Is Africa facing a nutrition transition under the double burden of disease?

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Abstract: The label 'diseases of affluence' for chronic diseases is a misnomer as they surface in poorer countries as well as in the poorer population groups in richer countries. On a global basis, 60% of the burden of chronic diseases exists in developing countries. This shift in the pattern of disease is taking place at a rapid rate, and demands immediate and effective action. Unfortunately, modern dietary patterns and physical inactivity patterns are risk behaviours that travel across countries and are transferable from one population to another like an infectious disease, affecting disease patterns globally. In Africa, the problem of obesity is emerging at a time when undernutrition remains a significant problem. Strategies that take account of both these important nutritional problems will need to be developed, particularly when dealing with children whose growth may be stunted. Africans need to analyse the impact that globalisation and rapid socio-economic transition have on nutrition and to identify the main political, socio-economic, cultural and physical factors which promote obesogenic environments. There are opportunities for countries with developing economies to effectively lift the double burden of disease through an integrated approach employing a range of policies and interventions to combat such public health nutrition problems.

1 Introduction

1.1 Globesity

While two billion people remain chronically hungry, the fat epidemic has risen sharply and bears a serious public health crisis to both developed and developing countries. Presently, 400 million adults are obese (a body mass index of more than 30 kg/m^2) and 1.6 billion are overweight (a body mass index of 25–30 kg/m^2) worldwide (WHO, 2006). This obesity epidemic 'globesity' which was often thought to be peculiarly an affluent problem, is now affecting those countries that have historically had lower rates of obesity. For instance, while the USA is by far the fattest country: 31% of adult males and 33% of adult females are obese (IOTF, 2007), there is now evidence of increasing overweight and obesity in Lebanon and Jordan (Tables 1 and 2) (IOTF/EASO, 2005). It has been anticipated that 18% of the global population is currently obese and that undernutrition and obesity often now both coexists within the same countries particularly in developing countries (WHO, 2002a–e; 2006).

The problem of obesity is of a particular concern because it is affecting children even more than adults, leading for example to the early onset of Type Two diabetes, at one time unknown in childhood. Worldwide, 155 million children are overweight, including 30–45 million obese children (Lobstein *et al*., 2004). Globesity is fast becoming more of a problem than famine and undernutrition, and has now reached a point where it is becoming a serious threat to the health of every nation striving for economic development.

Fat, stored in the torso, affects blood pressure, the fat levels in the blood, and interferes with the body's ability to use insulin effectively (RCP, 2005). Failure to properly use insulin can lead to the development of type 2 diabetes, a risk factor of cardiovascular diseases CVD (WHO, 2006). Obesity also poses a major risk for serious diseases, including hypertension and stroke, and certain forms of cancer. Its health consequences range from increased risk of premature death to serious chronic conditions that reduce the overall quality of life (Aboderin *et al.*, 2001).

Internationally, there has been a constant increase in the average daily calorie since the 1960s (Mackay and Mensah, 2004). The consumption of foods high in Fats, Sugar and Salts (FSS) is mounting throughout the developing world, while the share of cereals is declining; intake of fruits and vegetables remains inadequate (Hawkes, 2006). Families in industrialised nations spend more of their money than ever before on meals purchased away from home. Across the globe these commercially prepared meals which are rich in FSS are 2 to 5 times larger than two decades ago (Sturm, 2005; Ledikwe *et al*., 2005). In 2006 alone, 150 000 new foods and drinks products were launched worldwide; that is 300 new products appeared in stores around the globe each day (Kavilanz, 2007).

Table 1 Some example of obesity across the world (in some countries)

Location	*Country*	*Obesity among different sex*
America	USA	31% of adult males and 33% of adult females are obese
South Pacific	Nauru	80% of men are obese, 78% of women
	Tonga	47% of men and 70% of women are obese
	Samoa	33% of men are obese and 63% of women
Europe	Croatia	Largest portion of obese men (31%)
	Albania	Women are the most obese (36%)
	England	17% of men and 21% of women are obese
Eastern Mediterranean	Lebanon	36% of men are obese
	Jordan	The highest female incidence at 60%
Africa	Egypt	27.6% Female (18–60 years old)
	South Africa	The national survey of 1998 undertaken in all population groups reported that a third of men and more than half of women were overweight or obese.

