

## Thematic Article

# Cardiovascular risk in the Asia–Pacific region from a nutrition and metabolic point of view: visceral obesity

David R Sullivan MBBS, FRACP, FRCPA

*Department of Clinical Biochemistry, Royal Prince Alfred Hospital, Camperdown, Sydney, Australia*

The association between abdominal obesity and an increased risk of cardiovascular disease (CVD) is now well recognized. Both problems are becoming more prevalent within the Asia–Pacific region, but there are substantial differences within and between countries. The strength of the temporal relationship between obesity and CVD in the region has led to the suggestion that obesity is the driving force behind the continuing epidemic of CVD. This raises the question as to whether there are any special aspects to the Asia–Pacific epidemic of obesity and resultant problems as a result of genetic or developmental factors. It is clear that the experience of central obesity and its cardiovascular consequences in western society cannot be directly transposed to all countries in the region. Issues such as smoking, alcohol use and inactivity may carry different implications. The Asia–Pacific region has started from low baseline prevalence of both obesity and CVD, but this implies that the potential for major problems in the future is particularly severe.

**Key words:** Asia, cardiovascular, diabetes, obesity, Pacific.

## Introduction

Obesity was often omitted from the list of classical major risk factors for cardiovascular disease (CVD). This reflects the fact that its association with other major risk factors has tended to relegate it to the status of a dependent, rather than an independent risk factor during statistical analysis. It is now appreciated that obesity, particularly visceral obesity, is the common aetiological cause of a high proportion of several major risk factors including hypertension, dyslipidaemia and type II diabetes. This explains why visceral obesity fails to achieve independent risk factor status, but nevertheless offers a simple and powerful tool for the recognition of individuals and populations with an increased risk of CVD.

In the Asia–Pacific region, the increase in the prevalence of obesity has been associated with an increase in the incidence of type 2 diabetes and CVD. These problems have occurred despite the fact that the severity of the obesity remains relatively low by world standards.<sup>1</sup> This has led some to question whether a more stringent definition of obesity needs to be applied to some populations.<sup>2</sup> By contrast, a more lenient definition has been recommended for other groups.<sup>3</sup> This emphasizes the diversity that exists within the Asia–Pacific region. The important points are that the upward trend in the prevalence in obesity is very widespread, that it is unabated, and that the social factors responsible for the trend are likely to prevail or intensify in the foreseeable future. The full potential of the problem has not yet been realized, because there is a large proportion of the population that has yet to be fully exposed to these influences. Furthermore, the strategies to combat obesity have met with only limited success, while the interventions to cope with the resultant CVD risk factors and other consequences are complicated and expensive. This review examines the relationship between visceral obesity and CVD with regard to the special considerations that may apply to the Asia–Pacific region.

## Visceral obesity and CVD

One of the fundamental principles of CVD is that its aetiology is multifactorial. This has led to the concept that there are ‘many paths’ to CVD, and it is conceivable that these may differ according to time and place. While many western countries have successfully reduced smoking and saturated fat consumption, the rate of visceral obesity and type 2 diabetes has escalated. These opposing trends tend to obscure the impact of obesity on CVD in western countries. Furthermore, major epidemiological studies may not be of sufficient duration to confirm the relationship between CVD incidence and change in the level of major risk factors.<sup>4</sup>

The Asia–Pacific region has also experienced an increase in visceral obesity, but it is occurring from a lower base.<sup>1</sup> Its effect on CVD has not been offset by reductions in smoking or saturated fat consumption. The coronary heart disease (CHD) mortality rate has risen and stigmata of visceral obesity such as diabetes or low high-density lipoprotein (HDL) cholesterol are extremely prevalent amongst CHD patients.<sup>5,6</sup> In the ASPAC study, obesity was not as prevalent as one might have expected, but the cut-off was based on western definitions at a body mass index (BMI) level of 30 kg/m<sup>2</sup>. It is also interesting to note that the presence or absence of obesity was not recorded in the hospital notes in over 50% of cases. This suggests that obesity is not considered to be of major clinical importance.

The data concerning stroke differs in that the incidence of stroke in the Asia–Pacific region shows evidence of an earlier

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**Correspondence address:** Associate Clinical Professor David Sullivan, Department of Clinical Biochemistry, Royal Prince Alfred Hospital, Missenden Road, Camperdown, NSW 2050, Australia.  
Tel: +612 9515 8832; Fax: +612 9515 7931  
Email: [davids@bioc.rpa.cs.nsw.gov.au](mailto:davids@bioc.rpa.cs.nsw.gov.au)  
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decline.<sup>5,7</sup> This may reflect the availability of antihypertensive and lipid-lowering treatment.<sup>7</sup> However, the persisting prevalence of obesity and the increasing prevalence of diabetes seen in Singapore at this time probably blunted the improvement. The important point is that obesity and diabetes remain extremely powerful risk factors for ischaemic stroke. Peripheral vascular disease appears to maintain its association with CHD and diabetes in Asia-Pacific countries.<sup>8,9</sup> Returning to the theme of 'many paths to CVD', it may be concluded that the qualitative relationships between risk factors and all forms of CVD are maintained in the Asia-Pacific region. The quantitative importance of individual risk factors may vary, and it is likely that obesity plays a relatively major role in these countries.

