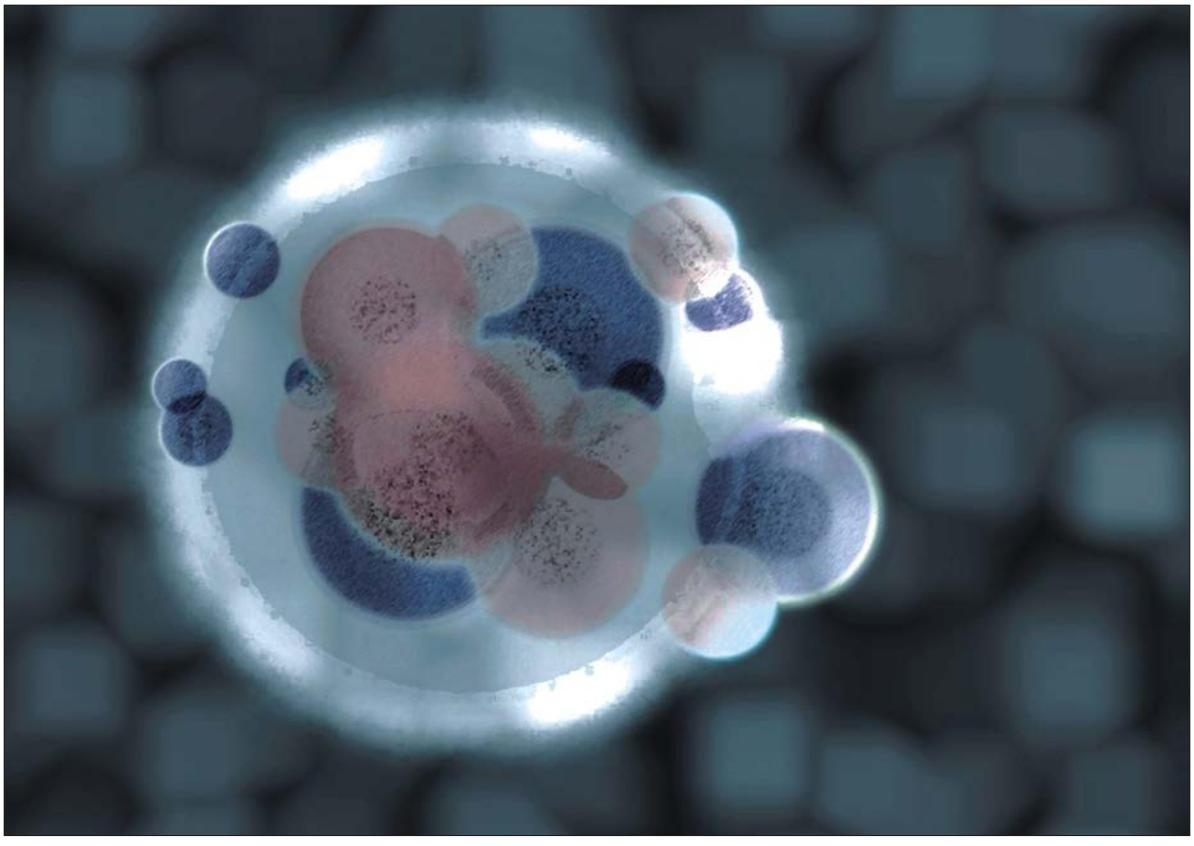

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Cardiac Risk Factor Changes Through an Intensive Multifactorial Life Style Modification Program in CHD Patients: Results from a Two Year Follow Up

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Abstract: The aim of present study was to prevent cardiac risk factor deterioration following patient discharge from hospital. We devised a two year Intensive Multifactorial Lifestyle Modification Program. One hundred Coronary patients suffering from first heart attack were recruited and randomized to either intervention group consisting of exercise sessions, lifestyle counseling and telephone follow ups or a usual care group. Lifestyle, risk factors, knowledge and attitudes regarding both groups on the first year and second year were evaluated to asses the program outcome. In the first year, blood pressure, HDL-c, LDL-c, total cholesterol, triglyceride and fasting blood sugar of intervention participants demonstrated significant improvement than control patients. However, this trend for some risk factors (HDL-c, LDL-c, blood pressure) was not maintained to the second year indicating the deterioration of these factors. At the end of two year, the program exerted significant improvement in triglyceride, fasting blood sugar, body mass index, smoking cessation, weight, waist-to-hip ratio and some areas of lifestyle behaviors in intervention than control patients. Knowledge of intervention participants also demonstrated significant improvements than controls. The current two year intervention program resulted in modest changes at the end of program. Further studies in this regard are needed to help clarify the subject.

