Review Article

Epidemiology and health impact of obesity: an Asia Pacific perspective

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The Asia-Pacific region contributes more than half the world population and includes some of the world riches and most developed countries alongside some of the world's poorest and least developed countries. Despite persisting levels of underweight in some countries, overweight and obesity have become a major public health concern for almost the entire region. Official levels of obesity ranges from over 80% of the entire adult population of some Pacific nations to less than 3% in the Philippines. There remains much debate about the most appropriate BMI cut points to define the overweight and obesity in Asian populations and thus the true levels of obesity are likely to higher in most Asian countries. The causes of this rapid increase in overweight within the region are likely to be complex. However, rapid development leading to a shift away from traditional diets to an eating pattern containing more high fat, high energy foods and drinks together with a significant reduction in physical activity through shifts in occupational and recreational patterns is likely to be major contributors to the problem. This weight gain has been associated with an epidemic of chronic diseases such diabetes, cardiovascular disease and cancers which is threatening to overwhelm the health care systems of less developed countries and results in an enormous, health, social and economic burden to the region.

Keywords: obesity, waist circumference, chronic disease, epidemiology, diabetes, cardiovascular disease, cancer, Asia Pacific

Introduction

The Asia-Pacific region covers a large proportion of the area of the world and contributes nearly half of the global population. However, it is a region of extremes containing the some of the world's largest and most populous nations (China, India, Indonesia) in addition to the smallest and least populous nations (Tuvalu, Nauru); it contains some of the world wealthiest and most developed nations (Japan, Korea, Australia) alongside some of the poorest and least developed nations (East Timor, Bangladesh, Kiribati, Laos). Until recently the major nutrition-related issue of concern to most of the region was under-nutrition and its associated infectious diseases. However, in recent decades there has been a rapid increase in the mean weight of the population to the point where overweight and obesity and their associated illnesses now dominate the health agenda of the region and cardiovascular diseases are now the most common cause of mortality.[1]

This rapid increase in the level of overweight and obesity throughout the region is associated with a significant health, social and economic burden that threatens to erode the health and social advances achieved over the last two to three decades in the region. As such it provides an enormous challenge to all countries to develop and implement effective obesity prevention and management strategies to address this problem.

What is overweight and obesity?

At the physiological level, obesity can be defined as a condition of 'abnormal or excessive fat accumulation in adipose tissue to the extent that health may be impaired'.[2] However, it is difficult to measure body fat directly and so surrogate measures such as the Body Mass Index (BMI) are commonly used to indicate overweight and obesity in adults. The Body Mass Index (BMI) provides the most useful and practical population-level indicator of overweight and obesity in adults. It is calculated by dividing body-weight in kilograms by the square of height in metres (BMI = kg/m^2). Both height and weight are routinely collected in clinical and population health surveys.

In the graded classification system developed by the World Health Organization (WHO), a BMI of $30kg/m^2$ or above denotes obesity (Table 1).[2] There is a high likelihood that individuals with a BMI at or above this level will have excessive body fat. However, the health risks associated with overweight and obesity appear to rise progressively with increasing BMI from a value below 25 kg/m^2, and it has been demonstrated that there are benefits to having a measurement nearer 20-22 kg/m^2, at least within industrialised countries. To highlight the health risks that can exist at BMI values below the level of obesity, and to raise awareness of the need to prevent further weight gain beyond this level, the first category of

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Table 1. Classification of overweight in adults according to BMI[2]

Classification	BMI (kg/m^2)	Risk of co-morbidities
Underweight	<18.5	Low (but risk of other clinical problems increased)
Normal range	18.5-24.9	Average
Overweight	≥ 25.0	
Pre-obese	25.0-29.9	Increased
Obese class I	30.0-34.9	Moderate
Obese class II	35.0-39.9	Severe
Obese class III	≥40.0	Very severe

overweight included in the new WHO classification system is termed 'pre-obese' (BMI 25-29.9 kg/m^2). For some it has been recognised that it is not only the total amount of fat but where that fat is stored which dictates the level of health risk associated with excessive weight. It is now known that changes in intra-abdominal or 'central' fat accumulation, reflect changes in risk factors for cardiovascular disease and other forms of chronic illness and therefore an assessment of central fat accumulation greatly assist in defining obesity. Some experts believe that a health risk classification based on waist circumference alone is more suitable as a health promotion tool than either BMI or waist:hip ratio, alone or in combination.[3] Recent work from the Netherlands has indicated that a waist circumference greater than 102cm in men, and greater than 88cm in women, is associated with a substantially increased risk of obesity-related metabolic complications (Table 2). The level of health risk associated with a particular waist circumference or waist-hip ratio may vary across populations.[2]

Table 2. Interim waist circumference cut-points[4]

	Risk of obesity-associated metabolic complications	
	Increased	Substantially increased
Men	≥ 94 cm (~37 inches)	≥ 102 cm (~40 inches)
Women	≥ 80 cm (~ 32 inches)	≥ 88 cm (~35 inches)

Source: WHO 2000[2]

Defining overweight and obesity in children is complicated by the fact that height is still increasing and body composition changes over time. A variety of methods have been used to define overweight and obesity in children and adolescents and comparison of surveys of weight status in children and adolescents is beset by the lack of comparability between methods and reference standards for defining overweight and obesity. There are currently a wide variety of approaches in use and there is little consistency in approach to defining childhood obesity throughout the region. Often separate studies from within the same country apply different standards to define overweight or obesity. In recent times, a range of expert bodies have identified body mass index (BMI)-for-age, as the most appropriate measurement of adiposity in children.[4-6] Many countries now use the BMI percentile charts produced in the US by the CDC (REF) or the International BMI for age cut-points proposed by Cole and others.[8]

