# Life Style Interventions in the Prevention of Coronary Artery Disease

*Shridhar Dwivedi*
Dean/Principal and Professor of Medicine/Preventive Cardiology
Hamdard Institute of Medical Sciences & Research, Jamia Hamdard,
New Delhi-110062

## SUMMARY

Lifestyle diseases particularly coronary artery disease (CAD) has been noted to be the most important cause of the morbidity and mortality all over the world. India is currently passing through this epidemic so much  so that it would be taking a heavy toll of Indian youth and economy to the tune of some 1.6 trillion $ during 2015-2030 . The main causative factors for CAD identified as coronary risk factors are: smoking / tobacco, physical inactivity, faulty diet, hypertension, diabetes, high level of cholesterol and stress. As most of these risk factors are lifestyle related attempt to modify them by appropriate interventions form the cornerstone of prevention of CAD epidemic. Studies done by Dean Ornish and several others prompted us to plan an interventional case control study in 640 patients of established CAD. These cases were given power point presentation regarding healthy lifestyle on one to one basis and followed up at three and six months. Primary outcomes variable were change in smoking /tobacco habits, physical activity, obesity, dietary habits, control of hypertension, diabetes and lipid profile.  At the end of intervention it was possible to bring down the tobacco consumption, improve physical activity, better control of hypertension ( $p < 0.03$) , reduction in obesity ( $p = 0.0005$) and raising HDL cholesterol ( $p\ 0.05$ ) significantly in test group.  Taking cue from above study a five step innovative strategy was developed for effective implementation of healthy life style in coronary patients attending Cardiac Clinic at HAH Centenary Hospital, Jamia Hamdard. This strategy  included sensitizing patients to locally developed visuals , posters and pamphlets at  registration desk , concurrent counseling by attending doctor  at the end of clinical examination and showing patients and their family the features of atherosclerosis during carotid  ultrasound assessment. These points were again reinforced at follow up visits. Initial results of current  intervention model  is very encouraging   in the sense that > 60% of  subjects have quit smoking and close to  50% have started regular walking and taking appropriate diet following our intensive counseling. It is thus possible to modify the risk prone behavior and making such people shun smoking / tobacco consumption, resume regular physical activity and eat appropriate diet. The above interventional model merits further evaluation and extensive application.

*Key Words:* Lifestyle, coronary artery disease, tobacco use, physical inactivity, faulty diet, intervention.

*Correspondence* :   Dr. Shridhar Dwivedi, Dean/Principal and Professor of Medicine/Preventive Cardiology, Hamdard Institute of Medical Sciences & Research, Jamia Hamdard, New Delhi-110062.   Email- shridhar.dwivedi@gmail.com

# Introduction:

Coronary artery disease (CAD) has been established to be the foremost cause of the morbidity and mortality globally (1-3).  India is currently passing through this epidemic in a subtle and silent way so much so that only its tip is visible in government hospitals or at private health care centers while the major portion of this morbid disease is submerged in the society.  According to a modest estimate about five years back it was predicted that India would require   an amount of Rs 3178.1 billion to treat various cardiovascular diseases while a sum of Rs 615.7 billion will be adequate enough to prevent it by lifestyle measures ( 4 ). However, in a most recent WHO report it has been calculated that a colossal amount of some 1.6 trillion $ would be needed during 2015-2030 for tackling cardiovascular ailments in India (5).  The very fact that it would be taking a heavy toll of Indian youth and economy is a compelling reason to take all steps to prevent this malady adopting evidence based medicine (6 ).

It is interesting to note that Sushruta -  the master clinician and surgeon    knew very well some 500 BC that physical inactivity and rich  fatty diet were twin causes for 'medoroga ' , known as   current day atherosclerosis,   and 'madhumeh' ,   popularly known as diabetes (7) . The type of exercise advocated by Sushruta like long walk, digging a well, wrestling, horse riding is akin   to that of current day treadmill exercise. Interestingly Madhvacharya 7th AD period ancient physician too described vividly  causative and diagnostic features of obesity (8). However, credit for firmly establishing coronary risk factors such as smoking , physical inactivity, faulty diet , hypertension, diabetes, high level of cholesterol and stress as the principal reasons for CAD cases  goes to Framingham Heart Studies initiated in late  1950s and the  landmark INTERHEART  study (9-10). As most of these risk factors are life style related attempt to  modify them by appropriate interventions formed the logical hypothesis to stem the tide of the CAD epidemic (11-12).

