

The emerging epidemic of obesity in developing countries

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Thirty years ago international nutritionists were focussing on childhood malnutrition, the 'protein gap' and how to feed the world's burgeoning population, and medical services in the developing world were concentrated on the fight against infectious diseases. Today the World Health Organization (WHO) finds itself needing to deal with the new pandemic of obesity and its accompanying non-communicable diseases (NCDs) while the challenge of childhood malnutrition has far from disappeared, TB and malaria rates are escalating, and the scourge of AIDS has emerged. This has created a 'double burden' of disease that threatens to overwhelm the health services of many resource-poor countries. WHO warns that the greater future burden of obesity and diabetes will affect developing countries, and the projected numbers of new cases of diabetes run into the hundreds of millions within the next 2 decades. The obesity pandemic originated in the US and crossed to Europe and the world's other rich nations before, remarkably, it penetrated even the world's poorest countries especially in their urban areas. The pandemic is transmitted through the vectors of subsidized agriculture and multinational companies providing cheap, highly refined fats, oils, and carbohydrates, labour-saving mechanized devices, affordable motorized transport, and the seductions of sedentary pastimes such as television. This paper briefly reviews these macro-environmental trends as well as considering some of the socio-behavioural influences on weight gain in traditional societies. It concludes, pessimistically, that the pandemic will continue to spread for the foreseeable future, and that, apart from educational campaigns, the governments and health services of poor countries will have few effective public health levers with which they can try to arrest the trend.

Introduction

The WHO Expert Consultation on Obesity held in 1997 warned of an escalating epidemic of obesity that would put the populations of most countries at risk of developing non-communicable diseases (NCDs).¹ The prevalence statistics on obesity have escalated rapidly since that date in almost all countries, and these country-specific trends are now coalescing to create a true pandemic. Most remarkably this pandemic is penetrating the poorest nations in the world—first amongst the urban middle-aged adults, but increasingly affecting semi-urban and rural areas, and younger age groups. Much has been written about these trends,^{2,3} their causes,^{4–6} and the possible public health measures and social engineering initiatives that would be

needed to halt and then reverse the pandemic.^{7–9} This review will summarize the most salient points and use a case study of The Gambia to add more detail to the general statistics. Readers are encouraged to view the photoessay by Felicia Webb¹⁰ in conjunction with this review.

Epidemiological trends

The pandemic is growing at such a pace that prevalence statistics become rapidly outdated. In response to this challenge The Department of Nutrition for Health and Development at WHO has been working with FAO to establish a Global Database on Body Mass Index² that will shortly be launched on the WHO website (www.who.int/nut/db_bmi.htm). Table 1 lists a selection of the data that will ultimately be available for both developed and developing countries. It illustrates several well-known features of the pandemic: (i) that the highest rates of obesity are concentrated in several of the Pacific Islands with record rates in Nauru where 79% of adults were recorded as

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Table 1 Selected statistics on overweight and obesity from most recent national prevalence surveys in adults

			Overweight (% BMI > 25 kg/m ²)			Obese (% BMI > 30 kg/m ²)		
Country	Survey date	Age range	Male	Female	Both	Male	Female	Both
Europe								
Germany	1998	18–79	67	54	60	19	22	21
Ireland	1997–99	18–64	66	48	57	20	16	18
Latvia	1997	19–64	51	50	50	10	17	14
Norway	1994	16–79	42	26	34	5	6	5
Sweden	1996–97	16–84	46	34	40	7	7	7
North America								
Canada	2000–01	20–64	56	39	47	16	14	15
USA	1999–2002	16+	66	60	63	26	32	28
Asia								
China	1990–2000	20+	22	26	25	2	4	3
India	1998	18+	4	4	4	0.3	0.5	0.5
Japan	2001	15+	27	21	23	3	3	3
Philippines	1998	20+	17	23	20	2	4	3
Singapore	1998	18–69	34	27	30	5	7	6
Pacific Islands								
Cook Islands	1998	17+	77	81	78	41	50	43
Fiji	1993	18+	32	50	42	7	21	14
French Polynesia	1995	16+	75	73	74	36	44	41
Nauru	1994	25–69	–	–	–	80	79	79
Vanuatu	1998	20+	46	52	49	12	20	16
Middle East								
Bahrain	1998–99	19+	60	62	61	23	34	29
Egypt	1998–99	18–60	49	71	62	13	33	25
Iran	1999	15+	29	39	34	6	14	10
Saudi Arabia	1995	18+	40	46	43	13	20	17
Africa								
Ghana	1987–89	20–65	5	18	11	1	6	3
Lesotho	1993	20–65	–	50	–	–	23	–
Morocco	1998–99	18+	25	45	36	4	16	10
South Africa	1998	15+	29	56	45	9	30	21

