The prevalence of obesity and other coronary risk factors in a suburban Sri Lankan community

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Increasing numbers of developing nations experience a rising incidence of non-communicable diseases in parallel with economic development. Thus, developing countries such as Sri Lanka face the double burden of both communicable and non-communicable diseases. We therefore conducted a study to assess the prevalence of obesity, diabetes mellitus, impaired glucose tolerance (IGT), dyslipidaemias, hypertension, central (android) obesity, hypertension and smoking habits in a random sample of 633 (312 male) subjects selected from an electoral list with a target population of 2974 persons. The prevalence (age standardized to the world population of Segi 95% CI) was IGT 5.27 (3.74–7.78), diabetes 5.02 (3.59–6.53), hypertension 15.25 (11.67–18.8), hypercholesterolaemia 14.86 (11.09–18.61), hypertriglyceridaemia 8.46 (6.27–10.64), low HDL cholesterol 11.18 (8.35–13.99), obesity 9.89 (7.24–12.52) and android obesity 16.35 (12.47–20.24). We conclude that the high prevalence of coronary risk factors is an indication for initiating programmes for primary prevention of obesity, diabetes and coronary heart disease in Sri Lanka.

Introduction

Cardiovascular disease is a significant public health problem in the developed world and is a common health problem associated with the adoption of atherogenic dietary habits seen in industrialized societies[1]. Increasing numbers of developing nations acquire such lifestyles during the process of development and experience an increase in the incidence of non-communicable diseases in parallel with economic development[2]. The populations most affected are those who have changed from traditional to western life style or have become rapidly industrialized over a short time span. As the toll exacted by communicable disease and malnutrition declines, it is replaced by cancer, chronic degenerative diseases and diseases associated with an atherogenic diet and overnutrition[3,4]. The United Kingdom passed through this phase of epidemiological transition in the 1920s[5]. Developing countries such as Sri Lanka are currently in the process of transition[6] and face the double burden of both communicable and non-communicable diseases[7]. The developed countries have initiated programmes for preventing cardiovascular disease and diabetes while developing countries concentrate their limited resources on preventing communicable diseases. As cardiovascular events decline with the advent of prevention programmes in the developed world they are rising to epidemic proportions in developing countries[1]. The World Health Organization estimates that 15% of deaths in developing countries are due to cardiovascular diseases[4].

The World Health Organization has recommended the development of national programmes for prevention and control of cardiovascular diseases and diabetes mellitus[8]. Appropriate exercise is clearly associated with a favourable risk factor profile, lower prevalence of non-insulin-dependent diabetes and reduction of upper-body obesity[9]. Thus control of obesity and greater physical activity are likely to be the most effective means of preventing coronary heart disease and diabetes in south Asian populations[10]. Knowledge about prevalence of coronary risk factors is an essential prerequisite to developing an effective programme for primary prevention. We therefore conducted a study to assess the prevalence of obesity, diabetes mellitus dyslipidaemias, hypertension and smoking habits in a suburban population in Sri Lanka.

Methods

The target population comprised adults in the defined electoral area (area 8 Maharagama, a suburb of Colombo) aged 30 to 64 years. Of the 4334 persons in the register 2974 were within the target population. A simple random sample was obtained from the electoral list by using a table of random numbers. The electoral list is compiled by census officials who make home visits. All residents of a household aged over 18 who are required by law to obtain a national identity card have their name and identity card number included in this list. Seven hundred individuals (337 men) were selected to participate in this survey, 633 (312 men) agreed to participate (Table 1), 65 were Tamil, 12 Muslim and the rest Sinhala (88% Sinhala, 10.3% Tamil). The percentage distrib-

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Table 1. Age and gender distribution of study population.

