

Beneficial Effects of Yoga Lifestyle on Reversibility of Ischaemic Heart Disease : Caring Heart Project of International Board of Yoga

J Yogendra*, Hansaji J Yogendra+, **S Ambardekar, RD Lele#, S Shetty***, M Dave****, Naaznin Husein*****

Abstract

Objectives : Yoga based lifestyle modifications have been earlier shown to be beneficial in coronary artery disease in a small number of patients. We evaluated the role of lifestyle modification based on Yoga techniques, stress management and dietary modifications in retardation of coronary artery disease.

Methods : This prospective, controlled, open trial included angiographically proven coronary artery disease patients (71 patients in study group and 42 patients in control group). They were assessed clinically, by biochemical parameters, stress myocardial perfusion and function studies and coronary angiography and on psychological parameters. The study group patients were given a family based Yoga Programme which included, control of risk factors, dietary modifications and stress management for a period of one year. The patients were assessed at baseline, at frequent intervals and at the end of one year.

Results : At the end of one year of yoga training, statistical significant changes ($P < 0.05$) were found in serum total cholesterol (reduction by 23.3% in study group patients as compared to 4.4% in controls); serum LDL cholesterol (reduction of 26% in study group patients as compared to 2.6% in the control group), regression of disease (43.7% of study group patients v/s 31% control group on MPI and 70.4% of study group v/s 28% of control group on angiography) arrest of progression (46.5% study group v/s 33.3% control group on MPI) and progression (9.9% of study group vs 35.7% of controls on MPI, 29.6% of study group v/s 60.0% of controls on angiography). At the end of the study improvement in anxiety scores was concordant with the improvement seen in the MPI. No untoward effects of the therapy were observed.

Conclusion : Yoga based lifestyle modifications help in regression of coronary lesions and in improving myocardial perfusion. This is translated into clinical benefits and symptomatic improvement. ©

INTRODUCTION

Prevalence of coronary artery disease is greatly increasing in our country for the last several years and is expected to assume epidemic proportions soon. Advances in therapy like angioplasty, stenting and by-pass surgery address effectively the problems of individual patients. However, they are expensive and are beyond the reach of the majority of

patients in our country. Besides, these procedures are focused upon treating the manifestations of the disease and not on the underlying causes of the disease.

With increasing understanding of various risk factors as causative agents of coronary artery disease, lot of interest is generated in prevention and regression of the coronary arterial disease. It has been also recognized that stress, anxiety and depression are also important in etiology and prognosis of coronary artery disease.¹

Ornish *et al*² were the first to document the beneficial effects of lifestyle changes in reversing the coronary heart disease. Manchanda *et al*³ in their study similarly showed encouraging results with their Yoga lifestyle intervention. However, both these studies included only a small number of patients.

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The Yoga Institute, Santacruz, Mumbai, India has been working on these lines for a number of years. Many cardiac patients have benefited from the training they obtained at this 86-year-old Yoga Institute.⁴ However, so far there was objective documentation using modern techniques only on some aspects, like biochemical parameters, changes in 2 D Echo and psychological parameters.⁵ No objective documentation was done for reversal of coronary blockages using techniques like coronary angiography and SPECT myocardial perfusion and function studies at rest and during exercise.

The objective of this study therefore was to determine whether a family based, yoga lifestyle intervention programme along with the control of risk factors and conventional medical treatment except statins can either reverse or arrest the progress of atherosclerotic obstructions, in patients known to have coronary artery disease.

MATERIAL AND METHODS

For this prospective, controlled, open trial, patients with proved chronic coronary artery disease were recruited. Their disease was earlier documented by history, electrocardiograms, echocardiography and treadmill testing. Patients of both sexes between the ages of 30 and 70 years were included. Their willingness to complete the entire span of the project (one year) was assured. Written informed consent was obtained from each participant. Patients with a history of acute myocardial infarction in recent past (two months) and unstable angina pectoris were excluded. Those with clinical cardiac failure, those with ejection fractions of below 30% by echocardiography and those who had undergone coronary angioplasties or by-pass surgery were also not included. Patients with mild-moderate anxiety or depression were allowed to enroll for the study. Absence of psychiatric illnesses like severe depression or anxiety, severe personality disorders and schizophrenia was confirmed. Patients habituated to alcohol were not included in the study. Ethical clearance was obtained from the institutional ethics committee.

