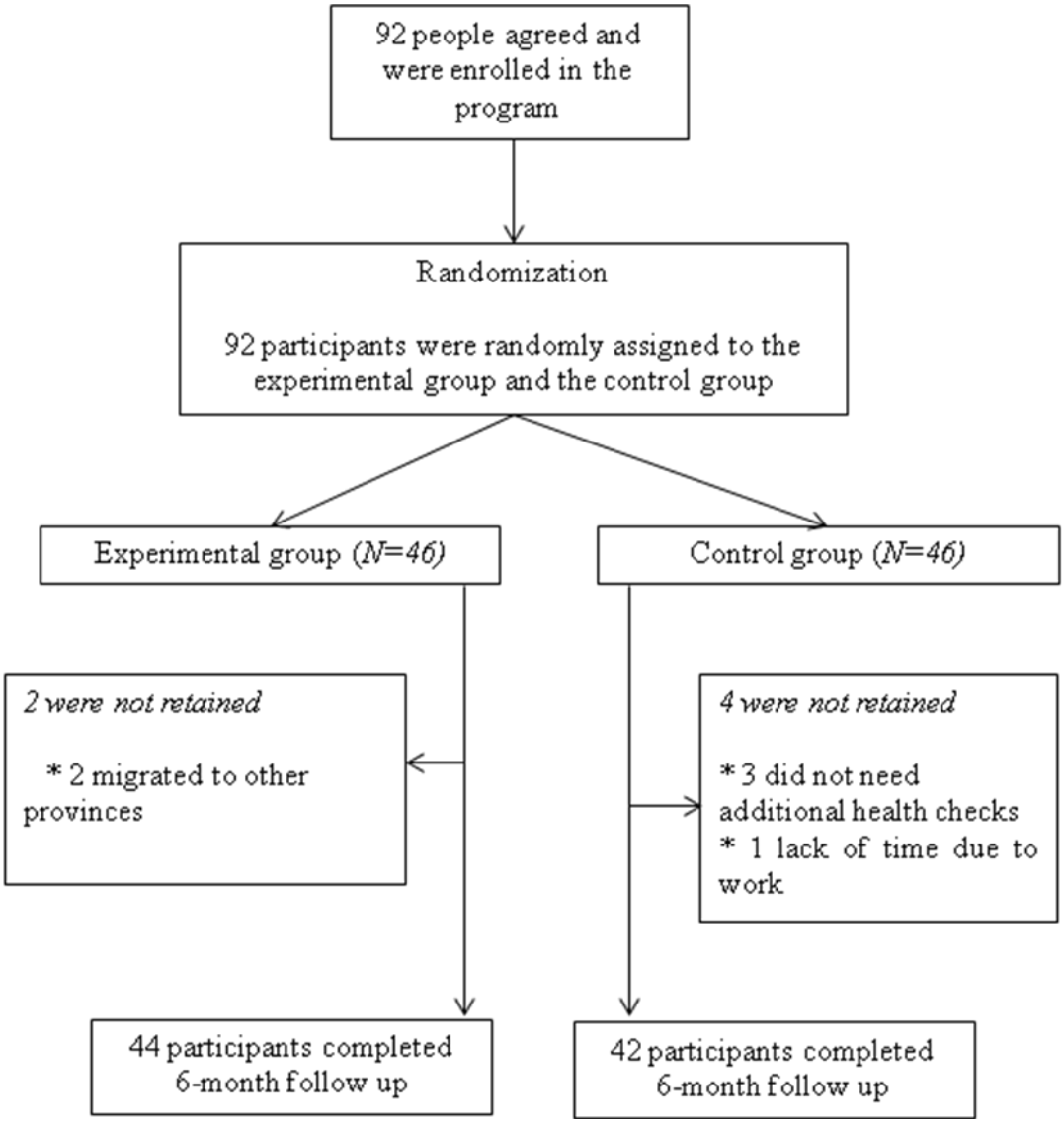

Figure 4. Flow chart of randomization and retaining to the study

Part I: Demographic Characteristics of All Participants

Demographic Characteristics of the Participants

In this study, participants in the experiment group were 41 females and 3 males with an average age of 59.57 years (*SD* = 9.99, range 50-75), while the comparison group were 30 females and 12 males with an average age of 62.67 years (*SD* = 7.89, range 50-75). The majority of participants had finished primary school (68.18% in experimental group vs 80.95% in comparison group). Regarding occupation, most participants in experimental group (47.8%) and comparison group (38.7%) were unemployed. The average income of experimental group was 6466.67 Baht (*SD* = 977.40) and that of the comparison group was 6261.90 Baht (SD = 685.68). Most participants in experimental group (38.6%) received no medical treatment and 18.2% received antihypertensive drugs plus lipid-lowering drugs. Similarly, most participants in the comparison group (29.5%) did not receive medication and 20.5% received antihypertensive drugs. All participants had metabolic syndrome diagnosed by having three of five risks factors. Of 44 participants in the self-management support program group had 59.1% met three metabolic syndrome criteria, 29.5% met four metabolic syndrome criteria, and 11.4% met five metabolic syndrome criteria. Of 42 participants in the standard care group had 50.0% met three metabolic syndrome criteria, 36.4% met four metabolic syndrome criteria, and 9.1% met five metabolic syndrome criteria. The comparison of demographic data between the experimental group and the comparison group revealed no statistically significant difference (see Table 4-1).

