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# ORIGINAL ARTICLE

# Is Hypercholesterolaemia Common Among Hong Kong Chinese?

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## Abstract

*There is growing concern that coronary heart disease (CHD) is becoming more common and that hypercholesterolaemia may be an important problem among Hong Kong Chinese. This study aims at finding out the prevalence of hypercholesterolaemia among adult patients in general practice. 1113 Chinese patients aged 21 to 60 attending a Government general outpatient clinic were randomly sampled. The demographic data and information on other CHD risk factors were obtained from each participant. All participants had their cholesterol measured by the Reflotron. The reflotron cholesterol results were validated and calibrated against laboratory results. The survey showed 10% of the sample had blood cholesterol > 6.2mmol/l, and 32% had borderline hypercholesterolaemia between 5.2 to 6.2mmol/l. Less than 1% of the people had cholesterol levels above 7.8mmol/l. Age had the most significant effect on cholesterol level especially in females after 40. One in four females over 50 had blood cholesterol levels > 6.2mmol/l. Twenty-one percent of the sample had ≥ 2 other CHD risk factors, over half of them had cholesterol >5.2mmol/l. The main problem among Hong Kong Chinese is borderline hypercholesterolaemia which is most significant in people with additional CHD risk factors. Cholesterol screening will be more cost-effective if directed to people known to have other CHD risk factors but may not be worthwhile for the low risk group.*

**Keywords:** Cholesterol, Chinese, screening, prevalence

## Introduction

There is growing concern that coronary heart disease (**CHD**) is becoming more common in the Chinese populations as they live longer and become more affluent.[1-4] For example, the total CHD deaths per 100,000 population nearly doubled from 28.4 in 1972 to 54.7 in 1992 in Hong Kong as a result of the aging of the population.[4] The age standardized coronary mortality rates in Hong Kong has remained the same in the last two decades in contrast to big declines in many Western countries.[1,4] The decline in CHD mortality in the U.S.A. has been attributed to the active national cholesterol campaign.[5] Some studies showed that hypercholesterolaemia was an important CHD risk factor in the Chinese,[6,7] as in the Westerners.[8-13] Should we be more active in the screening and treatment of hypercho-esterolaemia in our population? Two previous local studies on adults aged 18 to 64 years old

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showed that prevalences of hypercholesterolaemia > 6.2*mmol/l* were as high as 16%[14] and 20%.[15] These studies were carried out on very specific population groups whose results might not be applicable to general practice where most of the screening and treatments take place.

Is hypercholesterolaemia common among Chinese patients in general practice in Hong Kong? Our study aims at finding out the answer. We also hope to identify the high risk groups to whom services can be targeted. The information will help general practitioners rationalize their approach to screening and management of hypercholesterolaemia.

## Method

The study was carried out from June 15 to September 15, 1990 at a four-doctor Government general outpatient clinic in Wanchai, Hong Kong. Two trained interviewers sampled the subjects from patients consulting two of the four doctors each day. The doctors were selected in rotation each day so that their patients would have equal chance to be sampled during the study period.

Every one in four patients of the selected doctors were approached by two trained interviewers before their doctor consultations. Chinese patients aged 21-60 were invited to take part in the study. The next patient was invited if the initial sampled subject was outside the age limit, had been sampled before, or if he/she refused to participate.

The interviewers administered a structured questionnaire to each participant on demographic data and coronary heart disease (CHD) risk factors. The major CHD risk factors included male, family history of premature (before the age of 55) coronary heart death or sudden death, current smoking of ≥ 10 cigarettes per day, hypertension on treatment or blood pressure > 160/90, known diabetes mellitus, history of definite stroke or occlusive peripheral vascular disease, and BMI ≥ 30.[16]

Each subject was then seen by the second author (M.G.C.) for measurements of weight, height, blood pressure, and serum cholesterol after the interview. Serum blood cholesterol was measured by the Reflotron (Boerhinger Mannheim, W. Germany, 1988), a desk-top analyzer, on a drop of capillary blood obtained by a finger prick. All the cholesterol tests were performed by the second author (M.G.C.) who had received a training session from the supplier of the machine before the study. The testing procedures listed in the Operation Manual were closely followed. The Reflotron was calibrated every morning before the tests with check strips from the supplier. Quality checks by standard sera from the supplier were performed once a week.