Key words: Lifestyle modification, risk factor, coronary heart disease, cardiac rehabilitation, risk factor management

INTRODUCTION

The recent decades, have been associated with more sedentary lifestyle patterns. Regarding health status, morbidity and mortality from Coronary Heart Diseases (CHD) have rapidly increased. In fact, atherosclerotic disease has become the leading cause of mortality in developed countries, with the CAD being the number one killer in both men and women. Hardly to believe, ever since 1919 cardiovascular disease has been ranked number one cause of mortality in United States (Roberts and Barnard, 2005). To prevent the onset and recurrence of Myocardial Infarction (MI) the most important step is to control risk factors of atherosclerosis, the main cause

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of MI. Today, it is no secret that when dealing with cardiovascular events, lifestyle interventions rather than drug-therapy have distinguished advantages. Various lifestyle factors such as smoking, lack of exercise, inappropriate diet and physiologic factors like obesity, high serum lipid level and high blood pressure are known risk factors of coronary disease. Although risk factors have significant impact on life of patients with cardiovascular disease, considerable effort is required to affect behavior changes so that they would maintain healthy lifestyle alterations. The role of behavioral and related factors in cardiovascular prevention is nowadays more recognized than in the past. The seventh report of the US joint national committee on prevention, detection, evaluation and treatment of hypertension (Chobanian *et al*., 2003) enunciated that therapy can reach its goal only if patient is sufficiently motivated to take up the guidelines. This is the first requirement in patient behavior change and this can be achieved through a positive and coordinated relationship between patients and clinicians. Cardiac Rehabilitation Programs (CRP) have been introduced for this purpose. However, these are typically short-term exposures to lifestyle modifications. Since a lot of CRP's do not cover long-term follow up of patients, it is hoped that patients will maintain the lifestyle risk reduction programs. However, evidence from several studies, indicate that adherence to a lot of short-term interventions considerably decreases through the time and risk indicators once again begin to deteriorate (Moore *et al*., 1998; Willich *et al*., 2001). Based on a previous investigation, only one out of every three woman was exercising the recommended three times a week regimen in the year following the CRP program (Moore *et al*., 1998). These studies have indicated that lifestyle adherence by patients is a difficult task. Some other investigations have even reported deterioration of the risk factors to the pre-CRP values (Brubaker *et al*., 1996; Willich *et al*., 2001). A lot of interventional studies have shown a remarkable improvement in cardiovascular profile of patients by short term interventions. However, patients' feasibility to maintain this trend by continuing and adopting a new perspective of lifestyle remain unclear. Unfortunately, there are limited number of studied intervention attempts to address and investigate this pattern. Given these facts and figures, we conducted an Intensive Multi-factorial Lifestyle Modification (IMLM) program in a group of Iranian CHD patients and followed them up over a two year period to investigate the patients' feasibility to lifestyle changes for a longer time and effects of these changes on risk factors and cardiovascular status.

MATERIALS AND METHODS

Research design: The current study was performed in Tabriz, a large Iranian city located in Northwestern part of the country. Prior to study, the research protocol was reviewed by the corresponding university review board and was approved by local ethics committee. Patients hospitalized in the CCU ward of a large medical setting (Madani Heart Hospital, Tabriz, Iran) during December 2003 to September 2004, made up the initial core basis of the study. Fore patient recruitment process, all hospitalized patients were provided with adequate details of the study by either written brochures or verbal information depending on the patients' medical status. Then they were asked if they were willing to enter the study. All severely ill patients and those over the age of 65 were excluded. Patients qualifying for the study provided written informed consent in special forms supplied by local ethics committee. For estimating minimum sample size, variances and difference to be detected of 9 established coronary heart disease risk factor normally height, weight, BMI, total cholesterol, HDL, LDL, triglyceride and blood pressure (systolic and diastolic) amongst cases and controls were investigated. Sample size was calculated for each risk factor separately with 95% confidence. The sample size on the basis of total cholesterol was chosen that was 95. Thus, by rounding the number a total of 100 patients were recruited. On a random basis, 50 patients were assigned to the IMLM group and 50 to control group. Randomized allocation of patients to either group was carried out by a computer-generated variable block program by a blinded co-researcher. The randomization was balanced for parameters of age, gender, socioeconomic status and other demographic factors at the patient recruitment phase and prior to randomization. The lifestyle modification program was intended to be implemented after patients were discharged from hospital. Due to the nature and properties of the study, patients were not blinded to their group allocation. All the recruited patients regardless of their group assignment underwent a baseline lifestyle behavior, risk factor and knowledge/attitude assessment. Lifestyle behaviors were evaluated utilizing a questionnaire querying on type of diet, smoking status, physical activity and fat consumption. This survey was repeated at the end of the program too. Risk factor evaluation was undertaken by clinical examination of blood pressure, BMI, waist-to-hip ratio and laboratory examination of lipid profile (HDL, LDL, total cholesterol, triglyceride and fasting blood Sugar). This was also repeated at the end of first and second year. Lastly, the knowledge assessment covered

areas of patients' general knowledge on causes, signs/symptoms and prevention of coronary heart disease which was either re-undertaken at the end of the study. After baseline assessments, patients in intervention group received a 30 min hospital based consultation along with written guidelines for prevention of common established risk factors. IMLM participants were then scheduled for a two year post-hospital intervention program consisted of CRP exercise sessions, lifestyle counseling and telephone follow ups. The control group did not receive any kind of intervention.

