The investigation of serum lipids and prevalence of dyslipidemia in urban adult population of Warangal district, Andhra Pradesh, India

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Abstract

Lipid abnormalities are major risk factors for premature coronary artery diseases. We investigated serum lipids and the prevalence of dyslipidemia in urban adult population in Warangal district of Andhra Pradesh. We studied 1496 individuals 20–90 years of age. Health status was determined by questionnaires and physical check-ups. Total cholesterol (TC), LDL-cholesterol (LDL-C), HDL-cholesterol (HDL-C) and total triglycerides (TGs) were measured. TC >5.7 mmol/L, LDL-C >3.6 mmol/L, TGs >1.7 mmol/L, and HDL-C <0.9 mmol/L were defined as abnormal. Mean serum TC, LDL-C, and TG concentrations were increased. 52.7% of males and 42.9% of females having at least one abnormal lipid concentration. HDL-C was abnormally low in 7% of males and in 1.6% of females. The prevalence of hypercholesterolemia, hypertriglyceridemia and abnormally low HDL-C, especially the presence of slight hypertriglyceridemia, were higher in all age groups. The increase was most prominent in the middle age group (40–59 years). Hypercholesterolemia, hypertriglyceridemia and abnormally low HDL-C have increased considerably over the past 10 years in urban adult populations in Warangal district, Andhra Pradesh. Dietary changes and less physical activity resulting from rapid improvements in living conditions may be the causes for the increases. Enhanced preventive measures should be undertaken to modify these situations.

Keywords: Serum lipids, dyslipidemia, urban adult population, Andhra Pradesh, India.

Introduction

It has long been known that lipid abnormalities are major risk factors for premature coronary artery disease (CAD) (Martin *et al*, 1986 and Genest *et al,* 1991*)*. The usefulness of serum total cholesterol (TC) measurements in predicting initial CAD events has been established in numerous prospective epidemiologic studies (Kannel *et al*, 1979 and Rhoads *et al,* 1976*)*. The atherogenic LDL-cholesterol (LDL-C) component and the inverse relationship between the HDL-cholesterol (HDL-C) concentration and CAD risk have also been established (Gordon *et al,* 2007). Large-scale controlled trials have shown that lowering cholesterol in otherwise healthy adults reduces the risk of CAD (Frick *et al,* 1987). During the past 20 years, India has experienced remarkable socioeconomic development, with the mean income increasing by several fold. Consequently, the lifestyles of people throughout the country have changed dramatically. Several epidemiologic studies in

this country found that serum lipid concentrations were higher in a significant part of the population and that an increasing proportion of the population had dyslipidemia. From September to December of 2008, we measured serum TC, total triglyceride (TG), LDL-C, and HDL-C concentrations in a large-scale study of population in Warangal district of Andhra Pradesh to investigate the status of serum lipids and the prevalence of dyslipidemia.

Materials and Methods

A total of 1496 (857 males and 639 females) professional people in Warangal district of Andhra Pradesh, including educational faculties (total, 95%), and students (total, 5%) 20–90 years of age who attended annual general health examinations were recruited in this study. Most of them were well educated (>75% Post Graduation students of Universities have attended). Each participant was asked to fill in informed consent and a questionnaire, which included history of CAD risk factors such as

smoking, alcohol consumption, diabetes and hypertension. The physical examination emphasized measurement of height, weight and blood pressure. Body mass index was calculated by use of body weight (in kilograms) divided by height (in squared meters). Blood pressure was measured three times, with participants resting for at least 30 min, by a cardiologist using a standard mercury sphygmomanometer. Blood samples were collected from the antecubital vein after an overnight fast for 12–14 h. After clotting, blood was centrifuged at 1200g for 10 min to obtain serum for estimation of glucose, TC, HDL-C, LDL-C, and TG. Serum samples were stored at 4 °C, and the determinations were carried out within 24 h.

Serum glucose was measured by the glucose oxidase method. TC and TG concentrations were measured by routine enzymatic methods. HDL-C was measured by a homogeneous method that used polymer and polyanion together to block the non-HDL lipoproteins. HDL-C was then determined enzymatically. Measurements were carried out in a clinical laboratory that followed the criteria of the WHO Lipid Reference Laboratories.

