RISK FACTORS FOR CHRONIC DISEASES AMONG ROAD SWEEPERS IN BANGKOK

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Abstract. The nutritional and health status of road sweepers in Bangkok was investigated. Fifty-seven males and one hundred thirty-four females from 10 districts were selected for the study. The districts were sampled as cluster at random. From each district selected about 50% of road sweepers volunteered to participate in the investigation. Through questionnaires the age, marital status, place of origin, drinking and smoking habits were assessed. Anthropometric measurements, blood pressure and the lipid profile of these subjects were determined. According to a physical check-up and X-rays taken, all individuals investigated were apparently healthy. The age of the study group varied between 26 and 57 years. The median for the males was 47 years and for the females 37.5 years. Almost all the road sweepers were married. Smoking and alcohol drinking was widespread. Over- and undernutrition was found among the group investigated. 26.3% of the males and 1.5% of the females were undernourished. According to their systolic values, 15.8% of the males and 6.7% of the females were suffering from hypertension, and 38.6% of the males and 15.7% of the females had hypertension according to their diastolic values. 58.2% of the females and 29.3% of the males were overnourished. 57.9% of the males and 59.7% of the females had cholesterol levels above 200 mg/dl. Pathological values of LDL cholesterol were determined in 26.3% of the males and 28.4% of the females. The habit of consuming tonic drinks was widespread among the workers. The study concluded that behavior risk factors are highly prevalent in the group of workers belonging to the lower socio-economic class. Further investigations are presently being undertaken to study the after-effects of air pollution among this group of workers. The results will be subsequently reported in future publications.

INTRODUCTION

Bangkok is the center for migrants coming from the rural areas, especially from the northeast and north of the country to look for possible employment (Epstein, 1989; National Statistical Office, 1990; Yamwong *et al*, 1991; Pongpaew *et al*, 1993a). The health status of certain groups of migrants considered as displaced persons in an urban setting, run a higher risk of being affected by health problems. This was seen in a group of construction site workers investigated recently (Chanjanakitskul *et al*, 1992; Pongpaew *et al*, 1993a). Changes in their eating habits and increases in alcohol consumption and smoking were observed (Osuntokun, 1985; Hamburg, 1987; Epstein, 1989). There was also a change in their vitamin and lipid status (Pongpaew *et al*, 1993b; Pongpaew *et al*, 1994; Herbert *et al*, 1994; Tungtrongchitr *et al*, 1995). The following study was conducted to investigate the nutritional and health status of another group of workers belonging to the lower socio-economic sections of the population which is partly made up of migrants, namely road sweepers. These workers are especially exposed to environmental pollution comprising of dust and exhaust fumes from buses and cars. To investigate the risk in this population group, Thai male and female road sweepers from various districts in Bangkok were studied. Anthropometric measurements were taken from them; their lipid profiles were determined; blood pressure was recorded, and the prevalence of other chronic diseases besides hypertension was looked into. The findings could be used to implement strategies to

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prevent the occurrence of certain diseases among the group of road sweepers.

MATERIALS AND METHODS

Subjects

Fifty-seven male and 134 female road sweepers from 10 districts in Bangkok were investigated in this study. About 50% of all road sweepers from the districts, selected as clusters at random volunteered to co-operate in the investigation. While approximately 60% of them came from the central part of Thailand, the rest of these workers came from the northeastern, northern, eastern and southern part of Thailand (Fig 1). Through interviews by using a questionnaire, the age, marital status, place of origin, drinking and smoking habits were assessed. A physical check undertaken by a medical data as well as X-ray for excluding TB, pleural mass and fibro-infiltration were also performed.

