community action. Being such an integral part of human exis-
tence, food and nutrition will be a major focus in health pro-
motion for the future.

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Diet and cancer among Chinese in Singapore

H.P. Lee


Assessing food and health relationships: a case study of blood pressure determination in adult Melbourne Chinese

Bridget H.-H. Hsu-Hage BSc (Chung-Hsing), MS (Columbia), PhD (Monash) and Mark L. Wahlqvist BMEdSc, MD (Adelaide), MD (Uppsala), FRACP, FAIIT, FACN

An effective public health approach to cardiovascular disease prevention should be one which gives the general public alternatives in choice when fat, salt and sugar are reduced in the diet. Fat, salt and sugar are nutrients which can be found in various foods. Public health education can correct these nutrients into foods so as to be healthy choices. The usual nutrient-to-food conversion is indirect and can be misleading. For example, we are still unclear as to the potential benefit of polyunsaturated margarine over butter or olive oil. In a base-line data analysis of Chinese adults in Melbourne, we related food intake to other measures to major cardiovascular risk factors. In all models, fat intake accounted for a higher proportion of major cardiovascular risk factors than did nutrient intake. Melbourne Chinese, who consumed a wide variety of foods and are not fish, vegetables, and fruits, had a better cardiovascular risk profile. The findings are of importance in public health significance. Longitudinal documentation of changing fat intake, in addition to nutrients, and associated change in cardiovascular risk factors in this population are needed at this stage followed by further work to confirm its generalizability to Australians at large. This report focuses on finding of blood pressure determination in 547 adult Melbourne Chinese and reviews the way in which food and health relationships may be studied.

Introduction

Health status of an individual is a function of preventable risk
determinants and their determinants. Aside from genetic predispo-
sition, dietary factors play an important role in the determina-
tion of an individual's health. Cancer and cardiovascular
diseases, the two most widely researched chronic disease cat-
coratories, are said to be preventable because of the several estab-
lished risk factors for these diseases are of dietary or environ-
mental consequence. It is known that genetic factors account
for as much as 50% of the variance in serum cholesterol
between individuals; an individual's serum cholesterol,

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Figure 1. Proposed pathways in the determination of CVD risk.

- Migration
country of birth age of arrival length of stay
- Constitutional factors
gender age
- Non-dietary factors
education level household income marriage status
occupational status smoking
use of OCP pills physical activities social network/activities
- Type A behaviour
- FOOD HABITS
- NUTRIENT INTAKE
- macro-nutrients
- micro-nutrients
- FOOD INTAKE PATTERNS
- (grams or household measures)
- DIETARY PRACTICES
- use of chopsticks
- type of eating
- sitting out
- smoking
- food beliefs
- CVD RISK
- High blood pressure
- High blood cholesterol
- Overweight & obesity
- Smoking
- Elevated glucose level

Correspondence address: Dr. Bridget H.-H. Hsu-Hage, Monash
University, Department of Medicine, Block E, Level 5, 246
Clayton Road, Clayton, Victoria 3168, Australia. Fax + (61-3)-
330-1024.

FOOD HABITS
- NUTRIENT INTAKE
- macro-nutrients
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Constitutional factors
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Non-dietary factors
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Type A behaviour
- ETHNICITY (genetic factor)

Figure 1. Proposed pathways in the determination of CVD risk.

however, differs in response to fat intake14. For essential
hypertension, there is genetic involvement in the susceptibil-
ity to dietary factors such as sodium, potassium, calcium,
fats, total energy intake and alcohol16. Moreover, age, gender
and socio-economic status of an individual has been shown
to be associated with all-cause mortality, particularly cardio-
vascular mortality17,18, as well as dietary intake19. Deter-

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education level household income marriage status
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Non-dietary factors
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Type A behaviour
- ETHNICITY (genetic factor)
Dietary determinants of blood pressure

Age and body fatness are probably the most important non-dietary factors in the examination of blood pressure relationships. Socio-cultural factors have been observed to affect blood pressure in migrants and populations undergoing rapid industrialization.