The present communication briefly gives a brief account of our work about the causes behind CAD particularly among poor and young and the effective ways for lifestyle interventions under following headings : 1. Current scenario of lifestyle diseases in India; 2. Early observations on coronary risk factors; 3. Lifestyle interventions and CAD reversal; 4. Our initial experience about effect of lifestyle interventions on coronary risk factors  ; 5. Current model : Five steps for effective implementation of healthy lifestyle; 6. Conclusion

## Current scenario of lifestyle diseases in India

Concurrent with rapid urbanization and development there has been a remarkable change in the lifestyle of most Indians. People tend to smoke or

**Table 1:** Current burden of lifestyle related disorders in India

| Disease | Estimated number of people affected | Major risk factors |
|---------|-------------------------------------|--------------------|
| Obesity | 155 million | Physical inactivity , faulty diet, exercise |
| Hypertension | 140 million | Faulty diet, lot of salt, physical inactivity, tobacco, alcohol, stress. |
| Diabetes | 64 million | Physical inactivity, faulty diet, stress |
| CAD | 31.8 million | Smoking / tobacco, physical inactivity, faulty diet, stress. |
| Cancer | 12.7 million | Smoking / tobacco, faulty diet, physical inactivity |
| Stroke & COPD | 1.2 million | Hypertension, smoking / tobacco, Physical inactivity |
| Chronic respiratory diseases | 30 million | Smoking |

chew tobacco as a mark of social status, tend to ignore physical activity , eat more junk or fatty food , consume more salt, and prone to more psychosocial stress. The resultant effect of this change is epidemic like increase in life style related disorders (Table 1). According to a very modest calculation India is a home to 155 million obese, 140 million hypertensive, 31.8 million CAD, 64 million diabetes including pre-diabetes and 1-2 million stroke patients. (12)

**Early observations on coronary risk factors :** My early interest in role of life style in CAD stems from MD thesis on coronary risk factors some forty years ago (13-14) . It was observed that most important risk factors were smoking/ tobacco, hypertension, hypercholesterolemia hyperglycemia and obesity (Table 2). Out of these smoking and obesity have been a consistent risk factor in subsequent studies at Manipal and two regions of Delhi – one at north east , UCMS-GTB Hospital and another at south east , HIMSR, Jamia Hamdard ( 15- 18) . The recent surge of CAD among youth that too in low to lower middle segment of the society observed at Banaras, Delhi, Jaipur and down south Delhi during last four decades has made a

**Table 2:** Risk factors in ischemic heart disease (IHD)

| N= 308 / (118 IHD : 90 healthy control) ||
|---------------------|-------------------------------------------------|
| Smoking | 57.6% |
| Hypertension | 68.3% |
| Raised cholesterol | 47.1% |
| Hyperglycemia | 37.2% |
| Obesity | 26.6% |
| Diet | 7% |
| Occupation | Businessmen, passive agriculture workers, retd. people. |

**Table 3:** Risk factors in young CAD patients and control

| Parameters | CAD group (n=292) | Control Group (n=92) | p value | OR (95% CI) |
|---|---|---|---|---|
| Age (years± SD) | 36.3±4.11 | 35.6±3.26 | 0.1737 | - |
| Smokers* | 217 (74.3) | 13 (14.1) | <0.0001 | 17.6 (9.2-33.4) |
| Hypertension | 73 (25.0) | 12 (13.0) | 0.0235 | 2.2 (1.14-4.31) |
| Diabetes mellitus | 43 (14.7) | 7 (7.6) | 0.1115 | 2.10 (0.91-4.84) |
| Dyslipidaemia | 172/189 (91.0) | 73/83 (87.9) | 0.5787 | 1.39 (0.61-3.17) |
| High total Cholesterol | 36/189 (91.0) | 17/83 (20.5) | 0.9134 | 0.91 (0.48-1.74) |
| Low HDL-C | 122/177 (68.9) | 47/79 (59.5) | 0.1838 | 1.51 (0.97-2.62) |
| Figures in parentheses denote percentages *P<0.05 | | | | |