Intensive multifactor lifestyle modification program (IMLM): A protocol of the IMLM study has been shown in Fig. 1. Patients assigned to IMLM group were contacted by the case manager for timetabling the first CRP exercise session. A profile of the treatment program was sent to each participant for their further reference. The first year of the IMLM program was made up of 7 CRP exercise sessions during the first 6 month, two of which was established in the first month and the 5 remnant sessions continued to be established once per month up to the 6th month. Thereafter the program employed lifestyle counseling sessions and telephone follow-ups regularly for the following months (Fig. 1).

At the end of the first year participants underwent an assessment covering various disciplines of each patient's individual lifestyle and risk factors. Hence on, on the second year IMLM participants were scheduled for lifestyle counseling sessions every three month and one telephone follow up for each of the following two months. This cycle was repeated identically till the end of second year. At this point IMLM participants underwent a final lifestyle and risk factor assessment.

The core basis of the IMLM program was designed on the principles of patient behavior change. Based on these principles, during each stage of the program including CRP exercise sessions, counseling sessions and also telephone follow ups every patient was assessed in terms of readiness for behavior change and his stage of the change in order for establishing a stage-based counseling profile.

CRP exercise sessions were conducted under supervision of the program manager and by an exercise leader. Each session was a 60 min session consisting of a warm up followed by specifically designed heart targeting aerobic exercise. At the end of each exercise session, patients were provided with a manual to help them establish home-based aerobic exercises and also as an auxiliary measurement for adhering to lifestyle modifications. The manual also contained information on dietary modifications and nutrition facts on various nutrients.

Lifestyle counseling sessions on the first year were established two times respectively on the month 8 and 10. On the second year the sessions continued to be established with three month intervals adding up to 4 sessions. At entry to the lifestyle counseling sessions patients filled a 3 day diary of food intake questionnaire. Other factors including blood pressure, weight, stress level and physical activity were also obtained. Every individual participant was then provided with his corresponding risk factor note featuring his current risk indicator profile, his previous status and the optimal future goals. Participants were then interviewed to receive an individually based stage of the change oriented lifestyle counseling. The counseling was established featuring five using areas of a routine cardiac rehabilitation program namely stress management techniques, weight reduction, reduction of alcohol consumption and dietary modification guidelines. The consultations were based on each session's patient risk factor profile. The scheduled telephone follow ups were aimed at providing an assessment of the program progress, spotting any new symptom as well as providing an overall consultation on lifestyle behaviors.

Blood sample obtaining/laboratory investigation: Laboratory investigations by blood sample obtaining were conducted three times during the study; at baseline, at the end of first year and second year. This was aimed at evaluating the biochemical risk indicators among intervention and control group patients. Blood samples were taken by a lab technician after overnight fast of at least 12 h between 8 and 11 am. The blood samples were centrifuged immediately after the collection and sent to biochemistry laboratory of the hospital for analysis. The investigations included evaluation of Fasting blood sugar and lipid profiles i.e., total cholesterol, triglyceride, LDL and HDL. Kits used, were supplied by the hospital.

Usual care group participants: Patients randomly assigned to this group were notified that researchers would contact with them at the end of month 12 and month 24 (one contact each year) to schedule for life style and risk factor assessment. Patients were then informed of their results. A copy of the laboratory results were also made at disposal of the patients' respective physician. Patients in this group did not receive any kind of intervention. These patients were asked to follow their respective physician's advice.

