

## PREVALENCE OF HYPERCHOLESTEROLEMIA IN A KUWAITI HOSPITAL OUTPATIENT POPULATION

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Prospective epidemiological studies in many developed countries in Europe and North America have established a direct and strong relationship between elevated serum cholesterol levels and increased prevalence of coronary heart disease (CHD) in individuals within populations.<sup>1-5</sup> Primary and secondary prevention trials<sup>6-8</sup> have also established the importance of lowering serum cholesterol levels in the reduction of mortality and morbidity from CHD.

Life expectancy at birth in Kuwait in 1993 was 73.8 years, compared to 75.6 in the US and 75.8 in the UK.<sup>9</sup> As a direct consequence of increased life expectancy due to improvements in the standard of living, an increased prevalence of chronic degenerative diseases, including coronary heart disease, has been reported in Kuwait. In 1993, for example, the single most important cause of death among both sexes and nationalities was ischemic heart disease, accounting for 38.6 deaths per 100,000 population.<sup>9</sup> Because there is little information on the mean total serum cholesterol level and the prevalence of hypercholesterolemia in Kuwait, we decided to study them in a hospital outpatient population.

### Material and Methods

The study was carried out at the Clinical Chemistry Laboratory of Mubarak Al-Kabeer Teaching Hospital. Between January and June of 1995, a total of 1076 outpatient requests from known Kuwaiti Arabs were received for routine biochemical profiling. These formed the study population.

Total serum cholesterol was measured on a Hitachi 717 discrete autoanalyzer using enzymatic methods (Boehringer Mannheim). All reports with high blood

glucose, bilirubin, transaminases, urea, creatinine and uric acid were excluded. The remaining 751 apparently normal reports were subjected to statistical analysis to determine the mean total serum cholesterol and the prevalence of hypercholesterolemia among Kuwaiti Arabs.

### Statistical Analysis of Data

Simple descriptive statistics (mean, standard deviation and correlation coefficients) were used in the statistical analysis of data. Analysis of variance (Anova) was used to determine the differences in mean serum cholesterol values between subjects by age group and gender. Regression analysis was used to evaluate the type of relation between serum cholesterol level and age. These statistical analyses were carried out using the statistical package SPSS (version 6).

### Results

#### *Distribution of total serum cholesterol in the hospital outpatient population*

The median age of the population which we studied was 38.9 years and the male-to-female ratio was found to be close to one. Moreover, there was no significant ( $P>0.05$ ) difference in age pattern distribution between males and females.

A descriptive analysis of the cholesterol data indicated some deviation from gaussian distribution with significant values for skewness ( $0.705 \pm 0.138$ ). For normalizing the values, a log transformation (to the base e) was carried out, which resulted in an almost perfect gaussian distribution (Figure 1). The geometric mean of total serum cholesterol for the population was found to be 5.05 mmol/L, which was not significantly different from the arithmetic mean ( $5.17 \pm 1.1$  mmol/L).

Table 1 provides the geometric means and 95% confidence intervals for total serum cholesterol for each age group according to sex.

Figure 2 shows that in males, the total serum cholesterol level rose progressively with age, peaked around the age of 70 years, and then began to fall. In

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TABLE 1. Geometric means and 95% confidence intervals of total serum cholesterol values for each age group by sex among Kuwaiti hospital outpatients.

Age in years	Geometric means and 95% confidence intervals (mmol/L)			P-value (male/female)
	All	Male	Female	
1-19	4.17 2.76-6.30	4.08 2.72-6.13	4.25 2.80-6.46	NS
20-29	4.63 3.25-6.60	4.5 3.13-6.49	4.73 3.35-6.67	NS
30-39	4.99 3.40-7.33	5.04 3.46-7.33	4.95 3.35-7.33	NS
40-49	5.31 3.53-7.97	5.33 3.66-7.77	5.27 3.39-8.19	NS
50-59	5.64 3.80-8.37	5.47 3.69-8.10	5.91 4.02-8.68	NS
60-69	5.84 4.32-7.89	5.75 4.10-8.06	5.94 4.56-7.73	NS
70+	5.47 3.58-8.35	5.28 3.37-8.27	5.81 3.94-8.59	NS

NS=not significant.

TABLE 2. Mean total serum cholesterol levels in middle-aged Kuwaiti men compared with those from other countries.