Condensed from Nishida and Mucavele.² No recent data from South America are listed in the full table.

obese (BMI > 30 kg/m²) in 1994; (ii) the lowest rates are in the lesser developed countries of Asia where India records just 0.5% obesity, China, Japan, and the Philippines record 3%, and Singapore records 6%; (iii) that rates in Europe and North America are generally high but with some striking contrasts (for instance, 15% of Canadians are obese compared with 28% of US citizens, and 21% of Germans are obese compared with only 5% of Norwegians); (iv) that rates are high in many Middle Eastern countries though again with considerable heterogeneity (for instance, Iran has 10% of obese adults whereas Bahrain has 29%); and (v) that rates in Africa are very variable and reflect the stage of transition of each country.

Table 2 lists some rates of change in the obesity statistics derived by comparing the oldest and most recent national survey data available. Such data must be interpreted with caution for a number of reasons. First that, by virtue of the paucity of survey information available, comparisons are being made between surveys with substantially different sampling

schemes. The figures for Denmark in Table 2 show an apparent decrease in obesity rates but the more recent figures include much younger subjects and hence will tend to have a lower prevalence since obesity develops slowly during adulthood. Of more importance with respect to interpreting data from developing countries is a statistical artefact inherent in using a BMI cut-off of 30 kg/m² to measure changing rates. In countries where the BMI distribution has not yet shifted sufficiently to the right to tip many individuals beyond the defining threshold (cf. India and Japan in Table 2) the increase in obesity may appear negligible, but this might obscure the beginnings of an epidemic that may be developing as fast as in the developed nations.

To be truly useful as a tool for monitoring global trends the database will need to be updated regularly with nationally representative statistics (using a sampling frame that either balances or separately records the urban and rural areas) derived from direct anthropometric measurements. It should be possible

Table 2 Selected statistics on rates of change in national obesity rates in adults

Country	Survey date	Age range	Males		Females	
			% Obese	Change	% Obese	Change
Europe						
Denmark	1982	30–60	10	−0.13	9	−0.13
	1994	16+	8	7		
Germany	1984–86	25–69	15	+0.31	16	+0.44
	1998	18–79	19		22	
Ireland	1988–89	18–64	8	+1.37	13	+0.33
	1997–99	18–64	20		16	
North America						
Canada	1970–72	20–69	8	+0.26	13	+0.04
	2000–01	20–64	16		14	
USA	1960–62	20–74	11	+0.38	16	+0.39
	1999–2002	16+	26		32	
Asia						
India	1974–79	18+	0.2	+0.006	0.5	+0.002
	1998	18+	0.3		0.54	
Japan	1976–80	20+	0.8	+0.09	2.7	+0.03
	2001	15+	2.9		3.3	
Singapore	1992	18–69	4	+0.2	6	+0.1
	1998	18–69	5		7	
Pacific Islands						
Nauru	1975–76	25–69	63	+0.94	72	+0.34
	1994	25–69	80		79	
Middle East						
Kuwait	1980–81	18+	15	+0.70	30	0
	1998–2000	18+	28		30	
Saudi Arabia	1987–92	18+	16	−0.58	26	−1.10
	1995	18+	13		20	
Africa						
Morocco	1984–85	18+	2	+0.15	8	+0.58
	1998–99	18+	4		16	

Condensed from Nishida and Mucavele.² No data from South America or Sub-Saharan Africa are listed in the full table.

to interrogate it by age group and should contain data on children. The state-by-state statistics collated annually by the Centres for Disease Control in the US and the annual Health Surveys of England provide model examples of how best to monitor the trends in obesity and additionally contain information on some of the co-morbid conditions associated with obesity. The databases can be analysed by sex, age groupings, region, ethnicity and socioeconomic status. Each of these surveys shows an inexorable rise in obesity rates of close to 1% per annum. Such a wish list will be hard to achieve in resource-poor countries but is rapidly overtaking the need to monitor childhood undernutrition in terms of the overall burden of disease.

