THE ROLE OF ADVERSE LIFESTYLE CHANGES IN THE CAUSATION OF CORONARY ARTERY DISEASE

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Abstract- Adverse lifestyle changes like rapid change in dietary habits coupled with decreased physical activity and increasing rates of alcohol and tobacco consumption can increase coronary artery disease (CAD) risk factors and its mortality even higher than the rates predicted. To evaluate the role of adverse lifestyle changes factors in the causation of CAD, a hospital based case-control study was conducted in an urban area of East Delhi from April 2002 to December 2003. A total of 500 subjects with age group 30-75 (250 cases and 250 controls), were included in this study. To obtain more validate comparisons, 250 controls also was selected from community of East Delhi. The tool of enquiry was a pre-tested and pre-coded questionnaire. A confidence level of 95% and study power of 80% were considered for the interpretation of possible significant findings. Sexwise stratified analysis was separately done for male and female subjects using Multiple Logistic Regression. Comparison of male cases with their counterparts in both control groups indicated that milk consumption, using saturated oils for cooking medium, and tobacco consumption could account for as CAD independent predictors (P < 0.001). The comparison of female cases with their counterparts in both control groups also showed that majority of those significantly were nuts consumer. Male cases compared to males in hospital group and female cases compared with females in community control group significantly were nuts consumer and used saturated oils in their cookings respectively. Our study showed that dietary factors such as consumption of milk, nuts, saturated oils and smoking, as misbehavior factor, could play an important role in the causation of CAD in urban area of East Delhi, India.

INTRODUCTION

Coronary Artery Disease (CAD), the most frequently Cardiovascular disease, is caused by obstruction of blood in the coronary arteries resulting from deposition of cholesterol and fat in the wall of that arteries (1). These events result in common manifestations like angina, myocardial infarction, congestive heart failure, arrhythmias or sudden cardiac death. CAD has a multi- factorial etiology, with many of the risk factors being influenced by lifestyle (2). Adverse lifestyle changes like rapid change in dietary habits coupled with decreased physical activity and increasing rates of alcohol and tobacco consumption can increase CAD risk factors and CAD mortality

even higher than the rates predicted (3). Various studies have shown that diet is one of the earlier Coronary Artery Disease (CAD) risk factors where diet changes in terms of quantity or quality can increase the chance of main CAD risk factors like obesity, diabetes, hyperlipidemia and hypertension. It is also known that dietary modification play a large role in reducing or preventing the onset and changing the course (4-6). It is also known that the abuse of tobacco is probably the most widespread of the modifiable CAD risk factors. The number of cigarettes smoked per day correlated positively with the risk of CAD (relative risk 5.5 for more than 25 cigarette per day), non fatal myocardial infarction (relative risk 5.8) and angina pectoris (relative risk 2.6) (3,7). Many studies have been shown that Physical inactivity confers at least a two-fold increase in risk for CAD events and CAD mortality (8). The risk increases up to eight fold when measures of fitness, rather than estimates of inactivity are used. Physical inactivity also has been documented to play a role in causation of CAD risk factors such as hypertension, diabetes mellitus, obesity, hypercholesterolemia, etc (9).

Since the association between advers lifestyle factors like diet, tobacco consumption, alcohol intake and physical inactivity with Coronary Artery Disease had not been enough studied in urban areas of India, the present case control study aimed to explore the role of lifestyle pattern on getting CAD amongst urban population of East Delhi, India.

