Effect of Dietary Modification on Changes in Serum Lipids among Rural Thai Persons with Hypercholesterolemia

WITAYA SWADDIWUDHIPONG, M.D., M.Sc.*, PATCHREE NGUNTRA, B.Sc.*,
PRANEE MAHASAKPAN, B.Sc., M.P.H.*, CHAVEEWAN CHAOVAKIRATIPONG, B.Sc.*,
YUVADEE TATIP, B.P.H., M.P.H.*, SOMYOT KRINTRATUN, M.D.**

Abstract

This article reports on the effect of dietary modification on changes in eating patterns and serum lipids among hypercholesterolemic persons aged 40-59 years with no evidence of coronary heart disease in Mae Sot District, Tak Province, between 1995 and 1996. A total of 381 persons with total cholesterol levels ≥240 mg/dl and triglyceride levels <400 mg/dl were educated, counseled, and followed-up by the mobile health team at the health centres in the communities. The team comprised both hospital personnel (a physician, a health educator, and public health nurses) and the health centre workers. Of the 381 study persons, 331 (86.9 %) completed the one-year follow-up. The participants at one-year follow-up were more likely than at baseline to reduce intakes of dietary fat and cholesterol, whereas, there was an increased intake of vegetables and fruits. The mean total cholesterol level significantly decreased from 258.9 mg/dl at baseline to 236.1 mg/dl at one-year follow-up ($p<0.01$), giving an 8.8 per cent reduction. The mean change in low-density lipoprotein cholesterol levels was a 26.0 mg/dl decrease ($p<0.01$), yielding a 15.1 per cent fall. The mean high-density lipoprotein cholesterol level increased from 44.6 mg/dl at baseline to 46.8 mg/dl at one-year follow-up ($p<0.01$). The proportion of those who had a body mass index of <25 slightly increased from 70.7 per cent at baseline to 72.5 per cent at one-year follow-up. The dietary intervention program by the mobile team may be useful for lowering serum cholesterol among the rural population with hypercholesterolemia.

High levels of serum cholesterol are related to the risk of atherosclerotic disease, particularly coronary heart disease (CHD)[1-4]. Several clinical trials have demonstrated that lowering serum cholesterol can reduce morbidity and mortality from CHD[1,2]. Since diet has a major effect on serum lipids, dietary changes are essential to improve lipid profiles and reduce the risk of CHD.

* Department of Community and Social Medicine,
** Department of Internal Medicine, Mae Sot General Hospital, Tak 63110, Thailand.

The institution of dietary intervention is therefore the first step in the management of hypercholesterolemia for most patients. This paper reports on the effect of dietary modification on changes in eating patterns and serum lipids among hypercholesterolemic persons aged 40-59 years with no evidence of CHD nor other major (nonlipid) CHD risk factors in northern Thai communities.

MATERIAL AND METHOD

The study was conducted in Mae Sot District, Tak Province, 500 km north of Bangkok. The district is served by 20 health centres and one general hospital with 280 beds (Mae Sot General Hospital). The hospital is located in the municipal area, whereas the health centres are distributed among the rural villages. In 1995 we carried out a screening survey of persons 40-59 years of age throughout all the 54 rural villages in the district[5]. Of the persons tested for blood cholesterol, 381 with total cholesterol ≥240 mg/dl, triglyceride <400 mg/dl, and who had no evidence of CHD nor other major (nonlipid) CHD risk factors, were included in the study. These persons were educated, counseled, and followed up by the mobile health team at the health centres in the communities. The team comprised both hospital personnel (a physician, a health educator, and public health nurses) and the health centre workers. Health education through a group lecture and discussion about the risk of CHD and the benefits of modification of food intakes for lowering of cholesterol was provided to the subjects. Dietary information was modified from the Step-One diet recommended by the National Cholesterol Education Program[2,6]. They were counseled for dietary intake and evaluated at 6-month intervals. Dietary modification targeted the eating behaviors and explored possible changes that were both acceptable to them and effective in achieving reduction of intake of saturated fatty acids and cholesterol[2,6]. Those overweight and obese persons were encouraged to control excess weight.