Table 2 Mean BMI of African countries categorised by age and gender

		Age in years						
Country	*Sex*	*5–14*	*15–29*	*30–44*	*45–59*	*60–69*	*70–79*	*80+*
Cameroon	M		23.7	24.4	24			
	F		24.6	24.8	25			
Ethiopia	M	14.2	17.5	18.3	18	18	17.9	19.8
	F	14.5	18.9	18.6	17.3	16.7	17.6	18.6
Gambia	M		19.6	20.5	20.9	21	20	
	F		21	21.9	21.8	21.3	20.9	
Ghana	M							
	F		21.8	22.4	21.4			
Kenya	M							
	F		21.7	22.3	22			
Malawi	M				19.8	19.8	19.7	
	F				20.5	20.5	19.6	
Mali	M		18.9	20.5	20.8	20.3	19.6	20.2
	F		19.9	21.1	20.6	20	19.5	20.8
Nigeria	M		19.8	20.9	21.5			
	F		21	21.8	20.3			

Table 2 Mean BMI of African countries categorised by age and gender (continued)

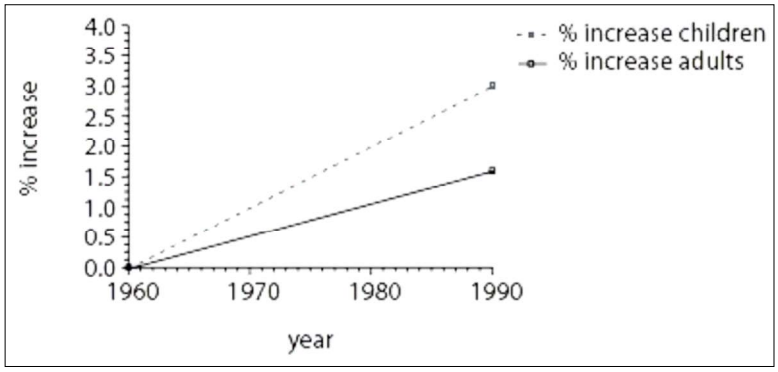
		Age in years						
Country	*Sex*	*5–14*	*15–29*	*30–44*	*45–59*	*60–69*	*70–79*	*80+*
Senegal	M		18.2	19.9	21	20.7	19.8	19.2
	F		19.6	21.4	22.1	22.2	21.3	20.7
Seychelles	M		22.9	23.5	23.1	23.2		
	F		23.2	25.7	27.2	27.5		
South Africa	M	13.8	21.5	24.2	25.3	24.8	24.4	
	F	14	24.4	28.5	29.9	28.8	27.7	
Tanzania	M							
	F		21.8	22.3	21.6			
Zimbabwe	M	15.3	19.5	20.8	21	21	20.1	20
	F	15.4	21.3	23	23.5	21.8	20.5	20.3

Source: Adapted from International Obesity Task Force: Global Burden of Disease Analyses (2007)

2 Global magnitude of childhood obesity

Childhood obesity is an increasing problem worldwide with 22 million children under age 5 years being classified as overweight (St-Onge *et al*., 2003; Rocchini, 2002). In developed countries, according to the NHANES III database, the prevalence of overweight (>95th percentile) in American children has tripled between the 1960s and the 1990s, in contrast to a 1.6-fold increase in adults over the same period (Figure 1) (Gielen and Hambrecht, 2004; WHO, 1998b). More recently, between the years 1999 and 2000, childhood obesity was found to have increased by 4% (Zametkin *et al*., 2004). Moreover, in the year 2000 alone, 30% of 6–19 year old children in the USA were diagnosed as being either overweight or at risk of being overweight and obese (WHO, 2003). A recent review on childhood obesity revealed 25% of American children to be overweight and 11% obese (Dehghan *et al*., 2205).