A case study of The Gambia

Detailed data on obesity from two nationwide surveys are available for The Gambia, a small West African country on the

southern edge of the Sahara that is typical of many nations in sub-Saharan Africa with respect to the epidemic. Gambia is in the early phases of the demographic and nutritional transitions described by Popkin.¹¹ Like many such countries urbanization is increasing rapidly with a constant passage of young people from the rural areas to seek education and work in urban areas.⁶ In 1995 a representative survey was conducted on 6048 rural and urban adults (>15 years) from 73 communities using multistage stratified cluster sampling based on the 1993 national census.¹² A second survey with similar results was conducted on 5373 adults in 1996–97^{13,14} (Figure 1). In the later survey the overall obesity rate was recorded as just 4% but this concealed major variations. In the rural population obesity was essentially undetectable in men (<0.2% prevalence) and only detectable in women >35 years at a prevalence of <3%. Among urban men the obesity rate was <2% but amongst women it was much higher (see below). Almost a decade later, although quantitative data are not available, the author's

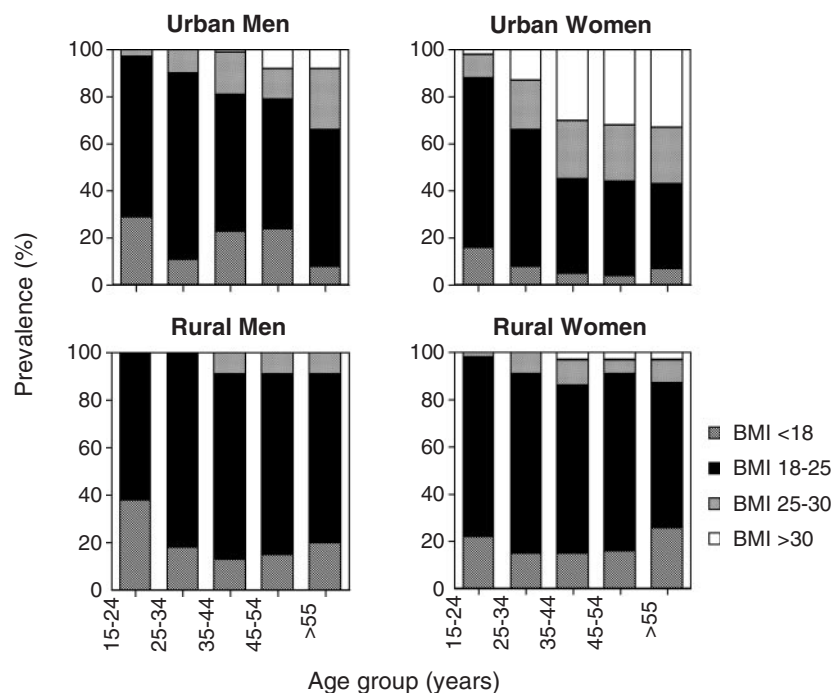


Figure 1 Body mass index distribution profiles in urban and rural Gambia taken from a community survey conducted in 1996/97. Redrawn from van der Sande *et al.*¹³ with permission

strong impression from having worked in rural Gambia for >25 years is that obesity is now rapidly penetrating the villages (see examples in the accompanying photo-essay¹⁰). This appears largely driven by the so-called 'remittance economy' (money sent home from family members who have migrated to the urban areas or abroad), which in turn has transformed the range of goods sold in the village shops. Prominent among these are large yellow plastic containers of imported vegetable oils. Throughout Africa these oil containers are recycled as water carriers and have completely displaced the metal kerosene drums that used to fulfil this function, thus providing a vivid visual picture of this one key component of the nutrition transition.

The Gambian survey revealed that there were also large differences between age groups and between men and women (Figure 1). In women >35 years 32.6% were obese compared with <2% of men in the same age group, a 17-fold difference. This strong gender divide is reflected in some of the other datasets from Africa listed in Table 1: in Ghana obesity is six times as common in women as in men, in Morocco four times, and in South Africa three times as common. The inferences that can be drawn from this dimorphic response are discussed below.