The health, social and economic costs associated with overweight and obesity

There is a wealth of evidence to show that the relationship between excess weight and risk of ill health is strong and consistent and begins at relatively low levels of BMI. Indeed, as a person's BMI creeps up through overweight into the obese category and beyond, the risk of developing a number of chronic non-communicable diseases such as NIDDM, CHD, gallbladder disease, and certain types of cancer increases rapidly.[2] There is also a graded increase in relative risk of premature death although this relationship only become pronounced in persons with a BMI greater than 30kg/m^2.[9] Before life-threatening chronic disease develops, however, many overweight and obese patients develop at least one of a range of debilitating conditions which can drastically reduce quality of life. These include musculo-skeletal disorders, respiratory difficulties, skin problems and infertility which are often costly in terms of absence from work and use of health resources. Table 3 lists the health problems that are most commonly associated with overweight and obesity. In developed countries, excessive body weight is also frequently associated with psycho-social problems.

The risk of developing metabolic complications is exaggerated in people who have central obesity. This is related to a number of structural differences between intra-abdominal and subcutaneous adipose tissues which makes the former more metabolically active and more susceptible to both hormonal stimulation and changes in lipid metabolism.[10] People of Asian descent who live in urban societies are particularly susceptible to central obesity and tend to develop NIDDM and CHD at lower levels of overweight than other populations.[11]

Obesity also places enormous financial burdens on governments and individuals, and represents one of the largest costs in national health care budgets, accounting for up to 6% of total expenditure in some developed countries.[12] In the USA in 1995, for example, the overall direct costs (hospitalisations, outpatients, medications and allied health professionals' costs) were approximately the same as those for diabetes, 1.25 times greater than those for CHD, and 2.7 times greater than those for hypertension.[13] Obesity is fast approaching cigarette smoking

Table 3. Relative risk of health problems associated with obesity

Greatly Increased *(Relative Risk >3)*	Moderately increased *(Relative Risk 2-3)*	Slightly increased *(Relative risk 1-2)*
NIDDM	Coronary heart disease	Certain cancers (post-menopausal breast cancer, colon cancer)
Hypertension	Gallbladder disease	Reproductive hormone abnormalities
Sleep apnoea	Osteoarthritis (knees)	Polycystic ovary syndrome
Insulin resistance	Hyperuricaemia and gout	Impaired fertility
Breathlessness	Dyslipidaemia	Low back pain due to obesity
	Endometrial cancer	Increased anaesthetic risk
		Foetal defects associated with maternal obesity

Source: adapted from WHO 2000[2]

as the major preventable cause of mortality in the USA.[14] The costs associated with pre-obesity [BMI 25-30 kg/m^2] are also substantial because of the large proportion of individuals involved. The economic impact of overweight and obesity does not only relate to the direct cost of treatment in the formal health care system. It is also important to consider the cost to the individual in terms of ill health and reduced quality of life (intangible costs), and the cost to the rest of society in terms of lost productivity due to sick-leave and premature disability pensions (indirect costs). Overweight and obesity are responsible for a considerable proportion of both.[12] Estimates of the economic impact of overweight and obesity in less developed countries are not available. However, the relative costs of treatment if available are likely to exceed those in more affluent countries for a number of reasons. These include the accompanying rise in coronary heart disease and other non-communicable diseases, the need to import expensive technology with scarce foreign exchange, and the need to provide specialist training for health professionals. As many countries are still struggling with under-nutrition and infectious disease, the escalation of obesity and related health problems creates a double economic burden.

Ethnic variations in the association between adiposity and health

A number of studies have compared the relationship between increasing BMI or waist circumference and risk of ill health in populations of Asian or Caucasian origin and reached a conclusion that Asian populations appear to be especially susceptible to the development of obesity-related illness, even at low levels of BMI.[15,16] In addition the health consequences of weight gain appear to be more intense than in those of European origin. The exact reasons for these variations in the relationship between BMI and health risk remain unclear[17] but it is widely accepted that Asians have a higher level of body fat at any given level of BMI when compared to Europeans and that Asians are more likely to store fat centrally.[18] A meta-analysis among different ethnic groups showed that for the same level of body fat, age and gender, American Blacks have a 1.3 kg/m^2 higher BMI and Polynesians have a 4.5 kg/m^2 higher BMI compared to Caucasians. By contrast, BMIs in Chinese, Ethiopians, Indonesians and Thais were shown to be 1.9, 4.6, 3.2 and 2.9 lower than in Caucasians.[19]

A recent study by Bell *et al*.,[20] analysed cross sectional data within adults aged 35-65 years from China, the Philippines and the USA and found variations in the relationship between BMI and blood pressure in different ethnic groups. They found that as BMI increased, the risk of hypertension increased for each ethnic group. However at BMI levels below 25 kg/m^2 the relationship between BMI and hypertension was significantly stronger among Chinese adults compared to Mexican Americans, non Hispanic whites and blacks. Ramachandran *et al.,*[21] used epidemiological data from an Indian population from Madras from Mexican Americans and non-Hispanic Whites to examine the relationship between anthropometric measurements and the prevalence of Type 2 diabetes in these ethnic groups. They found that although white Americans had the highest rates of obesity they had the lowest levels of diabetes. The Madras Indians and Mexican Americans had equivalent rates of diabetes occurring at much lower levels of BMI among the Asian subjects. In addition a recent study by Shiwaku *et al.,*[22] compared metabolic risk factors in Japanese men and women to a matched group of Mongolians. They found that the Mongolians had a higher prevalence of obesity and a higher body fat percent, but a weaker relationship between BMI and dyslipidaemia, than did the BMI-matched Japanese.