Fasting venous blood was obtained from each person and forwarded to the laboratory of Mae Sot General Hospital for lipid analysis. Serum total cholesterol (TC), triglycerides (TG), and high-density lipoprotein (HDL) cholesterol were measured by the enzymatic colorimetric method. The level of low-density lipoprotein (LDL) cholesterol was calculated with the Friedewald equation[7]. The mean of two prestudy samples measured within 8 weeks of each other was recorded as the baseline lipid level of each person. Prior to each follow-up visit, lipid analysis was measured and the results were used at the dietary advice session.

To evaluate the effect of the dietary modification program, we compared the results of lipid measurements at baseline (October-December 1995) and after one year of follow-up (November-December 1996). During the same period, we also determined changes in body mass index (kilograms per square meter, kg/m^2) and the average consumption frequency for selected food items during the past month. The food items in the questionnaire were selected and modified from the Thai National Food Consumption Survey[8].

We used the chi-square test for comparison of proportions and the paired *t*-test for comparison between means.

RESULTS

Of the 381 hypercholesterolemic persons included in the study, 331 (86.9 %) completed the one-year follow-up. Table 1 presents the sociodemographic characteristics of the subjects. The male to female ratio was about 0.4:1. Nearly all had an educational level of primary school grade 7 or less. The majority of them were farmers.

Table 1. Sociodemographic characteristics.

Characteristics	No.	%
Total	331	100.0
Age (years)		
40-49	145	43.8
50-59	186	56.2
Sex		
Male	101	30.5
Female	230	69.5
Education		
None	52	15.7
Primary	263	79.5
Higher	16	4.8
Marital status		
Single	9	2.7
Married	280	84.6
Widowed/divorced/separated	42	12.7
Occupation		
Farmers	220	66.5
Workers	39	11.8
Others	50	15.1
None	22	6.6

The subjects nearly always had their meals prepared at home. Before the dietary education program, 23.3 per cent of the persons interviewed at baseline ate more than three egg yolks in a week. This figure decreased to 5.7 per cent at one-year follow-up (Table 2). The proportion of persons who ate fatty cuts of meat >7 servings per week reduced from 15.4 per cent at baseline to 3.3 per cent at one-year follow-up. They also were more likely to reduce the frequency of intake of organ meats, coconut-oil enriched-food, and alcoholic beverages, whereas, there was an increase of intake of vegetables and fruits. At baseline, 52.6 per cent of the participants reported using palm oil for cooking, 17.8 per cent reported pork fat, and the remainder (29.6 %) used desirable liquid vegetable oils (soybean oil, cotton seed oil, corn oil, or sunflower seed oil). The proportion of persons reported using desirable vegetable oils increased to 59.2 per cent after one year of follow-up.

Of the 331 persons with serum total cholesterol ≥240 mg/dl at baseline, only 36.6 per cent continued to have a high level after one year of follow-up (Table 3). The mean total cholesterol level decreased from 258.9 mg/dl at baseline to 236.1 mg/dl at one-year follow-up, giving an 8.8 per cent reduction. At baseline, 2.1 per cent had an LDL cholesterol level of <130 mg/dl and 28.1 per cent had a level between 130 and 159 mg/dl. One year following the dietary intervention program, 28.0 per cent could achieve an LDL cholesterol level of <130 mg/dl and 43.9 per cent had a level between 130 and 159 mg/dl. The mean change in LDL cholesterol levels was a 26.0 mg/dl decrease, yielding a 15.1 per cent fall. The mean HDL cholesterol level slightly increased from 44.6 mg/dl at baseline to 46.8 mg/dl at one-year follow-up.

There were a few changes in BMI among the study persons. The proportion of those who had a BMI of <25 slightly increased from 70.7 per cent at baseline to 72.5 per cent at one-year follow-up (Table 4). The mean BMI decreased from 22.9 kg/m^2 to 22.7 kg/m^2 during the study period.

DISCUSSION

The general objective of dietary therapy is to reduce elevated serum cholesterol while maintaining a nutritionally adequate eating pattern. Dietary intervention should be designed to reduce the intake of saturated fatty acids and cholesterol and to promote weight loss in overweight persons[2,6]. Several clinical studies in developed countries have shown the effectiveness of dietary intervention in lowering cholesterol levels in both high-risk and usual-risk populations[9,10]. The

Table 2. Eating behaviors of the participants during the past month at baseline and at one-year follow-up.