Nutrient intake and blood pressure

Univariate correlation: results

In men, systolic blood pressure was positively correlated to both P/S (P, polyunsaturated S, saturated fatty acids) (r=0.15, P=0.0120) and M/S (M, monounsaturated fatty acids) (r=0.17, P=0.0068) intake ratios. In women, systolic blood pressure was positively correlated to P/S fatty acid intake ratio (r=0.25, P=0.0001), M/S fatty acid intake ratio (r=0.24, P=0.0001), and the per cent energy intake of PUFA’s (r=0.17, P=0.0058). There was a negative relationship between systolic blood pressure and saturated fatty acid (SFAs) intake (r=0.13, P=0.0264).

Multivariate models: results

Table 1 lists factors that are associated with systolic blood pressure of Melbourne Chinese. In men, systolic blood pressure is associated with dietary fibre, M/S fatty acid intake ratio and food variety, while M/S fatty acid intake ratio was associated with systolic blood pressure of women. Age accounted for 41% of the variation of systolic blood pressure in women. For men, education was positively related to systolic blood pressure, while for women systolic blood pressure increased with an increasing length of stay in Australia. Food variety is an independent predictor of systolic blood pressure in both men and women of moderate pressure of men decreased with an increasing food variety. The protective effect of food variety Table 1. Nutrient determinants of systolic blood pressure (mmHg), by gender.

Factors | b | p
--- | --- | ---
**MEN**
Age (yrs) | 0.78 | 0.0001****
ED | 1.98 | 0.0315*
BMI (kg/m²) | 0.78 | 0.0099**
Food variety | -0.06 | 0.050**
Energy (kJ/day) | 0.00094 | 0.0459*
D/fibre (g/day) | -0.32 | 0.0420**
M/S ratio | 8.56 | 0.0258*
% variation explained by the model | 36% |

**WOMEN**
Age (yrs) | 1.07 | 0.0001****
ED | 0.57 | 0.0001****
Food variety | -0.18 | 0.0352*
Energy (kJ/day) | 0.00046 | 0.310 NS
D/fibre (g/day) | 19.86 | 0.0001****
M/S ratio | 2.48 | 0.0017*
% variation explained by the model | 48% |

**Discussion**

Both systolic and diastolic blood pressure have been shown to be negatively associated with the intake of MUFAs. Studies have also shown the protective effect of dietary education and the P/S ratio. However, the study population of the above studies is known to have a much higher total fat intake, particularly SFAs and PUFA’s, compared to the Melbourne Chinese.

People consuming a vegetarian diet have been reported to have a lower blood pressure compared to those consuming meat. A complete vegetarian diet has also been reported to contain more PUFA’s and less total fat, SFAs and cholesterol. Although the total fat intake was also low in Melbourne Chinese, the fatty acid intake of Melbourne Chinese was predominantly MUFAs, not PUFA’s.

In a study of traditional Mediterranean diet and blood pressure, the 1444 study showed that a reduction of P/S ratio from the 0.464 to 0.367 was associated with decreases in systolic blood pressure, but not diastolic blood pressure, in a rural southern Italian population. The investigators achieved the 30% reduction of P/S ratio by means of increasing SFAs and a corresponding decrease in MUFAs so that total energy intake remained constant. In other words, the investigators have shown a negative relationship between systolic blood pressure and P/S fatty acid intake ratio while the customary M/S intake remains. In terms of dietary intake what has been effectively altered is the SFA intake. Thus, it is not clear whether it is the decreased P/S fatty acid intake ratio or the increased intake of SFAs that increased systolic blood pressure. However, it is evident that the manipulation of either P/S fatty acid intake ratio or saturated fat intake does not alter diastolic blood pressure of a population high in monounsaturated fatty acid intake.

M/S fatty acid intake ratio of Melbourne Chinese men was positively related to total energy intake, protein intake, total fat intake, the per cent energy intake of fat, the per cent energy intake of alcohol, and was negatively related to the per cent energy intake of carbohydrates. It is suggestive that a higher M/S fatty acid intake ratio is associated with a higher per cent energy intake of alcohol and total fat intake. On the other hand, M/S fatty acid intake ratio of women was independent of all macro-nutrient intakes and the contribution of macro-nutrient intake to energy.

The positive relationship of systolic blood pressure and M/S fatty acid intake ratio in Melbourne Chinese is not supported by current literature.