These variations in the association between BMI and fatness and between BMI and risk of chronic disease within the Asia-pacific region have lead to a call for population-specific BMI cut-off points for obesity to be developed.[23] Interim cut points which defined obesity at lower BMI levels in Asians and higher BMI levels in Pacific Islanders were proposed at a forum set up to address this issue in 1999.[24] These proposed cut-points were taken up by a number of countries throughout the region and other countries whilst other countries such as China and Japan determined their own national BMI cut-points.[25] In addition, the International Diabetes Federation proposed a series of ethnic-specific waist circumference cut-points to define abdominal obesity in their proposed definition of the metabolic syndrome.[26] An expert committee of the World Health Organization examined the issue in 2003 and concluded that there is strong evidence that the proportion of Asian people with a high risk of type 2 diabetes and cardiovascular disease is substantial at BMIs lower than the existing WHO cut-off point for overweight (25 kg/m2). However, it did not recommend

redefining the existing BMI cut-points for different ethnic groups as the available data did not indicate clear BMI cut-off points suitable for defining overweight or obesity in all Asians.[27] Instead they indicated that the cut-off point at which risk of ill health begins to rise varies from 22 kg/m2 to 25 kg/m2 in different Asian populations and the point defining high risk varies from 26 kg/m2 to 31 kg/m2 (Fig. 1).

Current rates of overweight and obesity in the Asia-Pacific region

Adults

The World Health Organization estimates that around one billion people throughout the world are overweight and that over 300 million of these are obese.[28] It is predicted that if current trends continue, that number of overweight persons will increase to 1.5 billion by 2015. Unfortunately there is not comprehensive data on the weight status of all countries within the Asia-Pacific region and where data is available the quality can be variable. Not all countries undertake national surveys that measure weight and height and even if this is undertaken, the data is not always reported in a format consistent with the WHO BMI cut-points. However, there are sufficient nationally representative studies to provide a reliable guide to the true levels of overweight and obesity within the region. Despite indications that ethnic-specific BMI cut-points may be warranted, data presented here is discussed in terms of the general WHO classification system for overweight and obesity.

Data on heights and weights is collected irregularly in Australia. The 1999/2000 AUSDiab study indicate that 19.1% of Australian men and 20.1% of women were obese and over half of all adult females and 60% of all adult males were classified as overweight.[29] The age-adjusted rates of obesity have risen 2.5 fold since 1980 for both men and women (Table 4). The study measured waist circumference and using a cut point of 94cm for males and 80cm for females found that over a half of all Australian adults could be classified as abdominal overweight or obese. Although young women had lower rates of abdominal overweight, by the age of 45 years women had reached a rate equivalent to males, which contradicts the belief that abdominal obesity is largely a male concern (Table 5). New Zealand also reported similar levels of overweight and obesity from its 2003 National Health Survey where 19.2% of men and 21.0% of women were defined as obese and a further 40.5% of men and 27.5% of women were classified overweight but not obese.[30]

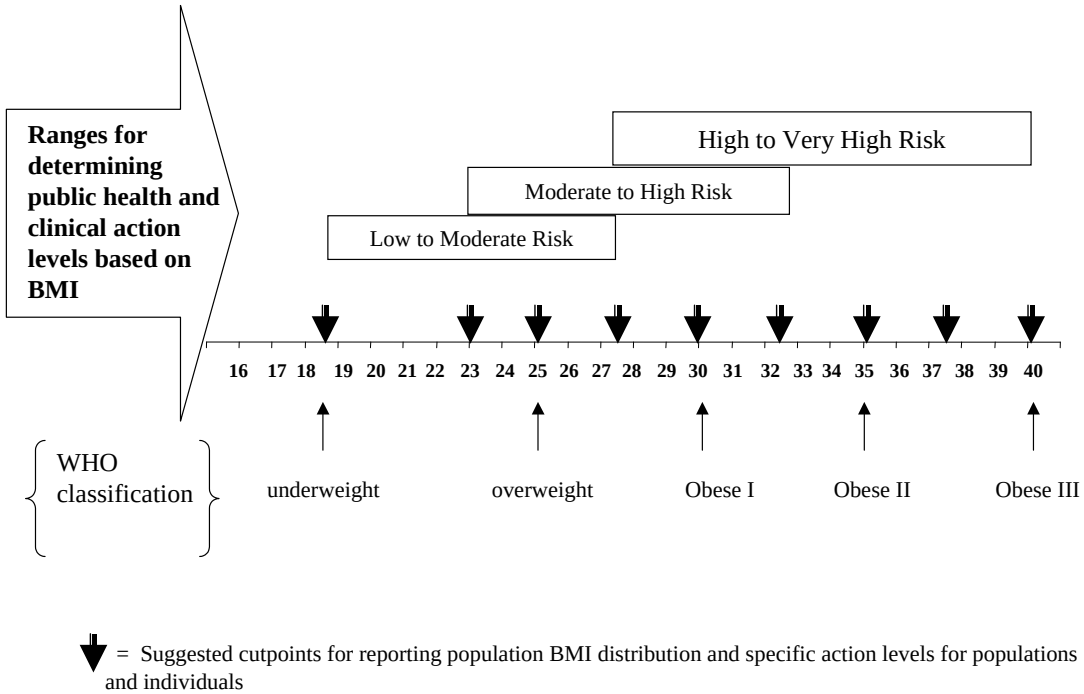


Figure 1. WHO Body Mass Index cut points for public health action[27]

