Original Article

Associations between dietary habits and risk factors for cardiovascular diseases in a Hong Kong Chinese working population – the "Better Health for Better Hong Kong" (BHBHK) health promotion campaign

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Diet and nutritional status have been shown to play pivotal roles in the occurrence of many chronic diseases. In this study, we examined the patterns of dietary habits and their relationships with risk factors for cardiovascular and chronic diseases in Hong Kong working populations. In April 2000, a 5-year territory-wide health promotion campaign supported by the Li Ka Shing Foundation was launched in Hong Kong by the Health InfoWorld of Hospital Authority. Between July 2000 and March 2002, 4841 Chinese subjects [2375 (49.1%) men and 2466 (50.9%) women, mean age: 42.4 ± 8.9 years (median: 43.0 years, range: 17-83 years)] from the general working class were recruited. Subjects were randomly selected using computer generated codes according to the distribution of occupational groups. A dietary questionnaire was used to assess 6 core dietary habits: daily fruit intake, vegetable intake, fluid intake, sugary drinks, regularity of daily meals and number of dining out each day. Overall, men had a worse cardiovascular risk profile and less desirable dietary habits than women. Those who had more unhealthy dietary habits were more likely to be obese and current smokers. Using logistic regression analysis with the dietary habits as independent variables, we found that obesity, smoking and constipation were independently associated with various unhealthy dietary patterns. In conclusion, there were close associations between dietary habits and risk factors for cardiovascular diseases in Hong Kong. More effective community education about healthy lifestyle is required in Hong Kong.

Key Words: dietary assessment, risk factors, cardiovascular diseases, urban health

INTRODUCTION

According to the World Health Organization, more than 70% of deaths in the world are related to chronic diseases, notably cardiovascular diseases (CVD), mental illnesses and cancers.[1,2] These chronic diseases are in turn related to a large number of environmental and lifestyle factors characterized by unhealthy dietary habits, physical inactivity and stressful living which are increasingly common in our modern societies.[3,4] In particular, diet and nutrition have been shown to play pivotal roles in the occurrence of CVD, hypertension, obesity and diabetes mellitus (DM) in both Caucasian and Chinese populations.[5-9] In the past few years, coronary heart diseases and stroke are the second and third leading cause of death in Hong Kong.[10]

The "Better Health for Better Hong Kong" (BHBHK) Campaign is a 5-year outreach health promotion project. It was launched in Hong Kong in April 2000 with the aim to increase local community awareness of the importance of healthy eating, physical activity and mental wellness. In agreement with Western data,[11,12] high prevalence of DM and obesity has been reported amongst Hong Kong subjects

(up to 10% and 30% respectively of the total population),[13] especially those from low socio-economic class.[14] These under-privileged subjects often have poor access to health education and screening programs due to low level of education, heavy work commitment and/or financial hardship. Against this background, the BHBHK Campaign had a particular focus on people from the working class.

This paper reported the data of the first phase of this Campaign that recruited 4841 subjects from various occupational groups. We aimed to examine the patterns of dietary habits and their relationships with risk factors for CVD in Hong Kong working populations. In light of the recent confirmatory evidence on the beneficial effects of

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lifestyle modification on the progression of CVD risk factors,[15,16] this information will provide major insights into the readiness of these high risk subjects to accept such intensive lifestyle modification programs.

MATERIALS AND METHODS
Subjects and Measurements
The BHBHK Campaign, held territory wide, is a joint collaboration on heath promotion between the Health InfoWorld of Hong Kong Hospital Authority and the Li Ka Shing Foundation with the latter's generous support of HK$10 million. It targets the lower income working population with the objectives to identifying the health issues of this group of people. This Campaign aims to arouse public awareness of the importance of a healthy lifestyle, not only in preventing diseases but also in achieving healthier lifestyle for all, and ultimately better long-term health for the community. Throughout the five-year Campaign, simple health tests were planned for some 30,000 members of the public. Educational programs and workshops were organized for the subjects to raise their concern of the importance of reducing the risk factors leading to major diseases. Another survey would be conducted 1 year after commencing the education programs to assess any improvement in the lifestyle in the working populations in Hong Kong. The Project has been evaluated and approved by the Ethical Committee, Hospital Authority, Hong Kong.