An increased intake of dietary fibre was negatively related to systolic blood pressure of men. The protective effect of dietary fibre for blood pressure is consistent with findings of other studies.

There is a large body of evidence linking the relationship between BMI and blood pressure. Positive relationships between body mass index and blood pressure have been reported in ecological studies and large-scale epidemiological studies. BMI was positively related to systolic blood pressure in men, but not women (Table 1).

The role of race is comparable to Australian, Melbourne Chinese men who had higher intakes of SFAs were likely to have a higher diastolic blood pressure.

**Food intake and blood pressure**

Univariate correlations: results

Table 1 lists food components that are related to systolic blood pressure of Melbourne Chinese. Systolic blood pressure was positively correlated to the intake of rice and fish in men, and the intake of nuts, vegetables, jam/honey, and soup in women. Systolic blood pressure was negatively correlated to the intake of biscuits in men and the intake of fatty snack foods in women.

Quite different from the examination of nutrient intake and diastolic blood pressure, where no univariate correlations were found, the food intake and diastolic blood pressure...
Age and body fatness are probably the most important non-dietary factors in the examination of blood pressure relationship. Socio-cultural factors have been shown to affect blood pressure in migrants and populations undergoing rapid industrialization[24-20].

Nutrient intake and blood pressure

Univariate correlations: results

In men, systolic blood pressure was positively correlated to both P/S (P, polyunsaturated and S, saturated fatty acids) (r=0.15, P=0.0130) and M/S (M, monounsaturated fatty acids) (r=0.17, P=0.0065) intake ratios. In women, systolic blood pressure was positively correlated to P/S fatty acid intake ratio (r=0.28, P=0.0001), M/S fatty acid intake ratio (r=0.24, P=0.0041), and the per cent energy intake of PUFAs (r=0.17, P=0.0058). There was a negative relationship between systolic blood pressure and saturated fatty acid (SFA) intake (r=-0.13, P=0.0264).

No correlation was found in men or women between dietary intake and diastolic blood pressure.

Multivariate models: results

Table 1 lists factors that are associated with systolic blood pressure of Melbourne Chinese. In men, systolic blood pressure is associated with dietary fibre, M/S fatty acid intake ratio and food variety, while M/S fatty acid intake ratio was associated with systolic blood pressure of women. Age accounted for 41% of the variation of systolic blood pressure in women. For men, education was positively related to systolic blood pressure, while for women systolic blood pressure increased with an increasing length of stay in Australia. Food variety is an independent predictor of systolic blood pressure in both men and women. Systolic blood pressure was positively correlated to the intake of alcohol and was negatively related to total energy intake.

Food-to-weight ratio was predictive of diastolic blood pressure in men while for women body mass index (BMI) was a better predictor. Age was positively related to diastolic blood pressure for women. Diastolic blood pressure was higher among the educated males. For women, diastolic blood pressure increased with an increasing length of stay in Australia.

Discussion

Both systolic and diastolic blood pressure have been shown to be negatively associated with the intake of MUFAs[5, 31]. Studies have also shown the protective effect of increasing P/S ratio[5, 33]. However, the study population of the above studies is known to have a much higher total fat intake, particularly SFAs and PUFAs, compared to the Melbourne Chinese.

People consuming a vegetarian diet have been reported to have a lower blood pressure compared to those consuming a meat diet[5, 32]. A complete vegetarian diet has also been reported to contain more PUFAs and less total fat, SFAs and cholesterol[33]. Although the total fat intake was also low in Melbourne Chinese, the fatty acid intake of Melbourne Chinese was predominately MUFAs, not PUFAs.

In a study of traditional Mediterranean diet and blood pressure, Buscaglia et al. showed that a reduction of P/S ratio from the 0.44 to 0.23 increases in systolic blood pressure, but not diastolic blood pressure, in a rural southern Italian population. The investigators achieved the 50% reduction of P/S ratio by means of increasing SFAs and a corresponding decrease in MUFAs so that total energy intake remained constant. In other words, the investigators have shown a negative relationship between systolic blood pressure and P/S fatty acid intake ratio while the customary M/S fatty acid intake ratio remains. In terms of dietary intake what has been effectively altered is the SFA intake. Thus, it is not clear whether it is the decreased P/S fatty acid intake ratio or the increased intake of SFAs that decreases systolic blood pressure. However, it is evident that the manipulation of either P/S fatty acid intake ratio or saturated fat intake does not alter diastolic blood pressure of a population high in monounsaturated fatty acid intake.