MATERIALS AND METHODS

The study was carried out on the urban population of East Delhi from April 2002 to December 2003 through a design strategy of hospital-based case-control study. Applying appropriate statistical formula and considering a confidence level of 95% and study power of 80%, a total of 500 subjects including 250 Cases with acute myocardial infarction selected from CCU and cardiology wards of Guru Teg Bahadur (GTB)

hospital and 250 hospital controls drawn from inpatient and outpatient wards of certain clinical departments of the hospital such as surgery, eye, and ENT wards were studied by consecutive sampling method. Cases were defined as male or female subjects with age range 30 to 75 years, survivors of a first MI as per ICD10 code 410 and residing in the urban area of East Delhi admitted to CCU or Cardiology wards of GTB Hospital in the time period of aforesaid. They had to fulfill the criteria for definite acute myocardial infarction as per the MONICA project – 1) two or more ECG showing specific changes, 2) ECG showing probable changes plus abnormal cardiac injury enzymes, or 3) Typical symptoms such as retrosternal pain plus abnormal enzymes. All diagnostic criteria for the cases were confirmed by the only expert Cardiologist working in the cardiology ward of hospital. To ensure comparability between cases and controls also to check whether hospital controls are different from the community, we selected a number of 250 community controls from different colonies of East Delhi according to an initial analysis of cases as per their place of residence. Community controls were selected by systematic random sampling. The tools of enquiry were a pretested-precoded questionnaire administered to both the case and control groups and physical examination. Age was matched for both the case and control groups (with an interval of ±2 years). Sexwise stratified analysis was separately done for male and female subjects. Association of lifestyle variables including diets, smoking and physical inactivity with CAD were studied using unconditional and conditional Odds Ratio (ORs) with 95% confidence intervals (CIs) obtained by Multivariate Logistic Regression technic.

RESULTS

In this study, 82% of cases, 75% of Hospital controls and 81% of Community controls were male and no significant association was found with respect to sex and CAD (p> .05). The univariate comparison of lifestyle behaviour in male cases with males in control groups are shown in table 1. In respect to diet factors, the higher percentage of male cases compared to males in both control groups gave

history of milk and nuts consumption routinly in their daily diets and used saturated oils as cooking medium in their daily cookings where the odds of getting CAD amongst individuals with routinly consumption of milk, nuts and saturated cooking medium varied from > 1.5 times to > 3.5 times, from > 2 to >4 times and nearly 2.5 times higher than their counterparts who had no history of consumption of these diets. Alcohol consumption and smoking were other lifestyle factors that played a significant role in the causation of CAD where alcohol consumers and smokers had a chance of nearly two times and more than three times higher getting CAD than male controls respectively [OR= 1.80 (95% CI= 1.19-2.72), p<.01] and [OR= 3.23(95% CI= 2.06-5.07), p<.001]. Comparison of the respected attributes of alcohol and smoke consumption like daily consumption of pegs in alcoholic persons or daily number of smoked in smokers, also duration of consumption of those showed that male cases had significantly higher percentages than those in male controls of both groups (table1). Compared with hospital controls, majority of male cases had history of leisure time physical activity along with its attributes such as daily time and duration and it accounted for a protective role for getting CAD. However, a reverse relation was seen when male cases were compared with males in community group, where not having physical activity amongst cases was 1.5 times higher than that male controls [ORs= 1.55 (95% CI=1.02-2.37), p<.05].

The comparison of lifestyle factors between female cases with females in control groups are shown in table 2.

Out of four diet factors, only nuts consumption was seen to be significantly associated with CAD in the both comparison done between female cases and females in hospital and community control groups (OR= 5.67 (95% CI, 1.83-18.28), P=.01 and OR= 9.11(95% CI,2.22-43.28), p<.01). Although, the higher percentage of female cases in comparison with females in both control groups were routinly milk consumer and user of saturated oils as cooking medium but, only the difference obsreved between female cases and females in community group was statistically significant (ORs=3.16(95% CI, 1.23-8.24), p=.01 & ORs=13.43(95% CI,1.63-293.44,p<.01 respectively). According to table 2, 15.5% and 4% of female subjects in case and community group were smokers, respectively, where the difference was seen statistically significant and probability of getting CAD amongst female smokers was over 5 time higher than non-smokers [ORs = 5.72 (95% CI=1.05-41.29), p= 04).

No significant difference was seen in respect to comparisons done for other lifestyle variables between female cases and females in hospital and community controls.