Table 4. Trends in age-standardised prevalence (%) of obesity in Australia, 1980-2000[29]

Gender	1980	1989	1995	2000
Males	7.2	9.3	17.6	17.1
Females	7.0	11.1	16.1	18.9

Table 5. Age specific prevalence (%) of abdominal overweight in Australia as defined by excess waist circumference

	25-34	35-44	45-54	55-64	65-74	75+	Total
Males	40.1	51.3	58.3	66.6	71.2	64.8	55.2
Females	36.6	46.9	59.1	72.7	79.7	67.5	56.5
Persons	38.4	49.1	58.7	69.6	75.9	66.3	55.9

Waist circumference males>94cm; females >80cm; Source: AusDiab Study Report, 2001[29]

All countries within Asia, where national rates of overweight and obesity have been reported, show levels well below that of Australia and New Zealand (Table 6) rates but most countries have also demonstrated rapid increases in recent years. In the Phillippines the 1998 National Nutrition Survey showed that only 17% of men and 23% of women were overweight or obese, with obesity rates very low. However, these figures were an increase from the same national survey 5 years pre-viously.[37] Both Japan and Korea reported very low obesity rates, but the levels of overweight were well above 20% for both males and females. In Japan the rates of overweight and obesity have increased steadily among males and older women over the past three decades, but mean BMI and level of overweight has actually decreased among younger Japanese females.[34] This is one of the few examples of a reduction in rates of overweight throughout the globe and a contributory factor is likely to be the extreme social pressure in young women in Japan to be thin.[40] The rates of overweight and obesity for Taiwanese men are similar to those of mainland China but women in Taiwan tended to be heavier. In contrast substantially more men and women from Hong Kong were overweight. The rate of increase in overweight and obesity in mainland China has been alarming, jumping from 14.6 to 21.8 between 1992 and 2002.[41] The ethnically diverse countries of Singapore and Malaysia had the highest levels of overweight and obesity within the region. Surveys of ethnic variation within both countries showed that subjects of Malay ethnic origin had significantly higher body weights than those of Chinese or Indian background. Comparisons of the weight status of urban and rural populations consistently reveal significantly lower levels of overweight and obesity in rural areas.

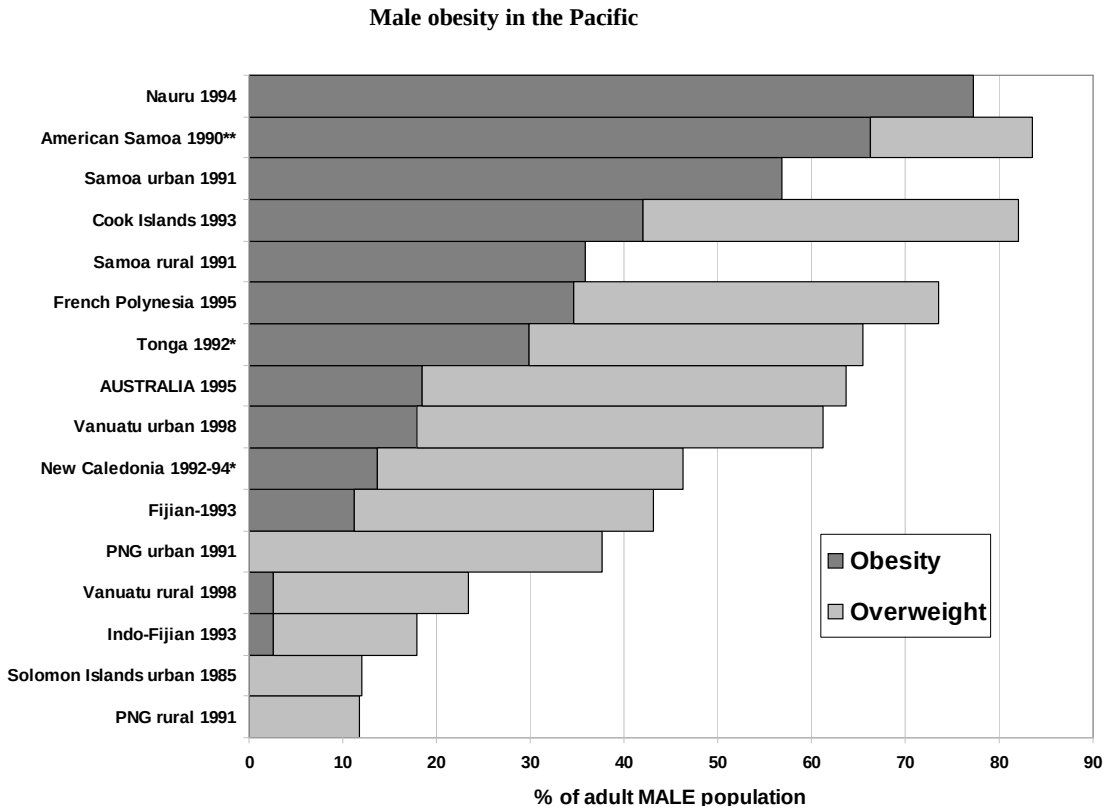
In contrast to Asia, populations from the Pacific Islands report some of the largest rates of obesity in the world. Although good quality data have not been collected in all countries, available information indicates that obesity is a serious problem in nearly all Pacific islands and states. The results of the most recent surveys were collected by the Secretariat of Pacific Communities in 2000[42] and are presented in Figure 2a for males and Figure 2b for females. Obesity rates range from a low of around 2% of the adult population in highland Papua New Guinea to between 60 and 80% obesity in Tonga, Samoa and Nauru. These rates of obesity greatly exceed the levels found in the rest of the region and are several time higher than those found in the United States of America.

