Thematic Article

Diet and hypertension in the Asia–Pacific region: a brief review

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In this paper, the possible reasons for the prevalence of hypertension in the Asia–Pacific region are examined, along with its likely dietary, nutritional and sociocultural causes. This brief survey indicates the need for more comprehensive blood pressure monitoring and surveillance throughout the region. Findings from research conducted in the region and elsewhere suggest that a variety of aetiological factors predict the occurrence of hypertension, most of which are similar to those observed in western populations. However, several lines of research suggest that obesity, abdominal obesity and a number of dietary constituents, in addition to salt, may play relatively greater roles than in western populations. It is argued that hypertension may be prevented via a combination of individual, community and governmental approaches which promote social capital, environmentally sustainable food production and the public health.

Key words: Asia, diet, hypertension, nutrition transition, prevention.

Introduction

The Asia–Pacific region usually includes Indonesia, Indochina, China, Japan, Papua New Guinea, the Pacific island states, Australia and New Zealand. By convention it excludes the Indian subcontinent and North and South America. Its population of some two billion people, one-third of humankind, spans many cultures in several stages of economic and nutrition transition. The various countries in the region face a variety of difficult health problems variously associated with poverty, increasing longevity, and economic prosperity played out on a complex stage of cultural traditions. Cardiovascular disease (CVD) is a increasing problem in several countries as Khor showed in a comprehensive review.[1]

Foremost among the health challenges of the region are the increasing prevalences of CVD and diabetes mellitus type II, both of which have been predicted by WHO to become the major global diseases of the coming decades.[2,3] The focus of this paper is one of the central risk factors for both CVD and cerebrovascular disease: hypertension.

A series of questions will be posed and attempts made to answer them, as follows:

1. How is hypertension defined and what is its current prevalence in the region?
2. How is hypertension linked to other CVD and cerebrovascular disease risk factors? In particular, are Asian risk factors similar to those in the west?
3. What are the dietary antecedents of hypertension in the cuisines of the Asia–Pacific region?
4. What are the likely distal causes of hypertension?
5. What can be done to prevent hypertension?

1. How is hypertension defined and what is its current prevalence in the region?

Hypertension is a largely preventable condition that has a huge negative impact on the health of populations, playing a key role in the causation of CVD and cerebrovascular disease. It is defined by the Joint Committee of the WHO/ISH as a resting systolic blood pressure greater than 140 mmHg and/or a diastolic pressure greater than 90 to 99 mmHg. In the west, it has been estimated that a reduction in population blood pressures of around 5 mmHg would reduce the incidence of stroke by 26% and heart disease by 15%.[4,5] In the Asia–Pacific region, a population-wide reduction of 3 mmHg in diastolic pressure is likely to decrease the number of strokes by about one-third.[6]

In industrialised countries, such as Australia and South Korea, about one in five adults suffer from or are treated for hypertension.[7,8] Prevalence rates tend to be higher among men than among women, at least until old age.[9] In the countries of the Asia–Pacific region, prevalence rates vary but generally they are similar to rates in western countries.[10] However, some evidence suggests that Polynesians experience higher blood pressure levels than Europeans and Asians (in urban work forces), which are associated with obesity and unknown ethnic factors.[11]

As in Australia and New Zealand, prevalence rates and associated death rates, decreased sharply in Japan during the two decades following 1950 – by about 15 mmHg.[7,12–14] They appear to be increasing in other countries, especially in urban areas. In China, hypertension accounts for as much as half of the stroke mortality.[15] Its prevalence has decreased in recent years in people over 45, but diastolic pressures have increased in young people.[16]

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The populations of China, Japan, Australia and New Zealand are the best studied, those in other countries remain relatively unexamined. Therefore, there appears to be a major need for the conduct of random population surveys to establish the prevalence of this and related conditions in several countries of the region. The age-adjusted prevalence of hypertension (defined as systolic blood pressure over 140 mmHg or diastolic over 90 mmHg), in China for example, is approximately 12% of men and 10% of women,[17] but the rate varies from country to country and within countries according to locality (for example, China[18]), sex and age.[19]

It has been known for some time that the prevalence of hypertension varies according to socioeconomic criteria in some western countries. As an example, men in professional and clerical occupations tend to have lower blood pressures than those in manual or unskilled occupations. Data from elsewhere in the region, in contrast, suggest that the urban–rural divide may be relatively more important, urbanites tending to experience increasing prevalence of CVD and hypertension;[17,20,21] the prevalence of hypertension among Beijing men was 21% in 1987–88.[22] The increasing longevity of most populations in the region is also a factor which is likely to increase the prevalence of the condition as blood pressure tends to increase with age.[17,19]

2. How is hypertension linked to other cardio- and cerebrovascular disease risk factors?

The main risk factors for CVD among people in the region appear to be similar to those observed in western populations. These include obesity, smoking and hypertension, although elevated serum cholesterol levels do not appear to be as common or as important.[1] Hypertension appears to be more closely associated with strokes in the populations of East Asia than in western countries.[6] However, it should be noted that this difference may be more apparent than real, as hypertension is a key factor in the causation of strokes in western countries.