Table 4-1

Demographic Characteristics of the Experimental and Comparison Groups

Demographic characteristics	Experimental (n = 44) n (%)	Comparison (n = 42) n (%)	p-value
Age (yrs)			.744[t]
Mean (SD)	59.57 (9.99)	62.67 (7.89)	
Range	50-75	50-75	
Gender			.545[c]
Male	3 (6.8%)	12 (28.6%)	
Female	41 (93.2%)	30 (71.4%)	
Educational level			.849[c]
Primary school	30 (68.18%)	34 (80.95%)	
Secondary school education	9 (20.5%)	3 (6.8%)	
High school education	1 (2.3%)	2 (4.5%)	
Diploma	3 (6.8%)	3 (6.8%)	
Bachelor degree	1 (2.3%)	0	
Occupation			.390[c]
housewife	21 (47.8%)	15 (38.7%)	
employee	10 (22.6%)	11 (25.0%)	
business	11 (25.0%)	14 (31.8%)	
government employee	1 (2.3%)	0	
government pension	1 (2.3%)	2 (4.5%)	
Income (baht/month)			.854[t]
Mean (SD)	6466.67 (977.396)	6261.90 (685.684)	
Medication			.362[c]
None	17 (38.6%)	11 (29.5%)	
Antihypertensive drugs	6 (13.6%)	9 (20.5%)	
Anti-diabetic drugs	0	1 (2.3%)	
Lipid-lowering drugs	3 (6.8%)	0	
Antihypertensive drugs plus Anti-diabetic drugs	3 (6.8%)	7 (15.9%)	
Antihypertensive drugs plus Lipid-lowering drugs	8 (18.2%)	4 (9.1%)	
Anti-diabetic drugs plus Lipid-lowering drugs	1 (2.3%)	3 (6.8%)	
Antihypertensive drugs plus Anti-diabetic drugs plus Lipid-lowering drugs	6 (13.6%)	7 (15.9%)	

Table 4-1 (continued)

Variables	Experimental (N=44) n (%)	Comparison (N=42) n (%)	p-value
Total number of MetS criteria			.144[C]
3	26 (59.1%)	22 (50.0%)	
4	13 (29.5%)	16 (36.4%)	
5	5 (11.4%)	4 (9.1%)	

Note. [t] = t-test, [c] = chi-square test, MetS = Metabolic syndrome

When compared baseline parameters between the experimental and comparison group, the independence t-test was used. The results showed that there was no statistically significant difference in all variable measures. This result determined that the characteristics of variables related to eating behaviors, physical activity and metabolic control of the experimental and comparison groups were similar at baseline (see Table 4-2).

Table 4-2

The Difference of Variables Related to Eating Behaviors, Physical Activity and Metabolic Control of the Experimental and Comparison Groups at Baseline

Variables	Experimental (N=42) Mean (SD)	Comparison (N=42) Mean (SD)	*t*	*p-value*
Measures related eating behaviors				
% CHO in diet	58.01 (11.47)	60.43 (11.71)	-1.027	.307
% Protein in diet	15.99 (4.21)	16.43 (5.28)	-.435	.665
% Fat in diet	26.03 (9.84)	23.69 (9.73)	1.112	.269
Cholesterol (mg/dl)	216.20 (158.30)	203.69 (168.76)	.357	.722
Fiber (g/day)	9.27 (4.78)	9.05 (5.29)	.202	.840
Sodium (mg/dl)	2000.00 (1375.35)	2190.83 (1262.30)	-.671	.564
Sugar (g/day)	38.56 (31.24)	37.71 (30.74)	.128	.899
Physical activity (MET)	36.06 (3.13)	37.39 (3.22)	-1.907	.060
Indicators for metabolic control				
WC (cm)	94.25 (9.71)	92.57 (10.67)	.765	.446
SBP (mmHg)	145.32 (17.76)	142.62 (16.64)	.726	.470
DSP (mmHg)	84.45 (7.34)	81.76 (14.52)	1.093	.278
FBS (mg/dl)	109.36 (34.71)	116.79 (35.57)	-1.125	.264
TG (mg/dl)	165.23 (78.32)	203.76 (132.06)	1.655	.102
HDL (mg/dl)	44.75 (9.11)	41.90 (9.86)	1.391	.168

Note. WC = waist circumference. SBP = systolic blood pressure. DSP = diastolic blood pressure. FBS = fasting blood sugar. TG = triglyceride. HDL = high density

Part II: The Comparison of Eating Behaviors, Physical Activity, and Metabolic Control Between Baseline and Post-test in the Experimental and Comparison Groups

The Comparison of Eating Behaviors Between Baseline and Post-test in the Experimental and Comparison Groups

To investigate the effect of a self-management support program on eating behaviors, one-way repeated measure ANOVA was conducted to compare the eating behaviors of people with metabolic syndrome between baseline and post-test of the experimental and comparison groups at the end of the program and three months after the end of the program.

The results showed that mean protein, fat, cholesterol, sodium and sugar intake of the experimental group decreased from baseline to the end of the program and slightly increased from the end of the program to three months after the end of the program, while mean carbohydrate and fiber intake of the experimental group increased from baseline to the end of the program and slightly decreased from the end of the program to three months after the end of the program. This finding showed no significant difference in all the dietary components of the experimental group between the three times of measurement. The results determined that all parameters did not change over time (see Table 4-3).

In the comparison group, the results showed that mean carbohydrate intake continuously decreased from baseline to three months after the end of the program, while mean fat and sugar intakes continuously increased from baseline to three months after the end of the program. Moreover, mean cholesterol, fiber and sodium

intakes increased from baseline to the end of the program and slightly decreased from the end of the program to three months after the end of the program, while mean protein intake slightly decreased from baseline to the end of the program and slightly increased from the end of the program to three months after the end of the program. However, the results of repeated measure ANOVA showed no significant difference in all the dietary components of the comparison group between the three times of measurement. The results determined that all parameters in the comparison group did not change over time (see Table 4-3).