Baseline complete clinical assessment was made. X-Ray chest, electrocardiograms, biochemical parameters (blood counts, fasting and postprandial sugars, lipid profiles, renal and hepatic functions), myocardial perfusion studies and coronary angiograms were obtained on all the participants. Their baseline levels of anxiety and depression were assessed by a psychiatrist using semistructured performa, Hamilton Depression Rating Scale (HDRS) for depressive symptoms and Anxiety Scale Questionnaire⁶ for anxiety symptoms (covert and overt).⁷

A comprehensive pretested questionnaire was developed to collect information about dietary pattern and frequency of consumption of various foods. Nutritional status was assessed using dietary parameters such as 24-hour food recall, food frequency consumption and anthropometrical measurements of weight and body mass index.

All the patients underwent ^{99m}Tc Sestamibi myocardial

perfusion and function imaging using treadmill exercise. Gated SPECT images were acquired on a single head gamma camera. Post processing, perfusion images were generated in a multi-view format along with a bull's eye polar map indicating the defect percentage. Left ventricular wall motion and thickening were evaluated using the gated images. Summed Stress Scores (SSS) and Summed Rest Scores (SRS) were generated by assessing the multi-view images on a 20 segment polar map.⁸ For comparison purposes MPI scoring system, duration of exercise, double product attained and LV ejection fractions were used.⁹

Coronary angiograms were obtained at two institutions using single plane angiography equipments. Multiple views were obtained as considered appropriate for individual patients. Left ventriculograms were performed for LV wall motion and ejection fractions. Each angiogram was analysed by at least two cardiologists who were not directly working for the project. They were blinded to the identity of the patients and the timings of angiography.

The patients were assigned either to the 'study group' or the 'control group'. Initially there were 80 patients in the study group and 60 patients in the control group. Due to various factors 11.25% dropped out from the study group and 30% dropped out from the control group.

The control group (N=42) was managed by conventional medical therapy including drugs, risk factor control, American Heart Association Step I diet¹⁰ and moderate exercises like walking.

The patients in the study group (N=71) were advised strict supervised Yoga based lifestyle modifications which included correct routines and sleep habits, recreation, managing interpersonal relationships, cultivation of faith and positive attitudes, correct attitude to work and '*sattvic yogic diet*' (appendix 1). This diet comprised of a low fat (mostly mono-poly unsaturated fatty acids) providing 10% of calories, low cholesterol - less than 50 mg daily, high carbohydrate - mostly complex, providing 70% of calories. These patients were also encouraged to take high soluble fiber diets consisting of vegetables and fruits, sprouted pulses, soyabeans and fenugreek seeds. In addition, the diet advised was rich in antioxidants (carrots for beta carotene, fruits for vitamin C, nuts like almonds and walnuts for vitamin E and flavinoids from coloured fruits and vegetables).¹¹

Supervised aerobic exercise in form of walking was advised on the basis of the patient's performance on treadmill testing.¹² They were also trained in yoga techniques. After inclusion in the study group, the patients along with their spouses spent two days in a camp at The Yoga Institute. During these two days, they were exposed to yoga techniques, diet as described above and also made aware of interpersonal relationships and relaxation techniques. Each participant was motivated and made to understand the importance of controlled lifestyle management. After this, they were followed up for one year as follows:

Once weekly for six sessions, once every fortnight for six

sessions, once a month for six sessions, three concluding sessions on every Sunday.