M/S fatty acid intake ratio of Melbourne Chinese men was positively related to total energy intake, protein intake, total fat intake, the per cent energy intake of alcohol, the per cent energy intake of fat, the per cent energy intake of alcohol, and was negatively related to the per cent energy intake of carbohydrates. It is suggestive that a higher M/S fatty acid intake ratio is associated with a higher per cent energy intake of alcohol and total fat intake. On the other hand, M/S fatty acid intake ratio of women was independent of all macro-nutrient intakes and the contribution of macro-nutrient intake to energy.

The positive relationship of systolic blood pressure and M/S fatty acid intake ratio in Melbourne Chinese is not supported by current literature. An increased intake of dietary fibre was negatively related to systolic blood pressure of men. The protective effect of dietary fibre for blood pressure is consistent with findings of previous studies[5, 34].

There is a large body of evidence linking the relationship between BMI and blood pressure. Positive relationships between body mass index (BMI) and blood pressure have been reported in ecological studies[5, 35] and large-scale epidemiological studies[5, 36]. BMI was positively related to systolic blood pressure in men, but not women (Table 1).

The role of trace elements compared to Australasian Melbourne Chinese men who had higher intakes of SFAs were likely to have a higher diastolic blood pressure.

Food intake and blood pressure

Univariate correlations: results

Table 1 lists the food components that are related to systolic blood pressure of Melbourne Chinese. Systolic blood pressure was positively correlated to the intake of rice and fish in men, and the intake of nuts, vegetables, jam/honey, and soup in women. Systolic blood pressure negatively correlated to the intake of biscuits in men and the intake of fatty snack foods in women.

Different from the examination of nutrient intake and diastolic blood pressure, where no univariate correlations were found, the food intake and diastolic blood pressure

Table 2. Nutrient determinants of diastolic blood pressure, by gender.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b</td>
<td>P</td>
</tr>
<tr>
<td>AGE (yrs)</td>
<td>0.78</td>
<td>0.001****</td>
</tr>
<tr>
<td>ED</td>
<td>1.98</td>
<td>0.031*</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>0.78</td>
<td>0.009***</td>
</tr>
<tr>
<td>Food variety</td>
<td>-0.05</td>
<td>0.009**</td>
</tr>
<tr>
<td>Energy (kJ/day)</td>
<td>0.00094</td>
<td>0.4590</td>
</tr>
<tr>
<td>D fiber (g/day)</td>
<td>-0.32</td>
<td>0.0258</td>
</tr>
<tr>
<td>M/S ratio</td>
<td>19.86</td>
<td>0.001***</td>
</tr>
<tr>
<td>%KJ alcohol</td>
<td>2.48</td>
<td>0.0078</td>
</tr>
<tr>
<td>% variation explained by the model</td>
<td>48%</td>
<td>48%</td>
</tr>
</tbody>
</table>
Table 3. Pearson correlation coefficients for relationships between food intake and blood pressure (mmHg, by sex).

Table 4. Food intake as a determinant of systolic blood pressure (mmHg), by sex.

Table 5. Food intake as a determinant of diastolic blood pressure (mmHg), by sex.

Multivariate models: results

Discussion

Assessment of Food and Health Relationship
Table 3. Pearson correlation coefficients for relationships between food intake and blood pressure (mmHg), by sex.