Children

Regardless of how it is defined, the rate of increase in levels of childhood overweight and obesity throughout the region is cause for concern. In 1995 around one in five school children in Australia were overweight or obese which is double the level found in 1985.[43] More recent smaller studies from defined geographical regions in Australia suggest that the children's weight status continues to rise dramatically and has now reached the point where almost one in three school aged children is overweight or obese.[44] Similar levels are found in New Zealand where the 2002 Children's Nutrition Survey showed that about one third of children between 5-14 years were overweight (21 percent) or obese (10 percent) (New Zealand MOH, 2003) although figures were higher in Maori and Pacific adolescents. A range of studies evaluating children's weight status in Asia are presented in Table 7 where it can seen that the levels of childhood overweight and obesity in some Asian populations have already reached levels found in "western" nations such as

Table 6. Obesity rates in Asian adults

				Men		Women	
Country	Source	Year	Age	BMI 25-29.9	BMI>=30	BMI 25-29.9	BMI>=30
Australia	29	2000	25+	48.3%	19.1%	30.2%	21.8%
New Zealand	30	2002/03	15+	40.5	19.2	27.5	21.0
Taiwan	31	1993-96	19+	22.3	2.3	19.9	5.6
China	32	1995-97	20-74	21.3	2.1	21.7	3.7
Hong Kong	33	1997	18+	28.3	2.5	23.5	3.8
Japan	34	2000	35-64	23.9	2.9	17.4	3.3
Korea	35	1998	19+	24.3	1.7	23.5	3.0
Malaysia	36	1996	18+	20.1	4.0	20.4	7.6
Philippines	37	1998	20+	14.9	2.1	18.9	4.4
Singapore	38	1998	18-69	28.6	5.3	20.3	6.7
Thailand	39	1997	20+	19.2	3.5	33.9	8.8



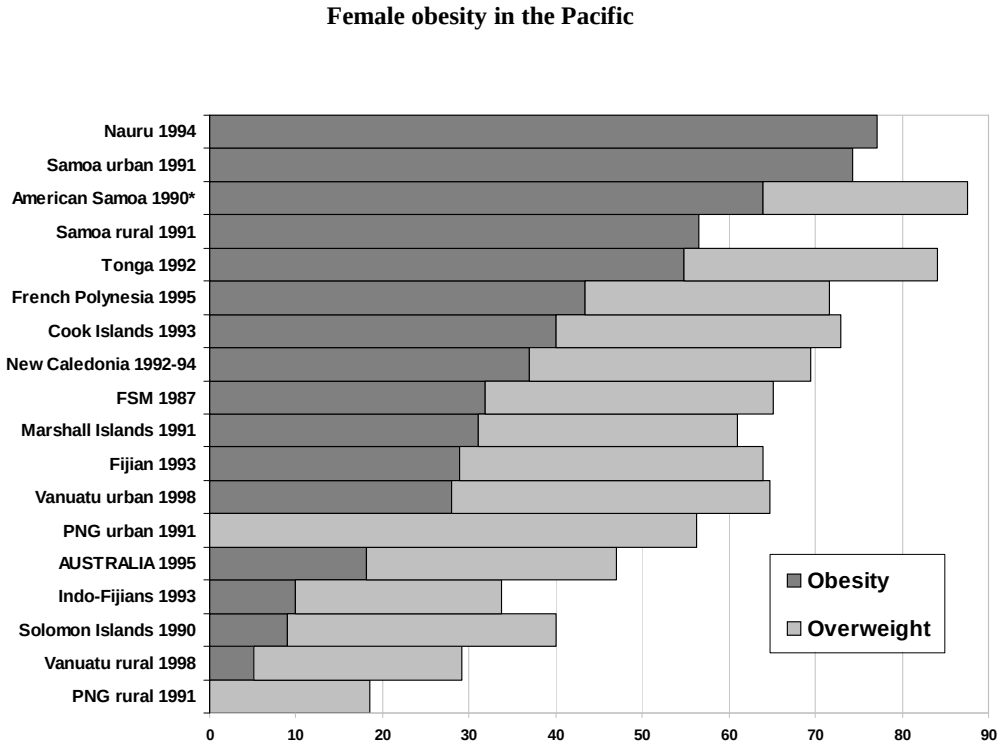


Figure 2a. Male obesity in the Pacific (top)[42] **Figure 2b.** Female obesity in the Pacific (bottom)[42]

Europe and the USA. However, care must be taken when comparing these results as they often apply different criteria to define overweight and obesity in children or have samples drawn from differing age ranges. Taking into consideration these limitations, it can be seen that the prevalence of overweight varied from 0.9% in Philippines[48] to around 25% in Taiwan[51] (Table 7).