Age (years)	Total	Male	Female
30–34	97	47	50
35–39	93	43	50
40–44	91	45	46
45–49	97	50	47
50–54	98	48	50
55–59	81	38	43
60–64	76	40	36
Total	633	312	321

ution for the ethnic groups nationwide was 73.95% Sinhala, 17.7% Tamil and 7.05% Muslim[11]. The participants were interviewed in their homes and invited to participate in the study by attending a hospital clinic located within 5 km of their homes. They were instructed to come in the morning after a 12-h overnight fast, after at least 3 days of unrestricted diet (carbohydrate intake > 150 g), usual levels of physical activity and abstaining from smoking. The height without shoes was recorded in cm and the weight without shoes was recorded in kg using a beam balance. The body mass index was calculated according to the formula BMI = weight in kg/height in metres^2 (kg m^{-2}). Obesity was defined as a body mass index > 25 in women and > 27 in men[12]. Waist and hip girths were measured with the subject standing, using a fibreglass tape with a spring balance attached to one end to hold the tape at a tension of 500 g. The waist was defined as the smallest girth between costal margin and illiac crests, and the hip as the circumference at the level of greater trochanters[13]. No data are available for central obesity in Sri Lanka hence we used European values which defined central obesity (android fat distribution) as a waist/hip ratio above 1.0 in men and above 0.85 in women[14,15].

Blood pressure was measured after 15 min rest in the right arm supported on a table at heart level with the patient seated. The mean of three readings was recorded as the blood pressure. A mercury sphygmomanometer with a 23 × 14 cm cuff (bladder 23 × 13cm) and a larger cuff for obese patients was used. Hypertension was diagnosed according to WHO criteria[16].

A 2-h glucose tolerance test was performed using glucose monohydrate dissolved in 350 ml of water (equivalent of 75 g anhydrous glucose load used). Patients were requested to remain seated and abstain from smoking during the 2-h period. Glucose was measured in venous whole blood using the glucose oxidase method and a Cobas Mira photoanalyser in the hospital laboratory. Samples were stored at 4°C and blood glucose estimations performed within 4 h of collection. Random samples of blood for glucose estimations were measured in duplicate. The correlation coefficient for duplicate readings was 0.992 and coefficient of variation was 1.7%. Diabetes mellitus and impaired glucose tolerance (IGT) were defined according to the WHO criteria[17]. Patients currently on oral anti-diabetic agents or insulin therapy were classified as diabetic.

Serum was separated from blood samples within 2 h of collection. High-density lipoprotein fraction was isolated for cholesterol analysis by the phosphotungstic acid and magnesium chloride method[18]. Serum high-density lipoprotein (HDL) cholesterol and total cholesterol were estimated by the CHOD-PAP method and total triglyceride by GPO-PAP method in an autoanalyser (Cobas Mira) using commercially available test kits (Boerhinger Mannheim GmbH, Germany). Assay coefficients of variation were 2% for HDL, 3% for total cholesterol and 4% for triglycerides. Hypercholesterolaemia was defined as total cholesterol greater than 6.5 mmol/l and hypertriglyceridaemia as triglycerides greater than 2.25 mmol/l[19]. Low HDL was defined as HDL cholesterol less than 0.9 mmol/l[20].

The 5-year age-specific rates were calculated and standardization performed by the direct method against the standard world population of Segi[21]. Results were expressed as age-standardization rates with 95% confidence intervals[22].

Results

The prevalence of smoking among males was 42% (95% CI 36–48). Only two women admitted to being smokers. The prevalence of cardiovascular risk factors is shown in Tables 2,3 and 4 while metabolic and anthropometric measurements are shown in Table 5.

Obesity was more common ($P < 0.05$) in women while hypertension ($P < 0.05$) and hypercholesterolaemia ($P < 0.05$) were more common in men (Tables 2 and 3).

Discussion

This study suggests that the prevalence of dyslipidaemias,

Table 2. Prevalence of impaired glucose tolerance (IGT) diabetes mellitus (DM), obesity, hypertension and central (android) obesity.