<table>
<thead>
<tr>
<th>Food intake components</th>
<th>b</th>
<th>p</th>
<th>Partial R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice</td>
<td>0.13</td>
<td>0.18</td>
<td>0.09</td>
</tr>
<tr>
<td>Fish</td>
<td>0.14</td>
<td>0.18</td>
<td>0.09</td>
</tr>
<tr>
<td>Biscuits</td>
<td>-0.13</td>
<td>0.18</td>
<td>0.09</td>
</tr>
<tr>
<td>Nuts</td>
<td>0.17</td>
<td>0.18</td>
<td>0.09</td>
</tr>
<tr>
<td>Vegetables/legumes/honey</td>
<td>0.13</td>
<td>0.18</td>
<td>0.09</td>
</tr>
<tr>
<td>Soup</td>
<td>0.13</td>
<td>0.18</td>
<td>0.09</td>
</tr>
<tr>
<td>Fatty snack foods</td>
<td>-0.15</td>
<td>0.18</td>
<td>0.09</td>
</tr>
<tr>
<td>DBP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sea foods</td>
<td>0.16</td>
<td>0.18</td>
<td>0.09</td>
</tr>
<tr>
<td>Fish</td>
<td>0.16</td>
<td>0.18</td>
<td>0.09</td>
</tr>
<tr>
<td>Light snacks</td>
<td>-0.14</td>
<td>0.18</td>
<td>0.09</td>
</tr>
<tr>
<td>Biscuits</td>
<td>0.12</td>
<td>0.18</td>
<td>0.09</td>
</tr>
</tbody>
</table>

NS = p>0.05; NS+ = p>0.05;* = p<0.01; ** = p<0.001; *** = p<0.0001.

Table 4. Food intake as a determinant of systolic blood pressure (mmHg), by sex.

<table>
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<tr>
<th>Factors</th>
<th>b</th>
<th>p</th>
<th>Partial R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>0.82</td>
<td>0.0001***</td>
<td>29.22</td>
</tr>
<tr>
<td>ED</td>
<td>3.39</td>
<td>0.0001****</td>
<td>1.43</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>0.90</td>
<td>0.0001**</td>
<td>1.72</td>
</tr>
<tr>
<td>Food variety</td>
<td>-0.16</td>
<td>0.0134*</td>
<td>0.96</td>
</tr>
<tr>
<td>Rice</td>
<td>1.70</td>
<td>0.0001***</td>
<td>0.88</td>
</tr>
<tr>
<td>Oatfl</td>
<td>1.43</td>
<td>0.0001**</td>
<td>1.36</td>
</tr>
<tr>
<td>Fish</td>
<td>2.19</td>
<td>0.0001**</td>
<td>1.13</td>
</tr>
<tr>
<td>Spices</td>
<td>1.65</td>
<td>0.0001**</td>
<td>1.02</td>
</tr>
<tr>
<td>Berries/grapes</td>
<td>2.01</td>
<td>0.0001**</td>
<td>1.02</td>
</tr>
<tr>
<td>Biscuits</td>
<td>-1.95</td>
<td>0.0001**</td>
<td>2.83</td>
</tr>
<tr>
<td>Olive oil</td>
<td>-2.16</td>
<td>0.0001**</td>
<td>0.95</td>
</tr>
<tr>
<td>Soup</td>
<td>-2.13</td>
<td>0.0001**</td>
<td>0.98</td>
</tr>
<tr>
<td>Melons</td>
<td>-1.53</td>
<td>0.0001**</td>
<td>0.47</td>
</tr>
</tbody>
</table>

% variation explained by the model: 45.9%

WOMEN |   |   |           |
| Age (yrs) | 1.16 | 0.0001*** | 41.94 |
| LOSA (yrs) | 0.28 | 0.0001** | 1.14 |
| Food acclimation | 0.23 | 0.0001** | 1.02 |
| Fruits | 2.34 | 0.0001** | 1.50 |
| Fish | 2.21 | 0.0001** | 0.53 |
| Biscuits | -0.62 | 0.0001** | 1.14 |
| Cream | 2.45 | 0.0001** | 0.52 |

% variation explained by the model: 48.0%

Table 5. Food intake as a determinant of diastolic blood pressure (mmHg), by sex.