Between July 2000 and March 2002, two leading labor unions in Hong Kong, namely Hong Kong Confederation of Trade Union and Hong Kong Federation of Trade Union with a total of 236 sub-unions and 450,000 members were invited by the project team to assist the recruitment of subjects. Members of these unions are generally labor from lower income population (average monthly income less than HK$10,000, the median monthly income in Hong Kong families). Subjects were randomly selected using computer generated codes according to the distribution of occupational groups as recorded in the 1996 Hong Kong Population By-Census Report. So the respective proportion of subjects in various occupational groups (group 1, professional or managerial; group 2, non-manual; group 3, manual; group 4, unskilled; and group 5: housewife or unemployed) in the study were similar to that in the community. Subjects being invited responded to their corresponding labor unions voluntarily. From the study, they would have a health check-up free of charge but otherwise there was no financial implication. A total of 11,965 invitations were sent and 4,841 subjects (40.5%) responded. All participants gave informed consent.

On the day of assessment, subjects were asked to complete a questionnaire and underwent simple health tests in the labour union offices. Participants did not require to pay any charges for the tests. The questionnaire included a dietary assessment, past medical history, family history of significant diseases, smoking status and alcohol intake, bowel habit, mental wellness and social background (occupation and education level). Constipation was defined as frequency of bowel action once every 3 days or more in the past one year.

The dietary assessment, which was based on a 1-week recall (as a habitual dietary consumption pattern for the past 1 week), concentrated on six dietary habits with two to four choices as the answers:

1. Daily fruit intake: none, ≤1, 2 to 3, ≥4 servings. [Unhealthy pattern if answer given was 'none']
2. Daily vegetable intake: none, ≤1 rice bowl, 2 to 3 bowls, ≥4 bowls (1 rice bowl ≅ 300 ml or 2 servings). [Unhealthy pattern if answer given was 'none']
3. Daily fluid intake (including water, juice or soup; 1 cup ≅ 250 ml): none, 1 to 3 cups, 4 to 7 cups, ≥8 cups. [Unheatlhy pattern if answer given was '3 cups or less']
4. Regular meals everyday: yes, no. [Unhealthy pattern if answer given was 'none']
5. Daily sugary drinks (such as soft drinks, beverages with added sugar, sweet soup; 1 cup ≅ 250 ml): none, ≤1 cup, 2-3 cups, ≥4 cups. [Unhealthy pattern if answer given was '≥2 cups']
6. Number of dining out each day: none, once, twice, ≥three times. [Unhealthy pattern if answer given was 'two times or more']

Dietary assessment on eating pattern was classified after consulting international guidelines, local expertise and assessment tools being used previously in Hong Kong.[17-22] In our questionnaires, 5 servings (e.g. 2 fruits and 1.5 bowel of vegetables) were regarded as optimal while 2 to 4 servings (e.g. 1 fruit and/or ≤1 bowel of vegetable) were borderline. Unhealthy pattern had excluded both healthy and borderline cases. This was based on the World Health Organization recommendation that a minimum of five servings of fruits and vegetables a day to obtain optimal health benefits.[17] The Hong Kong Center of Public Health also adopted similar recommendation.[18] Optimal daily fluid intake should have ≥8 cups of fluid while 4-7 cups are borderline. So less than 4 cups per day was defined as unhealthy. Not more than one cup of sugary drink a day is allowed by most dietitians and, hence, 2 cups or more per day was defined as unhealthy.[23] For dining out in Hong Kong, this almost always imply taking more 'oily' food,[19,22] and more than half of the meals being dining out was regarded as too much. Hence, dining out ≥2 times per day was defined as unhealthy.

The master questionnaire consisted of collections of questions which had been previously used in several local smaller scale studies (unpublished) on dietary habits and CVD assessment. Most questions including dietary assessment and CVD risk factors evaluation had been pre-tested before this project and reviewed for validity. Advise from an expert panel including dietitians, nutritionists, physicians and epidemiologists had also been sought to seek optimal content and criterion-related validity. The expert panel had discussed and gone through the questionnaire and approved individual criterion for unhealthy dietary habits with evidence-based references.[17-23] However, test-retest reliability has not been measured. Smoking and alcohol status were defined as current or ex-smoking and current or ex-alcohol drinking, respectively. "Alcohol" drinks included only regular consumption of alcoholic beverages such as table wine and Chinese double distilled rice wine, which have higher alcohol content. Hence, ex-drinkers were also included into the drinking group.