Step-wise regression analysis

Stepwise logistic regression analysis was carried out for both continuous and categorical variables having a p-value less than .20 based on the univariate analysis (Table 3).

In respect to milk consumption, only in male subjects it could account for as significant predictors for getting CAD on the multivariate model. The respected significant odds ratios observed from comparison of male cases with males in hospital and community groups were [OR =2.01(95%CI=1.07-3.72)] and [OR =2.16 (95% CI=1.19-3.91)], respectively.

Out of four comparisons for nuts consumption on the model, three of those were found to be significantly associated to CAD as that higher percent of female cases compared with their counterparts in both control groups, as well higher percentage of male cases compared to males in hospital group were nuts consumers in daily diets. The similar number of significant comparison was shown for cooking medium where male and female subjects who consumed saturated oils as daily cooking medium had higher chance of CAD compared with those that used unsaturated oils (ORs varied from 2.5 to 12.2).

Adjusting with other factors, smoking was the only non-diet factor that could account for as significant predictor for CAD in males on the model so that the odds of getting CAD amongst male smokers varied from more than 3 times to nearly 5 times than those in non-smokers.

Table 1. Comparison of lifestyle changes factors in male cases & controls

Variable	Cases vs. Hospital Controls				Cases vs. Community Controls			
	Case	Controls	OR (95% CI)	P	Case	Controls	OR (95% CI)	P
Type of Diet								
Vegetarian	91(44.5)	78(41.5)	(1)*0.89 (0.58-	NS	91(44.5)	78(38.5)	(1)*	NS
Non-vegetarian	114(55.5)	110(58.5)	1.35)		114(55.5)	124 (61.5)	0.79 (0.52-1.19)	
Milk consumption								
Yes	168(82)	110(58.5)	3.22 (1.99-5.23)	<.00	168(82)	148(73)	1.66(1.01-2.73)	.04
No	37(18)	78(41.5)	(1)*	1	37(18)	54(27)	(1)*	
Nuts consumption								
Yes	64(31)	19(10)	4.04 (2.24-7.35)	<.	64(31)	37(18)	2.02(1.24-3.30)	<.01
No	141(69)	169(90)	(1)*	001	141(69)	165(82)	(1)*	
Type of cooking medium								.
Polyunsaturated oils	165(80.5)	171(91)17	(1)*2.44 (1.28-	<.01	165(80.5)	192(95)	(1)*	<001
Saturated oils	40(19.5)	(9)	4.68)		40(19.5)	10(5)	2.44 (1.28-4.68)	
Alcohol								