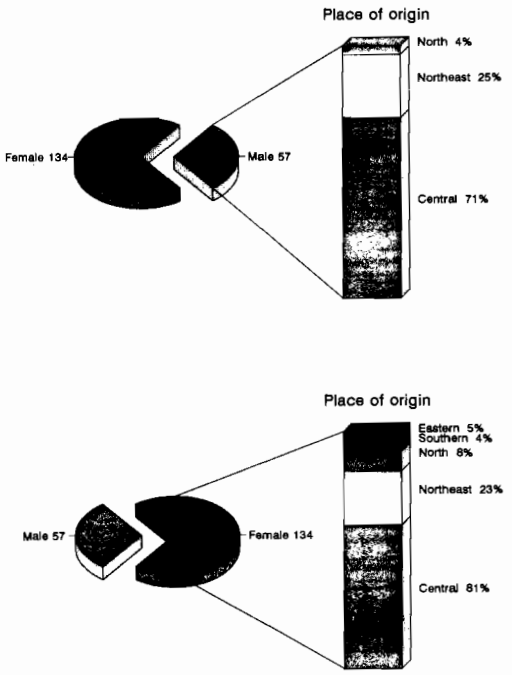

Fig 1–Socio-demographic characteristics of road sweepers by place of origin.

Analytical methods

The nutritional status of all subjects in this study was assessed by means of anthropometric measurements. The body weight of each individual dressed in light clothing was measured using a carefully calibrated beam balance (Detecto). Height measurements were taken using a vertical measuring rod. The body mass index (BMI) also called Quetelet index was conventionally calculated as weight in kg/height in meter^2. Standard techniques were applied in the measuring of tricep skinfold thickness (TSF), subscapular skinfold thickness (SST) and arm circumference (AC). The skinfold thickness was measured by using a Holtain skinfold caliper. Midarm muscle circumference (MAMC) was computed from the formula:

MAMC in cm = AC in cm - (O.314 × TSF in mm)

Twenty ml of venous blood was drawn from all subjects under investigation in the morning before breakfast and after their overnight fast. For the determination of cholesterol, high density lipoprotein-cholesterol (HDL-C) and triglyceride (TG), a commercially available Boehringer Mann-heim (Germany) test kit was used. Low density lipoprotein-cholesterol (LDL-C) levels were calculated by using the Friedewald formula. To distinguish between normal and pathological levels, the following cut-off points were selected. For cholesterol $\geq$ 200 mg/dl, for LDL-C $\geq$ 150 mg/dl, for HDL-C $\leq$ 35 mg/dl, and for TG $\geq$ 200 mg/dl. Serum enzymes, aspartate amino transferase (SGOT, SAST, EC 2.6.1.1) and alanine amino transferase (SGPT, SALT, EC 2.6.1.2) were measured according to the method of Reitman and Frankel (1957); alkaline phosphatase (ALP, EC 3.1.3.1) according to the method of Babson *et al* (1966). The other biochemical parameters, *ie*, glucose, blood urea nitrogen, creatinine were analysed by standard conventional method (Bauer, 1982).

Statistical analysis

The statistical software package MINITAB (Ryan *et al*, 1985) was used to evaluate the data. To determine statistically significant differences between males and females, the non-parametric Mann-Whitney U-Wilcoxon Rank Sum W test was applied. The Spearman rank correlation was used to calculate linear regression among variables.

RESULTS

All individuals investigated were apparently healthy and not suffering from an acute illness as determined by physical check up and X-ray. Most of the road sweepers (91% males and 88% females) were married (Fig 2). A significantly high number of males were found to be current or former smokers compared to females (Fig 3). However, the proportion of males and females who either never smoked or already quit smoking was higher than the proportion of current smokers. A rather high proportion, between 50% and 45% of the males and females were alcohol drinkers (Fig 4). Also, the proportion of males and females who consumed tonic drinks supposed to increase their working capacity was found to be 55% among the females and almost 80% among the males (Fig 5).

The median, range and 95% confidence interval are given for age, anthropometric parameters, blood pressure, variables of the lipid status, glucose, and conventional kidney and liver function tests in