Figure 1 The percentage increase in obesity in children and adults between 1960 and 1990



Source: Adapted from Gielen and Hambrecht (2004)

In the UK an 8% prevalence of childhood obesity changed to 20% from 1984–1998 (Labstein *et al*., 2003), while in Spain, the overall prevalence of childhood obesity changed from 25% to 35% during the period 1985 to 1996 (Moreno *et al*., 2002). Although the highest prevalence rates, for overweight and obesity among children, have been found in developed countries, its prevalence has also been found to be increasing in developing countries especially in Eastern Europe and the Middle East (James, 2004).

3 Countries undergoing nutrition and health transition

In Chile the prevalence of obesity in first graders increased from 6.5% and 7.8% in boys and girls, respectively in 1987 to 17% and 18.6% in 2000 (Albala *et al*., 2002; Caballero and Popkin, 2002).

In Egypt, the risk for obesity identified as being overweight among children aged less than six years was found to be 4.8% in 1995, with the highest prevalence in Cairo being 11.2% (Moussa, 1995). In 2001, overweight was reported to be 27.4% among children aged 10–14 years while among older children aged 14–8 years it was found to be 39.0%. In the same study, obesity was reported among children in the 6–10 years age group to be 10.4% while it reached 14.7% among older children between the ages of 10–14 years. The ratio was slightly higher for males than females (15.1% and 14.1% respectively). In contrast, adolescents aged 14–18 years showed a prevalence of obesity at 13.4% and in this age group, females showed a higher prevalence than males (15.3% and 10.9% respectively) (Nutrition Institute-WHO, 2001).

Similarly, childhood obesity and overweight are becoming increasingly evident in South Africa. The National Household Food Consumption Survey reported that 17.1% of South African children between the ages of one and nine living in urban areas are overweight (Steyn *et al*., 2005). Moreover, the THUSA BANA study on 10–15-year-old children from five different regions in the North-West province found the BMI and percentage body fat of black children (17.4, 19.9%, respectively) and mixed origin (16.8, 17.6%) to be lower than those of white (19.0, 20.8%) and Indian children (17.5, 20.2%) (Schutte *et al*., 2003). Body fat was significantly higher in girls of all races (23%) than in boys (15.2%). Results from this study suggest that ethnicity and gender affect BMI and body fat percent in South African children. In contrast, Monyeki *et al*. (1999) found that the prevalence of obesity and overweight in rural children aged 3–10 years from Limpopo province was low (0%–2.5% and 0%–4.3% in boys and girls, respectively). Therefore, urbanisation also appears to influence the prevalence of obesity in South African children.

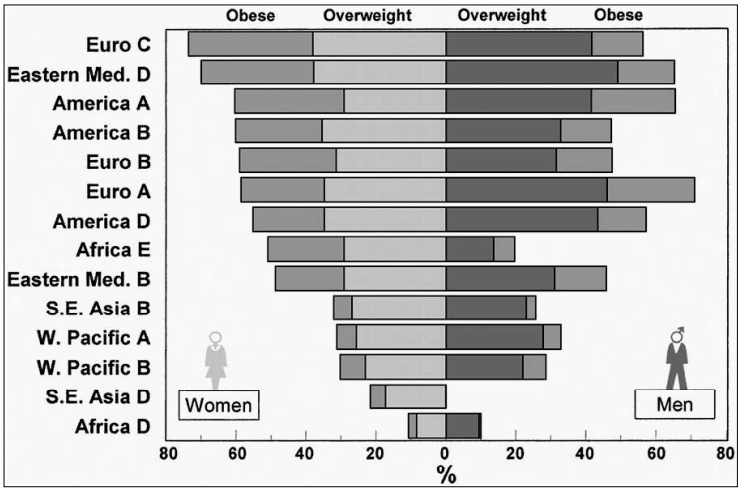
Childhood obesity is considered predictive for obesity later in life. About 70% of obese children and adolescents grow up to become obese adults (Whitaker *et al*., 1997; Parsons *et al*., 1999). It has been found to be a significant risk factor for increased morbidity and mortality, as well as numerous psychosocial problems (Davis and Christoffel, 1994; Adair and Popkin, 2005).

4 Double burden of disease

Although Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS), malaria and tuberculosis, along with other infectious diseases, still predominate in Sub-Saharan Africa and will do so for the foreseeable future, 79% of all deaths worldwide that are attributable to chronic diseases are already occurring in developing countries (Caballero and Popkin, 2002; WHO, 2002b).