The participants were advised to maintain the daily diary of their activities and these diaries were examined during follow-ups. Suggestions were offered after their scrutiny. During these follow ups, in each session; there were interactive programmes with yoga expert, cardiologist, psychiatrist and nutritionist. Yoga techniques were also taught in these sessions (appendix 2).

Patients in both the groups continued to take their drugs. The patients in the study group were not allowed statins. Patients in the control group, who were on statins, continued them.

The patients were assessed for clinical, psychological and dietary parameters at the baseline, 1.5 months, 4.5 months, 9 months and 12 months.

Biochemical parameters, myocardial perfusion images and coronary angiograms were obtained at the baseline and the end of 12 months.

For statistical analysis group variables on a continuous scale were expressed as mean along with standard deviation and categorical data as frequency with percentage. All statistical tests were two tailed and the acceptance level of statistical significance in overall analysis was $P = 0.05$. Comparative statistical analysis were carried out by using ANOVA i.e. analysis of variance in data measured on continuous scale and using suitable non-parametric ANOVA in data measured on ranking scale and Chi-square (X^2) test for efficacy and other variables. Univariate and multivariate analyses were performed using SPSS statistical package.

Both the groups were comparable to start with in terms of age, anthropometrical parameters, biochemical parameters, symptoms, myocardial perfusions scores and coronary lesions. Their assessed levels of anxiety and depression scores were also similar.

RESULTS

Diet, Weight and Cholesterol

Over the study period of one year, the total caloric intake by the patients in study group reduced by 31.5 % as compared

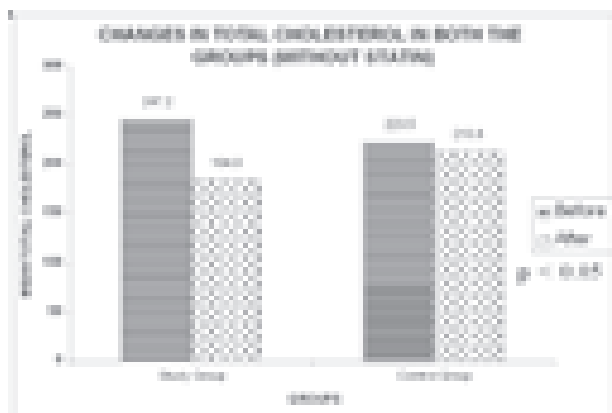


Fig. 1 : Changes in lipid profile (total cholesterol in both the groups) without statins

to that by the patients in control group 23% ($p < 0.05$) which was statistically significant. The total fat content also markedly reduced by 47.2% ($p < 0.05$) as compared to 25.7% in the control group. The complex carbohydrate content increased in the study group by 24.1% ($p < 0.05$) as compared to only 11.8 % in the controls. This was translated into their serum cholesterol levels. In the study group, average total cholesterol level fell to 184.8 mg% ($p < 0.05$) from the baseline level of 247.2 mg% ($p < 0.05$) and LDL cholesterol level fell to 108.4 from basal of 146.4, even without the use of Statins. Whereas in control group who were not on statins, average total cholesterol level fell to 213.8 mg% from the baseline level of 223.5 mg% and LDL cholesterol level fell to 147.3 from basal of 151.2. There was a negative co-relation between vegetarian diet and cholesterol ($r = -0.32$), which was statistically significant. Positive co-relations were obtained between processed food and blood pressure ($r = 0.081$) and change in simple carbohydrate and cholesterol ($r = 0.287$). These are statistically significant. Statistically significant negative co-relation was obtained between processed food and weight ($r = -0.197$) and change in complex carbohydrates (fiber) and cholesterol ($r = -0.214$). All overweight patients achieved near normal ideal body weight. The diabetic patients in the study group ($N = 33$) also achieved a balance in blood glucose level with the help of low glycaemic food (such as fenugreek seeds, sprouts). Patients in the study group achieved normal blood pressure largely due to weight reduction and cessation of processed foods and a diet high in fiber and potassium from fruits as compared to the control group. These findings were concordant with improvement in the myocardial perfusion status and angiography findings. The nutritional data also positively correlate to the decreased number of lesions (Figs. 1 and 2).