Table 4-3

The Comparison of Eating Behaviors Between Baseline and Post-Test in the Experimental and Comparison Groups

	Group	Mean (SD)			*F*	*p*-value
		Baseline	The end of the program	Three months after the end of the program		
Carbohydrate	Experimental	58.01 (11.47)	61.83 (10.48)	57.94 (11.72)	.716	.492
	Comparison	60.43 (11.71)	59.62 (9.76)	58.19 (11.95)	.310	.734
Protein	Experimental	15.99 (4.21)	15.44 (4.49)	16.61 (4.36)	1.005	.370
	Comparison	16.43 (5.28)	16.14 (4.63)	16.49 (5.13)	.070	.933
Fat	Experimental	26.03 (9.84)	22.74 (8.31)	25.45 (9.24)	1.957	.154
	Comparison	23.69 (9.73)	24.21 (8.08)	25.35 (9.75)	.583	.560
Cholesterol	Experimental	216.20 (158.30)	203.70 (176.47)	215.90 (180.83)	.084	.920
	Comparison	203.69 (168.76)	209.8 (163.82)	182.80 (174.91)	.509	.603
Fiber	Experimental	9.27 (4.78)	9.28 (7.57)	8.91 (6.08)	.063	.939
	Comparison	9.05 (5.29)	9.98 (6.54)	7.84 (4.61)	1.900	.156
Sodium	Experimental	2000.00 (1375.35)	1853.00 (908.77)	2101.00 (1204.91)	.559	.542
	Comparison	2190.83 (1262.30)	2252 (1213.28)	2150.31 (990.26)	.102	.903
Sugar	Experimental	38.56 (31.24)	32.03 (21.44)	34.97 (28.19)	.934	.397
	Comparison	37.71 (30.74)	43.21 (28.57)	45.65 (33.69)	1.375	.258

The Comparison of Physical Activity and Indicators for Metabolic Control Between Baseline and Post-test in the Experimental and Comparison Groups

The finding showed that physical activity level of the experimental group was at moderate intensity. In addition, the result of repeated measure ANOVA showed that the physical activity score of the experimental group increased from baseline to the end of the program and slightly decreased from the end of the program to three months after the end of the program. This pattern showed significant change overtime ($p < .01$) (see Table 4-4). In the comparison group, physical activity level was at light intensity. The result of repeated measure ANOVA showed that there was no significant change over time (see Table 4-4).

According to the indicators for metabolic control, waist circumference, systolic and diastolic blood pressure, fasting blood sugar, and triglyceride of the experimental group continuously decreased from baseline to the end of the program and to three months after the end of the program respectively, while HDL cholesterol of the experimental group continuously increased from baseline to the end of the program and to three months after the end of the program respectively. The results of repeated measure ANOVA showed that waist circumference, systolic and diastolic blood pressure and HDL cholesterol of the experimental group significantly changed overtime ($p < .01$), while the fasting blood sugar and triglyceride did not significantly change over time (see Table 4-4).

In the comparison group, waist circumference, diastolic blood pressure and HDL cholesterol continuously increased from baseline to the end of the program and to three months after the end of the program respectively, while systolic blood

pressure, fasting blood sugar and triglyceride decreased from baseline to the end of the program and increased from the end of the program to three months after the end of the program. The results of repeated measure ANOVA showed that waist circumference, fasting blood sugar and HDL cholesterol significantly changed over time ($p < .01$), while systolic and diastolic blood pressure and triglyceride did not change over time (see Table 4-4).

Table 4-4

The Comparison of Physical Activity and Metabolic Control Between Baseline and Post-Test in the Experimental and Comparison Groups

	Group	Mean (SD)			*F*	*p*-value
		Baseline	The end of the program	Three months after the end of the program		
Physical activity score	Experimental	36.06 (3.13)	40.43 (3.23)	39.27 (3.76)	45.582	.000**
	Comparison	37.39 (3.22)	37.90 (3.67)	37.28 (3.52)	1.683	.196
Waist circumference	Experimental	94.25 (9.71)	93.09 (9.92)	91.55 (9.83)	10.829	.000**
	Comparison	92.57 (10.67)	94.83 (10.15)	94.79 (10.37)	10.452	.000**
Systolic blood pressure	Experimental	145.32 (17.76)	136.43 (15.96)	134.65 (14.60)	11.43	.000**
	Comparison	142.62 (16.64)	139.93 (15.36)	141.48 (19.83)	.537	.587
Diastolic blood pressure	Experimental	84.45 (7.34)	79.25 (9.64)	80.09 (9.64)	8.157	.001**
	Comparison	81.76 (14.52)	82.10 (9.65)	82.98 (9.97)	.221	.750
Fasting blood sugar	Experimental	109.36 (34.71)	101.33 (30.90)	102.74 (29.29)	2.858	.076
	Comparison	116.79 (35.57)	106.76 (26.06)	119.43 (37.13)	4.336	.016*
Triglyceride	Experimental	165.23 (78.32)	156.25 (96.70)	158.16 (81.32)	.422	.615
	Comparison	203.76 (132.06)	168.24 (63.77)	180.00 (67.93)	3.032	.074
HDL cholesterol	Experimental	44.75 (9.11)	47.80 (10.86)	52.34 (10.82)	12.375	.000**
	Comparison	41.90 (9.86)	45.38 (12.34)	46.93 (11.03)	10.700	.000**

Note. * < .05. ** < .01.