Validation and calibration of the Reflotron cholesterol results were done on 125 subjects who also had blood cholesterol tested by the laboratory. The details of the validation study was presented in another paper.[17] The validation study showed that blood cholesterol (BC) level could be calculated from the reflotron cholesterol (RC) level by the regression equation: BC = 0.8395 + 0.8995 × RC.[17] The three threshold levels of RC that corresponded to the three commonly used blood cholesterol thresholds of 5.2, 6.2 and 7.8*mmol/l*[11] were 4.8, 6.0 and 7.7*mmol/l*, respectively.

All the data were analyzed using the SPSS-PC+ (Statistical Packages for Social Science – Personal Computer) programme[18] and the SAS (Statistical Analysis Software).[19]

## Results

### Sample

There were 1616 (56% females, 44% males) eligible patients approached, 1113 (69%)



(Continued on page 406)

completed the questionnaire and Reflotron cholesterol screening. These 1113 subjects made up the total sample for further analysis. There were 622 (56%) females and 491 (44%) males. The mean age of the sample was 38.7 years (S.D. 11.2). The distributions of the social class by occupation,[20] drinking status, daily physical activity levels and frequency of sweating exercises are shown in **Table 1.**

**Table 1: Characteristics of the Study Sample**

| | Proportion (N=1113) |
|---|---|
| Social Class | |
| I | 1% |
| II | 11% |
| III | 61% |
| IV | 17% |
| V | 10% |
| Daily Activity | |
| Light | 49% |
| Moderate | 41% |
| Heavy | 10% |
| Drinking Status | |
| Current Drinker | 14% |
| Ex-Drinker | 2% |
| Non Drinker | 84% |
| Sweating Exercises | |
| >3x/week | 18% |
| 1-3x/week | 28% |
| <1x/week | 54% |

One percent of the sample were known to have CHD. The number of known major CHD risk factors ranged from 0 to 5 and 21% had two or more. Nine percent were current smokers and 3% were ex-smokers. The sample were known to have hypertension in 14%, diabetes mellitus in 4%, hyperlipidaemia in 2%, previous strokes in 1% and other atherosclerotic diseases in 0.4%. Five percent of the subjects had a positive family history of premature CHD or sudden death in one or more parent or sibling. Five percent of the subjects had a BMI 30 or above. Seventy-one percent of people were aware of the association between hypercholesterolaemia and CHD, and 9% ever had their blood cholesterol checked before.

## Prevalence of Hypercholesterolaemia

The Reflotron cholesterol (RC) levels of the 1113 subjects ranged from 2.6 to 10.8*mmol/l* and the mean was 4.8 (S.D. 0.99) *mmol/l.* Four hundred and seventy (42%) of the subjects had blood cholesterol above the desirable level of 5.2 (RC 4.8) *mmol/l.* Thirty-two percent had borderline hypercholesterolaemia between 5.2 to 6.2*mmol/l*, 10% had blood cholesterol levels > 6.2 (RC > 6.0) *mmol/l*, and only 0.7% had levels > 7.8 (RC > 7.7) *mmol/l.*

**Table 2** shows the prevalence of hypercholesterolaemia by the number of CHD risk factors. Over half of those with ≥ 2 CHD risk factors had blood cholesterol levels > 5.2 (RC > 4.8) *mmol/l*) and 16% had levels > 6.2 (RC >6.2) *mmol/l.* Only 8% of the low risk group had blood cholesterol > 6.2*mmol/l.*

**Table 2: Prevalence of Hypercholesterolaemia by CHD Risk**

| | No. of CHD Risk Factors | |
|---|---|---|
| | < 2 (N=882) | ≥ 2 (N=231) |
| Blood Cholesterol* (*mmol/l*) | | |
| Mean | 5.06 | 5.37 |
| >5.2 & ≤ 6.2 | 32% | 37% |
| >6.2 | 8% | 16% |

* Blood Cholesterol
= 0.8395 + 0.8995 × Reflotron Cholesterol

## Effects of Patient Characteristics on Cholesterol

Pearson correlation analysis was done between cholesterol level and age, body mass

index, systolic blood pressure and diastolic blood pressure, and ANOVA (Analysis of Variance) was used to test the effects of sex, social class by occupation (I to V), daily level of physical activity (1=light, 2=moderate, 3=heavy), smoking status (1=current smoker, 2=ex-smoker, 3=non-smoker), drinking status (1=current drinker, 2=ex-drinker, 3=non-drinker), frequency of sweating exercise (1=>3x/wk, 2=1-3x/wk, 3=<1x/wk) on the cholesterol level.