The environmental vectors

Over several years Popkin has extensively analysed the environmental vectors of the obesity pandemic¹⁵ and has documented the profound changes in global food supply and in the relative costs of foodstuffs that have led the nutrition transition.¹⁶⁻¹⁹ In common with other analyses²⁰⁻²² he links together the changes in dietary patterns with those in physical

activity as the major drivers of population weight gain. These are summarized in the accompanying panel (Figure 2).

The general view is that the timing and magnitude of these 'ecological' changes are sufficient to explain the rapid increase in obesity and that the power of external factors (such as the low cost of highly refined oils and carbohydrates, encouragement towards motorized transport, increasing use of energy-sparing devices, increasingly sedentary employments, and the seduction of TV and video games) will ensure that the macro-environment will continue to be highly obesogenic unless governments engage in major new initiatives to re-engineer the way we live.^{8,9,15,20,21} Regular travellers to the developing world will have observed at first hand the astonishing rate at which these aspects of globalization are infiltrating traditional lifestyles even in the poorest of the developing countries. They first affect the more wealthy members of urban areas, but this is followed by a reversal of the socioeconomic gradient as obesity becomes a disease of the poor.^{30,31}

The socio-behavioural dimension

In the Western world social stigmatism against obesity and a widespread (though usually unsuccessful) obsession with trying to remain lean have probably helped limit to some extent the rate of rise in obesity. In many developing countries this psychological brake has been absent. The classic example comes from Polynesian islanders who associate large body size with power, beauty, and affluence.³² This is partly responsible for the astonishing rates of obesity among these communities listed in Table 1.

Studies in African Americans have reported a lack of social pressure to be thin and reduced social negativity toward obesity

• **The structure and composition of the diets of all nations are changing rapidly.**

Among the key changes are:

- The world's food supply and diets have been sweetened tremendously.²³
- Edible oil intake has grown very rapidly, particularly in Asia, the Middle East and Africa.¹⁷
- The energy density of diets - particularly in the low income world - seems to be growing rapidly.¹⁸
- The intake of animal-source foods is increasing rapidly in the low-income world.¹¹

• **Physical activity patterns across the globe are changing very rapidly.**

Among the key changes are:

- Vast shifts in the overall allocation of market work (away from agriculture and other energy-intensive occupations) towards service sector occupations.^{19,24}
- Concurrent marked reductions in the level of physical activity within each occupation.^{19,25}
- Changes in the types of transportation used and leisure activity patterns that reflect a rapid shift toward reduced energy expenditures.²⁶
- Mechanisation of all home production-related activities.²⁷
- Reduction of food preparation time by over half—from 2–3 hours per day to less than an hour per day—as food consumed away from home increases in the higher-income world.^{28,29}

Reproduced from Popkin¹⁵ with the author's permission.

Figure 2 Environmental drivers of the obesity pandemic

especially in women.^{33–35} However, with a few exceptions³⁶ there have been very few reports of attitudes to obesity in native African populations. We recently conducted a study in The Gambia using the body image assessment for obesity (BIA-O) and figure ratings scale (FRS) silhouette charts to explore body weight perceptions among urban adults and to study age and gender differences.³⁷ The results confirmed a high level of body satisfaction and obesity acceptance especially among and about middle-aged women. Within the limits of precision with which it is possible to compare subjective rating scores performed in culturally and educationally different populations, our results suggested that Gambians were more obesity tolerant than African Americans and much more tolerant than white Americans.³⁷ The association of thinness with HIV/AIDS is also thought to accentuate positive attitudes to overweight among Africans.³⁸

This satisfaction with a larger body size often extends to an actual desire to gain and maintain weight. Under-the-counter sales of steroids are misused to aid weight gain in a substantial proportion of Gambian women.

Thrifty genotypes and thrifty phenotypes

The existence of 'thrifty genotypes' propagated by a founder population that had survived famine or starvation during long

sea voyages to Pacific Islands, has been postulated as a possible explanation for the extreme rates of obesity and diabetes in some populations.³⁹ The concept remains valid but lacks any proof and any serious contenders for the identity of such thrifty genes.⁴⁰ Furthermore, we have argued elsewhere that all of humanity has been subjected to natural selection by famine, that this probably explains humankind's natural tendency to gain weight easily when food is abundant, and that the elusive concept of a thrifty genotype may, therefore, not merit a special status as an explanatory variable in populations from developing countries.^{40,41} Note that the profound sexual dimorphism in obesity rates in countries such as The Gambia also gives an important clue with respect to the relative roles of genetic and environmental/behavioural factors. It is clear that behavioural choices must be the key mediators of the profoundly different rates of obesity between men and women.