*Aggarwal, Aggarwal,Goel, Sharma, Dwivedi (2012)

startling revelation that with every passage of decade the prevalence of CAD is not only increasing but the age of onset for first CAD episode is getting preponed by five to ten year in each decade (Table 3) ( 18-19 ) .  One common trait all over India is the dominant presence of smoking and/or tobacco habit in younger people suffering from CAD (10, 18,20). This fact has been further corroborated by an autopsy study carried out in 100 cases dying due to road traffic accident in north east Delhi.  It was noted that 92% cases had evidence of coronary/aortic atherosclerosis as early as $2^{nd} – 3^{rd}$ decade. The mean age of these cases was 31.64 years and many of them were smokers and/or tobacco users (21-22). Above observations further strengthened our earlier hypothesis that faulty lifestyle like smoking /tobacco habit along with physical inactivity is the dominant factor behind the CAD among younger people (16)

## Lifestyle interventions and CAD reversal

It was Dean Ornish in 1990 who convincingly reported that CAD can be reversed and /or halted by appropriate dietary and stress management technique like yoga (11) . It was a revolutionary concept in the sense that till then curative measures like  antiplatelets, beta-blockers, statins , angiotensin converting enzyme - inhibitors (ACE -- inhibitors) - , coronary care unit care ( CCU care ) , angioplasty and or other aggressive mode of therapy was the only evidence based therapy for tackling  coronary problems. Nobody could dare talk of focusing on alternative methods like yoga, strict emphasis on smoking cessation and appropriate dietary regimen perhaps because of lack of strong evidence about their efficacy in reversing CAD process once started. Although there were several leads mainly from Finland and United States that strict avoidance of tobacco, emphasis on vegetarian diet with plenty of fruits and vegetables and daily exercise or walking for > 30 minutes every day would result in better control of diabetes and prevention of cardiovascular diseases or stroke. The results in elderly and women were more convincing (23-28). Even in

our own country Udupa ( 1975) and Datey (1976 )had published authentic evidence on beneficial role of yoga in hypertension and ischemic heart disease (29 -30).

Soon after Dean Ornish work several Indian studies demonstrated beneficial role of yoga in retarding coronary atherosclerosis (30-33). These studies had small number of cases that too without a long term follow up. Further, these could not be replicated in other cities of India because they required aggressive and costly procedures like coronary angiography which may not be available at all cities in first instance and even if available may be beyond the reach of common people who happen to be the major victim of CAD in their prime of youth. Therefore we badly needed a strategy which could be easily executed and monitored at all city hospitals and be effective in preventing CAD.

## Initial experience about effect of lifestyle interventions on coronary risk factors

Taking cue from Dean Ornish work and Finnish studies about the beneficial effects of lifestyle interventions in CAD we carried out a randomized controlled trial study in 640 eligible CAD subjects randomly divided into two groups at our centre (34). The study group was given interventional package in the form of power point presentation on one to one basis at baseline giving basic outlines of healthy lifestyle. They were also handed over a booklet in Hindi giving necessary details of healthy life style for maintaining healthy heart. Control group was not given such a package, though they were also told about harms of smoking, physical inactivity and faulty diet during routine management. The subjects were then followed at three and six months and

**Table 4:** Effect of lifestyle intervention on risk factors in subjects in study and control groups*

| Risk factors | Study group | | | | | | Control group | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Baseline (Ref) | Three months | | Six months | | | Baseline (Ref) | Three months | | Six months | | |
| | | OR | 95% CI of OR | | OR | 95% CI of OR | | | OR | 95% CI of OR | | OR | 95% CI of OR | |
| Hypertension | 1 | 0.41 | 0.289 | 0.586 | 0.30 | 0.193 | 0.467 | 1 | 1.08 | 0.805 | 1.445 | 1.05 | 0.775 | 1.408 |
| Obesity | 1 | 0.77 | 0.655 | 0.910 | 0.58 | 0.452 | 0.736 | 1 | 0.87 | 0.741 | 1.026 | 0.98 | 0.796 | 1.214 |
| Tobacco | 1 | 0.14 | 0.100 | 0.194 | 0.08 | 0.057 | 0.123 | 1 | 0.24 | 0.180 | 0.327 | 0.18 | 0.128 | 0.245 |
| Lipid profile disorders | 1 | ------ | ------ | ------ | 0.67 | 0.448 | 1.088 | 1 | ------ | ------ | ------ | 1.21 | 0.781 | 1.842 |
| Lack of physical activity | 1 | 0.97 | 0.790 | 1.186 | 0.63 | 0.515 | 0.763 | 1 | 1.27 | 1.024 | 1.570 | 1.20 | 0.964 | 1.535 |
| Diabetes | 1 | ------ | ------ | ------ | 0.52 | 0.383 | 0.701 | 1 | ------ | ------ | ------ | 0.71 | 0.537 | 0.939 |