Psychological Findings

The differences between the groups on both covert and overt anxiety scales were not statistically significant. In the study group concordance between improvement in anxiety and MPI was found in 90.3% ($N = 64$) patients for covert anxiety and 95.8% ($N = 68$) patients for overt anxiety (Table 1). The change in scores on HDRS between the study and control groups was not statistically significant (Table 2).

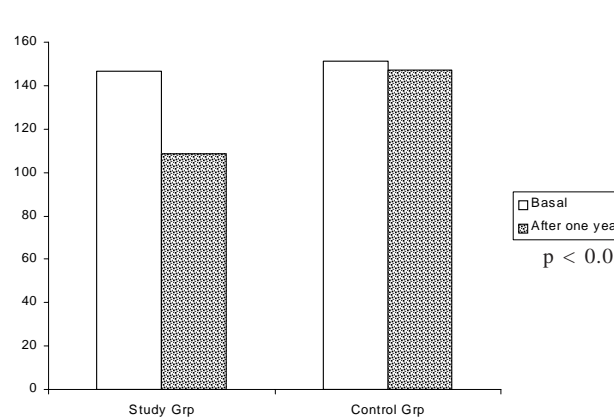


Fig. 2 : Changes in LDL cholesterol in both the groups without statins

Table 1 : Association between anxiety and MPI results

	Study Group	Control Group
Covert Anxiety		
Concordance	90.3% (n=64)	85.7% (n=36)
Discordance	9.7% (n=7)	14.3% (n=6)
Overt Anxiety		
Concordance	95.8% (n=68)	88.1% (n=37)
Discordance	4.2% (n=3)	11.9% (n=5)

By Chi-sq. test

Table 2 : HDRS scores (End of study)

	Study Group (n=71)	Control Group (n=42)	Significance
HDRS change (Mean ± SD)	1.63 ± 2.09	1.71 ± 1.80	NS

by ANOVA

Symptoms and Events

Patients in the study group showed marked improvement in their symptoms. Almost all of them rose in their functional class. Their functional class rose on an average from NYHA II to NYHA I and the consumption of the nitrate tablets likewise came down to half of their initial consumption at first follow up i.e. at the 1.5-month. At the end of one year about 50% of the subjects were symptoms free in the study group. Out of these 50 % of the patients half of them could go off nitrates. The patients in the control group also showed some improvement, though this was not as marked as the study group.

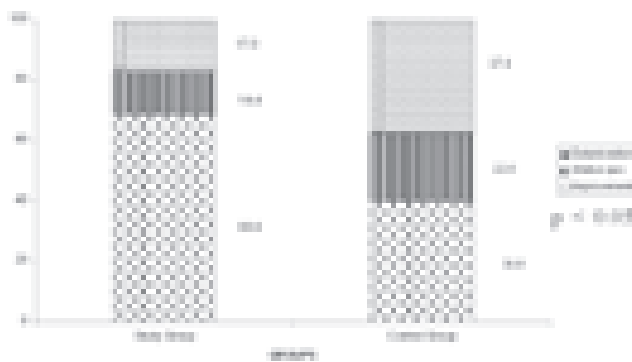


Fig. 3 : Overall improvement of lesions as per angiography status.

