

Atherogenic Aspects of Tobacco Smoking in a Coastal Population of Andhra Pradesh, India

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INTRODUCTION

The litany of disease and premature death from tobacco affects people of all continents (Chollat-Traquet, 1996). It is estimated that a third of the global adult population are smokers and users in other forms of tobacco are continue to increase at an alarming rate (Hurt, 1999). The use of tobacco products has brought an epidemic, which has already claimed millions in developed countries and is threatening to kill many more in developing countries (Jha and Chaupka, 2000). Developing countries face the spectra of tobacco-related diseases, and estimated 48% of men and 7% of women smoke, while in developed countries the figure 42% for men and 24% for women (Amos, 1990). While the rates of cigarette smoking have generally declined among adults in developed countries, they have risen in developing countries (Doll et al., 1994). Each year tobacco causes four million deaths, which constitutes nearly 11000 per day. World Health organization (WHO) estimated that 1.2 billion people continue to use tobacco and 4 million deaths from tobacco-occurred in 1999 and that annual number is likely to rise to 10 million by the 2030s causing more deaths world-wide than HIV, tuberculosis, maternal mortality, motor vehicle accidents, suicide and homicide combined (Roemer, 1999). Subsequent studies have reported a comprehensive estimate of two-fold risk of smokers developing heart diseases. About half were in china, India and other low- or middle income countries outside Europe (Jha et al., 2002).

Tobacco smoking is identified as a major public health problem and the major risk factor of morbidity and mortality due to coronary heart disease (CHD) across the world (Bulliyya, 1989; Kalpan and Keil, 1993). It is the leading preventable cause of death among men and women. India was one of the first countries in the world to report the adverse health consequences of tobacco use (Niblock, 1902). It has been a

common health problem for several decades and constitutes 20-25% of deaths from heart diseases and stroke (Brenowitz, 1988; Ramachandran, 1993; Reddy and Yusuf, 1998). The number of cases attributable to smoking would be nearly 13 million or 21% of the prevalent CHD cases (Gupta and Ball, 1990). The rate of CHD prevaience in our country is estimated almost 80-120 per 1000 population causing a major health concern. There are scanty reports available on tobacco use and smoking-behaviour and its association with CHD risk (Gupta, 1989b). The present study was designed to evaluate association of risk factors for CHD between smokers (tobacco users) and non-smokers (non-tobacco users).

MATERIAL AND METHODS

The subjects for this cross-sectional study comprised of 500 (266 males and 234 females) in 21 to 70 years age range selected randomly from 20 coastal villages of Nellore district, Andhra Pradesh. The study group consists of only normal and health subjects without having medication of known diseases and those extended their coope-ration in carrying the biometrical characters. Data on age, occupation, physical activity and life-style characters of each individual were recorded. Life-style practices including use of cigarettes/cigars/tobacco or other forms were recorded using a questionnaire. Based on habit of smoking or tobacco use, subjects were categorized as smokers / non-smokers. Subjects with current or past smoking habits were pooled together as smokers, irrespective of their habit of tobacco use or they smoked a pipe/hookah/ cigarette/bidi/cigar. If the subjects stated that they had never smoked any form of tobacco, they were classified into non-smokers.

The variables studied were anthropometry, blood pressure (BP) and serum lipids and lipoprotein levels. Body weight and standing height were measured with a balance and anthropometer rod respectively, without shoes or

heavy clothing. Body mass index (BMI) of each individual was calculated (weight in kilograms by height in meters square) as a measure of general overweight. Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured by recording the appearance and disappearance of Korotkoff's sounds in a sitting position using a standard sphygmomanometer. Subjects were classified as having hypertension if they had a DBP of 90 mmHg or high and/or a SBP of 140 mmHg or higher. Resting heart rate was measured on radial artery at the wrist. Serum total cholesterol, triglycerides, high-density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C) were estimated using standard laboratory procedures. Subjects were identified as CHD risk according to hypercholesterolemic (≥ 200 mg/dl of total cholesterol), hypertriglyceridemic (≥ 200 mg/dl of triglycerides), hypo-alpha-lipoproteinemic (≤ 35 mg/dl of HDL-C), hyper-beta-lipoproteinemic (≥ 130 mg/dl of LDL-C), atherogenic index-1 (≥ 4.5 of total cholesterol to LDL-C ratio) and atherogenic index-2 (≥ 3.5 of LDL-C to HDL-C ratio) based on the United States National Cholesterol Education Program (NCEP, 1994). Details pertaining to the sampling process as well as laboratory procedures have been previously described (Bulliyya et al., 1997).