### **Genetic and developmental differences in visceral obesity and its consequences**

If obesity is a relatively greater problem in the Asia-Pacific region, the question arises as to the basis for this difference. It is difficult to know how to judge this issue, but evidence suggesting a greater incidence of CHD among people from the Indian subcontinent raises the possibility of a genetic basis. Comparative studies in Singapore have documented a more adverse risk factor profile associated with a greater waist-to-hip ratio among Indian inhabitants compared to Malays and Chinese.<sup>10</sup> Although no environmental explanation could be identified, it would be very difficult to control for cultural differences between these groups. For example, a tendency towards higher homocysteine levels has also been noted in Indian populations, but this may be attributable to a higher rate of vegetarianism.<sup>11,12</sup> The concept of a 'thrifty gene' is often invoked to explain why some populations may be prone to store excess energy as visceral fat. Visceral fat is more metabolically active and responds to catecholamine levels to provide fatty acids as a fuel substrate when food is unavailable. If these fatty acids are chronically underutilised, they will lead to insulin resistance by the mechanisms described in the Randle cycle. They will also provide a substrate for hepatic lipoprotein production. This will increase the concentration of triglyceride-rich lipoproteins, leading to lipid exchange processes that modify HDL and low-density lipoprotein (LDL) particles, making the lipid profile more atherogenic. Visceral obesity also contributes to hypertension, and may play a prominent role in non-classical risk factors, such as obstructive sleep apnoea, which is very prevalent in some Pacific nations.

While a genetic explanation is appealing, it is possibly oversimplistic. The theory is most plausible among groups that have lived as hunter-gatherers until very recently. This is consistent with the severe problems of visceral obesity, diabetes and CVD found in Australian Aboriginals. It has even been suggested that it could be the result of genetic selection during the long sea voyages that led to the population of the Pacific Islands.<sup>12</sup> However, insulin resistance also affects populations that have a long history of a stable agrarian way of life.

An alternative hypothesis is that there are developmental factors that dictate the risk of visceral obesity and insulin resistance. It will be very difficult to prove this hypothesis, but one point in its favour is the observation that the burden seems to fall most heavily on the first generation to experience

the transition from tenuous macronutrient availability to macronutrient excess. The so-called 'Barker hypothesis' attributes the development of visceral obesity and insulin resistance in adulthood to placental insufficiency.<sup>13</sup> This assumes some sort of adjustment of homeostatic mechanisms during early development. There is some limited evidence available to support such a concept.<sup>14</sup> This could explain the observation that the burden falls on a particular generation, because the adjustment would be appropriate for generations that were to face an equally tenuous energy intake. However, it would be inappropriate for a generation that was not going to suffer occasional episodes of negative energy balance. Once energy intake had been assured, the early developmental adjustment of homeostasis would not be activated. This hypothesis is consistent with less severe levels of episodic food shortage, such as may occur in agrarian societies, but all theories about the underlying aetiology remain a matter of speculation at this stage.

### **Visceral obesity in the Asia-Pacific region: special considerations**

In view of the pivotal role that visceral obesity plays in the Asia-Pacific region, there is an obvious need for attention to appropriate nutrition, with particular emphasis on the avoidance of excessive energy intake. This must be accompanied by measures to preserve physical activity in the face of increasing levels of automation. Appropriate strategies, which highlight the role of Food Based Dietary Guidelines, are dealt with in the summary. They need to be supported by other risk factor strategies that also have an impact on visceral obesity and its metabolic consequences. Some major risk factors may require special attention in the Asia-Pacific setting.

An example is provided by smoking, which is very prevalent in male CHD patients, particularly in Japan, Korea, Taiwan, Singapore and Malaysia, all of which have smoking rates over 50%.<sup>15</sup> It might be argued that a reduction in smoking could exacerbate visceral obesity. There is evidence to the contrary,<sup>16</sup> but even if this was not the case, the quantitative importance of smoking as a risk factor could not be overlooked. Smoking may also indirectly affect other nutritional issues. If intrauterine development is a risk factor for visceral obesity and insulin resistance, the avoidance of smoking in women during gestation must be emphasised. The provision of adequate nutrition during conception, gestation and lactation, which is desirable from many other points of view, also becomes an issue in cardiovascular prevention. Another nutritional issue worthy of special consideration is the use of alcohol. The favourable effects of alcohol on the lipoprotein profile are well recognized, and they remain evident in studies from the region.<sup>17</sup> Nevertheless, the energy content of alcohol may pose a problem in individuals who are at risk of visceral obesity.