CI – confidence interval, OR – Odds ratio
Source - Ali Dehghani , PhD thesis 2012

risk factors were evaluated to find out reduction, if any in risk factors amongst them. There was a statistically significant difference in reduction in tobacco, improvement in  physical activity and reduction in  blood pressure  at three and at six months (p<0.03) ( Table 4) . Further there was statistically significant difference in obesity after 6 months of adherence to lifestyle measures in study group as against control group (p=0.0005).  There was also significant improvement in HDL cholesterol after six months (Table 5). However ,  there was no significant difference in reduction in diabetes at six months in the study group as compared to control group (p=0.419).

This study is remarkable in the sense that it is the first kind of a statistically robust long term   study emanating from India wherein health education plus clinical   service based intervention has produces reduction in coronary risk factors in established CAD patients. The preventive significance of above observations becomes important in view of the fact that merely by modifying four major risk factors one may achieve 90% reduction in sudden death in women (35) . Further , it is also  known that increased fruit and vegetable consumption is associated with decreased type 2 diabetes risk –a conclusion based on studying 3704 middle aged adults for a period spanning about 11 years (36).  On individual levels we do come across several examples where such life style intervention has brought reduction in coronary and other life style related diseases (37). There is also a strong possibility that individually focused intervention as this  may usher in such modifications   in siblings and children because most of the time such  habits are passed down to generations by elders in family (38 ).

**Table  5 :** Comparison of lipid profile before and after intervention in
the study and the control group in CAD subjects*

| | Group | Pre Mean | Post Mean | Change | p value |
|---|---|---|---|---|---|
| Cholesterol | Study | 160.85+/-43.55 | 147.63+/-45.01 | -11.843 | 0.74 |
| | Control | 163.31+/-45.56 | 153.01+/-45.64 | -2.74 | |
| HDL | Study | 35.23+/-7.82 | 37.15+/-7.61 | -1.68 | 0.05 |
| | Control | 36.84+/-8.32 | 36.86+/-8.41 | 0.78 | |
| LDL | Study | 94.208+/-34.96 | 78.24+/-39.58 | -8.06 | 0.96 |
| | Control | 98.38+/-40.39 | 78.24+/-39.58 | -8.32 | |
| Triglyceride | Study | 134.32+/-72.5 | 118.90+/-56.83 | -9.25 | 0.883 |
| | Control | 132.53+/-70.28 | 120.67+/-63.73 | -10.59 | |