Data are presented as means, standard deviations and percentages. Using t-test or Chi-square test, significant difference between smokers and nonsmokers for all the variables were evaluated, where appropriate. P-values of less than 0.05 were considered to be statistically significant.

RESULTS

The mean and standard deviations for anthropometry, BP, lipids and lipoproteins among smokers and nonsmokers are reported in table 1. There was no statistically significant difference in the mean values of age, body weight, height and BMI of the smokers as against nonsmokers. Comparison between smokers and nonsmokers with respect to SBP and DBP, the levels were greater in the former group, but no significant difference was observed. However, the mean pulse rate was significantly greater in smokers as compared to nonsmokers. The data on bioche-

Table 1: Study characteristics among smokers and nonsmokers of coastal Andhra Pradesh

Parameter	Smokers Mean (SD) N=261	Nonsmokers Mean (SD) N=239
Age (years)	46.1 (13.3)	45.6 (14.5)
Body weight (cm)	51.3 (6.2)	50.4 (5.6)
Height (cm)	170.0 (6.4)	169.5 (7.8)
Body-mass index (Kg/m ²)	17.8 (2.2)	17.9 (2.4)
Systolic BP (mmHg)	117.3 (9.4)	115.6 (11.5)
Diastolic BP (mmHg)	77.1 (7.4)	76.2 (8.1)
Pulse rate (beats/min)	74.3 (4.2)	73.3 (4.0)*
Total cholesterol (mg/dl)	172.9 (30.1)	172.3 (33.4)
Serum triglycerides(mg/dl)	145.7 (37.4)	145.3 (39.9)
HDL-cholesterol (mg/dl)	47.4 (5.5)	47.6 (5.5)
LDL-cholesterol (mg/dl)	96.1 (24.4)	96.1 (28.2)
Cholesterol/HDL-C ratio	3.7 (0.7)	3.6 (0.7)
LDL-C/HDL-C ratio	2.1 (0.6)	2.0 (0.6)

Differences between values with the superscripts are statistically significant at * $p < 0.05$ level (t-test)

mical variables reveal that the serum concentrations of total cholesterol, triglycerides, HDL-C and LDL-C were almost similar in smokers and non-smokers ($p > 0.05$). The mean ratios of total cholesterol/HDL-C (3.7 ± 0.7 vs 3.6 ± 0.7) and LDL-C/HDL-C (2.1 ± 0.6 vs 2.0 ± 0.6) were not so variants between smoking and nonsmoking groups.

Table 2 shows the prevalence of CHD risk profile according to sex between the smoking and the nonsmoking groups. It is very clear from the table that proportion of smokers dominated (52%) over nonsmokers. Three-fourth of the smoking group were males. As expected among non-smoking group, females dominate (68%) over their male counterparts. The proportion of hypertensive individuals for SBP (but not DBP) was significantly greater in smokers than in nonsmokers. However, the difference in prevalence of hypercholesterolemia, hypertri-glyceridemia, hyper-beta-lipoproteinemia and hypo-alpha-lipoproteinemia between the two groups was not significant. Both of the atherogenic indices (total cholesterol/HDL-C ratio and LDL-C/HDL-C ratio) were significantly higher in smokers than in nonsmokers. Overall results show that the prevalence each of the CHD risk factor was higher though not significantly different in both the sexes of smokers when compared to their respective sex group of nonsmokers

Table 2: Prevalence of coronary heart disease risk among smokers and nonsmokers of coastal Andhra Pradesh