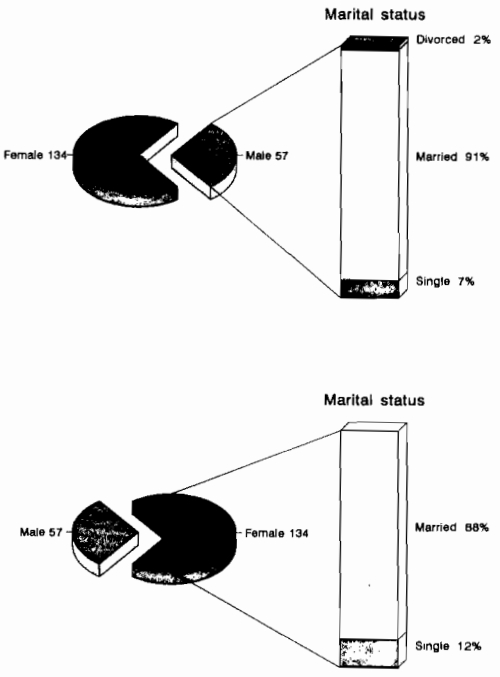

Fig 2–Socio-demographic characteristics of road sweepers by marital status.

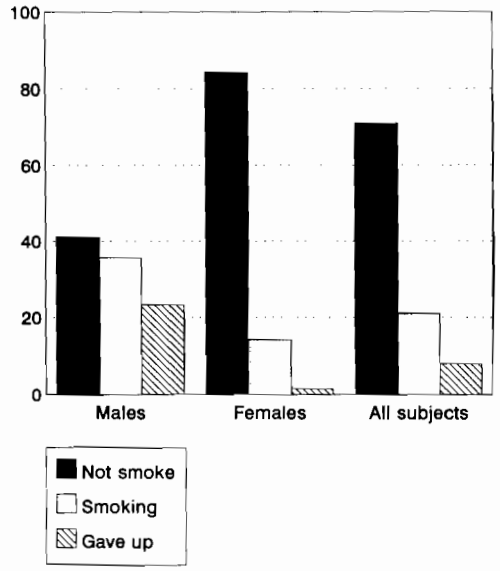

Fig 3–Smoking habit of Bangkok road sweepers.

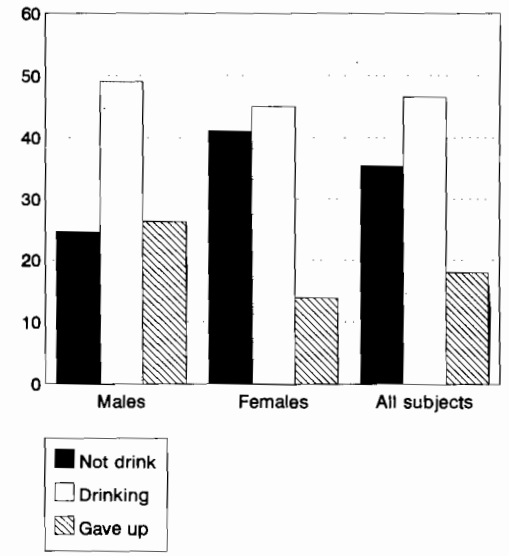

Fig 4–Alcohol drinking of Bangkok road sweepers.

Table 1 for males and females. The age of the road sweepers varied between 26 and 49 years for the males and 20 to 57 years for the females. No significant differences in the blood pressure, neither systolic nor diastolic variables, were found between the males and females. Serum glucose

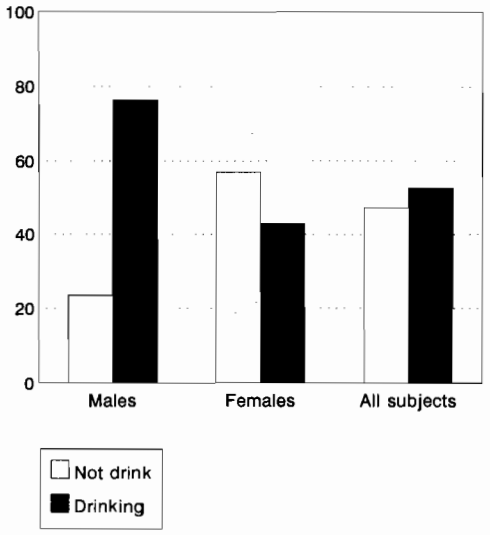

Fig 5–Tonic drink consumption of Bangkok road sweepers.

concentration was similar in both males and females, however, other values of clinical chemistry, *ie* blood urea nitrogen, creatinine, SAST, SALT and ALP were higher in males than in females. When ≥ 160 mmHg was taken as the cut-off point for hypertension for the systolic blood pressure and ≥ 95 mmHg as cut-off point for the diastolic blood pressure, 15.8% and 31.6% for males and 6.7% and 15.7% for females respectively had to be classified as hypertensive. The medians of weight, height and MAMC in the males were significantly higher than those of the female road sweepers. Among the females, the BMI, arm circumference and subscapular skinfold was higher than those of their male counterparts.