According to post-hoc analysis (Table 4-5) which was used to determine the point of differences after repeated measure ANOVA within the experimental group, the finding indicated that physical activity level significantly increased at both the end of the program and three months after the end of the program, while HDL cholesterol significantly increased only at three months after the end of the program. In addition, systolic and diastolic blood pressure significantly decreased at both the end of the program and three months after the end of the program, while waist circumference significantly decreased only at three months after the end of the program.

In comparison group, the findings of post-hoc analysis (Table 4-6) indicated that waist circumference and HDL cholesterol significantly increased at both the end of the program and three months after the end of the program, whereas fasting blood sugar significantly decreased only at the end of the program and significantly increased at three months after the end of the program.

Table 4-5

Post Hoc Comparison for Bonferroni Test of Physical Activity and Metabolic Control in the Experimental Group

	Mean (SD)					
	Baseline (1)	The end of the program (2)	Three months after the end of the program (3)	(1) vs (2)	(1) vs (3)	(2) vs (3)
Physical activity score	36.06 (3.13)	40.43 (3.23)	39.27 (3.76)	.000**	.000**	.023*
Waist circumference	94.25 (9.71)	93.09 (9.92)	91.55 (9.83)	.129	.001	.004**
Systolic blood pressure	145.32 (17.76)	136.43 (15.96)	134.65 (14.60)	.008**	.000**	1.000
Diastolic blood pressure	84.45 (7.34)	79.25 (9.64)	80.09 (9.64)	.003**	.015*	1.000
HDL cholesterol	44.75 (9.11)	47.80 (10.86)	52.34 (10.82)	.102	.000**	.027*

Note. * < .05. ** < .01.

Table 4-6

Post Hoc Comparison for Bonferroni Test of Metabolic Control in the Comparison Group

	Mean (SD)					
	Baseline (1)	The end of the program (2)	Three months after the end of the program (3)	(1) vs (2)	(1) vs (3)	(2) vs (3)
Waist circumference	92.57 (10.67)	94.83 (10.15)	94.79 (10.37)	.000**	.009**	1.000
Fasting blood sugar	116.79 (35.57)	106.76 (26.06)	119.43 (37.13)	.037*	1.000	.029*
HDL cholesterol	41.90 (9.86)	45.38 (12.34)	46.93 (11.03)	.027*	.000**	.385

Note.* < .05. ** < .01.

Part III: The Comparison of Eating Behaviors, Physical Activity, and Metabolic Control Between the Experimental and Comparison Groups

To investigate the effects of a self-management support program on eating behaviors, physical activity and metabolic control, Mixed Model Analysis of Variance (ANOVA) with Repeated Measures was conducted to compare the eating behaviors, physical activity and metabolic control of people with metabolic syndrome between the experimental group and the comparison group and also the differences between points of measurement.

The Comparison of Eating Behavior Between Groups at Each Point of Measurements

For comparison of the two groups, the finding demonstrated that there was no significant difference in the carbohydrate, protein, fat, cholesterol, fiber, sodium and sugar intakes at all points of measurement (see Table 4-7).

Table 4-7

The Comparison of Eating Behaviors Between the Experimental and Comparison Groups at Each Points of Measurement

	Group	Mean (SD)			Effect			
		Baseline	The end of the program	Three months after the end of the program	Time		Time*group	
					F	*p*-value	*F*	*p*-value
Carbohydrate	Experimental	58.01 (11.47)	61.83 (10.48)	57.94 (11.72)	.223	.800	.807	.448
	Comparison	60.43 (11.71)	59.62 (9.76)	58.19 (11.95)				
Protein	Experimental	15.99 (4.21)	15.44 (4.49)	16.61 (4.36)	.707	.494	.225	.799
	Comparison	16.43 (5.28)	16.14 (4.63)	16.49 (5.13)				
Fat	Experimental	26.03 (9.84)	22.74 (8.31)	25.45 (9.24)	1.376	.255	1.313	.272
	Comparison	23.69 (9.73)	24.21 (8.08)	25.35 (9.75)				
Cholesterol	Experimental	216.20 (158.30)	203.70 (176.47)	215.90 (180.83)	.088	.915	.074	.929
	Comparison	203.69 (168.76)	209.8 (163.82)	182.80 (174.91)				
Fiber	Experimental	9.27 (4.78)	9.28 (7.57)	8.91 (6.08)	1.207	.302	.587	.557
	Comparison	9.05 (5.29)	9.98 (6.54)	7.84 (4.61)				
Sodium	Experimental	2000.00 (1375.35)	1853.00 (908.77)	2101.00 (1204.91)	.099	.893	.576	.551
	Comparison	2190.83 (1262.30)	2252 (1213.28)	2150.31 (990.26)				
Sugar	Experimental	38.56 (31.24)	32.03 (21.44)	34.97 (28.19)	.347	.688	1.973	.147
	Comparison	37.71 (30.74)	43.21 (28.57)	45.65 (33.69)				

The Comparison of Physical activity and Indicators for Metabolic Control Between Groups at Each Point of Measurements

The results of the Mixed Model ANOVA with repeated measures which used to compare between two groups and point of measurement showed that there were significant time effect in physical activity, systolic blood pressure, fasting blood sugar, triglyceride and HDL cholesterol between three points of measurement, whereas there was no significant time effect in waist circumference and diastolic blood pressure (see Table 4-8).