<table>
<thead>
<tr>
<th>Factors</th>
<th>b</th>
<th>p</th>
<th>Partial R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>0.13</td>
<td>0.0010*</td>
<td>1.23</td>
</tr>
<tr>
<td>ED</td>
<td>2.01</td>
<td>0.0005***</td>
<td>2.45</td>
</tr>
<tr>
<td>Smoking</td>
<td>-2.86</td>
<td>0.0070**</td>
<td>1.18</td>
</tr>
<tr>
<td>WHR</td>
<td>54.13</td>
<td>0.0001***</td>
<td>12.85</td>
</tr>
<tr>
<td>Fish</td>
<td>2.16</td>
<td>0.0001***</td>
<td>1.39</td>
</tr>
<tr>
<td>Sea foods</td>
<td>1.34</td>
<td>0.0124*</td>
<td>1.23</td>
</tr>
<tr>
<td>Breakfast cereals</td>
<td>1.09</td>
<td>0.0231*</td>
<td>1.55</td>
</tr>
<tr>
<td>Biscuits</td>
<td>0.71</td>
<td>0.0001**</td>
<td>2.65</td>
</tr>
<tr>
<td>Tropical fruit</td>
<td>-1.12</td>
<td>0.0140*</td>
<td>1.68</td>
</tr>
<tr>
<td>Cruciferous vegetables</td>
<td>-0.75</td>
<td>0.0420*</td>
<td>0.92</td>
</tr>
<tr>
<td>Tea</td>
<td>-1.11</td>
<td>0.0434*</td>
<td>1.13</td>
</tr>
</tbody>
</table>

% variation explained by the model: 29.8%

Table 6. ASSESSING FOOD AND HEALTH RELATIONSHIP

<table>
<thead>
<tr>
<th>Factors</th>
<th>b</th>
<th>p</th>
<th>Partial R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>WOMEN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>0.22</td>
<td>0.0001**</td>
<td>11.93</td>
</tr>
<tr>
<td>LOSA (yrs)</td>
<td>0.18</td>
<td>0.0007**</td>
<td>2.08</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>0.54</td>
<td>0.0047**</td>
<td>3.04</td>
</tr>
<tr>
<td>Molluscs</td>
<td>1.05</td>
<td>0.0034*</td>
<td>1.37</td>
</tr>
<tr>
<td>Spirits</td>
<td>1.10</td>
<td>0.0225*</td>
<td>0.91</td>
</tr>
<tr>
<td>Confectionery</td>
<td>-1.18</td>
<td>0.0411*</td>
<td>1.24</td>
</tr>
</tbody>
</table>

% variation explained by the model: 21.9%

Discussion

Despite the indication that food variety may protect against the development of systolic blood pressure, we found that dietary blood pressure levels increased with a higher intake of rice, fish, fish and berries/grapes, and decreased with a higher intake of biscuits, chocolate drinks/coffee, soup, and sweet melon in men, adjusting for age, education level, BMI index and food variety. For women, an elevated systolic blood pressure was associated with a lower intake of biscuits and cream, adjusting for age, the length of stay in Australia, and the degree of food acclimation.

Studies have shown that fish intake reduces CHD mortality13, 14, and that a moderate intake of taurine (two to three portions per week) may reduce total mortality in men who have recovered from myocardial infarction15. Furthermore, it has been shown that omega-3 fatty acids, found in fish and marine animals, cause a reduction in VLDL, reduction in thrombogenic tendency, increase in fibrinolytic activity, and perhaps, reduction in blood pressure16. The protective effect of fish consumption is often associated with a nutritional status of Norwegian men15, a study of Japanese men living in Hawaii17, and descriptive studies of ecological comparison18.

Blood pressure and 24-hour urinary sodium and potassium excretion

Of the 87 subjects, men (14.6 %) and women (30.8 %) were being treated for hypertension (THT). There were no untreateed hypertensives (SBP ≥ 160 mmHg and DBP ≥ 95 mmHg). Three borderline hypertensives (140 mmHg<SBP< 160 mmHg or 90 mmHg<DBP< 95 mmHg) were being treated; all had DBP less than 90 mmHg and were included in the non-hypertensive (NHT) group. The THT were older and had higher BP. No differences were found between the THT and the NHT group for urinary sodium (Na) and potassium (K) excretion and urinary creatinine (C). Mean and standard error of the mean for age, SBP, DBP, urinary sodium, potassium and creatinine are shown in Table 6. There was no difference in these parameters between the urine collectors and the non-collectors.

Among the THT, there was a positive relationship between systolic BP and urinary sodium excretion and urinary Na+/K ratio in both men and women: urinary Na excretion was 0.90 in men and 0.83 in women; urinary Na/K ratio, 0.67 in men and 0.69 in women. Diabetic BP was primarily related to urinary Na/K ratio (r=0.86) and urinary K/C ratio (r=0.88) in men yet not statistically significant relationship. The intake of fruit and fish is known to be related to a healthy diet. A fruit and vegetable intake is related to therapy such as diuretics and K supplements. Among the NHT group, there was a negative relationship.
between systolic BP and urinary creatinine (r=0.49) and a negative relationship between diastolic BP and urinary protein excretion (r=0.41) in women; no relationships were found in men.