Eating behaviors	Percentage of population (n = 331)		p-value
	Baseline	One year	
Desirable reduction			
Eating >3 egg yolks/week	23.3	5.7	<0.01
Fatty cuts of meats >7 servings/week	15.4	3.3	<0.01
Organ meats >3 servings/week	7.3	3.6	0.04
High-fat processed meats >3 servings/week	1.5	1.5	1.00
Butter enriched-foods >3 servings/week	4.2	2.1	0.12
Coconut-oil enriched-foods >3 servings/week	10.3	5.7	0.03
Shellfish >3 servings/week	5.1	4.2	0.58
Alcoholic beverages >3 servings/week	10.3	4.8	<0.01
Desirable promotion			
Using desirable vegetable oils for cooking*	29.6	59.2	<0.01
Fish >7 servings/week	11.5	10.3	0.62
Vegetables >7 servings/week	62.8	73.1	<0.01
Fruits >7 servings/week	7.9	12.7	0.04

* Soybean oil, cotton seed oil, corn oil, or sunflower seed oil

Table 3. Serum cholesterol levels of the participants examined at baseline and at one-year follow-up.

Cholesterol levels (mg/dl)	Baseline No. (%)	One year No. (%)	p-value
Total	331	331	
Total cholesterol level			
<200	-	13 (3.9)	
200-239	-	197 (59.5)	
≥240	331 (100.0)	121 (36.6)	
Mean±SD	258.9±24.1	236.1±35.2	<0.01
LDL cholesterol level*			
<130	7 (2.1)	90 (28.0)	
130-159	93 (28.1)	141 (43.9)	
≥160	231 (69.8)	90 (28.0)	
Mean±SD	171.9±28.3	145.9±35.5	<0.01
HDL cholesterol level			
<35	29 (8.8)	19 (5.7)	
≥35	302 (91.2)	312 (94.3)	
Mean±SD	44.6±10.4	46.8±10.8	<0.01

*among those who had triglyceride < 400 mg/dl

Table 4. Body mass index (BMI) of the participants examined at baseline and at one-year follow-up.

BMI (kg/m^2)	Baseline No. (%)	One year No. (%)	p-value
<25	234 (70.7)	240 (72.5)	
25-29.9	89 (26.9)	82 (24.8)	
≥30	8 (2.4)	9 (2.7)	
Total	331 (100.0)	331 (100.0)	
Mean BMI±SD	22.9±3.5	22.7±3.6	<0.01

results of our study indicate that the dietary modification program using the mobile health team could produce changes in dietary fat and cholesterol intake and achieve significant reductions of both total and LDL cholesterol levels ($p<0.01$) in hypercholesterolemic persons 40-59 years of age. Success in serum lipid reduction might be due to increased awareness of the need for dietary modification and motivation for behavior change. Dietary habits of having meals prepared at home in this rural population might also contribute, in part, to a decrease in serum cholesterol since individuals who eat more meals at home are likely to have greater cholesterol reductions than do persons who eat more meals away from home[10]. The components of the dietary intervention program should therefore include patient education, dietary counseling, motivation for long-term behavior changes, and regular follow-up. It has been found that a cholesterol-lowering diet will maintain its effectiveness as long as dietary modification remains[10].

Excess body weight is not only associated with deleterious changes in the lipid profile, but also an independent risk factor for CHD[1,2,6]. A CHD risk reduction program by improving serum lipid levels should include control of excess weight. Overweight is usually defined as a BMI >25 in Thai adults[8]. The results of our study revealed a slight increase in the proportion of those who had a BMI <25 after one year of follow-up. These findings indicate that weight loss is notoriously difficult in overweight and obese persons.

Hypercholesterolemic patients receiving dietary therapy from a registered dietitian appear to gain significantly more nutrition knowledge and consume less dietary fat and cholesterol than those counseled by only a physician or nurse[11]. However, physicians and nurses continue to be the main providers of dietary counseling in most areas of Thailand, particularly in rural areas, where there is a lack of both dietitians and nutritionists. As the number and proportion of people with hypercholesterolemia have been increasing in the country due to changes in life style, sufficient nutrition

training is critical for these personnel. The dietary intervention program by a mobile health team may solve the personnel time constraints by using group dietary instruction for each community rather than individual instruction.