The cut-off point of BMI to determine between undernourished and well-nourished individuals is ≥ 20.1 kg/m² for males and ≥ 18.7 kg/m² for females (Anonymous, 1985). Overnutrition is considered when a male individual has a BMI of ≥ 25.0 kg/m² and a female ≥ 23.8 kg/m². A significant number of males, *ie* 26.3% and females, *ie*, 1.5% were found to be undernourished. The prevalence of overnutrition was significantly higher among the females with 58.2% than among the males with 29.3% (Table 2). No significant difference were found between males and females in terms of hypercholesterolemia (Table 2). 57.9% of males and 59.7% of females had cholesterol levels above 200 mg/dl. Pathological values of LDL-C were determined in 26.3% of males and 28.4% of females. 10 to 15% of road sweepers had elevated SAST and SALT.

Various parameters were correlated with each other as given in Tables 3 and 4. All anthropometric measurements except height measurements were found to correlate with both systolic and diastolic blood pressure. A negative correlation was found between HDL cholesterol and anthropometric variables, except for height, both in the male and female road sweepers. A significant correlation was found between LDL-C, triglycerides and weight, BMI, AC, TSF, SST and MAMC in the females.

DISCUSSION

When comparing the results of this study with those reported previously for construction site workers, fewer migrants seem to find employment as road sweepers in Bangkok. This is probably due to the fact that road sweepers are low-ranking government employees. Employment opportunities are therefore better for those living in the central part of Thailand rather than for migrants from other parts of the country who frequently come and go (Pongpaew *et al*, 1993a, b; Pongpaew *et al*, 1994; Tungtrongchitr *et al*, 1995). The age structure of road sweepers is also different from that of the construction site workers. More middle-aged individuals could be found among the road sweepers than among the construction site workers. Individuals working in construction sites are much younger. Consequently, most of the road sweepers, both males and females, are married. The behavioral pattern of both males and females is counter-productive to their health status. According to a physical check-up and X-rays taken, all individuals investigated were apparently healthy except for two males who were found to have pulmonary infiltration. Considering the fact that the road sweepers are exposed to a high level of air pollution evidence for gross lung involvement seems to be limited. A report from the Bangkok Metropolitan Administration indicates high lead and carbon monoxide pollution on the roads of Bangkok (Tables 5, 6) (Department of Policy and Planning, 1992), however, there is wide fluctuation in lead and carbon monoxide concentrations in the air according to location and over time.

A rather high proportion of road sweepers smoke, drink alcohol and consume tonic drinks. To

Table 1

Age, anthropometric parameters, blood pressure and biochemical parameters of Thai road sweepers in Bangkok.