Table 4-8

The Comparison of Physical Activity and Metabolic Control Between Groups and Each Point of Measurements

	Group	Mean (SD)			Effect			
		Baseline	The end of the program	Three months after the end of the program	Time		Time*group	
					F	*p*-value	*F*	*p*-value
PA	Experimental	36.06 (3.13)	40.43 (3.23)	39.27 (3.76)	33.157	.000**	23.807	.000**
	Comparison	37.39 (3.22)	37.90 (3.67)	37.28 (3.52)				
WC	Experimental	94.25 (9.71)	93.09 (9.92)	91.55 (9.83)	2.013	.148	19.225	.000**
	Comparison	92.57 (10.67)	94.83 (10.15)	94.79 (10.37)				
SBP	Experimental	145.32 (17.76)	136.43 (15.96)	134.65 (14.60)	7.311	.001**	3.743	.026*
	Comparison	142.62 (16.64)	139.93 (15.36)	141.48 (19.83)				
DBP	Experimental	84.45 (7.34)	79.25 (9.64)	80.09 (9.64)	2.257	.117	3.808	.031*
	Comparison	81.76 (14.52)	82.10 (9.65)	82.98 (9.97)				
FBS	Experimental	109.36 (34.71)	101.33 (30.90)	102.74 (29.29)	5.390	.007**	2.357	.102
	Comparison	116.79 (35.57)	106.76 (26.06)	119.43 (37.13)				
TG	Experimental	165.23 (78.32)	156.25 (96.70)	158.16 (81.32)	3.277	.046*	1.136	.320
	Comparison	203.76 (132.06)	168.24 (63.77)	180.00 (67.93)				
HDL	Experimental	44.75 (9.11)	47.80 (10.86)	52.34 (10.82)	9.956	.000**	.657	.520
	Comparison	41.90 (9.86)	45.38 (12.34)	46.93 (11.03)				

Note. * < .05. ** < .01. PA = physical activity. WC = waist circumference. SBP = systolic blood pressure. DSP = diastolic blood pressure. FBS = fasting blood sugar. TG = triglyceride. HDL = high density

Regarding the significant time effect in physical activity score between three points of measurement, there was also significant interaction effect between time and group. Paired sample t-test was used to examine the mean difference in physical activity score at each point of measurements. The results revealed that the physical activity score of the experimental group was significantly higher than that of the comparison group at both the end of the program (*MD* = 2.530, *SD* = 4.204, *p* = .000) and three months after the end of the program (*MD* = 1.995, *SD* = 4.372, *p* = .005) (see Table 4-9).

Table 4-9

Comparison of Physical Activity Score Between the Experimental and Comparison Groups

Points of measurement	Mean score (SD)		Mean difference (SD)	*t*	*p*-value
	Experimental	Comparison			
Baseline	36.06 (3.13)	37.39 (3.22)	-1.338 (4.380)	-1.980	.054
The end of the program	40.43 (3.23)	37.90 (3.67)	2.530 (4.204)	3.900	.000**
Three months after the end of the program	39.27 (3.76)	37.28 (3.52)	1.995 (4.372)	2.957	.005**

Note. **p < .01.

According to the significant time effect in systolic blood pressure between three points of measurement, there was also significant interaction effect between time and group. Paired sample t-test was used to examine the mean difference in systolic blood pressure at each point of measurements. The results showed no significant difference between post test scores of the two groups at both the end of the program and three months after the end of the program (see Table 4-10).

Table 4-10

Comparison of Systolic Blood Pressure Between the Experimental and Comparison Groups at Each Points of Measurement

Points of measurement	Mean score (SD)		Mean difference (SD)	*t*	*p*-value
	Experimental	Comparison			
Baseline	145.32 (17.76)	142.62 (16.64)	2.667 (24.324)	.710	.481
The end of the program	136.43 (15.96)	139.93 (15.36)	-3.500 (22.982)	-.987	.329
Three months after the end of the program	134.65 (14.61)	141.48 (19.83)	-6.476 (24.060)	-1.744	.089

Regarding to the significant time effect in fasting blood sugar between three points of measurement, there was no interaction effect between time and group. Independent t-test was used to examine the mean difference in fasting blood sugar at each point of measurements. The results showed significant difference between two groups at three months after the end of the program ($t(41) = -2.430$, $p = .017$). Then blood sugar at three months after the end of the program in the experimental group was significantly lower than that of the comparison group (see Table 4-11).

Table 4-11

Comparison of Fasting Blood Sugar Level Between the Experimental and Comparison Groups

Points of measurement	Mean score (SD)		Mean difference (SD)	*t*	*p*-value
	Experimental	Comparison			
Baseline	109.36 (34.71)	116.79 (35.57)	-7.428 (42.088)	-1.125	.264
The end of the program	101.33 (30.91)	106.76 (26.06)	-5.429 (37.586)	-.948	.346
Three months after the end of the program	102.74 (29.29)	119.43(37.13)	-16.691 (42.011)	-2.430	.017*

Note. *p < .05.

Data analysis revealed no significant time effect in fasting blood sugar at each point of measurements, beside there was no interaction effect between time and group. Independence samples t-test was used to examine mean differences in plasma triglyceride level between the experimental and comparison groups. The result showed no significant difference between the experimental and comparison groups at two posttests (see Table 4-12).