The simple health tests were conducted at the community venues conveniently accessible by the target subjects.There was minimal restrictions on fasting state to increase the response rates. Hence, only spot capillary blood glucose (BG) and cholesterol (but not fasting glucose, triglyceride and other lipid parameters) were measured (with desktop analyzers [Accutrend GC, Roche Diagnostics]), which would not be affected by fasting or not. The health check also included measurements of blood pressure, body weight, height and waist circumference. Blood pressure was measured in the right arm after at least 5 minutes of rest using the Dinamapp machine and the Karotkoff sound V was used as the diastolic blood pressure. Body weight, height and waist circumference were measured in subjects wearing light clothing and without shoes. The minimum waist measurement between xiphisternum and umbilicus was taken as the waist circumference. A team consisting of 3 trained nurses who used the same set of equipments including body scale, tape measures and desktop machines conducted all these health checks.

Based on these measurements, 6 CVD risk factors were defined as follows:

1. Obesity: General obesity (BMI ≥ 25 kg/m^2) and/or central obesity (waist circumference ≥ 80 cm for women and ≥ 90 cm for men) based on the WHO Western Pacific Region Guidelines for Asians.[24]
2. Hypertension: High BP (systolic BP ≥ 140 mmHg and/or diastolic BP ≥ 90 mmHg or both) and/or known history of hypertension and/or treatment with anti-hypertensive drugs with regular medical follow up.[25]
3. Hypercholesterolaemia: blood cholesterol ≥ 5.2 mmol/L.[26]
4. DM: fasting (after at least 8 hours of fasting) capillary BG ≥ 6.1 mmol/l and/or random capillary BG ≥ 11.1 mmol/l and/or treatment with known history of DM with or without anti-diabetic treatments with regular medical follow up.[27]
5. Smoking: current smokers and ex-smokers.
6. Known CVD: history of documented coronary heart disease, cerebrovascular accident, and/or peripheral vascular diseases with or without any active treatments.

All these factors have been shown to predict clinical outcomes including death, heart and kidney diseases in overseas and local populations.[26,28,29] The subjects were further stratified into low (one or no risk factor) and high risk groups (≥ 2 risk factors).

Statistical Analysis

Statistical analysis was performed using the SPSS (version 10.0) software on an IBM compatible computer. All results are expressed as mean $\pm$ SD or n (%) as appropriate. The Student's t-test, Chi-square test and one-way ANOVA were used for between group comparisons. Logistic regression analyses were performed with the six cardiovascular risk factors and constipation as dependent

Table 1. Clinical parameters and dietary patterns of 4841 Hong Kong Chinese subjects from working class.

	All (n=4841)	Men (n=2375)	Women (n=2466)
Clinical particulars:			
Age, years	42.4 ± 8.9	42.9 ± 9.2	42.0 ± 8.6*
#Smoking, n (%)	562 (11.6)	482 (20.3)	79 (3.2)**
#Alcohol intake, n (%)	775 (16.0)	627 (26.4)	145 (5.9)**
Systolic BP, mmHg	125 ± 19	131 ± 18	119 ± 18**
Diastolic BP, mmHg	76 ± 12	80 ± 11	72 ± 11**
BMI, kg/m^2	23.4 ± 3.4	24.1 ± 3.3	22.6 ± 3.4**
Waist, cm	79.8 ± 10.0	84.8 ± 8.5	75.0 ± 9.1**
Plasma glucose, mmol/l	4.7 ± 1.6	4.8 ± 1.6	4.5 ± 1.5**
Cholesterol, mmol/l	4.9 ± 0.8	5.0 ± 0.9	4.8 ± 0.8**
Obesity, n (%)	1815 (37.5)	1011 (42.5)	804 (32.6)**
Hypertension, n (%)	1080 (22.3)	703 (29.5)	377 (15.3)**
Hypercholesterolaemia, n (%)	1501 (31.0)	857 (35.9)	644 (26.1)**
Diabetes, n (%)	111 (2.3)	59 (2.6)	52 (2.1)
Known CVD, n (%)	34 (0.7)	14 (0.6)	20 (0.8)
High CVD risk, n (%)	1346 (27.8)	880 (37.0)	466 (18.9)**
Without CVD risk, n (%)	2038 (42.1)	774 (32.6)	1265 (51.3)**
Dietary habit:			
No fruit, n (%)	305 (6.3)	199 (8.4)	106 (4.3)**
No vegetable, n (%)	44 (0.9)	22 (1.0)	22 (0.9)
Low fluid intake, n (%)	823 (17.0)	406 (17.1)	417 (16.9)
Irregular diet, n (%)	1172 (24.2)	649 (27.3)	523 (21.2)**
Frequent sugary drinks, n (%)	731 (15.1)	489 (20.6)	242 (9.8)**
Frequent dining out, n (%)	784 (16.2)	587 (24.6)	197 (8.0)**
≥ 1 unhealthy diet pattern, n (%)	2503 (51.7)	1435 (60.4)	1068 (43.3)**
≥ 2 unhealthy diet pattern, n (%)	988 (20.4)	650 (27.4)	338 (13.7)**