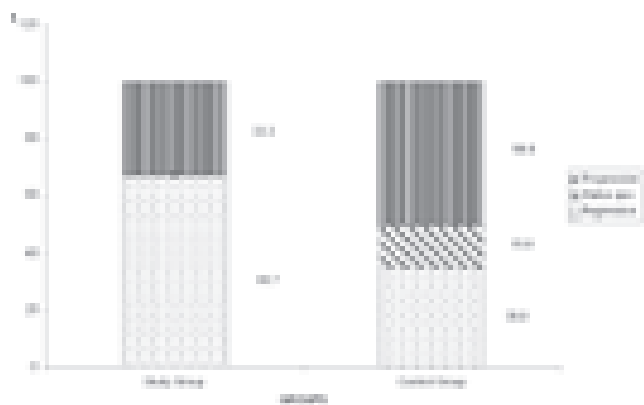


Fig. 4 : Overall improvement of patients as per angiography status

Over the study period of one year three patients (4.2%) in the study group required hospitalization for different cardiac problems. Two patients (2.8%) required to go for bypass surgery. These figures for the control group are five patients (11.9%) requiring hospitalization, two patients (4.7%) requiring angioplasty, four patients (9.5%) requiring bypass surgery. No casualty in either group during this one-year follow up. Four patients (5.6%) in the study group required to increase their anti-ischaemic drugs whereas nine patients (21.4%) in the control group required to take more tablets than the baseline therapy.

Improvement in the clinical parameters in the study group showed concordance with the myocardial perfusion imaging in 58 patients (81.6%) and showed discordance in 13 patients (18.3%). These figures for the control group are 34 patients (80.9%) and eight patients (19.1%) respectively

Clinical improvement in the study group showed concordance with the regression in coronary lesions in 39 patients (72.2%) whereas it showed discordance in seven patients (28%).

Clinical deterioration in the study group showed concordance in the coronary picture in six patients (11%) and discordance in two patients (3.7%).

These figures for the control group are as follow : Clinical improvement : 14 patients (56%) showed concordance and five patients (20%) showed discordance and clinical deterioration: four patients (16%) showed concordance, two patients 8% showed discordance.

Myocardial Perfusion and Function Imaging

On the basis of the imaging scores (Sum Rest Scores and Sum Stress Scores) exercise tolerance, double product achieved and the ejection fraction. Out of 71 patients in the study group, 31 patients (43.7%) showed improvement, 33 patients (46.5 %) maintained a status quo and seven patients (9.9 %) showed deterioration; five out of these seven were diabetic.

These figures for the 41 patients in the control group were: 13 patients (31%) improvement; 14 patients (33.3%) status quo, and 15 patients (35.7%) deterioration (Fig. 5, Fig. 6 (A) and 6 (B)).

Coronary Angiograms

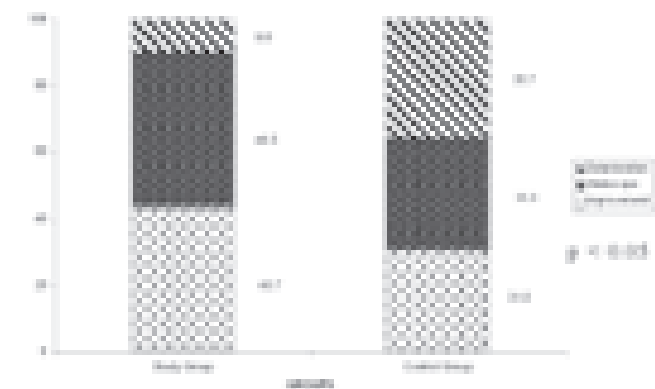


Fig. 5 : Overall improvement of patients as per MPI status

All 71 patients in the study group underwent initial coronary angiography. However only 54 patients consented for repeat angiography after one year. For the purpose of analysis, only findings of these 54 patients angiogram are included. A total of 153 coronary lesions were observed during study period. Over the period of one year 105 lesions (68.6%) showed regression (as defined by diameter stenosis reduction 10 absolute percentage points), 22 lesions (14.4%) showed status quo (change of less than 10 absolute percent points) and 26 lesions (17%) showed deterioration (diameter stenosis increasing by 10 absolute percent points).

In the control group all the 42 patients underwent initial coronary angiography but only 25 patients consented to repeat angiography. These 25 patients had 93 coronary lesions, which were analysed over the study period. Of these, 37 lesions (39.8%) ($p < 0.05$) showed regression, 21 lesions (22.6%) showed status quo and 35 lesions (37.6%) showed

progression (Fig. 3). Changes in the coronary lesions often correlated with changes in myocardial perfusion.