Country	No. of subjects	Age range (years)	Mean cholesterol (mmol/L)	Reference
Kuwait	202	40-49	5.33	This study
Former Yugoslavia	918	45-54	4.29	2
Italy	2000	40-49	5.8	3
USA	546	40-49	5.51	10
Norway	14,677	40-49	5.85	11
UK	7415	40-59	6.34	12
Russia	576	40-49	5.85	13
France	7434	45-49	5.8	14
Poland	400	50-59	5.36	15
India	51	41-50	4.63	16

females, however, the serum cholesterol level rose progressively until the age of 50 years, then increased sharply until the age of 60 years and then remained constant after that.

#### Comparison of total serum cholesterol levels in middle-aged Kuwaiti men with those of other countries

Table 2 shows the mean total serum cholesterol level in middle-aged Kuwaiti men compared with those from other countries of the world.<sup>10-16</sup> The mean level in Kuwaiti men (5.33 mmol/L) was slightly lower than in middle-aged

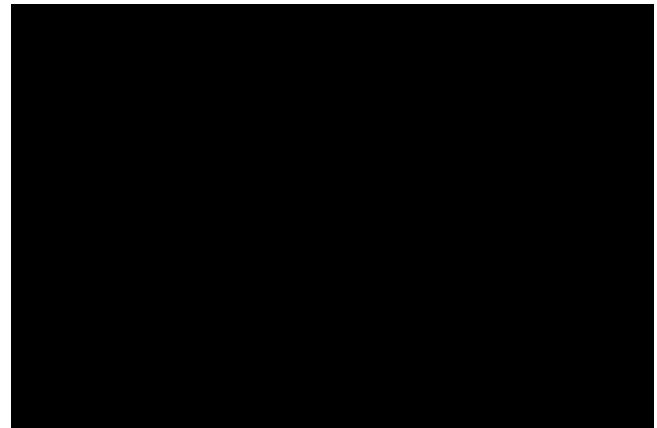


FIGURE 1. Gaussian distribution of log cholesterol values (to the base e) in Kuwaiti Hospital outpatients.

Americans (5.5 mmol/L), but higher than those of Yugoslavs (4.29 mmol/L) and Indians (4.63 mmol/L).

#### Prevalence of hypercholesterolemia in study population

The Consensus Conference on Cholesterol<sup>17</sup> suggests the classification of populations into those with desirable total serum cholesterol (<5.17 mmol/L); those with borderline high cholesterol (5.17-6.20 mmol/L); and those with high cholesterol (≥6.21 mmol/L). Based on this suggestion, we divided the whole study population into those with desirable, borderline-high and high total serum cholesterol (Figure 3). The prevalence of hypercholesterolemia (total serum cholesterol ≥6.21 mmol/L) in the outpatient population was 15.8%. It was 16% in males and 15.7% in females.

The prevalence of hypercholesterolemia increased with age among Kuwaitis of both sexes. For example, in males the prevalence of hypercholesterolemia increased progressively from 3.1% in the 1-19 year age group to 23.5% in the 50-59 year age group. The prevalence then fell progressively thereafter until it was 11.1% in those aged 70 years and above. In females, the prevalence rose progressively from 5% in those aged under 20 years to 18.8% in those aged 40-49 years. Then there was a significant increase to more than double (43.2%) in those aged 50-59 years. Thereafter, the prevalence fell progressively to 20% in those aged 70 years and above. Although there was no significant difference in the prevalence of hypercholesterolemia between males and females up to the age group of 50 years, thereafter the prevalence of hypercholesterolemia in females became significantly ( $P<0.01$ ) higher than in males.

Table 3 shows the prevalence of hypercholesterolemia in men aged 40-59 years in Kuwait compared with those of other countries. The prevalence of hypercholesterolemia in middle-aged men in Kuwait (22.2%) was lower than those

of the United States (39%), the Netherlands (32%) and Finland (56%), but higher than those of Italy (13%), Greece (14%), Yugoslavia (7%) and Japan (7%).