Cost-effectiveness considerations play a role in program design in most countries, particularly in developing countries. Considerations of cost as well as the possibility of adverse effects from lipid-lowering drugs, achieving the greater benefit from dietary intervention is essential.

The present study had some limitations. Our interview relied on self-reported dietary intakes that might not accurately reflect true intakes. We did not quantitate nutrient intake from the consumed diets of each person since the questionnaire estimates were only based on reported frequencies and not on reported portion size. However, changes in eating behavior and serum lipid levels were significantly evident following our intervention program. The use of the mobile team may be one cost-effective program for lowering serum cholesterol among the rural population with hypercholesterolemia.

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ผลการปรับเปลี่ยนพฤติกรรมการบริโภคอาหารในกลุ่มประชากรอายุ 40–59 ปี ที่มีภาวะโคเลสเตอรอลในเลือดสูง ในเขตอำเภอแม่สอด จังหวัดตาก

วิทยา สวัสดิวุฒิพงศ์, พ.บ., วท.ม., พัชรี เงินตรา, วท.บ.*,*
ปราณี มหาศักดิ์พันธ์, วท.บ., ส.ม., ฉวีวรรณ เชาวกีรติพงศ์, วท.บ.*,*
ยุวดี ตาทิพย์, สศ.บ., สมยศ กรินทราทันต์, พ.บ.***

รายงานฉบับนี้ได้นำเสนอผลการปรับเปลี่ยนพฤติกรรมการบริโภคอาหารในกลุ่มประชากรอายุ 40 – 59 ปี ที่มีภาวะโคเลสเตอรอลในเลือดสูงและยังตรวจไม่พบโรคหัวใจขาดเลือด หรือปัจจัยเสี่ยงที่สำคัญอื่น ๆ ในเขตอำเภอแม่สอด จังหวัดตาก ในช่วงปี 2538 – 2539 โดยผู้ป่วยจะได้รับการให้สุขศึกษา คำแนะนำทางด้านโภชนาการ และการนัดหมายติดตามที่สถานีอนามัย จากหน่วยสาธารณสุขเคลื่อนที่ของโรงพยาบาลแม่สอด จากจำนวนผู้ป่วยที่ศึกษา 381 ราย พบว่า 331 ราย (ร้อยละ 86.9) ได้รับการติดตามจนครบ 1 ปี ซึ่งจากการศึกษาพบว่า ผู้ป่วยมีแนวโน้มของการรับประทานอาหารที่มีไขมันสูงและโคเลสเตอรอลสูงลดลง ค่าเฉลี่ยของ total cholesterol ในเลือดได้ลดลงจาก 258.9 มิลลิกรัม /เดซิลิตร (มก./ดล.) เมื่อเริ่มโครงการ เหลือ 236.1 มก./ดล. เมื่อติดตามครบ 1 ปี ($p<0.01$) คิดเป็นอัตราลดลงร้อยละ 8.8 ในช่วงเวลาเดียวกันค่าเฉลี่ยของ low – density lipoprotein cholesterol ก็ลดลงจาก 171.9 มก./ดล. เหลือ 145.9 มก./ดล. ($p<0.01$) คิดเป็นอัตราลดลงร้อยละ 15.1 ในขณะที่ค่าเฉลี่ยของ high – density lipoprotein cholesterol เพิ่มขึ้นเล็กน้อย จาก 44.6 มก./ดล. เป็น 46.8 มก./ดล. ($p<0.01$) เมื่อเริ่มโครงการพบว่าผู้ป่วยร้อยละ 70.7 มีความหนาแน่นของมวลกายน้อยกว่า 25 กิโลกรัม/เมตร^2 ซึ่งได้เพิ่มขึ้นเป็นร้อยละ 72.5 ของผู้ป่วยทั้งหมด เมื่อติดตามครบ 1 ปี การปรับเปลี่ยนพฤติกรรมการบริโภคโดยหน่วยสาธารณสุขเคลื่อนที่น่าจะเป็นโครงการที่ดีโครงการหนึ่งในการลดระดับโคเลสเตอรอลในเลือดของผู้ที่มีภาวะโคเลสเตอรอลในเลือดสูง ในเขตชนบทไทย

* กลุ่มงานเวชกรรมสังคม,
** กลุ่มงานอายุรกรรม, โรงพยาบาลแม่สอด, ตาก 63110