Source - Ali Dehghani , PhD thesis  2012

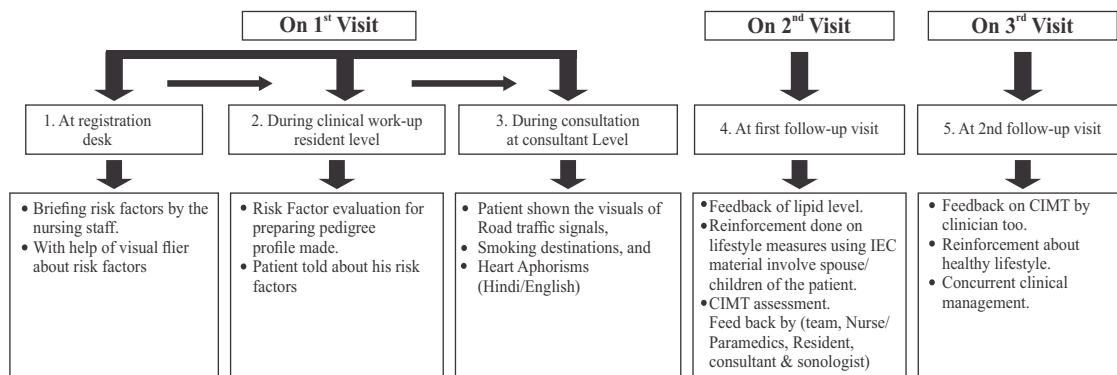| On 1st Visit | | | On 2nd Visit | On 3rd Visit |
|---|---|---|---|---|
| 1. At registration desk | 2. During clinical work-up resident level | 3. During consultation at consultant Level | 4. At first follow-up visit | 5. At 2nd follow-up visit |
| • Briefing risk factors by the nursing staff.<br>• With help of visual flier about risk factors | • Risk Factor evaluation for preparing pedigree profile made.<br>• Patient told about his risk factors | • Patient shown the visuals of Road traffic signals,<br>• Smoking destinations, and<br>• Heart Aphorisms (Hindi/English) | • Feedback of lipid level.<br>• Reinforcement done on lifestyle measures using IEC material involve spouse/ children of the patient.<br>• CIMT assessment. Feed back by (team, Nurse/ Paramedics, Resident, consultant & sonologist) | • Feedback on CIMT by clinician too.<br>• Reinforcement about healthy lifestyle.<br>• Concurrent clinical management. |

Fig. 1 : Current model : Five step for effective implementation of healthy lifestyle

## Current model: Five steps for effective implementation of healthy lifestyle

1. Lessons learnt from above study prompted us to develop a model of intensive counseling concentrating on quitting smoking / tobacco habit, physical inactivity, diet, correcting central obesity and managing stress at HAH Centenary Hospital, Jamia Hamdard starting Jan., 2012 ( Fig 1 ). The core features of this model is intensive health education comprising visuals, posters, aphorisms both in Hindi and English and comprehensive pedigree profiling of four major risk factors like tobacco, hypertension, CAD and diabetes in family and assessment of carotid intima media thickness (39 ) . Such a health intervention starts from registration desk at cardiac clinic and continues till final point of consultation under same roof. All subjects are given a colored visual depicting the harm inflicted by smoking/tobacco, inappropriate diet, central obesity, stress and physical inactivity at the entry point. They are also shown posters showing the hidden health message behind traffic light signals at the end of the clinical work up same day.

Beside these patient and his spouse / sibs / attendant are encouraged to read various posters displayed immediately outside the clinic. Notwithstanding these measures at 1st visit, patients are counseled again and again in the subsequent visits. In case of any default particularly smoking they are shown visual containing consequences of continued smoking (Fig. 2).



**GO AHEAD TOBACCO OR DRINK**
BUT BE READY TO LAND INTO ONE OF THESE PLACES

MORTURY

• CCU (Heart Attack)
• RESPIRATORY UNIT (Respiratory Failure)
• CANCER HOSPITAL
  (Cancers of Mount, Lungs, Breast, Cervix etc.)
• EMERGENCY (Stroke, Trauma, Bleeding)
• MORGUE (Sudden Death)

Fig. 2: Reinforcing not to smoke in follow up visit

We have been able to counsel some 200 cases suffering from CAD through such intervention. It was noted that > 60% of subjects quit smoking and /or tobacco habit and close to 50% started regular walking and eating appropriate diet following above intervention . This is a remarkable achievement in our model compared to western findings of low success rate in smoking cessation. One of our 60-year-old patient who was known to be having hypertension , diabetes , psoriasis and had stroke about 6 months back continued to smoke and drink alcohol more than moderate amount    till he visited our clinic; he   left smoking after our 1st counseling.

This success is not limited to smoking subjects only but in non smoking people also. As we are well aware that diabetes is the most important cause of CAD next to smoking, our model takes care of this factor too. Another case who was 56-year-old- male , non tobacco user and  obese , detected to be hypertensive , later on developing diabetes finally



Fig. 3:   A -56 –yr-old – male, non tobacco user  with manifest central obesity developed  hypertension, diabetes and finally detected to have TMT + ECG changes. He followed life style measures as per our counseling. His blood sugar improved and 64  slice MDCT revealed a normal coronary profile following three months of  life style  intervention.

diagnosed to have positive tread mill test (TMT ) and ECG ; he was suggested life style measures and given conventional antihypertensive drugs . After three months of above regimen his blood sugar improved and 64 slice computed tomography (CT) revealed a normal coronary profile (Fig.3 ).