Yes	111(54)	77(41)	1.70 (1.12-2.59)	.01	111(54)	80 (39)	1.80(1.19-2.72)	<.01
No	94(46)	111(59)	(1)*		94(46)	122 (61)	(1)*	
No. Pegs alcohol consumed in a day								
Never consume	94(46)	111(59)	(1)*	.01	94(46)	123(61)	(1)*	.01
0.5-3 (15- 90ml)	72(35)	44(23.5)	1.93 (1.18-3.16)		72(35)	51(25)	1.85(1.15-2.97)	
>3 (90ml)	39(19)	33(17.5)	1.40 (0.79-2.48)		39(19)	28(14)	1.82(1.01-3.30)	
Duration of alcohol consumed								
Never consume	94(46)	111(59)	(1)*	.03	94(46)	123(61)	(1)*	.01
<20 (year)	39(19)	29(15.5)	1.59 (0.88-2.87)		28(14)	39(19)	1.82(1.01-3.30)	
≥20 (year)	71(35)	48(25.5)	1.75 (1.08-2.84)		71(35)	51(25)	1.82(1.13-2.93)	
Smoking								
Yes	158(77)	97(50.5)	3.15 (2.00-4.98)	<.00	158(77)	103(50.5)	3.23(2.06-5.07)	<.001
Never	47(23)	91(49.5)	(1)*	1	47(23)	99(49.5)	1*	
Form of smoking								
Never smoker	47(23)	91(49.5)	(1)*	<.00	47(23)	99(49.5)	(1)*	<.001
Bidi	114 (55.5)	78(41.5)	2.83(1.75-4.58)	1	114 (55.5)	85(42)	2.83(1.76-4.53)	
Cigarette	44(21.5)	19(10)	4.48 (2.25-8.99)		44(21.5)	18(9)	5.15(2.57-10.48)	
No. Smoked in a day								
Never smoker	47(23)	91(49.5)	(1)*	<.	47(23)	99(49.5)	(1)*	<.001
<10	71(34.5)	45(24)	3.16 (1.83-5.46)	001	71(34.5)	32(15.5)	4.82(2.70-8.46)	
11-20	34(16.5)	27(13.5)	2.52 (1.30-4.89)		34(16.5)	30(15)	2.46(1.29-4.71)	
>20	54(26)	24(13)	4.50 (2.38-8.56)		54(26)	40(19.5)	2.93(1.66-5.21)	
Duration of Smoking								
Never smoker	47(23)	91(49.5)	(1)*	<.	47(23)	99(49.5)	(1)*	<. 001
<20 (year)	28(13.5)	23(12)	2.43 (1.21-4.93)	001	28(13.5)	12(6.5)	4.91(2.17-11.31)	
≥20	130(63.5)	71(38)	3.66 (2.27-5.92)		130(63.5)	91(45)	3.01(1.90-4.78)	
Physical activity								
Yes	69(33.5)	44(23.5)	(1)*	. 03	69(33.5)	89(44)	(1)*	.04
No	136(66.5)	144(76.5)	0.60 (0.38-0.96)		136(66.5)	113(56)	1.55(1.02-2.37)	
Hour of leisure time Physical activity								
No physical activity	136(66.5)	144(76.5)	0.80(0.38-1.68)	. 03	16(66.5)	113 (56)	2.71 (1.46-5.16)	.02
0.5 – 1 hour in a day	49(24)	27(14.5)	1.54 (0.64-3.70)		49(24)	44 (22)	2.51 (1.22-5.16)	
>1 hour in a day	20(9.5)	17(9)	(1)*		20(9.5)	45 (22)	(1)*	
Duration of physical activity								
No physical activity	136(66.5)	144(76.5)	0.78(0.41-1.47)	. 03	136(66.5)	113 (56)	2.24 (1.28-3.90)	.02
0.5-9 (years)	40(19.5)	21(11)	1.56 (0.68- 3.61)		40(19.5)	37(18)	2.01 (1.01-4.02)	
>9 (years)	28(14)	23(12.5)	(1)*		28(14)	52 (26)	(1)*	