Risk marker	Smokers			Nonsmokers		
	Male (190)	Female (71)	Total (261)	Male (76)	Female (163)	Total (239)
Hypertension	5.3	1.4	4.2	2.6	0.6	1.3*
Systolic BP (≥ 140 mmHg)	(10)	(1)	(11)	(2)	(1)	(3)
Hypertension	5.3	5.6	5.4	5.3	3.1	3.8
Diastolic BP (≥ 90 mmHg)	(10)	(4)	(14)	(4)	(5)	(9)
Hypercholesterolemia	10.5	11.3	10.7	15.8	10.4	12.1
Total cholesterol (≥ 200 mg/dl)	(20)	(8)	(28)	(12)	(17)	(29)
Hypertriglyceridemia	4.2	11.3	6.1	7.9	6.7	7.1
Triglycerides (≥ 200 mg/dl)	(8)	(8)	(16)	(6)	(11)	(17)
Hypo-alpha-lipoproteinemia	3.2	4.2	3.4	1.3	1.2	1.3
HDL-cholesterol (≤ 35 mg/dl)	(6)	(3)	(9)	(1)	(2)	(3)
Hyper-beta-lipoproteinemia	10.0	16.9	11.9	22.4	11.0	14.6
LDL-cholesterol (≥ 130 mg/dl)	(19)	(12)	(31)	(17)	(18)	(35)
Atherogenic index-1	5.3	16.9	16.9	3.9	1.8	2.5*
Cholesterol/HDL-C ratio (≥ 4.5)	(10)	(8)	(18)	(3)	(3)	(6)
Atherogenic index-2	4.7	7.0	5.4	1.3	2.4	2.1*
LDL-C/HDL-C ratio (≥ 3.5)	(9)	(5)	(14)	(1)	(4)	(5)

Values in parentheses denote sample number. Differences between values with the superscripts are statistically significant at * $p < 0.05$ level (Chi-square, d.f=1).

DISCUSSION

Cigarette smoking is generally a male habit in most of the countries with the exception of parts of country, it is ranged between 2% and 10% of women and between 40% and 60% of men use tobacco (Waldron, 1988; Nelson et al., 1995). These rates varied from 30% to 67% among males and 15-50% among females in different rural areas of India (Ramachandran, 1993; Gupta, 1988). The per capita consumption of cigarette has almost doubled since 1951(55) to 1981 (115), while bidi tobacco consumption has increased between 1951 (145) and 1981 (191) (Gupta, 1989a). This study recorded 38% of males and 14% of females belonging to smokers that is similar with other studies. It is observed that most of tobacco users are men and its use is more common in rural areas than in urban and among people of low-socio-economic status and low education level than among those of high socioeconomic status and education level. As observed in previous studies, womenfolk make extensive use of daily pan leaves, tobacco and betel liquid mixed with lime (Gupta, 1988, 1989a). Data from Delhi city suggested that 47% to 51% of the male smokers and 52% to 95% of female smokers smoke bidis. Further, it is

assumed that 50% of the male and 80% of the female smokers use bidis, with the remainder smoking cigarettes (Venkatnarayan et al., 1996). The devastating consequences of tobacco in terms of cancer and CHD are well documented in Indian studies (Gupta, 1989a,b).

Since smoking affects the cardiovascular system in an unfavourable way resulting in higher CHD risk prevalence, produces an acute risk in BP (Green et al., 1986; Seltzer, 1974). Smoking and hypertension cause approximately the same risk increase, which in turn markedly by enhance the risk of CHD in populations (William and Kannel, 1987). It was observed that the mean levels of pulse rate and prevalence of hypertension for SBP were greater in smokers, a finding similar to those of other studies. Most of the studies have concentrated on elevated BP as a strong predictor of risk for CHD (Kannel et al., 1980; Kalpan and Keil, 1993). The content of nicotine in tobacco smoke attributed to operate through increased levels of catecholamines in the blood that elevate heart rate and BP (Gupta et al., 1996). Moreover, quitting of smoking has been shown to have a 50% reduction of CHD risk. The prevalence of smoking increased over the years in the country that could contribute to a significant extent in raising hypertension at population level. It has

been observed that a constant secular increase in mean SBP from 123.4±11 mmHg to 128.8±17 mmHg in India from 1959 to 1995 resulted in an increase in hypertension prevalence from 6.3% in 1959 to 26.4% in 1995 in urban middle aged adults (Gupta et al., 1996).