Strokes are a major source of morbidity and mortality in western countries. In Australia, strokes are the second cause of death (12 133 deaths in 1997) and are the leading cause of long-term disability in adults; CVD accounted for $3.7 billion of direct health service costs and one-fifth of all drug prescriptions in 1997.[7] It remains to be seen whether decreases in physical activity, increasing overweight, alcohol and cigarette consumption (all traditional risk factors in the west) will increase the prevalence of hypertension in the region.

The evidence to date from regional studies suggests that this is likely as alcohol,[13,23–25] smoking,[26] high body mass indices (BMI)[27–29] and abdominal fat (waist-to-hip ratios)[30] have all been shown to positively predict the prevalence of hypertension.

There are quite strong indications from structural equation modelling of the metabolic syndrome among Hong Kong Chinese that blood pressure is predicted by age, obesity, waist-to-hip ratios, and by serum insulin and glucose intolerance.[19] The authors suggest that a central neurohormonal mechanism may account for these phenomena which appear to be mediated by obesity and ageing. A similar primary role for abdominal fat has been observed among Singapore Chinese in relation to CVD risk factors.[31] Jones stresses the importance of obesity as a risk factor for hypertension in Asian populations, even in very lean populations.[10] This is consistent with earlier arguments that hypertension, insulin resistance, vascular disease and related disorders may be linked as 'Syndrome X'.[32]

It is worth noting that hypertension may be associated with the development of diseases other than CVD or coronary heart disease (CHD); for example, Xie *et al.* linked it to increased incidence of cancers of various organs.[33]

3. What are the dietary antecedents of hypertension in the cuisines of the Asia–Pacific region?

Not a great deal is known about the role of dietary factors in the Asia–Pacific region especially in countries other than China and Japan. Clearly, excessive salt consumption, a feature of many traditional cuisines, is an important factor;[16,34–37] as are overweight and obesity.[28–30]

Mineral imbalances associated with adoption of processed foods such as Na:K (that is, relative potassium deficits[23]) and Na:Ca ratios may also be implicated.[38] Baba *et al.* suggest that intakes of sodium, potassium, calcium and alcohol are relatively more important causes of hypertension in Japanese (than in Americans) than is overweight.[39] Similarly, Griffith *et al.*[40] and Resnick[41] provide major reviews which support the role of calcium in the control of hypertension.

Other minerals may be important; for example, Yang and Chiu found that magnesium in drinking water was strongly related to the incidence of hypertension-related deaths in Taiwan.[42] The importance of this element in hypertension aetiology has been emphasised recently by Yamori and Mizushima,[43] and by Reusser and McCarron.[44] The Linxian Intervention trial found that vitamin and mineral supplementation among impoverished men and women in rural China brought about reductions in blood pressure.[45] This unusual finding suggests the need for more research that is sensitive to local conditions and dietary practices.

Bao *et al.* in Perth,[46] Mizushima *et al.* in Japan and Brazil,[47] Kodali *et al.*[48] and Bulliyya *et al.*[49] in India have demonstrated that fish and fish oil consumption are powerful antihypertensive factors. However, the way in which food is prepared is crucial, salted fish being associated with increased blood pressure.[50] Mizushima *et al.* have also observed higher salt intakes albeit with higher calcium intakes among consumers of small fish.[38]

The possible regulatory function of fatty acids, specifically n-3 fatty acids, has been emphasised recently by Simopoulos in his review of dietary patterns and blood pressure though in combination of other recognized lifestyle factors such as regular physical activity.[51] Mizushima *et al.* concur that n-3 fatty acids are antihypertensive along with taurine and habitual low intakes of energy and fat.[47]

More recently, soy consumption, a key feature of many cuisines in the Asia–Pacific region, has also been shown to be antihypertensive.[52] Changes in food consumption practices such as the use of vegetable oils for cooking may contribute to obesity and hypertension. Other changes include to displace more healthy traditional foods, for example, soy and fermented foods as well as ingredients including n-3 fatty acids which Simopoulos suggests are important in blood pressure regulation.[51]

A major unique regional nutrition research contribution concerns the antihypertensive roles of proteins and derivative amino acids. In three studies of Chinese populations, daily intakes of animal proteins and derived amino acids present in urine and serum (such as taurine and lysine) were inversely related to systolic blood pressure (SBP) and diastolic blood pressure (DBP).[53] The authors note that these and other amino acids are known to act as modulators or precursors of neurotransmitters related to the regulation of blood pressure. This is not an isolated finding; Yamori *et al.* have conducted extensive animal experiments, clinical trials and population studies which show that certain amino acids derived principally from fish and seafood (for example taurine), other animals and legumes are antihypertensive.[54–57] This Asian work is quite consistent with that of Meisel who has performed extensive investigations of the antihypertensive properties of amino acids derived from dairy proteins.[58]