**Table 3** shows those factors that have significant effects on the cholesterol level. Cholesterol levels increased with increasing age, systolic blood pressure, diastolic blood pressure, body mass index (**BMI**). It increased with social class from I to V which meant people from the lower social class tended to have higher cholesterol than those from the middle class (**Table 4**). There was no trend in the correlations between the cholesterol level and daily physical activity, frequency of sweating exercise or drinking. There was no significant correlation between cholesterol level and sex or smoking status. The correlations between cholesterol level and any of the factors except age were very weak although they were statistically significant because of the large sample size.

**Table 3: Variables that Had a Significant Effect on Cholesterol**

| Variable | Correlation Coefficient | P Value |
|---|---|---|
| **Pearson Correlation** | | |
| Age | 0.37 | <0.0001 |
| Systolic B.P. | 0.29 | <0.0001 |
| Diastolic B.P. | 0.25 | <0.0001 |
| B.M.I. | 0.22 | <0.0001 |
| **ANOVA** | | |
| Physical Activity | 0.015 | <0.0001 |
| Sweating Exercise | 0.014 | <0.0001 |
| Social Class | 0.014 | 0.003 |
| Drinking | 0.008 | 0.01 |

**Table 4: Blood Cholesterol Levels by Social Class**

| | Blood Cholesterol* | | | |
|---|---|---|---|---|
| | Mean (*mmol/l*) | >5.2 (%) | > 6.2 (%) | >7.8 (%) |
| Social Class | | | | |
| I (N=9) | 4.6 | 22 | 0 | 0 |
| II (N=124) | 5.1 | 39 | 11 | 0 |
| III (N=681) | 5.1 | 42 | 9 | 1 |
| IV (N=191) | 5.2 | 41 | 7 | 1 |
| V (N=108) | 5.4 | 54 | 18 | 1 |

* Blood Cholesterol = 0.8395 + 0.8995 × Reflotron Cholesterol

The distribution of cholesterol levels by age and sex of the sample is shown in **Table 5**. Overall 10% of the females and 9% of the males had blood cholesterol levels > 6.2*mmol/l*. The mean cholesterol level and prevalence of hypercholesterolaemia increased with age in both sexes. Blood cholesterol levels over 6.2*mmol/l* (RC >6.0*mmol/l*) were uncommon before the age of 40 but were found in 25% of the females and 18% of the males aged 51-60.

**Table 5: Blood Cholesterol Levels by Age & Sex of the Sample**

| | Blood Cholesterol* (*mmol/l*) | | | |
|---|---|---|---|---|
| Age & Sex | Mean (%) | >5.2 (%) | >6.2 (%) | >7.8 |
| 21-30 yrs | | | | |
| M (N=112) | 4.7 | 19 | 5 | 0 |
| F (N=213) | 4.8 | 24 | 2 | 0.5 |
| T (N=325) | 4.8 | 22 | 2 | 0.3 |
| 31-40 yrs | | | | |
| M (N=183) | 5.1 | 43 | 8 | 0.5 |
| F (N=163) | 5.0 | 36 | 6 | 1 |
| T (N=346) | 5.0 | 40 | 7 | 0.9 |
| 41-50 yrs | | | | |
| M (N=87) | 5.2 | 40 | 8 | 0 |
| F (N=116) | 5.3 | 52 | 16 | 1 |
| T (N=203) | 5.2 | 47 | 12 | 0.5 |
| 51-60 yrs | | | | |
| M (N=108) | 5.5 | 63 | 18 | 0 |
| F (N=130) | 5.8 | 74 | 25 | 2 |
| T (N=238) | 5.7 | 69 | 21 | 1 |

* Blood Cholesterol = 0.8395 + 0.8995 × Reflotron Cholesterol



*(Continued on page 409)*

## Discussion

We had over 1000 subjects in our sample with a wide spread of age, and social background. The Government outpatient clinic in our study was in a very central location and was attended by patients from all areas in the territory. We believe that our results could be applied to other general practice populations in Hong Kong. We used the Reflotron for cholesterol testing in our study in order to improve the response rate to the study.[17] The response rate in an earlier study using blood test for cholesterol measurement was only 30%.[21]