Coronary lesion-wise individual patients were considered to be improved (regression) or deteriorated (progression) depending on the amount of myocardium at jeopardy due to coronary lesions. Out of 54 patients, in study group 38 patients (70.4%) showed regression and 16 patients (29.6%) showed progression. In control group out of 25 patients, seven patients (28%) ($p < 0.05$) showed regression, three patients (12%) showed status quo and 15 patients (60%) showed the progression (Fig. 4, Fig. 7 (A) and 7(B)).

DISCUSSION

Prevalence of coronary heart disease in our country is on the rise. Lot of morbidity and mortality is associated with it. Modern methods viz. angioplasty, stenting and by pass surgery are at best only palliative and not curative. These are reserved for “obstructive” coronary lesions, which are responsible mainly for angina. Acute cardiac events like acute myocardial infarctions and sudden death occur generally due to thrombosis on the “non-obstructive” lesions. This is the explanation why cardiac interventions do not reduce morbidity and mortality from coronary artery disease, except for a few selected cases.

Concept of primary and secondary prevention has been long established but the claims of any study towards

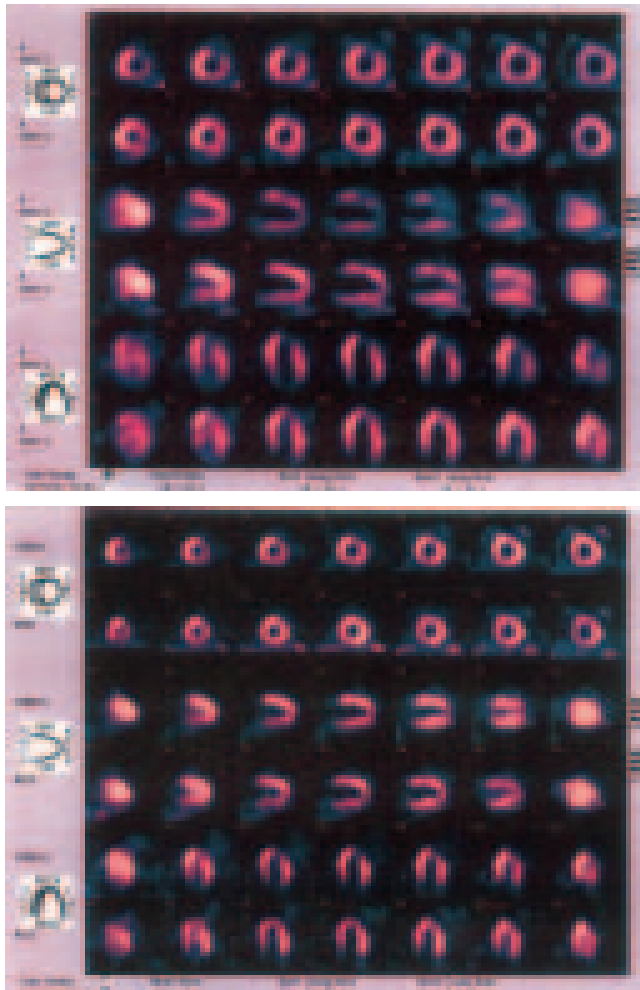


Fig. 6 : a) Jan 2001 - Before yoga : non transmural infarct in apex and basal septum : stress induced ischaemia in apex, anterior, lateral wall and inferior walls. Exercise duration 3.36 min LVEF 35% SRS 12, SSS 31 Double product 16940. Angiography showed triple V disease.
b) After yoga October 2002 - non transmural infarct in apex and basal septum : Improvement in perfusion in all 3 vascular territories. Exercise duration 6.13 min double product 20910 LVEF 60% SRS 12 SSS 17.