*= Reference category

Table 2. Comparison of lifestyle changes factors in female cases & controls

Variable	Cases vs. Hospital Controls				Cases vs. Community Controls			
	Case	Controls	OR (95% CI)	*P*	Case	Controls	OR (95% CI)	*P*
Type of diet								
Vegetarian	22(49)	33(53)	(1)*	NS	22(49)	25(52)	(1)*	NS
Non-vegetarian	23(51)	29(47)	1.19 (0.51-2.76)		23(51)	23(48)	1.14(0.46-2.78)	
Milk consumption								
Yes	32(71)	44(71)	1.01 (0.40-2.56)	NS	32(71)	21(44)	3.16(1.23-8.24)	. 01
No	13(29)	18(29)	(1)*		13(29)	27(56)	(1)*	
Nuts consumption								
Yes	17(38)	6(10)	5.67 (1.83-18.28)	.01	17(38)	3(6)	9.11(2.22-	<.01
No	28(62)	56(90)	(1)*		28(62)	43.28)	(1)*	
						45(94)		
Type of cooking medium								
Polyunsaturated oils	35(77.5)	56(90.5)	(1)*	NS	35(77.5)	47(98)	(1)*	<.01
Saturated oils	10(22.5)	6(9.5)	2.67 (0.80-9.18)		10(22.5)	1(2)	13.43(1.63-	
					293.44)			
Smoking								
Yes	9(15.5)	5(8)	2.85 (0.79-10.76)	NS	9(15.5)	2(4)	5.72(1.05-41.29)	04
Never	38(84.5)	57(92)	(1)*		38(84.5)	46(96)	(1)*	
Form of smoking								
Never smoker	38 (84.5)	57 (92)	(1)*	NS	38(84.5)	45(93.5)	(1)*	NS
Bidi	5 (11)	4 (6.5)	1.88 (0.40-9.02)		5 (11)	2(4.5)	2.96(0.47-23.54)	
Cigarette	2 (4.5)	1 (1.5)	3.00 (0.20-86.83)		2 (4.5)	1(2)	1.82(1.01-3.30)	
No. Smoked in a day								
Never smoker	38 (84.5)	57 (92)	(1)*	NS	38 (84.5)	45 (94)	(1)*	NS
<10	7(15.5)	5(8)	2.10 (0.54-8.35)		7(15.5)	3 (6)	2.76 (0.58-14.63)	
Duration of Smoking								
Never smoker	38 (84.5)	57 (92)	(1)*	NS	38 (84.5)	45 (94)	(1)*	NS
<20 (year)	3(6.5)	4 (6.5)	0.73 (0.09-4.98)		3(4.5)	0(0)	Indefinite	
≥20	4(9)	1(1.5)	5.85 (0.58-142.78)		4(9)	3(6)	1.54(0.27-9.35)	
Physical activity								
Yes	11(24.5)	9(14.5)	(1)*	NS	11(24.5)	8(16.5)	(1)*	NS
No	34(75.5)	53(85.5)	0.52 (0.18-1.55)		34(75.5)	40(83.5)	0.62(0.20-1.91)	
No physical activity	34(75.5)	53 (85.5)	0.63 (0.02-23.97)	NS	34(75.5)	40(83.5)	0.51(0.15-1.74)	NS
0.5 – 1 hour in a day	10(22.5)	7(12.5)	1.43 (0.00- 65.20)		10(22.5	6(12.5)	0.30(0.01-5.94)	
>1 hour in a day	1(2)	1 (2)	(1)*		1(2)	2(4)	(1)*	
Duration of physical activity								
No physical activity	34(75.5)	53 (85.5)	0.44(.05-3.48)	NS	34(75.5)	40(83.5)	2.24 (1.28-3.90)	NS
0.5-9 (years)	7(17)	7(11.5)	0.67(.05-7.74)		7(15.5)	6(12.5)	1.29(0.11-16.77)	
>9 (years)	3(7.5)	2(3)	(1)*		3(6.5)	2(4)	(1)*	

Table 3. Effect of multiple risk factors, modeled with logistic regression: A sexwise Prediction of cases versus control groups

Variable	Cases Vs. Hospital controls			Cases Vs. Community controls		
	Coefficient	SE	Adjusted OR (95% CI)	Coefficient	SE	Adjusted OR (95% CI)
Milk consumption (M*)						
-Yes	(M*) β_1=0.69	0.316	2.01(1.07-3.72)	(M*) β_1=0.77	0.30	2.16 (1.19-3.91)
-No	-		-	-		-
Nuts consumption						
-Yes	(M*) β_1=1.27	0.39	3.57 (1.63-7.80)	-	0.75	-
-No	(F*) β_1=1.68	0.72	5.39 (1.29-22.4)	(F*) β_1=2.39		10.9 (2.49-48.2)
Cooking medium						
-Polyunsaturated Oils	(M*) β_1=0.92	0.46	2.5(1.01-6.29)	(M*) β_1=1.248	0.42	3.48(1.51-7.99)
-Saturated Oils	-		-	(F*) β_1=2.50	1.18	12.2 (1.18-125.6)
Smoking						
-Yes	(M*) β_1=1.21	0.29	3.36 (1.88-6.01)	(M*) β_1= 1.57	0.27	4.81 (2.79-8.28)
-No	-		-	-		-

Abbreviations: M, male; F,female.