There is no absolute 'normal' level of cholesterol. The relation between cholesterol and CHD has been found to be curvilinear.[10-12] The incidence of CHD starts to increase above the level of 5.2*mmol/l*, it increases more sharply above 6.2*mmol/l* and very sharply above 7.8*mmol/l*.[11] Most guidelines use 6.2*mmol/l* as the threshold for hypercholesterolaemia, and 5.2*mmol/l* as the threshold for desirable levels.[22-25]

Ten percent of our population had hypercho-lesterolaemia of >6.2*mmol/l*; the prevalence was lower than those found by Lau *et al*[14] and Fong *el al*.[15] The age-standardized mean cholesterol level of the Hong Kong adult population aged 21 to 60,[26] estimated from our results, is 5.1*mmol/l*. This is lower than the 5.5*mmol/l* estimated by Fong *et al*.[15] The patients in the study by Fong *et al* were self-referred and many (7.9%) had CHD. It is not surprising that they had higher cholesterol levels than our unselected patients in general practice. Lau *et al* sampled their subjects from a public utility company and a hospital with variable response rates from 50% to 73% which might have biased the results. Our results showed that our population had lower mean cholesterol level and prevalence of hypercholesterolaemia over 6.2*mmol/l* than most Western countries.[10-13,27] They were lower than those of the Chinese in Singapore[28] but higher than those in China,[29] which coincided with the relative coronary mortality rates.[1,4]

Nearly half of our patients had blood cholesterol levels above the desirable level of 5.2*mmol/l*. The majority of these undesirable cholesterol levels were between 5.2*mmol/l* and 6.2 *mmol/l* (Reflotron cholesterol 4.8-6.0*mmol/l*). This borderline hypercholesterolaemia is significant for those with additional CHD risk factors but is of doubtful significance among the low risk group.[22-25,30,31]

Very few people (9%) ever had their cholesterol levels checked before our study. Many known to have other CHD risk factors like smoking, family history of premature CHD death or hypertension had never been screened for hypercholesterolaemia. There seems to be a need for more cholesterol screening among patients with additional CHD risk factors.

Very few people (< 1%) had cholesterol levels >7.8*mmol/l*. The benefit from lipid lowering drugs for cholesterol levels below 7.8*mmol/l* is doubtful.[25,26,31] The mainstay of treatment for hypercholesterolaemia in our population, if any is needed, is diet. Our limited resources may be better directed to the development and evaluation of community and individual dietary intervention programmes than lipid lowering drugs.

The prevalence of hypercholesterolaemia increased with age with a sharp rise after the age of 40 for females and after the age of 50 for the males. This increase was particularly marked in females after 40 which agreed with the finding of other studies.[14,15,28,32] It is believed that menopause has an adverse effect on lipid metabolism.[22,32] As many as one in four women aged 51-60 had Cholesterol levels > 6.2*mmol/l*. Some people believe that this is the reason for the rapid increase in CHD mortality rates in women after menopause.[4] However, because most of the studies on cholesterol have been

done on men, we are still not sure of the significance of hypercholesterolaemia in females and whether intervention makes any difference.[33]

We did not find the same social class effect on cholesterol level as an earlier study in Shatin.[34] Our results actually showed quite the opposite trend and so did our earlier study.[22] This may be due to differences in the methods of sampling and social classification. It must be stressed that the social class effect on cholesterol in our study was weak. The main difference was found in those from social class one whose sample size was very small. Further studies are required before we can conclude if social class has a significant effect on cholesterol levels.

## Conclusion

The main problem that Hong Kong Chinese have is borderline hypercholesterolaemia between 5.2 and 6.2*mmol/l*. This has implications for both screening and intervention programmes. Screening is most cost-effective for people with ≥ 2 CHD risk factors more than half of whom may have cholesterol levels that could double their CHD risk.[30] On the other hand, it may be a waste of resources to screen those without CHD or any additional CHD risk factor.

One fifth of the Chinese patients presenting to our general practice had 2 or more CHD risk factors. There is great potential for opportunistic screening for hypercholesterolaemia in general practice. Although there is still a lot of debate on the cost-effectiveness of treating hypercholesterolaemia, information on the cholesterol level may influence the management of other CHD risk factors like hypertension, diabetes, smoking, and obesity.

We now know that borderline hypercholesterolaemia is common among Hong Kong Chinese but we do not really know its significance or the effect of intervention on our population. Most of the research data related to hypercholesterolaemia have come from Western populations with higher mean cholesterol levels. Can these results be generalized to our population? More research is required to answer these questions.

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