According to the standard guidelines (World Health Organization Working Groups, 1986), obesity was defined as body mass index >30 kg/m^2 (males) or >28 kg/m^2 (females) and overweight as >25 kg/m^2 (females) or >27 kg/m^2 (males). Persons whose mean blood pressure was $\geq$140/90 mmHg or who were taking antihypertensive medications were classified as hypertension. Persons with a fasting blood glucose >7.0 mmol/L or who were taking antidiabetic medication were considered as having diabetes mellitus. Hypercholesterolemia was defined as TC >5.7 mmol/L, high LDL-C as LDL-C >3.6 mmol/L, hypertriglyceridemia as TGs >1.7 mmol/L, and low HDL-C as HDL-C <0.9 mmol/L. Dyslipidemia was defined by the presence of one or more than one abnormal serum lipid concentration. The Expert Panel on Recommendations for Prevention and Treatment of Dyslipidemia also set TC <5.2 mmol/L, LDL-C <3.1 mmol/L, HDL-C <1.03 mmol/L, and TGs <1.7 mmol/L as the desired values for serum lipids (Wang *et al*, 1987).

Participants were divided into 8 age groups (17– 24, 25–34, 35–44, 45–54, 55–64, 65–74, 75–79, and $\geq$80 years). Appropriate variables were compared by either the X^2 test. All reported *P* values are based on two-sided tests and *P* <0.05 was considered as statistically

significant. The statistical calculations were performed with SPSS 10.0 (SPSS, Inc.).

Results and Discussion

Clinical features of the population
The number of individuals and the clinical features of the participants are shown in Table 1. Males had a higher body mass index than females. As a consequence, the prevalence of obesity was higher in males than in females. Of the males, 37.9% were overweight, whereas 25.4% of females were overweight. Across all age groups, 30.2% of males and 25.8% of females had hypertension, and 7.5% of males and 5.6% of females had a history of diabetes mellitus. The prevalence of diabetes increased with age in both genders (*P* <0.001 for trend). The proportion of energy from fat has been increasing (18.4% in 1982, 23.12% in 1991, and 34.99% in 1997) in the general Indian population (Feng *et al*, 2002). The most important findings of this survey were the considerable increases in hypercholesterolemia, hypertriglyceridemia, and abnormally low HDL-C, which are well-known risk factors for cerebrocardiovascular diseases, in all age groups.

Serum lipids in different age and gender groups
The age- and sex-specific mean values for serum lipids are shown in Table 2. Median serum TC tended to increase with age up to 70 years, after which it is decreased gradually. TC values were lower in females than in males in the age groups <50 years and increased with age, indicating that changes in adiponectin hormone secretion in the postmenopausal period affect lipid metabolism. In individuals >50 years of age, TC was higher in females than in males. LDL-C displayed a pattern of change with age similar to that of TC. HDL-C was higher in females than in males in all age groups, with median concentrations of 1.27 mmol/L in males and 1.50 mmol/L in females. There was little change in HDL-C level with age.

Serum TGs increased significantly with age. The median TG concentration tended to increase with age in males up to age of 45 and in females up to age 65, after which it is decreased gradually. In the age groups younger than 60 years, TGs values were higher in males than in females, but in the age groups older than 60 years, TGs values were higher in females than in males.

Table 1: Clinical characteristics of participants

	Men (n=857)	Women (n=639)	*p*
Mean (SD) age, yrs	41.75 (16.29)	43.46 (15.89)	<0.001
Mean (SD) blood pressure, mmHg			
Systolic	117.51 (14.79)	114.10 (18.35)	<0.001
Diostolic	75.51 (8.74)	72.34 (10.01)	<0.001
Prevalence of hypertension, (%)	30.2	25.8	<0.001
Mean (SD) blood glucose, mmol/L	4.83 (1.16)	4.80 (1.02)	0.225
Prevalence of diabetes mellitus, (%)	7.5	5.6	<0.001
Mean (SD) BMI, (kg/m2)	24.13 (2.91)	22.81 (3.43)	<0.001
Prevalence of overweight (%)	37.9	25.4	<0.001
Prevalence of obesity (%)	10.2	7.4	<0.001