Encouraged by this favorable response to our intensive health education we have now decided to take this campaign to some of the neighboring schools and sensitize the young minds about the healthy life style for ensuring good cardiovascular health.

## Conclusion :

Coronary risk factors particularly tobacco use, physical inactivity and dietary modification can be modified appropriately if pursued aggressively by treating physicians and paramedical team using appropriate health education materials in hospital setting . A case for spreading healthy life style among youth is strongly advocated for preventing CAD epidemic.

## Acknowledgements :

## References:

1. Indrayan A (2005) . Forecasting vascular disease cases and associated mortality in India. Background Papers: Burden of Disease in India, National Commission on Macroeconomics and Health, Government of India, 197-215.

2. National Health Profile (2006): www.cbidghs.nic.in

3. Shah B, Mathur P (2010). Surveillance of cardiovascular disease risk factors in India: The need & scope. *Indian J Med Res* **132**:634-642.

4. Dwivedi S, Aggarwal A (2009). Economic implications of preventive cardiology: Indian perspective. *Ann Natl Acad Med (Sci)* **45**:97-116.

5. Bloom DE, Cafiero ET, Jané-Llopis, E, *et al* (2011). The Global Economic Burden of Noncommunicable Diseases. Geneva: World Economic Forum.

6. Aggarwal A, Muktesh G, Dwivedi S (2013). Coronary artery disease –an Indian perspective . *European Heart Journal* **34**:1857-58 .

7. Dwivedi G, Dwivedi S (2007). Sushruta –The Clinician- Teacher par

excellence. *Indian J Chest Dis Allied Sci* **49**:51-52.

8.   A Rout, Jaishish, JV. Madhavacharya (2013). *J Ass Physicians of India* (**61**):89.

9.   Dawber TR, More FE, Man GB (1957). Coronary heart disease in the Framingham Study.  *Amer J. Pub Health* **(47)**:2-4.

10.  Yusuf S, Hawken S, Ounpuu S, Dans *et al* ( 2004). Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries ( the INTERHEART study): case control study. *Lancet* **364**: 937-52.

11.  Ornish D, Brown SE, Scherwitz LW (1990). Can lifestyle changes reverse coronary heart disease? The Lifestyle Heart Trial. *Lancet* **336**:129-133.

12.  Dwivedi S, Aggarwal R (2013). Lifestyle modification to prevent and control diseases. Chapter in API Textbook of Medicine, Editor / Publisher Y P Munjal, API , New Delhi.

13.  Dwivedi S **(**1971). Evaluation of coronary risk factors (MD - Thesis), Institute of Medical Sciences, Banaras Hindu University, Varanasi.

14.  Dwivedi S, Somani PN and Gode KD (1975). Risk factors in patients of coronary artery disease. *Indian J Preventive Social Medicine* **6**:139-145.

15.  Dwivedi S, Girish, Chaturvedi A (1999). Profile of risk factors in young coronary patients – An urban and semiurban scenario. *J Ass Physicians India* **47**: 654-655.

16.  Dwivedi S, Dwivedi G, Chaturvedi A, Sharma S (2000). Coronary artery disease in the young : Heredofamilial or faulty life style or both. *J Ind Acad Clinical Medicine* **1** :222-229

17.  Lotfi M H, Dwivedi S, Kannan AT, Sundaram K R (2008). The role of adverse lifestyle changes in causation of CAD. *Acta  Medica Iranica* **46**:125-132.

18.  Aggarwal A, Aggarwal S, Goel A, Dwivedi S (2012). A retrospective case control study of modifiable risk factors and cutaneous markers in Indian patients with young coronary artery disease .*J R Soc Med Cardiovascular Dis* 1 :8. DOI 10.1258/cvd.2012.012010

19.  Aggarwal A , Muktesh G, Dwivedi S ( 2013 ). Coronary artery disease in young . Chapter in Book  Clinical Medicine Update 2013, Academy of Clinical Medicine , .Edited / Published  by BB Rewari , PGIMER and RML Hospital New Delhi .