Student's t-test and Chi-square test, *p*-value comparing men and women: *<0.01, **<0.001; #Current smoker: 557 (11.5%) (men vs. women: 480 [20.2%] vs. 79 [3.2%], *p*<0.001); #Current drinker: 760 (15.7%) (men vs. women: 620 [26.1%] vs. 143 [5.8%], *p*<0.001); BP, blood pressure; BMI, body mass index; CVD, cardiovascular disease; Obesity = $\geq$BMI 25 kg/m^2; Low fluid intake = ≤ 3 cups of water per day (1 cup $\cong$ 250 ml); Frequent sugary drinks = ≥ 2 cups per day (1 cup $\cong$ 250 ml); Frequent dining out = $\geq$two times per day

variables, and age, gender (men=1, women=0), smoking status (yes=1, no=0), alcohol intake (yes=1, no=0) and the six unhealthy dietary habits (yes=1, no=0) as independent variables with expression of odds ratio (95% confidence intervals, CI). A *p*-value <0.05 (2-tailed) was considered to be significant.

RESULTS

Of the 4841 subjects, 2375 (49.1%) were men and 2466 (50.9%) were women. The mean age was 42.4 ± 8.9 years (median: 43.0 years, range: 17-83 years). For their monthly income, 29.2% earned HK$ ≤6000, 49.0% earned HK$ 6000-20000 and 21.8% earned HK$ >20000. Concerning education level, 815 (16.8%) finished high school or university (≥11 years of schooling), 2858 (59.0%) finished middle school (≥6 years and <11 years of schooling) and 1168 (24.1%) were illiterate or up to elementary school (<6 years' schooling).

Table 1 summarizes their clinical particulars. Of these 4841 subjects, 51.6% had at least one of the 6 unhealthy dietary habits, 20.4% had ≥2, 5.8% had ≥3, 1.7% had ≥4 and 0.1% had all 6 unhealthy habits. Overall, men had a worse CVD risk profile and less desirable dietary habit than women. Table 2 summarizes the clinical characteristics of the subjects categorized according to their dietary habits. Those who had more unhealthy dietary habits were more likely to be obese and current smokers.

Due to the close association between constipation, dietary fibers and colo-rectal cancer,[30] we also examined the relationship between dietary habits and this undesirable bowel habit. Of the 3 unhealthy dietary habits, we selected lack of fruit or vegetable consumption or drinking ≤3 glass of water per day which have been frequently reported amongst subjects with constipation. We found that there was a linear association between the number of these 3 dietary habits and frequency of constipation in both men and women (see Table 3).

Using logistic regression analysis with the clinical parameters and unhealthy dietary habits as independent variables, table 4 summarizes their relationships with obesity, hypertension, hypercholesterolaemia, DM, history of CVD, smoking and constipation. Obesity was independently associated with age, male gender, irregular meals, frequent sugary drinks and frequent eating out.

Table 2. Clinical characteristics of 4841 Hong Kong Chinese subjects from working class categorized according to their dietary habits.