### **Conclusions**

The Asia-Pacific region may not have the greatest severity or the highest incidence of visceral obesity by international standards. Nevertheless, visceral obesity seems to play a disproportionately large role in the epidemic of CVD and type 2 diabetes currently facing this area. One of the most pressing problems will be the need to define cut-offs for visceral obesity that are appropriate for individual populations. It is highly

likely that these will vary across the region. Public health advice and intervention will need to concentrate on dietary habits and physical activity, but the risk of an increase in non-visceral obesity should not discourage vigorous efforts to minimise the alarming rates of smoking in many Asia-Pacific countries. Unfortunately, most strategies to control visceral obesity in western countries have been relatively unsuccessful. Novel approaches developed for the Asia-Pacific region may provide a better approach to this worldwide problem.

#### References

1. Molarius A, Seidell JC, Sans S, Tuomilehto J, Kuulasmaa K. Waist and hip circumferences, and waist-hip ratio in 19 Populations WHO-MONICA Project. *Int J Obes* 1999; 23: 116–125.
2. Saw SM, Rajan U. The epidemiology of obesity: a review. *Ann Acad Med Singapore* 1997; 26: 489–493.
3. Rush EC, Plank LD, Coward WA. Energy expenditure of young Polynesian and European women in New Zealand and relations to body composition. *Am J Clin Nutr* 1999; 69: 43–48.
4. Grover SA. Role of WHO-MONICA Project in unravelling of the cardiovascular puzzle. *Lancet* 2000; 355: 668–689.
5. Khor GL. Nutrition and cardiovascular disease: an Asia Pacific perspective. *Asia Pac J Clin Nutr* 1997; 6: 122–142.
6. C-E Tan, Ritchie G, Lim K, Janus E, Kusmana D, Keech A. Diabetes and obesity in CHD patients in the Asia-Pacific region: the ASPAC study. *Atherosclerosis* 2000; 151: 15.
7. Venketasubramanian N. A review of the role of stroke units in the modern day management of stroke – implications for stroke care in Singapore. *Singapore Med J* 1998; 39: 82–85.
8. Sim EK, Koo G, Adebo OA, Lim MC, Choo MH, Lee CN. Prevalence of peripheral artery disease in patients with coronary artery disease. *Ann Acad Med Singapore* 1993; 22: 898–900.
9. Bhuripanyo P, Graisopa S, Suwanwatana C, Prasertkaew S, Kiatsayompoo S, Bhuripanyo K, Wangsai W. Vascular complications in noninsulin dependent diabetes mellitus (NIDDM) in Srinaragarind Hospital, Khon Kaen. *J Med Assoc Thai* 1992; 75: 570–577.
10. Hughes K, Aw T-C, Kuperan P, Choo M. Central obesity, insulin resistance, syndrome X, lipoprotein (a) and cardiovascular risk in Indians, Malays and Chinese in Singapore. *J Epidemiol Community Health* 1997; 53: 394–399.
11. Chambers JC, Obeid OA, Refsum H, Ueland P, Hackett D, Hooper J, Turner RM, Thompson SG, Kooner JS. Plasma homocysteine concentrations and risk of coronary heart disease in UK Indian Asian and European men. *Lancet* 2000; 355: 523–527.
12. Binden JR, Baker PT. Bergmann's rule and the thrifty genotype. *Am J Phys Anthropol* 1997; 104: 201–210.
13. Paneth N, Susser M. Early origin of coronary heart disease (the 'Barker hypothesis'). *BMJ* 1995; 310: 411–412.
14. Subbiah MT, Deitemeyer D, Yunker RL. Decreased atherogenic response to dietary cholesterol in pigeons after stimulation of cholesterol catabolism in early life. *J Clin Invest* 1983; 71: 1509–1513.
15. Ritchie G, Lai M, Park Y, Tamesis B, Tan A, Carruthers A, Keech A. Prevalence of smoking in the Asia-Pacific: the ASPAC study. *Atherosclerosis* 2000; 151: 279.
16. den Tonkelaar I, Seidell JC, van Noord PA, Baanders-van Halewijn EA, Ouwehand IJ. Fat distribution in relation to age, degree of obesity, smoking habits, parity and estrogen use: a cross-sectional study in 11,825 Dutch women participating in the DOM-project. *Int J Obesity* 1990; 14: 753–761.
17. Umeda T, Kono S, Sakurai Y, Shinchi K, Imanishi K, Nishikawa H, Ogawa S, Katsurada M, Wakabayashi K, Honjo S, Todoroki I. Relationship of cigarette smoking, alcohol use, recreational exercise and obesity with serum lipid atherogenicity: a study of self-defence officials in Japan. *J Epidemiol* 1998; 8: 227–234.