The positive relationship between urinary sodium excretion and systolic BP among the THT, yet not among the NHT group, may suggest that either hypertension or its treatment is responsible for the relationship. Though potent and negative, the relationship between urinary potassium excretion and systolic BP among the NHT group may similarly reflect the relative importance of dietary potassium intake in blood pressure control, although not in men. The sex difference in intriguing and may suggest that women achieve lower BP through potassium responsiveness.

References
Table 6. Mean values (SEM in parentheses) for sex, SBP, DBP, uric acid, sodium, potassium, and creatinine excretion, by ‘hypertensive’ (treated hypertensive vs non-hypertensive), by gender.

<table>
<thead>
<tr>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>25-34</strong></td>
<td><strong>25-34</strong></td>
</tr>
<tr>
<td><strong>SBP</strong></td>
<td><strong>DBP</strong></td>
</tr>
<tr>
<td><strong>143.6±0.9</strong></td>
<td><strong>110.9±0.3</strong></td>
</tr>
<tr>
<td><strong>UR</strong></td>
<td><strong>UR</strong></td>
</tr>
</tbody>
</table>

**Note**: All values are in mmHg for blood pressure and sodium and potassium in mmol/L.

References

評估食物與健康的關係：
墨爾本中國成人血壓測定的研究

概要

一個有效的預防心血管病的公共衛生方法應該是，在減少飲食中脂肪、鹽和糖的同時，給予選取食物的機會。脂肪、鹽和糖是一類可在各種食物中找到的營養素。公共衛生教育工作者要這些營養素轉換成食物，以便於每日食物的選擇。通常營養素轉換成食物是相對的，並可能誤導。例如，我們對高脂肪和高糖的人造黃油製造量和椰子油仍然不明確。在墨爾本成人的基礎數據分析中，我們把食物和營養素主要心血管病風險因子進行詳細分析，結果發現，食物與主要心血管病風險因素的相關營養素為：墨爾本華人食物種類廣泛，並多食魚類、蔬菜和果品，因此心血管病的風險較低。這些在公共衛生的意義上是重要的，因為除營養素外，食物的轉變會引起該人群心血管病風險因子的轉變。該文闡述了547位墨爾本華人血壓測定的發現，並評論了食物與健康關係可能的研究途徑。

Introduction

The human species is known to have subsisted for thousands of years on a diet high in plant foods and low in animal products. It is only in the last 200 years that many industrialized countries, along with economic development, have changed their diet to one rich in animal products, fat and sugar. It has been widely recognized that the emergence of chronic degenerative diseases in the developed world is significantly associated with changes in the dietary pattern. In the developing world, while some countries remain concerned with the problems of hunger, malnutrition and communicable diseases; in other countries (including China), there have been considerable changes in the national diets, leading to the “westernization” of the dietary pattern, characterized by a decreased intake of plant foods and an increased intake of animal foods. This paper will describe the dietary changes which have occurred in China in recent years as well as the corresponding changes in disease patterns.

Recent dietary transition in China

The pattern of food consumption in China has been subject to significant changes in the last 30-40 years. According to the national statistics of food production, consumption of animal foods increased significantly from 1977-1987 (Table 1) and the same trend continues. Tables 2 and 3 show the changes in food and nutrient consumption in 12 provinces in China from 1982-1990, based on a household dietary survey.4 The data closely show significant increases in meat, poultry, egg, fish and oil consumption as well as a slight decrease in cereal consumption (the traditional staple food in the Chinese diet). By the late 1980s, the average dietary energy intake in China had reached 2500 kcal per capita, suggesting the problem of food provision had basically been solved. The changes are more profound in the urban areas. The national average fat intake in the urban population in 1988 reached 29.5 % of the total energy intake, which is very close to the upper limit of the WHO goal of 30 % of energy. Figure shows that during the last 40 years, the consumption of animal food, oil and fat, and sugar consumption in Shanghai city rapidly increased. According to a 1989 survey on urban elderly residents in Beijing, average egg consumption was approximately one egg per person per day (Zhuo et al., unpublished data). Although lower than the consumption level of the

Dietary transition in China and its health consequences

Junshi Chen MD
Institute of Nutrition and Food Hygiene, Chinese Academy of Preventive Medicine, Beijing, China.