(a) men (n=2375)

		Number of unhealthy dietary habits		
	Total	0 (n=941)	1-2 (n=1226)	≥3 (n=208)
Age, years	42.9 ± 9.2	44.3 ± 9.2	42.3 ± 9.1	39.2 ± 8.8***
Smoking, n (%)	482 (20.3)	120 (12.7)	272 (22.2)	90 (42.8)***
Alochol intake, n (%)	627 (26.4)	207 (22.0)	338 (27.6)	82 (38.6)***
Systolic BP, mmHg	131 ± 18	131 ± 18	131 ± 17	131 ± 16
Diastolic BP, mmHg	80 ± 11	80 ± 11	80 ± 11	80 ± 11
BMI, kg/m^2	24.1 ± 3.3	23.9 ± 3.2	24.3 ± 3.2	24.3 ± 3.8
Waist, cm	84.8 ± 8.5	84.5 ± 8.4	85.0 ± 8.4	85.2 ± 9.3
Obesity, n (%)	1009 (42.5)	369 (39.1)	549 (44.7)	91 (43.7)*
Hypertension, n (%)	701 (29.5)	297 (31.6)	346 (28.3)	58 (28.0)
Hypercholesterolaemia, n (%)	853 (35.9)	355 (37.7)	429 (35.0)	69 (33.0)
Diabetes, n (%)	62 (2.6)	32 (3.3)	28 (2.2)	2 (1.0)
Known CVD, n (%)	14 (0.6)	8 (0.9)	4 (0.3)	2 (1.0)
High CVD risk, n (%)	879 (37.0)	328 (34.9)	466 (38.0)	85 (40.9)

(a) women (n=2466)

		Number of unhealthy dietary habits		
	Total	0 (n=1398)	1-2 (n=995)	≥3 (n=73)
Age, years	42.0 ± 8.6	42.8 ± 8.2	41.2 ± 8.9	39.2 ± 8.5***
Smoking, %	79 (3.2)	24 (1.7)	45 (4.5)	10 (13.7)***
Alcohol intake, %	145 (5.9)	69 (4.9)	64 (6.5)	12 (16.4)***
Systolic BP, mmHg	119 ± 18	120 ± 19	118 ± 18	120 ± 18*
Diastolic BP, mmHg	72 ± 11	72 ± 12	71 ± 11	73 ± 10
BMI, kg/m^2	22.6 ± 3.4	22.6 ± 3.4	22.6 ± 3.5	23.8 ± 3.6*
Waist, cm	75.0 ± 9.1	74.8 ± 9.0	75.2 ± 9.2	76.6 ± 10.1
Obesity, n (%)	804 (32.6)	438 (31.3)	338 (34.0)	28 (38.4)
Hypertension, n (%)	377 (15.3)	221 (15.8)	146 (14.8)	10 (13.7)
Hypercholesterolaemia, n (%)	643 (26.1)	371 (26.6)	250 (25.2)	22 (29.6)
Diabetes, n (%)	52 (2.1)	35 (2.5)	16 (1.6)	1 (1.4)
Known CVD, n (%)	20 (0.8)	8 (0.6)	12 (1.2)	0
High CVD risk, n (%)	465 (18.9)	255 (18.3)	193 (19.4)	17 (23.3)

One-way ANOVA test, *p*-value for trend: *<0.05, **<0.01, ***<0.001; BP, blood pressure; BMI, body mass index; CVD, cardiovascular disease; High CVD risk = 2 or more of the followings: obesity, hypertension, hypercholestesolaemia, diabetes, smoking, known CVD

Table 3. Association between constipation and unhealthy dietary habits in the 4841 Hong Kong Chinese subjects.

	Total	0	Number of selected unhealthy dietary habits 1	2 or 3
All	n=4841	n=3807	n=932	n=102
Constipation, n (%)	140 (2.9)	94 (2.5)	42 (4.4)	5 (4.9)*
Men	n=2375	n=1969	n=447	n=45
Constipation, n (%)	1.0	17 (0.9)	6 (1.2)	0
Women	n=2466	n=1798	n=515	n=57
Constipation, n (%)	4.8	77 (3.9)	36 (8.1)	5 (11.1)**

One-way ANOVA test, p-value for trend: *<0.01, **<0.001; Constipation = bowel opening once every 3 days or more in the past 1 year; Selected unhealthy dietary habits = no fruit, no vegetable or ≤3 cups of water per day (1 cup ≅ 250 ml)

Table 4. Logistic regression analysis with obesity, hypertension, hypercholesterolaemia, diabetes, history of cardiovascular disease (CVD), smoking status and constipation as dependent variables and age, male gender, smoking status, alcohol intake and 6 unhealthy dietary habits as independent variables.