In developing world, the double burden of disease is a significant health problem; overweight and obesity are emerging at a time when undernutrition remains (Popkin, 2002; WHO, 1998a; 2000a–b; Murray and Lopez, 1996). As a result, stunting and obesity would co-exist in many regions (Figure 2); Asia (Iran and India), Latin America (Brazil and Mexico) and many parts of Africa (Morocco, South Africa, Cameroon, Nigeria, Egypt and Tunisia) (Galal, 2002). While these health conditions are linked to poverty, both require stronger action by governments, health professionals and industries. This shift in the pattern of disease is taking place at an accelerating rate and creating a major public health threat which demands immediate and effective action (WHO, 1998a–b; 2000b).

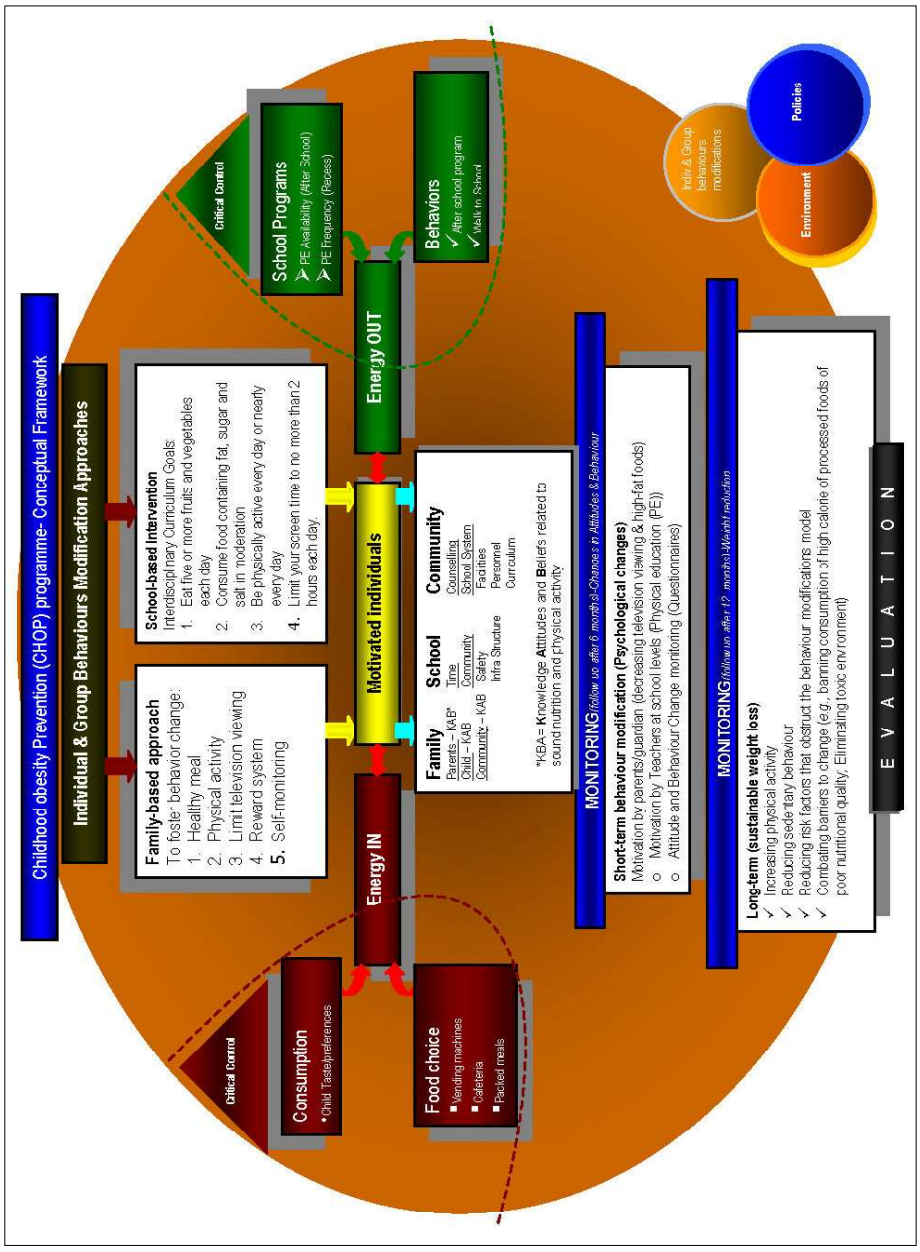
Figure 2 Preliminary estimates of the prevalence of overweight and obesity in 45 to 59-year-olds in different parts of the world