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The pattern of food consumption in China has been subject to significant changes during the last 30-40 years, although the average dietary pattern is still based on plant foods. These changes have been characterized by increased consumption of animal products and decreased consumption of cereals. These trends are supported by both national food disappearance records and by household survey data on the intake of specific foods. Changes in urban areas have been much more substantial than in rural areas. Preliminary findings show that the dietary transition is associated with simultaneous decrease in the prevalence of some communicable diseases and an increase in the prevalence of the major chronic degenerative diseases, such as cancers and cardiovascular diseases.

Table 1. Food Consumption in China, 1978-87 (g/kg capita/year)

<table>
<thead>
<tr>
<th>Year</th>
<th>Cereals</th>
<th>Tablet of Meat</th>
<th>Egg</th>
<th>Milk</th>
<th>Fish</th>
<th>Fruits</th>
<th>Vegetables (kg)</th>
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</thead>
<tbody>
<tr>
<td>1978</td>
<td>193.45</td>
<td>1.80</td>
<td>8.88</td>
<td>1.97</td>
<td>1.00</td>
<td>3.50</td>
<td>6.60</td>
</tr>
<tr>
<td>1980</td>
<td>200.03</td>
<td>1.96</td>
<td>11.05</td>
<td>2.60</td>
<td>1.31</td>
<td>3.22</td>
<td>7.84</td>
</tr>
<tr>
<td>1982</td>
<td>213.81</td>
<td>2.30</td>
<td>12.79</td>
<td>2.27</td>
<td>1.50</td>
<td>3.41</td>
<td>6.74</td>
</tr>
<tr>
<td>1984</td>
<td>219.15</td>
<td>2.54</td>
<td>13.77</td>
<td>2.64</td>
<td>1.53</td>
<td>3.27</td>
<td>7.40</td>
</tr>
<tr>
<td>1986</td>
<td>225.40</td>
<td>3.56</td>
<td>13.81</td>
<td>2.53</td>
<td>1.90</td>
<td>3.83</td>
<td>7.39</td>
</tr>
<tr>
<td>1988</td>
<td>229.32</td>
<td>4.03</td>
<td>14.44</td>
<td>2.96</td>
<td>2.15</td>
<td>4.02</td>
<td>9.84</td>
</tr>
<tr>
<td>1990</td>
<td>213.46</td>
<td>4.70</td>
<td>15.24</td>
<td>3.28</td>
<td>2.38</td>
<td>4.93</td>
<td>9.31</td>
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<tr>
<td>1992</td>
<td>190.94</td>
<td>5.24</td>
<td>17.04</td>
<td>3.27</td>
<td>2.40</td>
<td>5.40</td>
<td>12.20</td>
</tr>
<tr>
<td>1994</td>
<td>171.44</td>
<td>5.06</td>
<td>17.00</td>
<td>3.16</td>
<td>2.00</td>
<td>5.34</td>
<td>12.00</td>
</tr>
</tbody>
</table>

Source: China Statistical Bureau, China.

Table 2. Changes in food consumption by Chinese people in 12 provinces (g/kg capita/year)

<table>
<thead>
<tr>
<th>Year</th>
<th>Cereals</th>
<th>Tablet of Meat</th>
<th>Egg</th>
<th>Milk</th>
<th>Fish</th>
<th>Fruits</th>
<th>Vegetables (kg)</th>
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<tr>
<td>1982</td>
<td>206.8</td>
<td>2.20</td>
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<td>17.00</td>
<td>3.16</td>
<td>2.00</td>
<td>5.34</td>
<td>12.00</td>
</tr>
</tbody>
</table>

Source: China Statistical Bureau, China.

Note: a National nutrition survey. b Total diet study.

Correspondence address: Dr Junshi Chen, Institute of Nutrition and Food Hygiene, Chinese Academy of Preventive Medicine, 29 Nan Wei Road, Beijing, 100000, China.