Parameters	Male		Female		p-value
	median (range) (n = 57)	95% CI	median (range) (n = 134)	95% CI	
Age (years)	47.0 (26.0-49.0)	40.7-50.3	37.5 (20.0-57.0)	35.0-40.0	0.0000[a]
Weight (kg)	62.3 (43.8-93.8)	58.6-64.7	58.5 (39.9-83.9)	55.8-60.2	0.0143[a]
Height (cm)	165.5 (150.0-178.0)	162.5-166.5	152.0 (142.0-175.0)	151.1-153.4	0.0000[a]
BMI (kg/m^2)	22.5 (15.5-33.4)	21.4-24.3	24.8 (16.9-34.9)	23.7-25.5	0.0015[a]
Arm circum (cm)	28.0 (22.0-41.0)	27.4-29.7	29.0 (20.0-39.0)	28.5-30.0	0.2418
Subscapular skinfolds (mm)	10.6 (5.2-30.0)	9.8-13.0	15.1 (7.2-30.0)	14.0-17.0	0.0001[a]
Tricep skinfolds (mm)	8.7 (2.9-34.0)	6.8-11.7	15.1 (5.2-26.9)	14.2-16.0	0.0000[a]
MAMC (cm)	25.8 (16.8-30.3)	24.5-26.6	24.2 (17.2-30.5)	23.6-24.7	0.0029[a]
Systolic BP (mm Hg)	131.0 (108.0-188.0)	124.3-137.3	128.0 (94.0-220.0)	125.0-131.0	0.1613
Diastolic BP (mm Hg)	86.0 (58.0-128.0)	81.7-92.3	80.0 (55.0-112.0)	78.0-82.0	0.0194
Cholesterol (mg/dl)	205.0 (97.0-359.0)	193.0-218.7	211.0 (118.0-461.0)	200.0-220.0	0.7792
HDL-cholesterol (mg/dl)	48.0 (27.0-107.0)	46.7-53.0	55 (28.0-107.0)	52.0-57.8	0.0112[a]
LDL-cholesterol (mg/dl)	127.0 (50.0-288.0)	121.7-136.3	124.5 (62.0-378.0)	121.0-136.0	0.8179
Triglyceride (mg/dl)	110.0 (50.0-425.0)	96.7-128.3	99.0 (48.0-406.0)	91.4-112.8	0.1438
Glucose (mg/dl)	90.0 (47.0-397.0)	87.0-94.0	87.0 (70.0-296.0)	86.0-89.0	0.0909
Blood urea nitrogen (mg/dl)	13.5 (7.0-22.5)	12.7-14.0	11.5 (5.0-29.3)	11.6-12.3	0.0001[a]
Creatinine (mg/dl)	1.10 (0.85-1.35)	1.05-1.15	0.95 (0.65-1.80)	0.90-0.95	0.0000[a]
SAST (U/l)	35 (23-201)	32.7-36.0	27.5 (20-192)	26.2-29.8	0.0000[a]
SALT (U/l)	23 (10-154)	20.7-27.3	17 (10-123)	(16-18)	0.0001[a]
Alkaline phosphatase (U/l)	27.5 (18.8-46.6)	25.6-30.0	23.5 (13.6-71.3)	22.4-24.6	0.0000[a]

[a] Mann-Whitney U-Wilcoxon Rank Sum W test (Two-tailed)

Table 2

Number and percentage of individuals with overnutrition, undernutrition hypertension and abnormal lipidemia in road sweepers.

	Male (n = 57)		Female (n = 134)		Total (n = 191)	
	n	%	n	%	n	%
A. Obesity						
BMI male ≥ 30.0 female ≥ 30.0	3	5.3	15	11.2	18	9.4
B. Overnutrition						
BMI male ≥ 25.0 female ≥ 25.0	17	29.3	65	48.5	82	42.9
BMI male ≥ 25.0 female ≥ 23.8	17	29.3	78	58.2	95	49.7
C. Undernutrition						
BMI male ≤ 20.1 female ≤ 18.7	15	26.3	2	1.5	17	8.9
D. Hypertension						
Systolic ≥ 160 mmHg	9	15.8	9	6.7	18	9.4
Diastolic ≥ 95 mmHg	18	31.6	21	15.7	39	20.4
E. Lipidemia						
Cholesterol ≥ 200 mg/dl	33	57.9	80	59.7	113	59.1
HDL-C ≤ 35 mg/dl	3	5.3	3	2.2	6	3.1
LDL-C ≥ 150 mg/dl	15	26.3	38	28.4	53	27.7
Triglyceride ≥ 200 mg/dl	7	12.3	13	9.7	20	10.5
F. Liver function						
SALT (> 35 U/l)	12	21.1	15	11.2	27	14.1
SAPT (> 40 U/l)	11	19.3	10	7.5	21	10.9
ALP (> 50 U/l)	0	0.0	2	1.5	2	1.1
G. Hyperglycemia						
FBS > 110 mg/dl	4	7.0	11	8.2	15	7.9