In addition, the prevalence of obesity was reported to be around 5% in Australia on the basis of the definition by Cole *et al*.,[8] and as high as 11-16% in Taiwan using a criteria of >120% of ideal body weight. In most countries including South Korea, Malaysia, China, Taiwan and Hong Kong obesity rates were greater in males than in females. Generally rates of childhood obesity were

greater in urban compared to rural areas and greater in countries of greatest economic development. A study of Saraburi Province in Thailand in 2000 found that obesity rates among Kindergarten children were 22.7% in urban areas and 7.4% in rural areas.[53] Even countries just beginning the process of economic transition such as Indonesia have not escaped this problem. A study of pre-school children from high income families in Jakarta found that 16.1% of children were obese.[54]

The rate of increase in levels of childhood overweight in Asia has been rapid. In Thailand, the prevalence of obesity in 6 to 12 year old children rose from 12.2% in 1991 to 15.6% in 1993. In Japan, the percentage of obese children aged 6-14 years increased from 6.1% in boys and 7.1% in girls in the time-period 1976 to 1980, to 11.1% and 10.2% in 1996 to 2000.[52] Surprisingly, the increase was more pronounced in smaller towns than in large metropolitan areas. In contrast very rapid increases in childhood overweight and obesity have occurred in urban areas of China. Four large cross-sectional studies were used to analyse the time trends in obesity in Chinese children aged 2-6 years between 1989 and 1997. Whilst overall rates of obesity increased from 2.4% in 1989 to 6.4% in 1997, the rates of obesity in urban children increased from 1.5% to 12.6% and prevalence of overweight increased from 14.6 to 28.9% during the same period.[55]

Although the epidemic of obesity seems to have affected a wide range of countries, under nutrition is still a problem in some countries in the area. In Philippines, for example, among 6-10 year-old children, 41% were classified as stunted on the basis of height-for-age and 30% were found to be underweight on the basis of weight-for-age.[48] In China, the proportion of underweight was 9% among children aged 6-9 years and 15% among adolescents aged 10-18 years.[45] There is limited information about children's weight status in the Pacific. Surveys examining children's growth have revealed that between 2-23% children under 5 years in certain Pacific communities may have mild to moderate under-nutrition. Similar studies have also indicated that between 2-30% of children surveyed could be considered overweight or obese.[56] A recent study of Tongan schoolchildren showed that rates of obesity were relatively low (2.1-3.8%) in males aged 5-19 years. However, the rates reached 19.4% for urban teenage (12-19 year old) females.[57]

Factors contributing to the development of obesity in Asia-Pacific

Weight gain and obesity develop when the energy intake from food and drink exceeds energy expenditure from physical activity and other metabolic processes. Many analyses have attempted to define the key determinants of obesity and there remains a degree of controversy over which factors have made the greatest contribution to the recent rise in the rates of obesity. Research has consistently shown that numerous and diverse factors, including environmental and social factors, influence behaviours that in turn can lead to excessive weight gain. As the environments become more 'obesogenic' (obesity-promoting), the behaviours that lead to obesity are increasingly the default or automatic ones.[58] Although, the specific factors driving weight gain in Asia-Pacific are likely to be country-or regional-specific, an international review of the factors associated with population weight gain was undertaken by WHO as part of the 'Expert Report on Diet, Nutrition and the Prevention of Chronic Disease'[59] This review identified several key dietary, activity and societal issues associated with weight gain which are presented in Table 8.

A number of researchers have identified the rapid changes in lifestyle that have accompanied economic transition in recent years and suggested they represent the most likely cause for the increase in population weight in Asia. Modernisation and open trade markets have resulted in profound changes to the diets and levels of

Table 7. The prevalence of childhood overweight and obesity from selected studies within Asia

Country	Prevalence of combined Overweight And obesity	Age range	Sample size	Definition used	Date and Data source	Source
Australia	M –19.5% F- 21.1%	2-18 y	2962	IOTF	National Nutrition Survey 1995 2-18 yr	43
China	M- 8.4% F- 7.0%	6-18 y	2688	IOTF	The 1997 China Health and Nutrition Survey	45
Hong Kong	M-13.4% F-10.5%		25,000	>120% of median weight for height	1996 Survey of schools	46
Malaysia	M-10.9% F-8.0%	7-16 y	6239	NCHS >+2 SD	1994/95 Multi-ethnic study of children from 22 schools in KL	47
Philippines	M-1.1% F-0.8%	0-5 y 6-10 y		NCHS >+2 SD	1998 National survey	48
South Korea	M-15.1% F-10.2%	<20 y	2,163	>=120% IBW	2001 NHANES study. Representative national data	49
Thailand	M- 17.5% F- 17.7%	0-5 y		0-5y % W/H > 120%, 6-14y BMI for age (above 95 %)	1995 National nutrition survey Thai growth reference	50
	M- 9.2% F- 10.8%	6-14 y				
Taiwan	M-26.8% F- 16.5%	6-18 y	13,935	85th and 95th percentile of reference growth percentiles	2001 National Childhood fitness study	51
Japan	M- 11.1% F- 10.2%	6-14 y	57,000		1996-2000 national Nutrition Survey, Nation-wide	52

Table 8. Summary of the strengths of evidence on factors that might promote or protect against weight gain and obesity

Evidence	Decreases risk	Increases risk
Convincing	Regular physical activity High dietary fibre intake	High intake of energy-dense foods* Sedentary lifestyles
Probable	Home and school environment that supports health food choices for children Promoting linear growth	Heavy marketing of energy dense foods and fast foods outlets Adverse social and economic conditions in developed countries (especially for women) Sugar-sweetened soft drinks and juices
Possible	Low glycaemic index foods Breastfeeding	Large portion sizes High proportion of food prepared outside of homes Rigid restraint/periodic disinhibition eating patterns
Insufficient	Increased eating frequency	Alcohol

* energy dense foods are high in fat/sugar and energy dilute foods are high in fibre and water such as vegetables, fruits, legumes and whole grain cereals. Source: Adapted from WHO 2003[59]

physical activity throughout Asia. Families generally consume more fats and oils, more meat, more sugar and less vegetables and cereals than in the past.[60] Motorised transport has replaced bicycles and television, computers and videos are becoming the preferred leisure time activities throughout the region at the expense of more active pursuits.[61]