Statistical analysis: Clinical details of each patient regarding adopted lifestyle patterns, their knowledge on heart disease and their health status risk markers i.e., HDL, LDL, blood pressure and total cholesterol, were registered

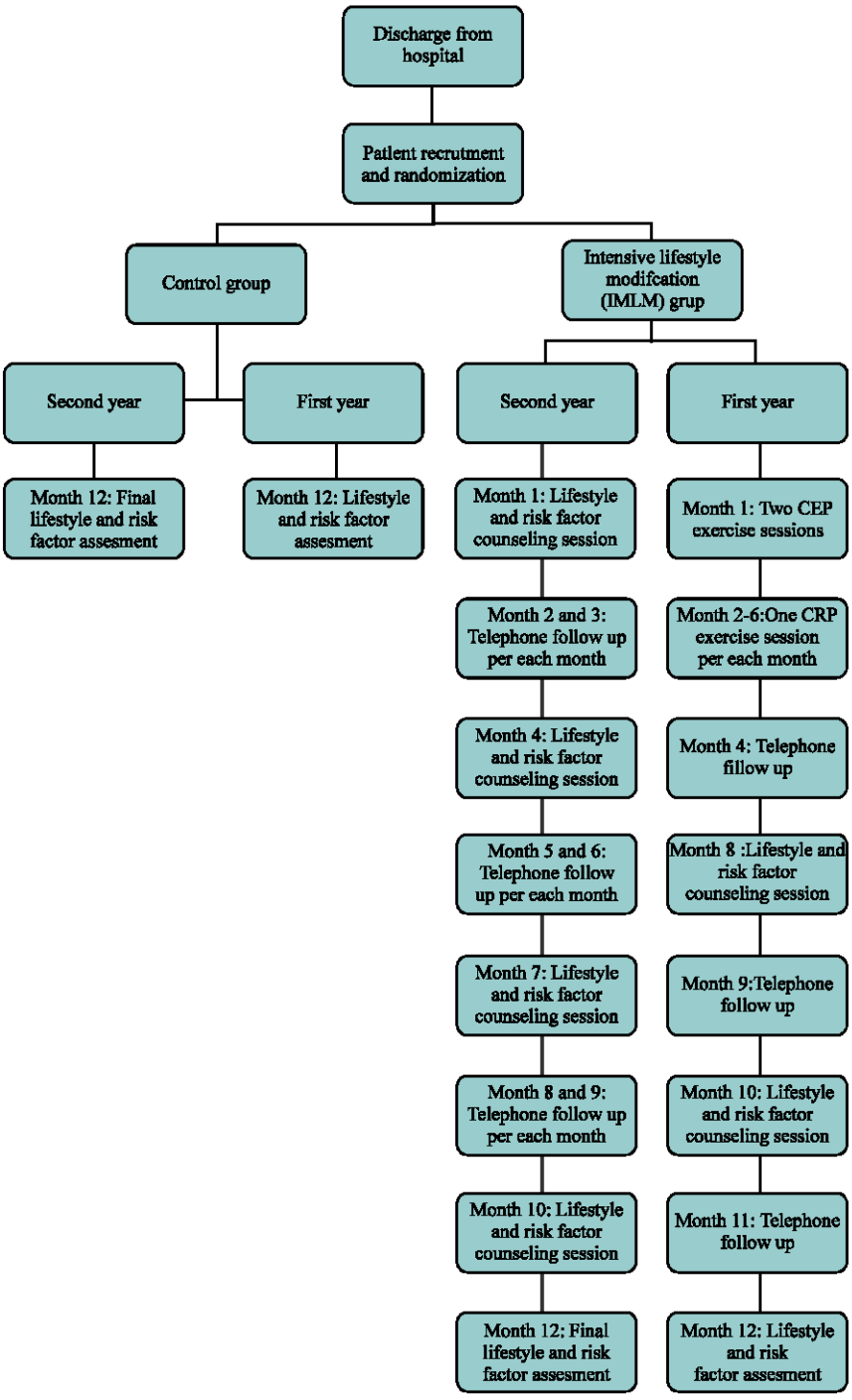

Fig. 1: Protocol of the study

and matched at baseline, at the end first year and at the end of the program follow up (second year). The data was collected through questionnaire, clinical and laboratory examinations. Variable and indicator definitions including categorization and coding were done for each variable using statistical package SPSS version 12 software for Microsoft windows. Chi-square analysis for demographic characteristics, Student t-test for continuous variables and Paired t-test for effect of interventions before and after intervention were used when applicable.

RESULTS

Baseline comparison of IMLM group and control group: At baseline, there was no significant difference between the two groups for any of the demographic characteristics such as age, sex, educational level, family size, socioeconomic status, hypertension and Hyperlipidemia (p-values >0.05, Table 1). In this study, a total of 100 patients (50 case, 50 control) suffering from first attack of myocardial infarction were evaluated. The patients were from the local Tabriz (Iran) population who resided either within the city or at the newly established attached city districts. The socioeconomic status was determined using three parameters; the type and size of dwelling, monthly family income and level of education and occupation and was divided into three categories: High class: where the patient and/or his spouse had at least 16 year of education, at least one of them was in a high professional or managerial occupation living in an owned house with more than 4 rooms and monthly family income no less than 10,000,000 IRs (Iranian Rials). Low class: where both spouses had <10 years education, work in a semiskilled or unskilled occupation, live in a rented house with less than two rooms and monthly income less than 2,500,000 IRs. Middle class: one or both spouses had more than 12 years education, work in a skilled or low governmental occupation and live in a rented or owned house with 2-4 rooms and monthly family income less than 1,000,000 IRs. Age variable was matched for the intervention and control patients. Patients were almost equally distributed among the age groups. Either group exhibited a male predominancy. Majority of patients in either group were married. Majority of the patients in both belonged to the lower and middle socio-economic status. The Reason could be attributed to the fact that patients belonging to upper socio-economic strata probably choose to go to private healthcare settings, while hospitals belonging to government are usually preferred by lower and middle class people. As for family size, majority of patients in either group had a well populated family size (more than three children).