Notes: Note that 191 countries are included in the subregional groupings, which have been constructed on the basis of the observed infant mortality rates and life expectancies of the different countries. To illustrate the nature of the regions specified, the three countries with the biggest populations in each subregion is defined below. Afr D, Nigeria, Algeria, and Ghana; Afr E, Ethiopia, Congo, and South Africa; Amr A, USA, Canada, and Cuba (all the countries in region); Amr B, Brazil, Mexico, and Colombia; Amr D, Peru, Ecuador, and Guatemala; Emr B, Iran, United Arab Emirates, and Saudi Arabia; Emr D, Pakistan, Egypt, and Sudan; Eur A, Germany, France, and UK; Eur B, Turkey, Poland, and Uzbekistan; Eur C, Russian Federation, Ukraine, and Kazakhstan; Sear B, Indonesia, Thailand, and Sri Lanka (all countries in region); Sear D, India, Bangladesh, and Myanmar; Wpr A, Japan, Australia, and Singapore; and Wpr B, China, Vietnam, and Philippines.

Source: Adapted from James *et al*. (2001)

Figure 3 Conceptual framework for Childhood Obesity Prevention (CHOP) programme (see online version for colours)



Source: Adapted from Tewfik (2008)

Strategies that take account of both these important nutritional problems will need to be developed, particularly when dealing with children whose growth may be stunted (Tewfik, 2008) (Figure 3).

Since people's health behaviour has been regarded as the cause of many modern diseases, there has been a dramatic increase in public, private and professional interest in preventing overweight and obesity through changes in individual behaviour, such as weight reduction, increased exercise, and dietary change during the past twenty years. The increased interest in behavioural determinants of health and disease has drawn attention to the importance of health behaviour change (Glanz *et al*., 1991). 'Behavioural medicine', is a field introduced to study relationships between health and behaviour, and apply behavioural change methods to enhance health (Sarafino, 1996).

Various research programmes have been established to identify and test the most effective methods for achieving individual behavioural change (Glanz *et al*., 1991). Therefore, the main focus of health promoters, nutritionists and health professionals should be to modify those aspects of behaviour (Figure 3) which are known to have an impact on health and lifestyle (Naidoo and Wills, 2000).

5 Healthy lifestyle behaviour

Since childhood obesity has been attributed to unhealthy dietary and lifestyle behaviour, resulting from inconsistent knowledge, attitude and behaviour, therefore to address childhood obesity and its related risk factors a behaviour modification approach should be implemented to intervene at individual and community level (Figure 3). The achievement of healthy lifestyle behaviour among school children can be realised through; daily consumption of 5 or more fruits and vegetables, 1 hour/day physical activity, <2 hour/day screen time, decreasing consumption of FSS foods. This should be advocated by raising nutrition and health awareness among target population and the reducing the influence of obesogenic environment through:

- An improved school environment that promotes healthy eating and increased physical activity through policies, curriculum (and extra-curricular activities), improved school catering/food service and activity options, and the creation of school health teams.
- Increased awareness among teachers and parents about risk factors and underlying causes of childhood obesity resulting from the project's healthy lifestyle messages.

While estimates of the relative contribution of lifestyle factors to health problems vary, it is clear that many of the public health problems of our time have a significant individual decision-making behavioural component.

African countries need to analyse the impact that globalisation and rapid socio-economic transition have on health and nutrition. Furthermore, countries with developing economies need to identify the main political, socio-economic, cultural and physical factors which promote obesogenic environments (Choi *et al.*, 2001). There are opportunities for these countries to effectively lift the double burden of disease through integrated approach employing a range of policies and intervention programmes to combat such public health nutrition problems (Chopra *et al*., 2002; Tewfik, 2008).