	IGT		DM		Obesity		Hypertension		Central obesity	
Age	M	F	M	F	M	F	M	F	M	F
30–34	0 (0)	1 (2)	0 (0)	1 (2)	1 (2.1)	3 (6)	2 (4.2)	0 (0)	2 (4.2)	0 (0)
35–39	1 (2.2)	2 (4)	1 (2.2)	1 (2)	1 (2.2)	3 (6.1)	2 (4.55)	1 (2.)	5 (11.3)	1 (2.0)
40–44	2 (4.4)	4 (8.7)	2 (4.4)	3 (6.5)	2 (4.4)	6 (13.0)	7 (15.5)	5 (10.8)	4 (8.8)	9 (19.5)
45–49	3 (6)	4 (8.5)	3 (6)	3 (6.3)	3 (6)	9 (19.1)	11 (22)	8 (17.0)	17 (34)	11 (23.4
50–54	2 (4.1)	3 (6)	3 (6.2)	4 (8)	4 (8.3)	8 (16)	16 (33.3)	6 (12)	13 (27.1)	9 (18)
55–59	3 (7.8)	3 (6.9)	3 (7.8)	4 (9.3)	6 (15.7)	7 (16.2)	12 (31.5)	11 (25.5)	10 (26.3)	8 (18.6)
60–64	3 (7.5)	3 (8.3)	3 (7.5)	2 (5.5)	5 (12.5)	7 (19.4)	11 (27.5)	10 (27.7)	10 (25)	8 (22.2)
Total	14 (4.4)	20 (6.2)	15 (4.8)	18 (5)	22 (7)	43 (13.4)	61 (19.5)	41 (12.7)	61 (19.5)	46 (14.3)

Results as number of subjects (with age and gender-specific crude prevalence in parenthesis).

Table 3. Prevalence of dyslipidaemias.

	Hypercholesterolaemia		Hypertriglyceridaemia		Low HDL	
Age	Male	Female	Male	Female	Male	Female
30–34	3 (6.38)	1 (2)	0 (0)	1 (2)	2 (4.26)	0 (0)
35–39	7 (15.9)	3 (6.12)	2 (4.55)	1 (2.04)	1 (2.27)	3 (6.12)
40–44	11 (24.4)	2 (4.35)	1 (2.22)	3 (6.52)	5 (11.1)	2 (4.35)
45–49	9 (18)	8 (17)	3 (6)	7 (14.9)	7 (14)	9 (19.2)
50–54	13 (27.1)	7 (14)	9 (18.8)	5 (10)	6 (12.5)	6 (12)
55–59	8 (21.1)	9 (20.9)	6 (5.8)	5 (11.6)	6 (15.8)	7 (16.3)
60–64	9 (22.5)	7 (19.4)	7 (17.5)	7 (9.4)	9 (22.5)	11 (30.6)
Total	60 (19.2)	37 (11.5)	28 (8.97)	29 (9.03)	36 (11.5)	38 (11.8)

Results expressed as number of subjects (with age and gender-specific crude prevalence in parenthesis).

Table 4. Prevalence of impaired glucose tolerance, diabetes mellitus, hypertension, hypercholesterolaemia, hypertriglyceridaemia, low HDL state and obesity.

Impaired glucose tolerance	5.37	(5.27)	[3.74–6.78]
Diabetes mellitus	5.21	(5.02)	[3.59–6.43]
Hypertension	16.11	(15.25)	[11.67–18.8]
Hypercholesterolaemia	15.32	(14.86)	[11.09–18.61]
Hypertriglyceridaemia	9	(8.46)	[6.27–10.64]
Low HDL	11.69	(11.18)	[8.35–13.99]
Obesity	9.95	(9.89)	[7.24–12.52]
Central obesity	16.9	(16.35)	[12.47–20.24]

Results given as crude prevalence with age-standardized prevalence in parentheses and 95% confidence intervals within square brackets.

Table 5. Metabolic and anthropometric measurements.