Table 4-12

Comparison of Triglyceride Level Between the Experimental and Comparison Groups

Points of measurement	Mean score (SD)			
	Experimental	Comparison	*t*	*p*-value
Baseline	165.23 (78.32)	203.76 (132.06)	-1.655	.102
The end of the program	156.25 (96.70)	168.24 (63.77)	-.675	.501
Three months after the end of the program	158.16 (81.32)	180.00 (67.93)	-1.348	.181

As there was significant time effect in HDL cholesterol at all points of measurement, while there was no interaction effect between time and groups. Independence t-test was used to verify mean differences in plasma HDL cholesterol level between the experimental and comparison groups at each point of measurements. The analysis indicated that no significant difference in plasma HDL cholesterol level between the experimental and comparison groups at the end of the program, however at three months after the end of the program, HDL cholesterol level in the experimental group was significantly higher than that of the comparison group ($t(41) = 2.297$, $p = .024$) (see Table 4-13).

Table 4-13

Comparison for Independence t- Test of Plasma HDL Level Between the Experimental and Comparison Groups

Points of measurement	Mean score (SD)		Mean difference (SD)	*t*	*p*-value
	Experimental	Comparison			
Baseline	44.79 (9.31)	41.91 (9.86)	2.881 (13.056)	1.391	.168
The end of the program	47.93 (10.83)	45.38 (12.34)	2.548 (17.182)	.964	.338
Three months after the end of the program	53.26 (10.03)	46.93 (11.03)	6.333 (12.044)	2.297	.024*

Note. *p < .05.

Discussion

The purpose of this study is to examine the effects of a self-management support program on eating behaviors, physical activity and metabolic control among people with metabolic syndrome. Results from the present study revealed that the self-management support program is effective in increasing physical activity and improving metabolic control particularly for controlling HDL cholesterol and blood sugar, but unsuccessful in improving eating behaviors, waist circumference, systolic and diastolic blood pressure and triglyceride.

As the finding revealed that the self-management support program is unsuccessful in improving eating behaviors, it may be due to the complex nature of eating behaviors as there are many influenced factors including biological need and preferences, cultural, social, religious, economic, environmental, and even political factors (McNaughton, Crawford, Ball & Salmon, 2012). Moreover, healthy eating patterns are not likely to occur or persist without convenient sources of healthy foods and attractiveness (Fisher et al., 2005). Healthy eating behavior is also influenced by the immediate competing demand and preferences which can derail an intended diet control (Pender, Murdaugh, & Parsons, 2006). For instance, a metabolic syndrome person prefers high fat to low fat food because of taste or flavor preferences. As a consequence, the person fails to control the competing preference leading to poor dietary control.

In addition, eating behavior is controlled by environmental forces. Community-level factors such as supermarket location and availability of health foods are associated with dietary patterns and a healthy diet (Moore, Diez Roux, Nettleton,

& Jacobs, 2008). The easy access to supermarket location and availability of health foods is one of barriers to changing eating behavior (Seligman, Bindman, Vittinghoff, Kanaya, & Kushel, 2007). Similarly, a recent review found that improving access to market location and reducing prices of healthy foods were effective in increasing healthy eating (Matson-Koffman, Brownstein, Neiner, & Greaney, 2005). Moreover healthy food's availability and price have the potential to influence dietary intake (Krukowski, West, Harvey-Berino, & Prewitt, 2010). Furthermore, the chronic care model explains that promoting change in the chronic condition care in chronic care model requires ongoing adjustment by the affected persons through self-management support and interactions with the health care system and community that include public policy and built environment (Bodenheimer, Wagner, & Grumbach, 2002). In addition, self-management ecology explained that improving healthy eating behavior need a multilevel approach which emphasized the relationship that exists between individual behavior and the social environment (Fisher et al., 2005).

The present study showed that healthy eating supportive resources are limited in the community. There was little information and few resources that enhanced participant's ability to manage their eating behaviors. There are tempting and attractive foods for stimulating hungriness including food and restaurant advertisements or food gift vouchers, but those foods are of less nutritional value and mostly high in carbohydrate, fat, cholesterol, salt, sugar and calories, and low fiber. In addition, participants who received the program sometime did not have a convenient way to prepare foods at home. They bought instant food at the fresh-food market, super market or restaurant. But the resources of healthy food were not promoted and there was less readymade healthy food. Also, many people cannot

afford to buy healthy food as healthy foods are rather expensive. Inadequate community resources may be one reason to explain failure of the program to change eating behavior.

In this study, another explanation for ineffective in improving eating behaviors may be due to the age of the participants. Mostly, participants were the elderly. In Thai society, elderly people are commonly living with their family and the younger family members will be responsible for preparing food and cooking for the elderly member (Ounsuvan, 2010). Thus, the eating behavior of the elderly is strongly influenced by family members. In the present study, participants who received the program needed family members to prepare meals for them. Family members often set the food menu preparation and taste based on their preferences and habit. So, it was difficult for the elderly participant to control their diets. They have meals as family members prepared them. Moreover, there were more than one generation in the family including children, adults, and the elderly. Third age range creates difficulties in planning meals for the family to eat together. Also as some participants relied on dining out in the restaurants, because of convenience, they were more likely eating food that they preferred. In addition, in this study some participants did not receive any encouragement or reminding of what not to eat or how much they should eat from friends or family members, so they did not eat properly. The study of Whittemore, Milkus, and Grey (2005) suggested that barriers to diet self-management might include inadequate support from friends and family. Similarly, Cherrington, Ayala, Scrinci, and Corbie-Smith (2011) found that barriers related to diet self-management were inadequate social support at home, especially related to food preparation. Thus, the management of eating behaviors requires social

support especially supports from family members and the community. Lack of social support, therefore may be one explanation the failure to change eating behavior among the participants who received the program in this study.