The related concept of a 'thrifty phenotype' is perhaps of much greater immediate concern in resource-poor countries.^{42,43} The term 'thrifty phenotype' was coined by Hales and Barker to describe the disadapted metabolic state arising as a consequence of a fetus that has been undernourished and, hence, forced to adopt a series of survival strategies appropriate to its frugal early nutrient supply but maladaptive if nutritional conditions improve later in life.⁴⁴ There is little evidence that this contributes to obesity itself⁴⁰ but there is strong evidence that it increases the risk of chronic disease in individuals who gain weight and this has led to an active debate as to how best to introduce preventive measures. Programmes to feed pre-pregnant and pregnant women would, at first sight, seem to be required, but Yajnik has raised concerns that this may actually exacerbate the risk for the offspring of small Indian mothers by creating what he describes as the 'thin-fat' baby syndrome.^{45,46} To date there is no resolution to this debate and policy makers are left without clear guidance.

The coexistence of obesity and malnutrition

The paradoxical coexistence of adult obesity with childhood malnutrition has been stressed by a number of commentators,⁴⁷ particularly in relation to the situation in Central and South America where the nutrition transition is more advanced.⁴⁸ Doak *et al.*⁴⁷ have shown that a large number of households, particularly in middle-income countries, contain both underweight and obese individuals and describe these as 'dual burden' households. Our experience in The Gambia is that children enrolled within our malnutrition rehabilitation centre frequently have mothers in whom there are no signs of an overall caloric deficit within the household. In the urban hospitals it is not at all uncommon to find severely malnourished children brought in by overweight-to-obese mothers. In these cases the malnutrition is usually caused by poor mothering practices and infections.

The issue as to whether malnutrition in childhood predisposes to later obesity is difficult to analyse owing to the lack of prospective cohorts in developing countries. Such links have been claimed by studies showing that short adult stature is a risk factor for obesity even after adjusting for contemporary differences in socioeconomic status.⁴⁹

Health consequences—‘The Double Burden of Disease’

The recent WHO report on Diet, Nutrition and the Prevention of Chronic Diseases placed obesity at the top of the public health agenda as the major avoidable risk factor for a wide range of NCDs.⁵⁰ The ensuing Global Strategy on Diet, Physical Activity and Health noted that already 66% of deaths from NCDs occur in low-income countries and this figure is projected to rise. Owing to higher rates of case-specific mortality in countries with poor health services the average age at death from NCDs is lower in developing countries.

The modern emergence of NCDs as a major health threat in countries still battling with the unfinished agendas of infectious diseases and childhood malnutrition has been termed ‘The Double Burden of Disease’. Together with AIDS, and the re-emergence of TB and malaria due to drug resistance, this threatens to bring the already struggling health services of many developing countries to their knees. In 2005, WHO has renewed its call for action⁵¹ basing part of its argument on the simple economic consequences of inaction. It has been calculated that China will lose \$556 billion to heart disease, stroke, and diabetes in the period 2005–15.^{51,52}

The prospects of halting the obesity pandemic within the foreseeable future appear remote especially in communities that have battled for generations to escape from the gruelling routines and the frugal diets and living conditions of a subsistence livelihood. Paradoxically further economic development may be one of the best ways out of the problem by taking populations beyond the poverty-obesity links described by Stunkard.³⁰ In the meantime public education campaigns warning of the health consequences of very high levels of body fat will be the most that many countries can afford. Reluctantly, it has to be stated that the medium-term outlook is, therefore, grim if we are searching for miracles. However, gradual progress can be made against the two leading avoidable risk factors for chronic disease, namely smoking and obesity. A recent series on chronic diseases in *The Lancet* leads with a call to set the modest target of a 2% per annum decrease in deaths from chronic diseases worldwide.^{53,54} This would avert 36 million deaths by 2015 of which the great majority would be in low-income and middle-income countries.

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