### Discussion

One of the main problems of computing mean values and determining prevalence rates is defining and selecting a suitable population. In this study, we selected an outpatient hospital population and then excluded that part of the population that showed abnormalities in other analytes that might affect serum cholesterol concentration. Ideally, in a prevalence study, a house-to-house survey should be the method of choice for randomly selecting the population, but since this was meant to be a preliminary study, we decided to use an easily assessible population—a hospital outpatient population. Our results showed that the mean total serum cholesterol for the whole population which we studied was within the desirable level, although it was on the borderline-high level in the middle-age group in both males and females. Further, in this age group, the serum cholesterol level was lower than those of developed

countries like the United States, but higher than those of developing countries like India. The reason for the elevated serum cholesterol in Kuwaiti Arabs may be dietary, because the diet in Kuwait, which is high in total calories, saturated fat and cholesterol, has been reported to be associated with high serum cholesterol.<sup>19,20</sup> Our finding that total serum cholesterol rose with age confirmed previous reports.<sup>21,22</sup> A study<sup>23</sup> revealed that two factors were responsible for this rise: increasing production of LDL (low density lipoprotein) and decreasing fractional clearance of LDL by LDL receptors. We also found there was a fall in total serum cholesterol in males after the age of 70 years, a phenomenon which is probably related to decreased food intake and mental deterioration associated with advancing age. It is important to note our observation that in women, the total serum cholesterol level showed a marked increase after menopause and remained relatively higher than that of men and did not show any significant decline after the age of 70 years.

The prevalence of hypercholesterolemia in middle-aged (40-49) Kuwaiti males in the hospital outpatient population was 22.2%, suggesting that one in every five Kuwaiti men of middle age may have an increased risk of coronary heart disease. This prevalence rate in Kuwait is higher than those of Italy, Greece, Yugoslavia and Japan, but lower than those of the United States, the Netherlands and Finland.<sup>18</sup> Another important finding was the very high prevalence rate (43.2%) of hypercholesterolemia in females aged 50-59 years and 31.2% in those aged 60-69 years.

Although a hospital outpatient population is not the best for studying the prevalence of a disease, this preliminary study supports the need for a thorough study of the prevalence of hypercholesterolemia in the entire Kuwaiti population, in order to find out if hypercholesterolemia constitutes a health problem in Kuwait.

TABLE 3. Prevalence of hypercholesterolemia (serum cholesterol  $\geq 6.21$  mmol/L) in males aged 40-59 years from different countries.

Country	Prevalence (%)	Reference
Finland	56	18
United States	39	18
The Netherlands	32	18
Kuwait	22.2	This study
Greece	14	18
Italy	13	18
Former Yugoslavia	7	18
Japan	7	18

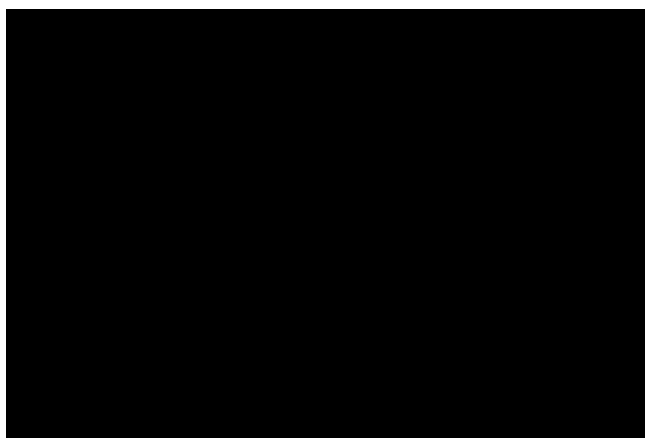


FIGURE 2. Variation of total serum cholesterol with age in Kuwaiti Hospital outpatients.

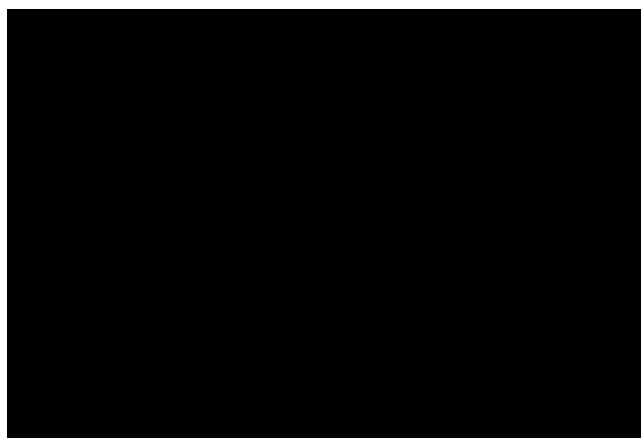


FIGURE 3. Prevalence of desirable, borderline-high total serum cholesterol among Kuwaiti Hospital outpatients.

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