Finally, Woo *et al.* suggest that among Asians endothelial dysfunction and thus heart and related diseases, may involve new risk factors in addition to those previously seen in the west.[59] For example, hyperhomocysteinaemia, folate deficiency, low high-density lipoprotein (HDL) cholesterol, insulin resistance, abdominal obesity and various genetic factors may play relatively more important roles in the aetiology of these non-communicable diseases.

Clearly, much more work is required to examine the food consumption patterns which are associated with normal and elevated population blood pressure levels. In particular, the factors involved in the decrease in population blood pressures in Japan, Australia and New Zealand require consideration. The only common factors they appear to share are the reduced prevalence in smoking, and to a degree, the implementation of community-wide blood pressure screening. The Australians appear to have increased the amounts of n-6 fatty acids in their diets[60] while the Japanese appear to have doubled the amount of animal fats (from a low base) and increased their protein intake in the form of increased consumption of meat, eggs and dairy products.[20]

4. What are the likely distal causes of hypertension?

Why are CVD and cerebrovascular diseases increasing? In traditional biomedical terms, it is because there have been changes in various risk factors (proximal causes). However, if we are to bring these diseases under control, we need to examine more distant causes, which are to be found in changes in society that have occurred during the past 50 years but especially during the past two decades.

Popkin *et al.* have written extensively about the nutritional aspects of these changes, that are generally known as the 'nutrition transition'.[61–63] Essentially, the nutrition transition is part of a socioeconomic change that has occurred as countries in the Asia–Pacific region (and elsewhere) have industrialised and urbanised. In doing so, many people have become less physically active and have consumed more animal products, more vegetable fats, salt, sugars and refined foods as happened earlier in western Europe and North America. It is also likely that these obvious changes may also be accompanied by increased stress levels and immune system dysfunction.

P. McMichael has argued that changes such as the nutrition transition are largely the result of economic and political arrangements invented by economic powers to govern world trade in their favour.[64] As a result, since 1945 there has been a shift from colonialism, through what was called the 'development project' to 'globalisation' and the rule of the 'free' market – the latter adopted by the Chinese government in its economic reforms of the past two decades.

Underpinning such political changes, and to an extent, resulting from them, have been increases in population, the remorseless drift to the cities, expansion of the built environment onto previously fertile, productive land and changes in people's lifestyles, beliefs and values.[65] An example of the rise of the 'cult of self' and materialism is seen in Beijing, young adults expressing markedly more materialistic views and owning many more material possessions than older or rural people.[66]

This change has all the hallmarks of postmodernism. Individualism and materialism are encouraged as good things, traditional authorities have declined and governments espouse neo-liberal views (ironically including the Communist government of the People's Republic of China). These changes are ably assisted by mass education and global communications (for example Channel V).

This may seem to be a long way from hypertension. However, we do need to attempt to track how social environmental changes affect health outcomes, as Marmot and Wilkinson suggest.[67] We now have powerful statistical techniques to do so; Tupoulahi, for example, has shown how obesity in Tonga results from a complex interplay of behavioural, cognitive, demographic and cultural variables.[68]

5. What can be done to prevent hypertension?

There are many approaches that have been demonstrated to be useful. However, they all require various forms of social capital. McMichael and Beaglehole in their review of the outlook for global public health emphasise the point that social institutions have to be developed which promote both the environment and population health.[69] In a sense, several of the diet-related problems of populations in the region stem from poorly integrated agricultural and food processing sectors. Foods are often produced and distributed as monocultures without reference to any wider concerns about environmental sustainability or public health. Those countries that have seen decreases in their rates of hypertension and CVD have been fortunate enough to inherit or to develop social institutions that have fostered the production distribution of healthier foods or adequate monitoring, screening and treatment programs. The institutions vary; in a country such as Japan, a network of local government health agencies has sought to increase professional's and lay people's awareness about hypertension and other dietary issues. In other countries such as Australia, non-government organisations like the National Heart Foundation have played leading roles. It doesn't always matter how the organisations are formed, so long as they are strong enough to raise awareness and take action on a broad front to combat public health problems. The success of the Gareem Bank in Bangladesh demonstrates that powerful social institutions can be built up in a relatively short time from very poor beginnings.

The key dietary aims among urbanised populations include reduced salt intake and increased calcium and dietary fibre intakes.[70] Several levels of intervention may be required.