	Male	Female
Total cholesterol (mmol/l)	5.1 (1.1)	4.76 (1.18)
Triglycerides (mmol/l)	1.5 (1.1)	1.38 (1.23)
HDL (mmol/l)	1.1 (0.8)	1.32 (0.7)
Systolic blood pressure (mmHg)	127 (24)	125 (31)
Diastolic blood pressure (mmHg)	82 (8)	77 (12)
Body mass index (kg/m^2)	25.2 (5.1)	27.1 (7.2)
Waist/hip circumference ratio	0.93 (0.09)	0.85 (1.1)

Values are means (SD in parentheses).

obesity, hypertension impaired glucose tolerance and diabetes in suburban Sri Lanka is higher than in European subjects but not as high as those reported in migrant south Asian populations[21,23–25].

The NIH Consensus Development Conference and the WHO expert committee[26,27] have stated that serum cholesterol has no major effect on the occurrence of coronary heart disease if the population mean is 4.5 mmol/l or less. In our study the population mean was 5.11 mmol/l suggesting that suburban Sri Lankans are at risk from coronary heart disease. HDL cholesterol levels less than 0.9 mmol/l are accepted as a coronary risk factor. The prevalence of low HDL cholesterol is 9% in European populations[28] and 13% in our study sample. Hypertriglyceridaemia and/or low HDL in the presence of normal cholesterol with central obesity are thought to be associated with syndrome X and have been implicated as a cause for the high rate of coronorary heart disease in south Asians[10].

Studies from small isolated primitive communities show that an age-related rise in blood pressure and hypertension are not invariable accompaniments of ageing, but socioeconomic changes associated with development may lead to increases in levels of blood pressure[29]. Although data from studies of Indian immigrant populations in the UK imply that hypertension does not make a significant contribution to excess coronary vascular disease in south Asians[30] we have reported an association between hypertension and coronary vascular disease in diabetic Sri Lankans[31]. The prevalence of hypertension in this study is similar to that observed in Indian populations[32], mean blood pressures are similar to those seen in European populations[10] but lower than mean blood pressures in rural Sri Lankans[33].

The high prevalence of smoking and obesity suggests that control of the tobacco industry and a national food policy should be a major component of primary prevention strategies.

Data collected over the past three decades in developed countries emphasize the key role of obesity, hypertension, dyslipidaemia, a high prevalence of smoking and non-insulin-dependent diabetes as risk factors for coronary heart disease. The causes of cardiovascular diseases in developing countries appear to be the same as in the developed world[34]. It has been shown that preventive programmes can reduce coronary disease mortality in developed countries[35]. We conclude that health services in Sri Lanka should encourage healthy lifestyles and incorporate strategies for primary prevention and control of non-communicable diseases within the preventive care system.

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斯里蘭卡郊區居民的肥胖症和其它冠心病危險因子的發病率

摘要

與經濟發展相平衡，發展中國家的非傳染性疾病正在增長，例如斯里蘭卡正面對傳染性與非傳染性疾病的雙重負擔。因此，我們從 2974選舉人名單中隨機選取 633 人（其中 312 位是女性）進行研究，評估其肥胖症、糖尿病、葡萄糖耐量不良（IGT）、高脂血症、高血壓、中央肥胖症（男性樣的）、高血壓的發病率與吸煙習慣。結果發現： IGT 發病率 5.27 (3.74－7.78) 、糖尿病 5.02 (3.59－6.53) 、高血壓 15.25 (11.67－18.8) 、高膽固醇血症 14.86 (11.09－18.61) 、高甘油三酯血症 8.46 (6.27－10.64) 、低高密度脂蛋白膽固醇 11.18 (8.35－13.99) 、肥胖症 9.89 (7.24－12.52) 和男性樣肥胖症 16.35 (12.47－20.24) 。我們得出結論，這些冠心病危險因子的高發病率可作爲斯里蘭卡預防肥胖症、糖尿病和冠心病的指南。