20.  Gupta R (1996). Lifestyle risk factors and coronary heart disease prevalence in India. *J Assoc Physicians India* **44**:689-93.

21. Dev G, Wahi M, Verma S K, Dwivedi S, Aggarwal B B L (1999). Coronary atherosclerosis- an autopsy study. *Current Advances in Atherosclerosis Research* (**2**): 15-21.

22. Wahi M , Verma S K, Dev G, Dwivedi S (2000). Aortic atherosclerosis in north Indian population: A pilot autopsy study. *Cardiology Today* **4**:31-34

23. Pichke CR, Ornish D (2008). Long term effects & lifestyle changes on well being and cardiac variables among coronary heart disease patients. *Health Psychol* **27**:584-592.

24. Leslie SJ (2001). Cardiology in the 21st century. Proceedings of the Royal College of Physicians of Edinburgh **31**:320-326.

25. Tuomilehto J, Lindstrom J, Eriksson J G *et al* (2001). Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance *N Engl J Med*. **344**:1343.

26. Wood DA, Kotseva K, Connolly S, *et al* (2008). Nurse-coordinated multidisciplinary, family-based cardiovascular disease prevention programme (EUROACTION) for patients with coronary heart disease and asymptomatic individuals at high risk of cardiovascular disease: a paired, cluster-randomised controlled trial. *The Lancet* 371: 1999 – 2012.

27. Jerome LF, Mihriye M, Barbara V J, *et al* (2008). Effect of Statins Alone Versus Statins Plus Ezetimibe on Carotid Atherosclerosis in Type 2 Diabetes. The SANDS (Stop Atherosclerosis in Native Diabetics Study) Trial. *J Am Coll Cardiol* **52**:2198–205.

28. Dod HS, Bhardwaj R, Sajja V, *et al* (2010). Effect of intensive lifestyle changes on endothelial function and on inflammatory markers of atherosclerosis. *Am J Cardiol* **105**:362-367.

29. Udupa KN, Singh RH, Settiwar RM (1975): Physiological and biochemical studies on the effect of yogic and certain other exercises. *Indian J Med Res* **63 :** 620-624.

30. Patel C, Datey KK ( 1976) : Relaxation and biofeedback techniques in the management of hypertension. *Angiology* **27:** 106-113

31. Yogendra J, Yogendra HJ, Ambardekar S, *et al* (2004). Beneficial effects of Yoga lifestyle on reversibility of ischaemic heart disease: Caring Heart Project of International Board of Yoga. *J Ass Physicians India* **52**:283-293.

32. Bijlani RL, Vempati RP, Yadav RK, *et al* (2005). A brief but comprehensive lifestyle education program based on yoga reduces risk factors for cardiovascular disease

and diabetes mellitus. *J Alt Comple Med* **11**:267–274.

33. Manchanda SC, Narang R, Reddy K S, *et al* (2007). Retardation of coronary atherosclerosis with yoga life style intervention. *J Ass Physicians India* **48**:687-694.

34. Ali D (2012). A hospital based study of the effectiveness of the lifestyle intervention in reduction of coronary heart disease risk factors. PhD. Thesis. (Community Medicine) Faculty of Medicine, University of Delhi.

35. Chiuve S (2011). Healthy lifestyle led to low risk for sudden death in women. *JAMA* **306**:62-69.

36. Earl S Ford, Ali H Mokdad (2001). Fruit and Vegetable Consumption and Diabetes Mellitus Incidence among U.S. Adults . *Preventive Medicine* **32 :** 33-39

37. Dwivedi S, Aggarwal R (2010). Impact of health intervention on tobacco practice and oral health in a family: an illustrative pedigree. *Health Positive* **2:** 38-40**.**

38. Dwivedi S, Aggarwal A, Nishant S, Aggarwal S, Sharma V (2013). Role of family milieu in tobacco addiction: A study in a tertiary-care institution in India. *J Health Popul Nutr* **31**:130-132 .

39. Dwivedi S, Aggarwal A (2008). Pedigree profile: A valuable tool in the risk assessment of coronary artery disease in young. *South Asian J Prevent Cardiol* **12**:5-15.