In addition, the shift away from traditional subsistence lifestyles has resulted in many changes that have contributed to increasing fatness in the Pacific nations. Traditional foods of past generations such as fresh fish, meat, and local fruits and vegetables have been replaced by rice, sugar, flour, canned meats, canned fruits and vegetables, soft drinks and beer.[62] Many Pacific Islanders have come to depend on food imported from abroad.[63] In addition, the increasing use of modern technology and the shift from agriculture-based occupations to civil servant office work has resulted in a sharp decrease in the day-to-day physical activity of many Pacific Islanders.[64]

Rates of obesity-related chronic disease in the Asia-Pacific region

The rapid increase in the mean population BMI and the level of obesity in Asia-pacific has been accompanied by an equally dramatic increase in the rates of weight-related chronic diseases. The levels of coronary heart disease, diabetes, stroke and certain cancers has been rising steadily throughout the Asia-Pacific region for the last two decades and seven out every ten deaths in the region is now attributed to non communicable diseases such as these.[1] The potential costs in terms of health and social burden of increasing weight-related disease in enormous. It has been estimated that over the next 10 years China alone will lose 558 billion USD as a result of premature deaths from heart disease, stroke and diabetes.[65]

The evidence linking increasing body weight and risk of type II diabetes in particularly strong. An analysis for the WHO Global Burden of Disease estimated that approximately 58% of diabetes mellitus globally can be

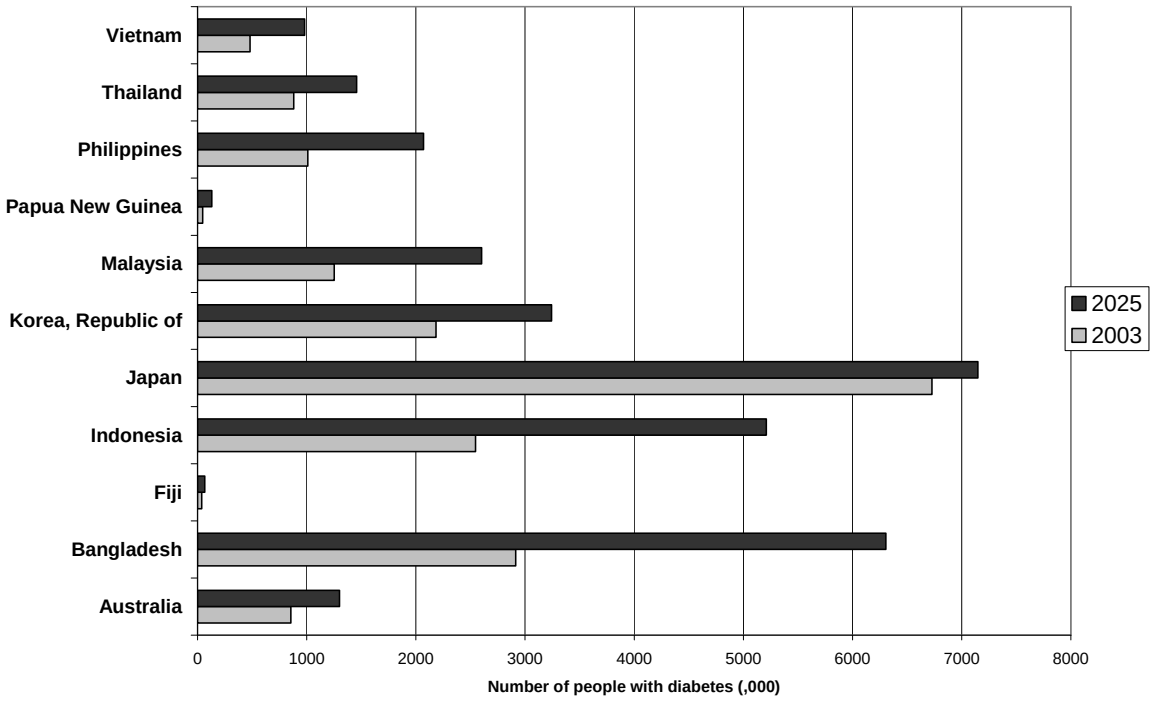


Figure 3. Estimated increases in prevalence of diabetes in selected countries, 2003 - 2025[68]

attributed to weight gain.[66] However this figure ranges from around 30% in some developing countries up to 90% of type 2 diabetes cases in the most developed countries. Asia already accounts for a sizeable proportion of the world's population with diabetes and the number of people with diabetes is expected to treble by the year 2030.[67] The International Diabetes Federation estimates that 89 million Asian people have diabetes and four of the five biggest diabetic populations are in Asian countries; India 32 million; China 22 million; Pakistan 9 million; and Japan 7 million diabetics. (IDF, 2003). Between 1996 and 2002 prevalence of diabetes in the larger cities of China increased from 4.6% to 6.4%; a 40% increase over a period of just 6 years.[1] The World health Organization estimates that these rates of diabetes in Asia will almost double by 2025[69] creating 330 million new diabetics in the region and leaving an enormous health burden (Fig. 3). The island states of the Western Pacific already have the unenviable title of the highest recoded levels on type 2 diabetes in their adult population. Around one third of all adults in Nauru were diabetics in 2003[68] and Tonga, French Polynesia and Fiji also had diabetes rates in excess of 10%. In contrast, New Guinea and the Solomon Islands had rates of diabetes below 3%. The epidemic of diabetes has been identified as one of the greatest threats to the health of the Pacific region.[1]