The study result is incongruent with the study of Bo et al. (2007) which the lifestyle intervention on metabolic syndrome could reduced fat intake and increased fiber intake after 12 months. In addition, Pettman et al. (2009) who studied the effects of a self-management program for overweight adults with metabolic syndrome also found significantly reduced overall energy intake and improved diet intake after 12 months. The time for reaching goal in the above two study was about 12 month that was longer than this study.

Determination to physical activity, people with metabolic syndrome who received a self-management support program has higher physical active at both the end of the program and three months after the end of the program than those who received usual care. This result confirms the hypothesis that the self-management support program could improve physical activity. Based on the study framework, the participants received knowledge and skills training pertaining physical activity management through small group education and individual coaching. The small group approach was reported to be more effectively in managing lifestyle to control weight and health outcomes than the one-on-one individual interventions (Ash et al., 2006). The small group approach allows people to be active participants, enhance efficient communication and help meet different needs of each person (Stele, 1998). In this study, the small group education and individual coaching approach better increased participants' knowledge and self-management skills for collaborative goal setting and action plan, problem solving and self-monitoring. Small group discussions

also increased the confidence in their competence of the experimental group to perform physical activity and gave social support. The finding is congruent with the study of Duru, Sarkisian, Leng, and Mingione (2010) in the researcher enhanced which promoted physical activity of the older African-American women by combining small-group Bible readings and discussion with 45 minutes of physical activity, and a small-group pedometer competition.

Selecting own choice of activity may be one reason for the effectiveness of the program. In this study, participants who received the program selected a type of exercise upon their preference and set their own goals to increasing physical activity. The exercise chosen were enjoyable, convenient and accessible. Also choosing own choices of exercise might motivate and raised confident of the experimental group to take action. It is congruent with the study of Coleman, Cox, and Roker (2008) revealed that the personal choice to engage in physical activity positive influenced on physical activity participation.

In this study, the promising result of the program may be due to the effect of self-monitoring. People with metabolic syndrome who participated in the program were asked to record all activities including exercise, household, occupation, transportation, hobby and sedentary activities, and to plot the number of minutes of daily exercise in physical activity logbook. The act of keeping a daily record increased awareness of activity level and served as a reminder to exercise. Therefore, from keeping regularly recording, the people keep doing exercise. Helsel, Jakicic, and Otto (2007) also found that self-monitoring diaries is an effective moderation of change physical activity behaviors. Similarly, the study of Wang et al. (2012) showed that physical activity self-monitoring was significantly affected to improve adherence

physical activity and increase physical activity levels. Furthermore, recording sedentary activities such as watching television, sitting- reading a book or newspaper, hand sewing, lying in bed awake and doing nothing helped participants increased awareness of participants of their sedentary activities and attempted to change. In this study, the researcher found that people with metabolic syndrome who received the program reduced their sedentary time by doing light or moderate-intensity activity. They mentioned that physical activity self-monitoring helped them aware of their physical inactivity, so they kept doing exercise regularly.

Furthermore, people with metabolic syndrome who received the program in this study received feedback about the daily energy expenditure in terms of daily energy expenditure as daily MET activity value and the frequency of exercise for providing information of progress in physical activity and triggered to action. Receiving regular feedback on physical activity is important to check the sufficiency of participants' awareness, to identify the barriers to change daily physical activity and to facilitate recognition of progress of physical activity (Van Hoye, Boen, & Lefevre, 2012). Feedback, therefore, could motivate people with metabolic syndrome to carry on exercise. Evidence suggested that feedback has been associated consistently with improved adherence to exercise (McBride, Koehly, Sanderson, & Kaphingst, 2010) and feedback is frequently included in successful behavior change intervention (Artimian et al., 2010).

High self-confidence among the participants may be a reason for program success. The people with metabolic syndrome who received the program received motivation by motivational interviewing technique to increase the confidence of physical activity and ensured the continuity of exercise. Motivational support

enhanced participants' confidence in their ability to successfully change behavior (Miller & Rollnick, 2002). Increased confidence and self-efficacy facilitated in behavior change (Holloway & Watson, 2002). People with metabolic syndrome were assessed for exercise self-confidence for enhancing continued exercise at every appointment. If the exercise self-confidence scores as below 7, the researcher would motivate them. In this study it was found that the majority of the people with metabolic syndrome who received the program obtained the exercise self-confidence score of more than 7 which indicated high confidence for exercise. Similarly, McAuley et al. (2011) studied the effect of self-regulatory processes to exercise adherence and found that higher efficacy was associated with better exercise adherence.

Social support may also explain the success of the program. People with metabolic syndrome received social support from the researcher, friends and family, and the community to increase physical activity. The researcher informed them about the types, benefit, and appropriate exercises as well as the resources for exercise. Friends and family also encourage them to engage in physical activity and avoid sedentary behavior. People who rarely perform exercise in community but would like to go to farther sport stadium or the sports club would be provided transportation, it is found that they exercised regularly and strictly followed an action plan. Springer, Kelder, and Hoelscher (2006) suggested that social support from friends and family has a maximum effect on promoting people in physical activity among sedentary persons. In addition, the community already established the exercise area combined with the exercise programs but most of the participants who received the program hardly join the provided programs. After having informational support about disease

management from the researcher and they gained support from the community in terms of forming several exercise groups that they can participate to including the Lanna Thai dances called Fon Jerng, Rum Krabong, and Chi-gong. It is shown that they turned to use the exercise resources and participated to the programs provided by the community. It was conformed to Kouvonen et al. (2011) who state that social support may assist individuals in maintaining physical activity Thus, support from friends, family and the community are important factors for people with metabolic syndrome to perform exercise regularly.