Table 2: Serum lipids mean values by age and gender

	TC (mmol/L)		TGs (mmol/L)		HDL-C (mmol/L)		LDL-C (mmol/L)	
Age, years	Males	Females	Males	Females	Males	Females	Males	Females
17–24	3.92	3.92	1.01	0.81	1.32	1.46	2.11	2.14
25–34	4.42	4.19	1.52	0.94	1.26	1.51	2.49	2.3
35–44	5.01	4.56	1.92	1.24	1.24	1.49	2.72	2.52
45-54	4.92	5.01	2.11	1.58	1.24	1.5	2.91	2.98
55-64	5	5.39	1.79	1.78	1.28	1.49	2.96	3.28
65-74	5.09	5.52	1.72	1.93	1.34	1.52	3	3.16
75-79	5.11	5.47	1.71	1.72	1.34	1.56	2.98	3.1
> 80	4.99	5.37	1.81	1.97	1.3	1.54	2.86	2.94

Table 3: Prevalence of dyslipidemia

	Hypercholestero-lemia, %	Hypertriglycer-idemia, %	Low HDL, %
Males			
Younger (20-39 yrs)	14.8	24.7	7.1
Middle age (40-59 yrs)	38.4	45.1	7.7
Older (>60 yrs)	40.5	40.2	6.2
Females			
Younger (20-39 yrs)	8.8	7.3	1.8
Middle age (40-59 yrs)	37	27.9	1.5
Older (>60 yrs)	62	46.5	1.6

In 2007, the Expert Panel for the Prevention and Treatment of Dyslipidemia has proposed a recommendation for curing dyslipidemia and set desired TC values as <5.2 mmol/L (Wang et al, 1987). In the present study, 13.6% of the participants had TC concentration above that value, but their TC concentrations has not reached the standard of hypercholesterolemia (TC >5.7 mmol/L).

Prevalence of dyslipidemia
On the basis of the diagnostic criteria mentioned above, dyslipidemia was observed in 52.7% males and 42.9% females, with significant difference between the two sexes (P <0.001). In adults >60 years of age, the prevalence rate was even higher: 68.4% and 78.2% for males and females, respectively. The prevalence of dyslipidemia is shown in Table 3. The desired TC concentration is <5.2 mmol/L (Wang *et al,* 1997) and 14.8% males and 8.8% females 20–39 years of age had serum TC above that value. In the middle age group (40–59 years), the prevalence was >35% in both genders.

In older adults ($\geq$60 years), 40.5% of males and 62% of females had TC above the desired concentration cutoff. On the basis of the diagnostic criteria for dyslipidemia in India, hypercholesterolemia (TC >5.7 mmol/L) occurred in 6% of males and 2.8% of females in the younger group, in 20% of males and 18.5% of females in the middle age group, and in 20.2% of males and 38.7% of females in the older group. The prevalence of LDL-hypercholesterolemia followed the same trend as that for hypercholesterolemia. HDL-C was abnormally low more often in males than in females: 20% of males and 4% of females had HDL-C <1.03 mmol/L. HDL-C (<0.91 mmol/L) was abnormally low in 7% of males, and 1.6% in females.

Abnormally low HDL-C is also a risk factor for CAD (Lewis *et al,* 1992) The second report of the National Cholesterol Education Program Adult Treatment Panel reaffirmed that HDL-C concentrations <0.91 mmol/L are a major risk factor for coronary heart diseases and HDL-C concentrations >1.55 mmol/L are protective (The Expert Panel on Detection, 1993). We found that HDL-C was low (<0.91 mmol/L) in 7.2% of males and 1.5% of females and the prevalence of higher HDL-C was lower in males than in females. The prevalence of abnormally low HDL-C has increased over the past 20 years (Wang *et al*, 1997). Presumably, the lifestyle factors affecting serum cholesterol are also involved in the increasing prevalence of abnormally low HDL-C.

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