what extent alcohol consumption is related to the rather high prevalence of hypertension is a question that needs to be investigated further. The habit of consuming tonic drinks seem to be widespread among manual workers because an equally high proportion of construction site workers also consumed tonic drinks (Pongpaew *et al*, 1993b). To a certain extent, tonic drinks can be considered to be beneficial in that these contain an excess of vitamins B and C. However, the caffeine content of these drinks is also rather high. In the females, this might affect the outcome of pregnancy and also, as some investigators have reported, it might have an effect on the increased level of total serum cholesterol, especially in elderly women (Pelletier and Baker, 1987; Carson *et al*, 1993). Therefore, the consumption of tonic drinks might be related to the increased levels of cholesterol found in almost 60% of the individuals investigated here. The findings of this investigation that quite a high proportion of males and especially of females are overnourished and even obese contrasted with the results obtained on the investigation on construction site workers. Almost none of the construction site workers investigated were overnourished. Obviously, the physical workload of construction site workers is much heavier than those of road sweepers.

The median values for cholesterol measured in road sweepers is higher than those reported by other

Table 3

Correlation between anthropometric parameters, age, blood pressure and serum lipids in male road sweepers.

Parameters	Weight	Height	BMI	Arm	Tricep	Subscap	MAMC
Age	0.2704[a]	-0.4258[b]	0.3969[b]	0.2447	0.4630[b]	0.4175[b]	0.0717
Cholesterol	0.2236	-0.0811	0.2092	0.2968[a]	0.2426	0.2220	0.2133
HDL-C	-0.2707[a]	-0.0446	-0.2951[a]	-0.2701[a]	-0.2989[a]	-0.2803[a]	-0.2460
LDL-C	0.2154	-0.0634	0.2270	0.3260[a]	0.2995[a]	0.2306	0.2439
Triglyceride	0.4533[b]	-0.1831	0.5093[b]	0.4677[b]	0.4282[a]	0.4057[b]	0.3818[b]
Systolic BP	0.4618[b]	-0.1172	0.4594[b]	0.4735[b]	0.4198[b]	0.5320[b]	0.3827[b]
Diastolic BP	0.5691[b]	-0.0962	0.5697[b]	0.5737[b]	0.4888[b]	0.6293[b]	0.4610[b]
SAST	0.3408[b]	-0.0064	0.3604[b]	0.3731[b]	0.0931	0.2356	0.3670[b]
SALT	0.5221[b]	-0.1028	0.5746[b]	0.5588[b]	0.3576[b]	0.4067[b]	0.4862[b]
ALP	-0.1957	-0.2024	-0.0855	-0.0514	0.0561	-0.0112	-0.0460

[a] $p < 0.05$
[b] $p < 0.01$

Table 4

Correlation between anthropometric parameters, age, blood pressure and serum lipids in female road sweepers.

Parameters	Weight	Height	BMI	Arm	Tricep	Subscap	MAMC
Age	0.2289[b]	-0.1124	0.2317[b]	0.2798[b]	0.1381	0.1705[a]	0.3037[b]
Cholesterol	0.1203	-0.2254[b]	0.2321	0.1709[a]	0.1806[a]	0.1326	0.1237
HDL-C	-0.4033[b]	-0.2029[a]	-0.3175[b]	-0.2590[b]	-0.2113[a]	-0.2659[b]	-0.2705[b]
LDL-C	0.2285[b]	-0.1606	0.3236[b]	0.2419[b]	0.2589[b]	0.2311[b]	0.1942[a]
Triglyceride	0.3526[b]	0.1041	0.2844[b]	0.2633[b]	0.2336[b]	0.2016[a]	0.2545[b]
Systolic BP	0.3130[b]	-0.0299	0.3216[b]	0.2686[b]	0.2416[b]	0.1965[a]	0.2397[b]
Diastolic BP	0.3966[b]	0.0291	0.3568[b]	0.3118[b]	0.2980[b]	0.2903[b]	0.2688[b]
SAST	0.1332	0.0259	0.0788	0.0745	0.1265	0.1207	0.0445
SALT	0.1646	-0.0332	0.1358	0.1118	0.1722[a]	0.1358	0.0596
ALP	0.2305[b]	-0.0643	0.2333[b]	0.1461	0.2107[a]	0.2766[b]	0.0966

[a] $p < 0.05$
[b] $p < 0.01$

investigators in Thailand (Nitiyanant *et al*, 1987; Pingsuthiwong *et al*, 1994). The health and nutritional status of road sweepers seem to be different from other groups of manual workers. The nutritional status of the road sweepers is better and the rate of overnutrition among them is higher. It might be concluded that the workload among road sweepers is less than for the construction site workers

Table 5

Concentrations of air lead from selected roads and areas of Bangkok.