Diabetes is usually the first indicator of a wide range of metabolic conditions associated with weight such as hypertension, coronary heart disease, stroke, kidney disease and premature death. Each year 17 million people die from stoke and coronary heart disease throughout the world and the Asia-Pacific region is thought to account for at least 50% of these deaths.[70] However, the prevalence of cardiovascular disease (CVD) varies greatly across the region with countries being divided into three bands based on their CVD mortality. Countries in the 'high mortality' category have a CVD mortality rate that exceeds 30% of deaths and include New Zealand, Australia, Singapore, some Pacific Islands and urban areas of China. The 'intermediate mortality' category with 20-30% of total deaths from CVD consists of rural China, Hong Kong, Japan, Korea and Malaysia. The 'low mortality' category of countries including Thailand, the Philippines and Indonesia have less than 20% of total deaths from CVD.[71] Although the major contributor to CVD mortality is throughout the region is coronary heart disease, deaths from cerebrovascular disease (strokes) dominate in Japan, Korea and China.[71] However, the patterns of CVD deaths in Asia-Pacific are changing. Whilst some CVD rates in some countries such as Australia and Japan appear to have declined in recent decades, they continue to increase in other countries such as mainland China (despite small improvements in large cities), Malaysia, Singapore, Korea and Taiwan. In China, the prevalence of hypertension increased from 14.4% in 1991 to 18.8% in 2002 and the prevalence of CVD increased from 31.4 to 50.0% and CVD mortality from 27 to 32% of all deaths over a similar period.[41] A large regional study involving eight countries across the region identified increasing BMI as one of the major drivers of these increases.[72]

Cancers are an emerging health concerns within Asia-Pacific and already account for a significant proportion of early death and morbidity in the region. The incidence of cancer and its contribution to overall mortality vary greatly from over one third of all deaths in Australia to less than 3% of deaths in Indonesia.[73] Weight gain has long been associated with increased risk of sex hormone-dependent cancers such as breast cancer but recent research has concluded that a wide range of cancers including colon, breast (postmenopausal), endometrium, kidney, and esophageus are associated with obesity.[74] Some studies have also reported links between obesity and cancers of the gallbladder, ovaries, and pancreas. Cancer is increasing throughout the Asia-Pacific region and changing patterns of cancer incidence reflects increasing rates of overweight, obesity and physical inactivity. Overall, cancers of the lung, breast, bowel, stomach and prostate account for almost half of all cancer diagnosed worldwide.[75] Although cancer data from Asia-Pacific is limited, there are clear variations in the major types of cancers within the region which are associated with the level of development. In the South Asia and more rural areas of East Asia, the major cancers are those associated with poor hygiene such as stomach and cervical as well as lung cancer. In more developed areas of the region the predominate cancers and those rising most rapidly include the obesity-related cancers such as cancers of the breast, colon and liver as well as lung cancer.[76] A recent study by Kuriyama and others[77] found that overweight and obesity could account for 4.5% (all subjects) or 6.2% (never-smokers) of the risk of any cancer in Japanese women and -0.2% (all subjects) or 3.7% (never-smokers) in Japanese men. Although the incidence of obesity-related cancers is lower in Japan (especially among men) than in countries with higher levels of obesity, the proportion of cancer incidence attributable to weight is similar to studies of USA women (3.2%)[78] and Spanish women (8.8%).[79] The figure is likely to higher in Australia where more than 25 per cent of cancer cases and more than 7600 cancer deaths each year are attributed to overweight and obesity, physical inactivity, poor diet and drinking alcohol.[80]

Conclusion

The average weight of the population together with the level of people currently classified as overweight or obese in the Asia-pacific region has been rising rapidly in recent decades. The Pacific Island nations have some of the highest reported levels of obesity in the world and Australia and New Zealand have rates of obesity that are comparable to most rich nations including the USA. Although the officially recorded rates of obesity, as defined by the WHO criteria, remain low within Asia there is consensus that the true level of overweight is much higher than reflected by these figures. Some Asian countries have defined their own BMI cut-points for obesity and when applied, these reveal that overweight and obesity affects around one third to one half of the population. The speed and rate of weight gain within the region is a cause of great concern. Already overweight and obesity is associated with a significant, social, health and economic burden in the region and unless action is taken to

address the problem continued increases in the level of weight related chronic disease such as diabetes, CVD and cancers will overwhelm the health care systems and threaten further social and economic advances within Asia-Pacific.

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Review Article

Epidemiology and health impact of obesity: an Asia Pacific perspective

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肥胖的流行病學與健康衝擊：一個亞洲太平洋觀點

亞洲太平洋地區的人口佔全球一半以上，包括世界上富裕而且最先進的國家，但同時也有世界上最窮極最少開發的國家。儘管有些國家的人民仍持續體重不足，但過重及肥胖幾乎已變成整個亞太地區主要的公共衛生議題。依照官方▪法，此區的成人肥胖程度從小於3%的菲律賓到大於80%的一些太平洋國家都有。亞洲國家目前對於定義過重及肥胖的理想BMI切點仍持續爭議中，因此，大部分亞洲國家的實際肥胖程度可能更高。而造成此地區過重者快速增加的成因可能很複雜。然而，快速發展造成飲食型態由傳統飲食轉變為高油、高熱量食物及飲料，伴隨著職業及休閒模式改變所造成的體能活動顯著減少可能是主因。這樣的體重增加可能與慢性病，例如糖尿病、心血管疾病及癌症有關。而這些疾病正壓迫亞太地區一些已開發國家的健康照護系統並造成龐大的健康及社會經濟負擔。

關鍵詞：肥胖、腰圍、慢性病、流行病學、糖尿病、心血管疾病、癌症、亞洲太平洋