	Obesity (R^2=0.058, p<0.001)	Hypertension (R^2=0.143, p<0.001)	Hypercholesterolaemia (R^2=0.070, p<0.001)	Diabetes (R^2=0.077, p<0.001)	Smoking (R^2=0.238, p<0.001)	Past history of CVD (R^2=0.078, p=0.002)	Constipation (R^2=0.100, p<0.001)
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age	1.04 (1.04, 1.05)***	1.08 (1.07, 1.09)***	1.05 (1.05, 1.06)***	1.08 (1.06, 1.11)***	/	1.10 (1.06, 1.15)***	0.97 (0.95, 0.99)**
Male gender	1.44 (1.26, 1.64)***	2.33 (1.98, 2.73)***	1.53 (1.32, 1.77)***	/	5.95 (4.55, 7.77)***	/	0.14 (0.09, 0.24)***
Smoking	/	0.68 (0.53, 0.86)**	/	/	/	/	/
Alcohol intake	/	/	/	/	2.21 (1.79, 2.74)***	/	/
No fruit	/	/	/	/	1.94 (1.42, 2.64)***	/	2.06 (1.17, 3.65)*
No vegetable	/	/	/	/	2.24 (1.06, 4.73)*	/	/
Low fluid intake	/	/	/	/	/	/	/
Irregular meals	1.20 (1.04, 1.39)*	/	/	/	2.23 (1.82, 2.73)***	/	/
Sugary drinks	1.30 (1.09, 1.55)**	/	/	/	2.00 (1.59, 2.52)***	/	1.59 (1.00, 2.53)*
Frequent dining out	1.25 (1.06, 1.49)**	/	/	/	/	/	/

OR (95% CI) = Odds ratio (95%) confidence interval; p-value: *<0.05, **<0.01, ***<0.001

Hypertension was independently associated with age, male gender and smoking (negative association). Hypercholesterolaemia was independently associated with age and male gender. Diabetes and CVD were both independently associated with age. Smoking itself was independently associated with male gender, drinking alcohol, lack of fruit or vegetable consumption, irregular meals and frequent sugary drinks. Constipation was independently associated with age, male gender, no fruit and frequent sugary drinks.

DISCUSSION

The prevalence of 'diseases of urbanization' such as CVD, DM, obesity, hypertension is increasing in Hong Kong.[12,31,32] However, information on dietary habits in Hong Kong Chinese is relatively limited. Woo et al compared the dietary intake of Chinese people living in Hong Kong, San Francisco, Sydney and Pan Yu (a city in Southern Mainland China) using the Mediterranean Diet Score and reported that Hong Kong had the worst score among the four geographical regions.[33] The same team also reported that only 50-60% of Hong Kong Chinese had a daily fat and cholesterol intake which was within the recommended range (i.e. daily cholesterol intake <300 mg and fat intake <30% of total energy).[34]

There are now increasing epidemiological data showing the relationships between various disease states, especially CVD, and unhealthy dietary habits, notably, low intake of fibers and anti-oxidants, high intake of animal fat and refined sugar.[35-37] In this report, instead of investigating on individual food items, we adopted a more 'real-life' strategy in our dietary assessment and focused on several unhealthy dietary habits including consumption of fruit or vegetable, daily intake of fluid and sugary drinks, meal regularity and frequency of dining out.

In this study involving more than 4000 subjects from working class, we found that more that half of the studied subjects had at least one of the 6 unhealthy dietary habits. People with multiple unhealthy dietary habits were more likely to be obese, smokers and alcohol drinkers. More importantly, unhealthy dietary habits were particularly prevalent amongst young to middle aged people. Although children were not studied in our program, a recent study among Mexican school children in US demonstrated that up to 80% of these children had a low intake of fruits and vegetable, and 90% of them consumed at least one soft drink and one portion of high-fat-containing snacks everyday.[38] These results suggest that people from the younger generation were more likely to adopt unhealthy dietary habits which will have long term health consequences. In support of these findings, in Hong Kong, 10-30% of school children are overweight, some of whom exhibit early evidence of metabolic syndrome.[39] Similarly, 2-3% of Hong Kong subjects aged less than 40 years have diabetes[40] and 20-30% of our diabetic patients have disease onset before the age of 40 years.[41]