DISCUSSION

The present study aimed to explore the role of adverse lifestyle changes on the causation of Coronary Artery Disease (CAD) in an urban area of East Delhi, India. In this section, We are going to discuss and compare the significant results based on multivariate model, in which four independent CAD predictor namely; milk consumption, nut consumption, saturated oils and smoking are discussed. In our study no significant association was found between type of diet and CAD. This may be due to the fact that compared to last decades, the rate of non-vegetarian diet is being more common amongst indian people. In our study and based on multivariate analysis, milk consumption was found to be a significant predictor of CAD for male subjects of East delhi as that the chance of getting CAD amongst milk consumers was more than two times higher than non-consumers. It is known that not just the fat and cholesterol in dairy products, but also the animal protein and milk carbohydrates that are linked to heart disease. Since the last four decades, study after study after study has implicated cow's milk and other dairy products as a cause of heart disease and clogged arteries. In a large survey, researchers from 19 western countries concluded that heart disease mortality rises as consumption of milk protein rises (9). In another study (1994) researchers studied seven countries with a high consumption of dairy products and found that heart disease mortality rose as milk supply rose (10, 11). In India in a study performed by Singh et al in Moradabad (1996), it was reported that subjects eating trans fatty acids (vegetable ghee) plus clarified butter (as Indian ghee and a milk product) or those consuming clarified butter as total visible fat had a significantly higher prevalence of coronary artery disease compared to those consuming clarified butter plus vegetable oils (12).

Although evidence from prospective cohort studies have indicated that a high consumption of plant-based foods such as fruit and vegetables, nuts, and whole grains is associated with a significantly lower risk of coronary artery disease, in this study nut consumption was found to be a significant risk factor for CAD in both sexes. The answer to question why nuts consumption in our study was found to be more a risk factor than a protective factor, can be explained by the fact that the higher proportion of CAD patients belonged to middle and high social classes and since higher proportion of individuals in these groups, due to their economic capacity, were nuts consumers compared to lower classes. However, it was difficult to quantify the amount of nuts consumed by subjects; it may be

considered as an initial finding that should be properly evaluated in future studies measuring quantity of intake.

In our study, saturated oils were found to be significantly associated to CAD in both sexes when it was adjusted with other factors. It was observed that there are very few studies that had implicated or even mentioned the role of cooking medium in India. It is logical that this has to be examined, as cooking medium is a major source of fat in Indian diets compared to earlier. It is a common message for the public that certain cooking mediums are harmful for CAD. This could be explained by the fact that the cooking medium produces hypercholesterolemia or dyslipidemia and thus proving to be a risk factor. Absolute classification of cooking mediums in two main categories of polyunsaturated and saturated oils and also not quantifying assessment of oils consumed by subjects may be a weak point in our study. However, these findings may be considered as lead points for future in-depth studies on the role of different cooking oils in getting CAD.

As it was expected, smoking proved to be the most important CAD risk factor in our study where the odds of getting CAD amongst male smokers was more than three times higher than in non-smokers. In India, epidemiological studies have confirmed that smoking is an independent risk factor for CAD and among various methods of tobacco consumption, cigarette, bidi, hukah (pipe) smoking and tobacco chewing are common in different parts of India. However, Bidi (tobacco rolled in Diospyrus melanoxylon leaf) is the commonest form of tobacco smoked in India (13). Our findings are in agreement with results found in various worldwide case-control and cohort studies of acute myocardial infarction that smoking was found to be a significant predictor for CAD (12, 14-16). Our study supports the conclusion that tobacco control programmes in India and other countries of the region could have an important public-health impact.

In conclusion, our study showed that dietary factors such as milk and nuts consumption, also saturated oils and smoking, as misbehavior factor, could play an important role in the causation of Coronary Artery Diseases (CAD) in urban area of East Delhi, India.

Conflict of interests

We have no competing interests.

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