The association between smoking and CHD as well as the mechanisms is well established in cross-sectional as well as in longitudinal studies (Hurt, 1999; Glantz and Parmley, 1991). Tobacco smoking most likely promotes atherosclerotic disease, by its actions on lipid metabolism and coagulation by haemodynamic effects and or by causing endothelial injury (Pittilo, 1990; Lassila et al., 1988; Jacobs et al., 1990). Low levels of HDL-C are associated with higher smoking rates and subsequently increase the incidence of coronary disease (Anonymous, 1997). However, reverse is the case with high levels of LDL-C that, correlate with low levels of protective HDL-C (Valkonen and Kuusi, 1998). The acute effects of tobacco smoke include increased blood levels of total cholesterol, triglycerides and LDL-C. Results obtained in this study are in agreement with those studies reported from other investigations (Lassila et al., 1988; Green et al., 1985). This is attributed to use of tobacco, which yields high blood concentrations of nicotine levels in smokers, which is known to have an effect of atherogenesis (Glantz and Parmley, 1991; Pittilo, 1990).

The present study reveals that subjects who smoke cigarettes regularly are more likely to develop the risk of CHD than nonsmokers. The results further highlight the need to prevent tobacco use in prevention of many of the health hazardous. Promotion of smoking cessation should be a public health priority that has documented many health benefits. The WHO has strongly recommended that reduction of tobacco use as one of its top disease-control initiative through which plans to make public a global intervention policy on World No Tobacco Day on 31 May. The Government of India has imposed a prohibition order on smoking in all health care establishments, offices, educational institutions and transport services on its territories as a preventive measure. As we entered the new millennium, necessary efforts should be made effectively to eliminate the social and economic

burden due to tobacco use. Though tobacco control programs emphasize primary prevention, it is not the only way to reduce the damage to tobacco causes, while never smoking is obviously the most desirable situation and stopping smoking before age 30 eliminate virtually all the long-term mortality effects (Doll et al., 1994). It has been consistently documented that the risk of CHD is 2-4 times higher in smokers and more than twice in light smokers. The rate of risk declined to the level of non-smokers within 3-5 years after cessation. Smoking control and cessation would result in long-term health benefits for the society and nation as a whole in reducing the emerging epidemic of CHD and several other tobacco-associated non-communicable diseases.

ACKNOWLEDGEMENTS

The author is indebted to Professors Dr.P.Chengal Reddy and Dr.P.Reddanna for their inspiration during the course of this study. He is also very grateful to the Council of Scientific and Industrial Research (9/152(100)90/EMR-I), and the Department of Science and Technology (SR/OY/GB-20/93), New Delhi for providing financial assistance.

KEY WORDS Tobacco Use. Smoking. Chewing. Atherogenesis. Cardiovascular Risk. Serum Lipids. Blood Pressure. Andhra Pradesh.

ABSTRACT Cigarette smoking has been recognized as a public health problem in India. The objective of the study was to evaluate the risk of coronary heart disease between smokers and nonsmokers. The study population involved 500 healthy rural subjects aged 21-70 years from coastal areas of Nellore district, Andhra Pradesh. Based on the current smoking habits, subjects were divided into smoking and nonsmoking groups. Females were less likely than males to smoking habits (38% vs 14%). The mean values of age, body weight, height, body mass index, systolic pressure and diastolic pressure, serum total cholesterol, triglycerides, high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), and the ratios of total cholesterol/HDL-C and LDL-C/HDL-C as atherogenic indices were not statistically different between smokers and nonsmokers. However, the mean pulse rate was significantly greater in smokers than nonsmokers. There were no significant differences in the prevalence of hypertension for diastolic pressure, hypercholesterolemia, hypertriglyceridemia, hypo-alpha-lipoproteinemia and hyper-beta-lipoproteinemia between groups. It was found that the prevalence of hypertension for systolic blood pressure as well as both the atherogenic indices (total cholesterol/HDL-C ratio and LDL-C/HDL-C ratio) were significantly higher in the

smoking group than those found in the nonsmoking group ($p < 0.05$). The present study suggest that smoking habit is associated with increased the risk of CHD among smokers as compared to nonsmokers. The consequences of tobacco use and smoking is a public health concern in India as the most important preventable cause of disease and death with regard to the emerging degenerative disease epidemics.

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