Risk factor changes: At baseline, there was no significant difference in risk factors of patients between the two groups. Though the blood pressure, HDL, LDL and fasting blood sugar of patients in IMLM group were slightly lower than the corresponding values in the control group, neither gained statistical significance; nor the marginally higher value of triglyceride, total cholesterol, weight and waist-to-hip ratio in the IMLM group did demonstrate any statistically significant difference (p-values >0.05, Table 2).

Table 1: Baseline comparison of demographic characteristics between patients in IMLM group and control group

Variables	IMLM N (%)	Usual care N (%)	Total N (%)
Age			
40-45	11 (22)	9 (18)	20 (20)
45-50	12 (24)	11 (22)	23 (23)
50-55	9 (18)	10 (20)	19 (19)
55-60	10 (20)	11 (22)	21 (21)
60-65	8 (16)	9 (18)	17 (17)
Mean (years)	53.2	54.8	54
Sex			
Male	45 (90)	39 (78)	84 (84)
Female	5 (10)	11 (22)	16 (16)
Education			
<10 years* (Secondary school)	17 (34)	16 (32)	33 (33)
12 years (Secondary diploma)	25 (50)	28 (56)	53 (33)
16 years (University)	8 (16)	6 (12)	14 (14)
Marital status			
Married	47 (94)	44 (88)	91 (91)
Single	3 (6)	6 (12)	9 (18)
Family size			
<3	15 (30)	14 (28)	29 (29)
>3	35 (70)	36 (72)	71 (71)
Socioeconomic status			
High	6 (12)	5 (10)	11 (11)
Middle	28 (56)	29 (58)	57 (57)
Low	16 (32)	16 (32)	32 (32)
Hypertension			
Yes	15 (30)	16 (32)	31 (31)
No	35 (70)	34 (68)	69 (69)
Diabetes mellitus			
Yes	9 (18)	12 (24)	21 (21)
No	41 (82)	38 (76)	79 (79)
Hyperlipidemia			
Yes	15 (30)	16 (32)	31 (31)
No	35 (70)	34 (68)	69 (69)

A look at the patient risk factors registered on the first and second year of the follow up indicates marked improvements within the first year of the program in IMLM patients (Table 2). However despite these clear improvements, the data showed that this trend for a number of risk indicators have not been adequately maintained to the second year. The separate changes observed within the two year follow up are described as follows:

Risk factor changes over the first year: Comparison of the data on risk factors of patients at baseline and the first year of the follow up indicates substantial improvements in a lot of risk factors in IMLM participants while the patients in the control group have maintained more moderate changes during the same period resulting in various significant differences in favor of intervention participants (Table 2). At the end of first year, IMLM participants increased the HDL values by 7% while the UC patients indicated a deterioration of the value by 8.5%. This trend represented a significant change in favor of the intervention group ($p<0.05$). LDL values had also significantly reduced in intervention group than control group (13 vs. 3.4%, $p<0.05$). Moreover, at this period, total

Table 2: Risk factor changes in IMLM and Usual cared patients during the course of follow up

	IMLM participants				Usual care participants		
Risk factor	Base line	First year	Second year	Significance	Base line	First year	Second year
Pulse (min^{-1})	78.65±6	76.00±4	75.85±4*		73.40±3	73.50±5	73.00±4
BP (mm Hg)							
Syst.	138.00±24	131.00±21	130.00±21	**	139.00±23	138.00±19	139.00±21
Diast.	84.00±10	76.00±9	78.00±8	**	91.00±12	89.00±9	88.00±10
Lipid profile (mg dL^{-1})							
TC	212.90±50	171.00±46*	188.80±43*	**,***	195.00±45	182.00±47	194.50±47
HDL-c	37.40±13	40.10±14	38.90±13*	**	41.10±15	38.60±13	41.20±14
LDL-c	146.00±45	127.50±37*	134.80±38*	**	174.00±53	168.00±46*	141.80±40*
TG	255.70±131	162.00±116*	177.60±121*	**,***	227.00±129	181.00±119*	180.70±118*
FBS	128.10±21	110.00±17*	115.80±18*	**,***	135.00±23	132.00±22	134.70±23
Physical fitness							
BMI ($kg\ m^{-2}$)	28.10±4	25.20±2*	25.80±2*	**,***	27.20±4	26.70±3	26.90±3
Weight (kg)	77.45±17	68.30±14*	73.80±16*	**,***	73.30±15	71.00±14	72.40±15
Waist-hip ratio	1.01±0.3	0.90±0.2*	0.98±0.1*	**,***	0.99±0.2	0.98±0.1	0.99±0.1