Location	Result	The quantities of air lead in 24 hr ($\mu g/m^3$)		
		1989	1990	1991
Yaowaraj area	mean	2.33	2.21	2.34
(Yaowaraj Road)	range	1.58-4.40	0.83-3.18	1.29-3.97
Mansri area	mean	3.34	5.09	1.92
(Bamrung Muang Road)	range	2.35-5.45	4.97-6.41	0.57-3.22
Silom Road	mean	3.14	2.37	1.90
	range	1.67-4.33	0.33-4.75	0.86-3.00
Pratoo Nam area	mean	1.97	2.06	1.76
(Rajprarop Road)	range	1.43-2.66	1.46-2.83	0.48-4.25
Si Phraya Road	mean	2.81	1.25	1.39
	range	1.37-6.17	0.57-3.34	0.68-1.96
Bang Lampoo area	mean	1.15	1.13	1.11
	range	0.95-1.61	0.91-1.99	0.74-1.63
Sukhumvit Road[a]	mean	1.71	-	1.06
	range	1.28-1.97	-	0.56-1.47
Lan Luang Road	mean	1.85	4.19	0.94
	range	1.18-3.81	3.18-4.83	0.28-1.74
Sapankuai area	mean	1.18	0.86	0.62
(Paholyothin Road)	range	0.69-1.69	0.43-1.17	0.26-0.97

[a] Sukhumvit road: Department of Meteology.
From Department of Policy and Planning, Bangkok Metropolitan Administration, 1992.

investigated before. Risk factors such as cigarette smoking, alcohol and tonic drink consumption are highly prevalent in a group of road sweepers as well as in the group of construction site workers. Although the proportion of individuals showing a cholesterol level of more than 200 mg/dl is quite high, only a few of them have low HDL-cholesterol levels. This is different from the lipid status of individuals in most westernized societies where high cholesterol levels goes along with low HDL-C levels (Seidell *et al*, 1990). Further investigations are necessary to evaluate the risk pattern in the development of cardiovascular diseases in those population groups with not only a comparably high cholesterol but also a high HDL-C level which is supposed to be a preventive factor.

Further investigations are presently undertaken to study the after-effects of air pollution for this group of workers. Results will be reported in a preceding publication. Preliminary results did not show a serious effect on the health of road sweepers.

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Table 6

The quantities of carbomonoxide on the roads in Bangkok.

Location	Result	The quantities of carbonmonoxide in 1 hr (mg/m^3)		
		1989	1990	1991
Mansri area	mean	12.91	11.59	16.76
(Bamrung Muang Road)	range	0.6-52.65	0.11-42.38	3.17-40.19
Silom Road	mean	15.69	10.46	9.83
	range	0.57-42.94	0.11-22.60	0.11-24.55
Yaowaraj area	mean	7.8	12.42	9.53
(Yaowaraj Road)	range	1.13-23.00	1.13-28.25	0.45-20.22
Bang Lampoo area	mean	6.96	5.75	6.57
	range	0.40-23.81	0.5-25.36	0.27-24.92
Sapan Kuai area	mean	7.49	7.10	6.38
(Paholyothin Road)	range	1.02-40.68	1.99-21.38	0.11-27.69
Pratoo Nam area	mean	7.92	13.68	5.84
(Rajprarop Road)	range	1.13-30.51	2.12-53.11	0.11-21.70
Lan Luang Road	mean	3.65	6.11	3.33
	range	0.6-33.90	0.87-21.92	0.11-15.37
Sukhumvit Road	mean	3.71	4.73	2.78
	range	0.6-12.93	0.05-18.89	0.11-16.61
Si Praya Road	mean	6.08	2.65	1.97
	range	0.27-37.46	0.11-11.68	0.11-9.03

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