A prudent diet with frequent intake of whole-meal cereals, fruit and vegetables has been shown to be associated with decreased risk of CVD.[7,8,42] Similar negative association has also been found between healthy diet and development of type 2 DM.[43,44] In our study, people who did not eat fruit or vegetable or had low fluid intake were often smokers and obese, and had constipation. Smoking and obesity are CVD risk factors and constipation with inadequate dietary fibers is associated with cancer of the gastro-intestinal tract.[30] In this regard, WHO recommends a daily intake of vegetables and fruit of >400g (5 servings).[17] This dietary pattern rich in vegetables and fruit is associated with potential health gain mainly due to reduction in CVD and cancers.[45] Using WHO mortality data, Joffe and Robertson estimated that over 26,000 deaths would be prevented annually in the European Union if people could increase their intake of vegetables and fruit to recommended level.[46]

In this study, we found that obesity was independently associated with several unhealthy dietary habits including irregular meals, frequent sugary drinks and frequent dining out. Furthermore, these unhealthy dietary habits frequently coexisted with smoking and undesirable bowel habits. Obesity is now a global epidemic associated with early mortality and excess morbidity.[47] Our data highlighted the important role of proper dietary intervention in the prevention and management of the alarming surging problem of obesity.

The associations between unhealthy dietary habits and some other CVD risk factors, such as hypertension, hyperholesteroleamia and DM, were not statistically significant. This could be due to the relatively low percentages of these CVD risk factors in this survey and the total number of subjects recruited might not be large enough.

Given the voluntary nature of this health screening project which targeted the working population, our results cannot be generalized to the whole population. It is well recognized that participants of health awareness project are generally more health-conscious. Yet, in this relatively large scale program, we detect a high proportion of these volunteers having unhealthy dietary habits and adverse health profiles. Despite some limitations due to sampling and methodology such as voluntary basis of participants and lack of reliability assessment of our questionnaires, our overall results are in agreement with other international studies regarding the close associations between dietary habits and risk factors for CVD. There are now randomized clinical trials confirming the beneficial effects of structured educational programs to change lifestyles on development of diseases such as DM and CVD,[48-50] the challenge lies in how to translate these programs to the large population in the community. Against this background, apart from providing insight into the dietary patterns of our less privileged fellow citizens, our study will also form the basis of interventional educational programs to improve health status.

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Original Article

Associations between dietary habits and risk factors for cardiovascular diseases in a Hong Kong Chinese working population – the "Better Health for Better Hong Kong" (BHBHK) health promotion campaign

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香港華人工作族群飲食習慣與心血管危險因子之相關性 – "更好的健康為更好的香港"(BHBHK)健康促進運動

飲食與營養狀況是許多慢性疾病發生的重要角色。本研究我們評估香港的工作族群，他們的飲食習慣模式與他們的心血管及慢性疾病危險因子之相關性。在 2000 年 4 月，一個由李嘉誠基金會贊助，醫院管理局健康資訊天地發起的港區五年的健康促進計畫正式上路。在 2000 年七月至 2002 年三月期間，從綜合工作類別召募 4847 名華人研究對象[2375 名男性(49.1%)及 2466 名女性(50.9%)，平均年齡：42.4 ± 8.9 歲(中位數：43.0 歲，範圍：17-83 歲)]。研究對象是從根據職業類別分布電腦產生的的編碼中隨機選取。一個膳食頻率問卷用以評估六個核心飲食習慣：每日水果攝取、蔬菜攝取、液體攝取、含糖飲料、每日各餐的規律性與每日在外用餐次數。整體上，男性比起女性有較差的心血管風險狀況及較差的飲食習慣。那些有較多不健康的飲食習慣者較有可能為肥胖者或是目前有抽菸。使用羅吉斯迴歸分析，飲食習慣當做自變項，我們發現肥胖、抽菸及便秘與不健康的飲食模式具有獨立相關性。總之，在香港飲食習慣與心血管疾病危險因子有密切相關。香港需要更多有效的關於健康生活型態的社區教育。

關鍵字：飲食評估、危險因子、心血管疾病、城市健康。