BP = Blood Pressure; Syst = Systolic; Diast = Diastolic; TC = Total Cholesterol; HDL-c = High Density Lipoprotein Cholesterol; LDL-c = Low Density Lipoprotein Cholesterol; TG = Triglyceride; FBS = Fasting Blood Sugar; BMI = Body Mass Index *: Significant ($p<0.05$) compared to baseline (paired samples t-test) **: Significant ($p<0.05$) comparing two groups on the firs year (Student t-test), ***: Significant ($p<0.05$) comparing two groups on the second year (Student t-test)

cholesterol and triglyceride levels had undergone significant reduction in favor of IMLM participants than usual cared patients ($p<0.05$). A similar trend (sig. $p<0.05$) was also observed for blood pressure and fasting blood sugar values at this period. In terms of physical fitness, IMLM participants also demonstrated some significant improvements. This was featured by the reduction of BMI (10.3 vs. 1.8%), weight (11.8 vs. 3.1%) and waist-to-hip ratio (10.8 vs. 1.01%) (p-values<0.05).

Risk factor changes on the second year: Patients in the IMLM group sustained a mean weight loss of approximately 4 kg at the two years; this was statistically significant in comparison with the corresponding value (1 kg) in the control group ($p<0.05$). Similarly comparison of waist-to-hip ratio values in the two groups determined a significant reduction in favor of IMLM patients than control patients over the same period of time ($p<0.05$). The same was true for BMI values in which significant changes were observed in favor of IMLM participants ($p<0.05$). The pulse rates of IMLM patients demonstrated a non significant decrease in comparison with the Usual Care patients at this period ($p>0.05$). The same was true for blood pressure in which the value fore IMLM participants demonstrated a non significant reduction comparing with the respective value for control group patients ($p>0.05$). Fasting blood sugar values were significantly lower at the end of this period ($p<0.05$). Similarly the average triglyceride level in the IMLM participants significantly decreased at the two year period when compared with the control patients ($p<0.05$). This lowering in the triglyceride levels equated an almost 30% reduction compared with the baseline. At the end of the follow up, the IMLM patients reduced LDL cholesterol levels by a mean value of almost 8%. However, this reduction did not gained statistical significance when compared with the respective value in the control patients ($p>0.05$). Similarly for the HDL cholesterol values, the 4% increase observed at the two year period in IMLM participants determined no significant change compared with the controls ($p>0.05$). Total cholesterol levels demonstrated significant reduction than the control group at the end of the program ($p<0.05$).

Change in lifestyle behaviors: At the end of the follow up almost 60% of the participants in the IMLM group used vegetarian diet in their regimen while the corresponding value for the control group was only 30%. This demonstrated a significant difference ($p<0.05$). In terms of smoking habits, before implementation of the program 30% of the patients in IMLM group were smokers; at the end of the follow up only 10% of them were still smoking. Comparing with the 30% smokers in the usual care patients at the end of follow up, we observed a significant reduction in favor of IMLM patients ($p<0.05$). As observed in Table 3 at baseline majority of both IMLM and control patients were physically inactive. Two years on, at the end of the program 88% of IMLM vs. 20% of control patients were taking regular physical activity. This difference was statistically significant ($p<0.05$). Furthermore, at the end of follow up, 82% of IMLM participants were using heart rate monitoring to determine activity. This was statistically significant when compared to the corresponding value of 36% in the control patients ($p<0.05$). Changes in lifestyle behaviors of patients have been described in detail at Table 3.

Changes in knowledge: Participants' knowledge on coronary heart disease among intervention and control group was compared by a self-administered questionnaire

Table 3: Life style changes In IMLM and Usual cared patients at baseline and at the end of the program