While age, sex and genetic susceptibility are non-modifiable risk factors, other associated risks are modifiable; behavioural, biological and societal factors, which include a complex mixture of interacting socio-economic, cultural and other environmental parameters (Freedman *et al*., 1997; 2002).

Balanced diet, adequate nutrition and physical activity are important factors in the promotion and maintenance of good health throughout the entire life course. Their roles as determinants of chronic NCDs are well established and they therefore should occupy a prominent position in prevention and management activities (Tewfik, 2008).

6 Conclusion

In general, the double burden of disease is most effectively lifted by a range of integrated policies and programmes. Such an integrated approach is the key to action in countries where modest public health budgets will inevitably remain mostly devoted to prevention of deficiency and infection.

Given the rapidity with which traditional diets and lifestyles are changing in many developing countries, it is not surprising that food insecurity and undernutrition persist in the same countries where chronic diseases are emerging as a major epidemic.

WHO is helping to develop strategies that will make healthy choices easier to make. This could be further facilitated by appropriate public health approaches that combines primary and secondary prevention which are considered to be the most cost-effective, affordable and sustainable course of action to cope with the chronic disease epidemic worldwide (WHO, 2002a–e).

Nevertheless, the need for action to strengthen control and prevention measures to counter the spread of the chronic disease epidemic is currently widely recognised by many African countries, however these countries are lagging behind in implementing such measures. The two sides of nutrition related problems (over- and undernutrition) need to be brought together and treated in the context of the whole spectrum of malnutrition. Opportunities for actions at different levels should be facilitated to evade millions sufferers from an array of serious health disorders; for example; strengthened interaction and partnerships; implementing sound regulatory, legislative and fiscal approaches; and more stringent accountability mechanisms should be followed. In addition to effective and sustainable public awareness campaigns that sensitise policy-makers, private sector partners, medical professionals and the public at large.

References

Aboderin, I., Kalache, A., Ben-Shlomo, Y., Lynch, J.W., Yajnik, C.S., Kuh, D. and Yach, D. (2001) *Life Course Perspectives on Coronary Heart Disease, Stroke and Diabetes: Key Issues and Implications for Policy and Research*, Geneva: WHO.

Adair, L.S. and Popkin, B.M. (2005) 'Are child eating patterns being transformed globally?', *Obes Res*, Vol. 13, pp.1281–1299.

Albala, C., Vio, F., Kain, J. and Uauy, R. (2002) 'Nutrition transition in Chile: determinants and consequences', *Public Health Nutr*, Vol. 5, pp.123–128.

Caballero, B. and Popkin, B.M. (2002) *The Nutrition Transition: Diet and Disease in the Developing World*, Elsevier Ltd., ISBN: 978-0-12-153654-1.

Choi, B.C.K., Bonita, R. and McQueen, D.V. (2001) 'The need for global risk factor surveillance', *Journal of Epidemiology and Community Health*, Vol. 55, p.370.

Chopra, M., Galbraith, S. and Darnton-Hill, I. (2002) 'A global response to a global problem: the epidemic of overnutrition', *Bull. World Health Organ.*, Vol. 80, pp.952–958.

Davis, K. and Christoffel, K.K. (1994) 'Obesity in preschool and school aged children', *Arch Pediatr Adolesc Med.*, Vol. 148, pp.1257–1261.

Dehghan, M., Danesh, N.A. and Merchant, A.T. (2005) 'Childhood obesity, prevalence and prevention', *Nutrition J.*, Vol. 4, p.24, www.nutritionj.com/content/4/1/24.

Freedman, D.J., Serdula, M.K. and Khan, L.K. (2002) 'The adult health consequences of childhood obesity', in C. Chen and W.H. Dietz (Eds.) *Obesity in Childhood and Adolescence. Nestle Nutrition Workshop Series Pediatric Programme*, Philadelphia: Lippincott Williams & Wilkins, Vol. 49, pp.63–82.