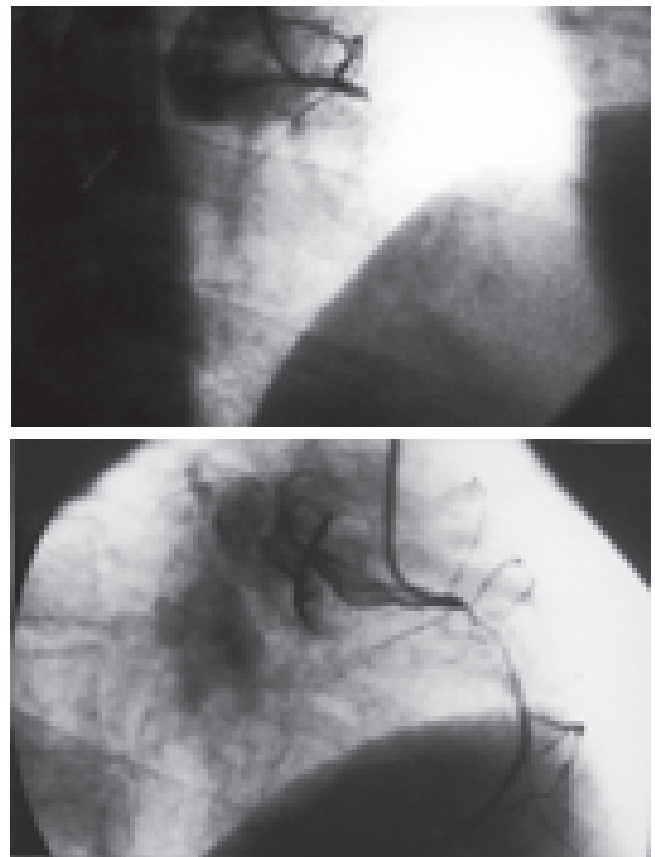


Fig. 7 : a) Total occlusion of RCA soon after origin b) Opening of artery at the end of treatment

regression of the coronary lesions have been always looked at with a lot of suspicion.¹³ A number of trials using cholesterol-lowering drugs have conclusively shown regression of coronary lesions they have also shown significant reduction in number of acute events. The MAAS (Multicentre Anti Atheroma Study) showed that with Simvastatin, the mean baseline LDL - 0 of 169-mg/ dl reduced by 31% along with a 7% increase in HDL-C. In this study, coronary lesions progressed in 23% of patients as compared to 32% of controls and regression was seen in 19% of patients as compared to 12% of controls. Clinical events were found in 30 patients as compared to 36 patients.¹⁴

Ornish *et al*¹ showed short term and long term benefits of lifestyle changes (without using cholesterol lowering drugs) on coronary lesions and clinical manifestations of coronary artery disease (Sample size, n = 28). Manchanda *et al*² showed similar benefits in Indian patient population (Sample size, n = 21). In both these studies, number of subjects was small. Our study looked at 71 subjects. The findings corroborate well with earlier such studies. Reduction in the stenosis diameter was not large in all patients however, clinical benefits far exceeded the expectations. One important reason for this is that the blood flow varies to the fourth power of the radius of the blood vessel. Secondly, plaque stabilization may be occurring without causing much increase in the arterial lumen. Improvement in endothelial function, platelet function and other coagulation factors may be another mechanism behind clinical improvement.

One finding which is very striking in the study is that some tight lesions showed more remarkable regression of the plaque. Ornish's study has also made a mention of these.

Psychological improvement as seen in changes in Anxiety Scale Questionnaire scales (covert and overt) in our study is keeping in line with similar findings from previous studies. Linden *et al*¹⁵ reported that patients who received psychosocial treatment showed greater reductions in psychological distress, systolic blood pressure, heart rate and cholesterol levels.

Our study did not look at the possible mechanism of these beneficial effects of yogic lifestyle on ischaemic heart disease. Dang and Kulshrestha in their study¹⁶ showed reduction in glucose, lipids, VMA, MDA and cortisol levels. Apart from these, beneficial effects on plasma catecholamines, leukotrienes, IL-1, IL-6 and TNF are likely to be responsible. This will form a subject of the future study.