	IMLM participants N (%)			Usual care participants N (%)	
Life style behavior	Baseline	Second year	Significance	Baseline	Second year
Diet type					
Veg.	13 (26)	30 (60)	*	24 (48)	15 (30)
Nonveg.	25 (50)	6 (12)		9 (18)	25 (50)
Occasional non veg.	12 (24)	14 (28)		17 (34)	10 (20)
Smoking					
Yes	15 (30)	5 (10)	*	5 (10)	15 (30)
No	35 (70)	45 (90)		45 (90)	35 (70)
Exercise vigorously 20 min 3 times per week					
Yes	10 (20)	44 (88)	*	11 (22)	10 (20)
No	40 (80)	6 (12)		39 (78)	40 (80)
Determine activity by monitoring heart rate			*		
Yes	14 (28)	41 (82)		13 (26)	18 (36)
No	35 (72)	9 (18)		37 (74)	32 (64)
Eat low fat					
Yes	17 (34)	36 (72)	**	19 (38)	26 (52)
No	33 (66)	14 (28)		31 (62)	24 (48)
Type of oil					
Saturated	13 (26)	0	*	12 (24)	9 (18)
Unsaturated	5 (10)	24 (48)		4 (8)	5 (10)
Both	32 (64)	26 (52)		34 68)	36 (72)

*: Significant comparing two groups p<0.05, **: Non significant comparing two groups p>0.05

Table 4: Comparison of knowledge and attitude towards coronary disease between IMLM and usual care patients

	IMLM participants N (%)			Usual care participants N (%)	
Knowledge/Attitude	Baseline	Second year	Significance	Baseline	Second year
Q. 1 Are overweight people more likely to hypertension?					
Yes	39 (78)	48 (96)	*	44 (88)	37 (74)
No	11 (22)	2 (4)		6 (12)	13 (26)
Q. 2 Does treatment of hypertension reduce chances of stroke?			*		
Yes	37 (74)	48 (96)		43 (86)	29 (58)
No	13 (26)	2 (4)		7 (14)	21 (42)
Q. 3 Blood clot blocking in coronary artery can be modified?			*		
Yes	22 (44)	47 (94)		18 (36)	23 (46)
No	28 (56)	3 (6)		32 (64)	27 (54)
Q. 4 Do more people die of CHD than any other disease?			**		
Yes	37 (74)	43 (86)		44 (88)	39 (78)
No	13 (26)	7 (14)		6 (12)	11 (22)
Q. 5 Is there a relationship between cigarette and CHD?			*		
Yes	41 (82)	49 (98)		43 (86)	41 (82)
No	9 (18)	1 (2)		7 (14)	9 (18)
Q. 6 Can people feel high blood pressure?			**		
Yes	28 (56)	38 (76)		38 (76)	37 (74)
No	22 (44)	12 (2)		12 (24)	13 (26)
Q. 7 If heart skips a beat, is that a positive sign of CHD?			**		
Yes	30 (60)	38 (76)		23 (46)	29 (58)
No	20 (40)	12 (24)		27 (54)	21 (42)
Q. 8 Are there many kinds of heart and blood vessel disease?			*		
Yes	24 (48)	47 (94)		19 (38)	26 (52)
No	26 (52)	3 (6)		31 (62)	24 (48)
Q. 9 Can rheumatic fever be prevented?			*		
Yes	29 (58)	49 (98)		22 (44)	35 (70)
No	21 (42)	1 (2)		28 (66)	15 (30)
Q. 10 Is a pain on the left side of chest a positive sign of CHD?			*		
Yes	40 (80)	49 (98)		39 (78)	41 (82)
No	10 (20)	1 (2)		11 (22)	9 (18)

*: Significant comparing two groups at second year p<0.05, **: Non significant comparing two groups at second year p>0.05

at patient recruitment and at the end of the program (Table 4). Though no significant difference of knowledge between the two groups was observed at the baseline stage, two years on, at the end of the program IMLM participants demonstrated substantial improvement than UC patients in majority of investigated areas. This was featured on their significantly improved (p<0.05) awareness on areas of heart disease causes (question 1, 5), symptom (question 10) and prevention (question 2, 3, 9). Other areas of knowledge regarding

epidemiology of CHD (question 4), symptoms of hypertension (question 6) as well as a symptom of CHD (question 7) demonstrated a slight non significant improvement.

DISCUSSION

Coronary heart disease risk factor management and difficulties in maintaining lifestyle adherence after a cardiovascular accident has been well described in various investigations (Moore *et al*., 1998; Willich *et al*., 2001; Brubaker *et al*., 1996). Unless treatment is simultaneously aimed at sustainable changes in patients' risk factor profile, the disease process will continue at its previous pace (Pyörälä, 1996). On the other hand, such sustainable improvements can only be achieved through long term behavior changes. The behaviorally oriented stage of the change model in rehabilitation and counseling programs, also utilized in the current study have become increasingly influential as a framework for health promotion programs (Pinto *et al*., 1998). This frame work suggests that intervention programs might be tailored to individuals' stage of readiness. The Change of Heart study demonstrated the benefits of relatively brief stage-based behavioral counseling for the two of the three risk behaviors i.e., dietary fat intake and regular physical activity (Steptoe *et al*., 1999). In our investigation, to study the effect of risk factor modification by means of non pharmacological interventions we scrutinized every risk factor separately. Each factor was amenable to modification through interventions aimed at behavior change. Elevated serum triglyceride and total cholesterol concentrations were significantly reduced by intensive dietary consultation intervention. Similar to previous investigations, these findings clearly indicate that considerable changes in dietary habits in CHD patients are feasible. However, these favorable effects may not be attributed solely to the adoption of a low fat diet, because our intervention also included additional components such as exercise or stress management.