Wahlqvist has suggested that an important approach for clinicians and others is to pursue a series of small changes in the public's health and dietary habits so that they can be successfully assimilated.[71] Several sociobehavioural models have been used successfully to bring about a variety of health gains in the populations. The transtheoretical model or stages of change model is one such model.[72,73]

Examples at the level of the individual include the Dietary Approaches to Stop Hypertension (DASH) studies which have encouraged the greater use of fruits and vegetables, cereals and low-fat dairy products among multiracial American groups.[74] Others include the Trial of Nonpharmacologic Interventions in the Elderly (TONE) study among elderly people which promoted dietary and physical activity changes to combat high blood pressure[75] and the Lyons Heart Study which demonstrated major secondary prevention effects among myocardial infarction survivors treated with an n-3 rich modified Mediterranean diet, though with no reported effects on blood pressure.[76]

A health promotion intervention which targeted dietary behaviours that predates the DASH studies was conducted in Japan.[77] Untreated hypertensive men and women aged 35–69 years were randomly allocated to treatment ($n = 56$) and control groups ($n = 55$). The intervention consisted of four education classes in the first 6 months and four classes in the following year. They were encouraged to reduce their dietary sodium, increase their milk intake, participate in brisk walking and if necessary to reduce their alcohol and sugar intakes. At both 6 months and at 1½ years mean systolic pressure was 5–6 mmHg less in the intervention group, though diastolic pressure and BMI were not significantly different.

A somewhat more drastic form of intervention has been conducted by Sjostrom *et al.* in Sweden.[78] He invited hypertensives, many of whom were also diabetic to spend 1 month on a 'fat farm' (and subsequently, a 1 week 'booster'). They were given access to as many lectures on healthy eating and physical activity as they wished but were not forced to comply with any behavioural change except for the requirement that they had to cook their own lunches. The mean systolic pressures dropped by the end of the month's stay by over 20 mmHg from approximately 160 mmHg on entry. These reductions in blood pressure (and associated weight losses) were maintained for up to 5 years, and the effects were greater among non-university educated patients than tertiary educated. This suggests that intensive periods of behavioural skills acquisition may have lasting effects.

In a more naturalistic clinical mode, the Dutch College of General Practitioners has pioneered the use of information technology in doctors' offices which enables them to closely monitor biomedical indices such as height and weight in order to prescribe small dietary and physical activity improvements.[79] This could be used to monitor the effects of similar lifestyle changes on blood pressure.

At the level of community interventions there are many examples of CVD prevention interventions such as the Stanford Three City Study, the Pawtucket Heart study, and the North Karelia program which has been particularly successful. Healthy Eating programs conducted by the Singapore and Malaysian Departments of Health provide useful regional examples of ways in which major conditions such as hypertension might be effectively controlled.

A large scale regional example of a combined community hypertension screening and intervention trial was carried out over a 3½ year period in seven cities in China.[80] Subjects in the treatment group experienced substantial reductions in the incidence of hypertension and their awareness of the problem was increased. This study shows that mass screening and intervention is both feasible and effective in China. Iso *et al.* have reported similar results from a similar intervention in rural Japan; screening and intervention was associated with a decrease in the incidence of hypertension.[81]

Community interventions which are focused on likely risk factors for hypertension may be particularly useful such as physical activity programs (for example, the Western Australian Partners program,[82] the Australian Quit smoking programs, and the School Health and Physical Education (SHAPE) and Body Owners school-based health promotion programs).[83,84] Various point of sale programs have been operated by food retailers which could have major impact on food consumption, for example, the American 5 a Day program, which promotes fruit and vegetable consumption.[85]

At the level of national and local government, there are a number of policy approaches that may be important in combating hypertension such as the promotion of public transport (for example, in the Netherlands and in Brazil), and food policies that encourage the consumption of healthy foods – the recent importing of fruit and vegetables into Poland is one striking example of an effective food policy.[86] The pricing policy operated by the Chinese government is another example of the power of national governments to influence the populations' food intake.[63] In this regard, it is important that food-based dietary guidelines, which respect traditional cuisines and cultural diversity, are promoted strongly throughout the Asia–Pacific region.[87]

Conclusions

This brief overview has shown that hypertension is a major problem in the Asia–Pacific region which requires a great deal more research. This should focus on the dietary and lifestyle factors that influence the prevalence of hyertension; and the ways in which the condition can be prevented in populations. Several principles which may help guide such action-orientated research are as follows:

- Social institutions are required which operate on a broad front to promote environmentally sustainable food supplies and the public health.
- Monitoring of population health indices is required in all countries of the region; the health of all sections of the population is of primary importance;
- National governments should promote culturally appropriate food consumption patterns (that is, food-based dietary guidelines) along with the ideals of community and 'the public good'. The market is a good servant but a terrible master.
- Socioeconomic developments have major effects on the public's health and should be adopted with caution.

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