Similarly a study of patients who have already undergone interventions like angioplasty or by-pass surgery could be interesting.

Limitations

One of the limitations of the study was non-availability of QCA (Quantitative Coronary Angiography) to all our patients. Though we have minimized subjective errors by having each coronary angiogram reported by two cardiologists not directly involved in the study, it would have made analysis of coronary angiograms more accurate if QCA was used.

It is not always possible to control the lifestyle changes adopted by patients in a study of this kind. Hence there is a possibility of dilution of the findings. A placebo effect is also present which can account for disproportionate changes in the various parameters.

CONCLUSION

Yoga based lifestyle is beneficial in reversal of ischaemic heart disease.

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Appendix I : Definition of a yogic diet

A yogic diet is a lacto-vegan nutritionally balanced, low fat, moderate protein, high complex carbohydrate diet. This diet includes fresh non-processed food with minimum non-irritating spices and condiments, and very easy to digest. It excludes tea, coffee and carbonated beverages.

Appendix 2 : Yoga Programme

Session	Hansaji Yoga expert	Dr.Ambardekar Cardiologist	Dr. Dave Psychiatrist	Naaznin Dietician-Nutritionist
1	Duty	Anatomy and physiology	Relation between the heart and the mind	Food pyramid
2	Habits	Anatomy and physiology	Mind thoughts, emotions, behavior	Vegetarian and non-vegetarian diet
3	Relaxation	Risk factor	Mind conscious, unconscious	Fats
4	Listening	Risk factor	Mind working through the nervous system	Carbohydrates
5	Reflection	Risk factor	Impact of external events	Proteins
6	Interpersonal relationship and family as A unit	Risk factor	Stress its meaning	Vitamins
7	Balance	Risk factor	Individual factors	Minerals
8	Perspective	Risk factor	In perception of stress	Modification in diet
9	Steadiness	Pathophysiology	Changes associated with stress	Sattvic diet
10	Recreation	Pathophysiology	Stress risk factor	Cooking procedure
11	Perseverance	Pathophysiology	Feedback 1	Digestive system
12	Total approach	IHD investigation	Importance of recreation	Importance of sattvic diet
13	Life energy	IHD investigation	Importance of recreation-2	How diet affects the Heart
14	Fortitude	IHD investigation	Attitude 1	Calories
15	Flexibility	Management	Attitude 2	Diabetic diet
16	Attitudes	Management problem solving	Mental health and disease	Diet in hypertension
17	Karma yoga	Management	Mental health and disease, common	Health importance of balanced meal
18	Positivity	Management problem solving	Symptoms of mental	Meal timings
19	Acceptance	Management problem solving	Mental health and disease	Menu planning
20	Discipline	Management problem solving	Anxiety problems	Sattvic recipes
21	Detachment	Management problem solving	Mental health and disease depression	Importance of emotions
			Management of problems and situations 1	Questions and answers
			Management of problems and situations 2	
			Feed back	

Each day was preceded by a Satsang, an interactive session with Dr. Jayadeva Yogendra, the Director of The Yoga Institute and Smt. Hansaji Jayadeva Yogendra, the Dean of The Yoga Institute. The participants were taught yogic techniques of meditation asanas, pranayams, mudras, kriyas, appropriate for heart patients.

Announcement

ABP (Association of Physicians of Bareilly) is hosting **Uttar Pradesh Diabetes Convention (UPDA CON)** on **30th and 31st October, 2004**. It is recognised by RSSDI for Credit Hours.

For more details please contact : **Dr. Jitendra Jauhari**, Organising Chairman, Upnishad, 321, City Station Road, Bareilly. Tel. : 0581-2470538 (O), 2476396 (R) or **Dr. PK Bass**, Organising Secretary, 106, Bara Bazar, Bareilly. Tel. : 0581-2477557 (O), 2421670 (R) 9837033120 (M), Email : drpkbass@yahoo.com