Patient education is an essential component of patient care after MI and it has been found to be cost effective. Since patients learn by variety of methods, it is most efficacious to match an individual learning style with an appropriate teaching technique. Therefore in the lifestyle counseling sessions this method was utilized in order to assist patients understand the cause of cardiovascular accident, identify risk factors present in their lifestyle and suggest possible modifications for the removal of risk factors identified. The counseling sessions provided information in a structured easily understood way to encourage patients to adopt behavior that will result in improved health status. The beneficial effects were demonstrated in several important areas. The number of non-smokers after the program was substantially higher in the IMLM group. This finding coincides with the result that intervention in form of individually planned consecutive counseling sessions achieved a reduction in cigarette consumption. However, this conflict with findings of a previous study which reported that there were no significant differences in smoking cessation between an experimental and a control group (Scalzi *et al*., 1980). We believe this discrepancy is due to differences in the teaching methods and suppose that an individualized teaching program has a greater influence.

The positive effects of the counseling sessions were also featured in the substantial improvement of awareness regarding heart disease amongst intervention patients.

We established exercise sessions and taught each patient how to exercise efficiently. After the program regular exercise significantly increased in favor of the IMLM participants. Almost the same results were reported in several previous studies (Lee, 1998; Jo, 1999). It is hard to draw definite conclusion from these results, but it suggests that this kind of program may be beneficial at reducing some risk factors of atherosclerosis in myocardial infarction patients.

Wasson *et al*. (1992) reported that frequent telephone contacts may achieve a better medical status and outcomes rather than follow up visits alone. Telephone contacts have the privilege of being frequently usable, convenient in a way that can be set at desired periods and can be timed when they are most needed. In the current study, the scope of telephone therapy was expanded to incorporate with regular lifestyle counseling. We established lifestyle counseling sessions and telephone follow ups preceded by cardiac rehabilitation exercise sessions. However, after two years of follow up we found that some impressive improvements in cardiac risk factor in IMLM participants during the first year had been only partially maintained to the second year especially for a number of important risk indicators. The long term lipid metabolism control appeared insufficient. While the mean LDL level of IMLM patients was reduced to the safe zone on the first year, this was not maintained on 2nd year. Similarly HDL values at the end of follow up demonstrated no sensible improvement than control patients. At the end of the program only part of the risk factors demonstrated significant improvements than usual care patients (Table 2). While the limited long term effect of intervention may be initially surprising,

these results are consistent with the studies investigating post hospital period. Lear *et al.* (2003) found that after one year post CRP interventions, only some modest benefits to global cardiac risk score had been achieved. In the other study, no significant difference in weight, serum lipids or exercise capacity was reported (Brubaker *et al.*, 2000).

Giving the fact that IMLM participants had a higher proportion of vegetarians with low fat diet and still demonstrated no evident difference in ultimate plasma lipid level, it is possible to attribute (though not limit) the reason to the contributory element of genetics i.e., over time there may occur an adoption to the intervention resulting in plasma cholesterol level to be more reflective of genetics than environment. On the other hand, it is noteworthy that more elaborate interventions like Stanford Coronary Risk Intervention Program (SCRIP) (Haskell *et al.*, 1994) or the Life style Heart Trial (Ornish *et al.*, 1990) have resulted in more remarkable improvements. They utilized the program on a much longer period and with a more aggressive risk factor target. Therefore, a conclusive component can not be necessarily driven through the current two year trend.

Willich *et al.* (2001) evaluated the long term development of cardiac risk factors in coronary patients after cardiac rehabilitation therapy. They also reported short term success in the adequate control of cardiac risk factors among patients following in hospital rehabilitation therapy. The unsustainability in risk factor improvements amongst CHD patients has been attributed in part to several reasons. First, the lack of coordination of treatment approaches between rehabilitation clinics and patients' private physician, Second, insufficient effort on preventive measurements implemented from the side of patients' physicians- perhaps due to increasing budget constraints in health care systems and the third low patient compliance have been blamed for this circumstance. The overall cumulative impact of these parameters might explain some of the non-sustainable improvements in risk factor profiles of patients. Indeed, at present it does not appear possible to derive a definite answer. Further studies conducted in larger scale as well as among other populations would help clarify the subject.

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