Comparing with the comparison group that received the traditional health education approach, the findings showed no improvement of physical activity. The traditional health education approach usually focuses on the routine instruction of technical disease-specific skills and provides information about their condition. It is not based on patient needs or patient context, so it is not designed to match patient needs (Glang, Rimer, & Viswanath, 2008). Moreover, the traditional health education approach does not coach the people in changing health behavior (Bandura, 2004). Although the traditional health education is effective in the transfer of knowledge, skills and attitudes, it is inadequate for changing behavior (Mayer-Mihalgki & DeLuca, 2009). Evidence from controlled clinical trials suggests that self-management education is more effective than patient education in improving clinical outcomes (Farmer, 2007). All the reasons mentioned, therefore, explained how the program works effectively in enhancing physical activity of people with metabolic syndrome in this study.

Regarding metabolic control, the finding revealed that the program had benefits on waist circumference, blood pressure and HDL cholesterol. The

improvements of those parameters may result from the participants' adherence to medication regimen and the recommended lifestyle, particularly controlling sodium intake and increasing physical activity. Adherences with taking antihypertensive medication achieve adequate blood pressure control (Hill et al., 2011). Similarly, the study of Gee et al. (2012) demonstrated that adherence to antihypertensive medication is associated with high rate of hypertension control. According to Aburto study, the consumption of sodium of less than 2 g/day can lower blood pressure and help control blood pressure, from which systolic blood pressure was reduced 3.47 mmHg and diastolic blood pressure was reduced 1.81 mmHg (Aburto et al., 2013). Moreover, the moderate intensity physical activity has been shown to lower blood pressure in hypertensive people with systolic and diastolic blood pressure by 6.9 mmHg and 1.9 mmHg, respectively (Fagard & Cornelissen, 2007). In this study, the experimental group reduced sodium intake (an average 1.85 g/day) from baseline in concurrent with moderate physical activity decreased their systolic blood pressure value approximately 8.89 mmHg from baseline.

A reduction in waist circumference and raising HDL cholesterol in participants who received the program may result from increased physical activity level. According to Ross and Bradshaw (2009) the moderate intensity physical activity could increase energy expenditure and burn off some of the body fat that has accumulated around the abdomen. Also this type of physical activity could increase HDL cholesterol (Mestek, 2009). Grundy et al. (2005) reported that the best exercise to reduce waist circumference and raise HDL cholesterol is a good aerobic workout including fast walking, jogging, swimming, cycling, aerobic class such as yoga, jazzercise, kick boxing, etc. In the present study, people who received the program

participated in Lanna Thai dances and Chi-gong which are the activities that exert their abdominal muscles to keep fit. So, they can reduce waist size as average 2.7 cm. that is less than the study of Pattyn, Cornelissen, ToghiEshghi, and Vanhees (2013) that the mean reduction in waist circumference was 3.4 cm. However, as the HDL cholesterol level increased averagely 7.59 mg/dl from baseline to three months after the end of the program. In the present study, the result is better than the previous study, the meta-analysis of the controlled trials investigated the effect of exercise on the cardiovascular risk factors constituting the metabolic syndrome found that a significant mean increased in HDL cholesterol 2.32 mg/dl were observed after the dynamic endurance exercise or aerobic workout (Pattyn et al., 2013).

For the triglyceride, the finding showed that the program may not be effective in decreasing triglyceride level. This finding may be confirmed to the unimproved eating behavior in this study. According to Grundy et al (2004), reducing the triglyceride level without using medication will occur when the people modify their food consumption including reducing carbohydrate, sugar and fat diets as well as limiting alcohol intake. In this study, consumption of fat was controllable (average 25.45% of total calories), while consumption of sugar was still uncontrollable (average 34.97 g/day). The consumption of carbohydrate was also uncontrollable at first three months (average 61.83% of total calories). However, it was controllable at three months later (average 57.94% of total calories).

Comparing with the comparison group, blood sugar of the experimental group was significantly lower than that of the comparison group at three months after the end of the program. It may be due to the participants who received the program can control the consumption of carbohydrate and the regular moderate intensity

physical activity. Carbohydrate is the component of the diet that has the greatest influence on blood sugar (Sheard et al., 2004), since it will be converted to glucose and enters the blood stream where it raises blood glucose level. Keeping blood glucose level at goal is to balance the dietary intake and physical activity. Regular physical activity improves blood glucose level by improving insulin sensitivity and increasing metabolism to generate energy. Dragusha et al. (2010) studied the impact of diet and physical activity in treatment of metabolic syndrome and reported that diet control together with physical activity could reduce blood glucose by 0.45 mmol/L or 8.11 mg/dl. In the present study, participants who received the program similarly have blood glucose level decreased by 6.62 mg/dl.

The results of metabolic control in the present study showed inconsistency with the study of Chan et al. (2008) which the intensive lifestyle management education program and self-management support could decrease triglyceride and blood pressure, but not improved in waist circumference, blood glucose and HDL cholesterol in adult with metabolic syndrome. The results of metabolic control in the present study also difference from study of Tonstad et al. (2007) in which their nurse-led lifestyle counseling program could reduced only triglyceride level in people with mild hypertension. Inconsistent finding may be due to the different intervention used, age of participants and the program duration. The previous studies used the intensive lifestyle management education program and nurse-led lifestyle counseling program, whereas the present study used small group education and discussion and self-management support. In addition, the participants in the previous studies were young adult, whereas participants in present study are from elderly group which have difference in the impact of diet and physical activity. Moreover, the previous studies

were 6 month long, while the present study was only 3 month long. This program length may not be enough to show its effect on some components of metabolic syndrome.