Freedman, D.S., Srinivasan, S.R., Valdez, R.A., Williamson, D.F. and Berenson, G.S. (1997) 'Secular increases in relative weight and adiposity among children over two decades: the Bogalusa Heart Study', *Pediatrics*, Vol. 99, pp.420–426.

Galal, O.M. (2002) 'The nutrition transition in Egypt: obesity, undernutrition and the food consumption context', *Public Health Nutr.*, Vol. 5, pp.141–148.

Gielen, S. and Hambrecht, R. (2004) 'The childhood obesity epidemic: impact on endothelial function', *Circulation*, Vol. 109, pp.1911–1913.

Glanz, K., Lewis, F. and Rimer, B. (Eds.) (1991) *Health Behavior and Education. Theory, Research and Practice*, San Francisco/Oxford: Jossey-Bass.

Hawkes, C. (2006) 'Uneven dietary development: linking the policies and processes of globalization with the nutrition transition, obesity and diet-related chronic diseases', *Global Health*, Vol. 2, p.4.

International Obesity Task Force (IOTF) (2007) *Global Obesity Map*, IOTF, London.

International Obesity Task Force/European Association for the Study of Obesity (IOTF/EASO) (2005) 'EU platform briefing paper', *EU Platform on Diet, Physical Activity and Health*, International Obesity Task Force, Brussels.

James, P.T. (2004) 'Obesity: the worldwide epidemic', *Clinics in Dermatology*, Vol. 22, pp.276–280.

James, P.T., Leach, R., Kalamara, E. and Shayeghi, M. (2001) *The Worldwide Obesity Epidemic. Obesity Research*, Vol. 9, pp.228–233, doi: 10.1038/oby.2001.123.

Kavilanz, P.B. (2007) 'Gluten-free knocks low-carb fad off the shelf: new food products labeled "gluten-free" jumped 86% last year. But new low-carb product launches fell by more than half from peak levels of 2004', *CNNMoney.com*, 2 February.

Labstein, T.J., James, W.P. and Cole, T.J. (2003) 'Increasing levels of excess weight among children in England', *Int J Obes Relat Metab Disord.*, Vol. 27, pp.1136–1138.

Ledikwe, J.H., Ello-Martin, J.A. and Rolls, B.J. (2005) 'Portion sizes and the obesity epidemic', *J Nutr*, Vol. 135, No. 4, pp.905–909.

Lobstein, T., Baur, L. and Uauy, R. and IASO International Obesity TaskForce (2004) 'Obesity in children and young people: a crisis in public health', *Obesity Reviews*, Vol. 5, pp.4–104.

Mackay, J. and Mensah, G. (2004) *Atlas of Heart Disease and Stroke*, Geneva: WHO.

Monyeki, K.D., van Lenthe, F.J. and Steyn, N.P. (1999) 'Obesity: does it occur in African children in a rural community in South Africa?', *Int J Epidemiol*, Vol. 28, pp.287–292.

Moreno, L.A., Sarria, A. and Popkin, B.M. (2002) 'The nutrition transition in Spain: a European Mediterranean country', *Eur J Clin Nutr.*, Vol. 56, pp.992–1003.

Moussa, F. (1995) 'Nutrition survey for assessment of Vitamin A status in Egypt', Final report, Nutrition Institute in Collaboration with UNICEF, Cairo.

Murray, C.J.L. and Lopez, A.D. (Eds.) (1996) 'The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and projected to 2020', Global Burden of Disease and Injury Series, Harvard School of Public Health on behalf of the World Health Organization and the World Bank, Cambridge, Vol. 1.

Naidoo, J. and Wills, J. (Eds.) (2000) *Health Promotion, Foundations for Practice*, Edinburgh, London: Baillière Tindal.

Nutrition Institute-WHO (2001) 'Food consumption pattern and nutrient intake among different population groups in Egypt', Final report, Nutrition Institute in collaboration with WHO, Cairo.

Parsons, T.J., Power, C., Logan, S. and Summerbell, C.D. (1999) 'Childhood predictors of adult obesity: a systematic review', *Int J Obesity*, Vol. 23, pp.S1– S107.

Popkin, B.M. (2002) 'The shift in stages of the nutritional transition in the developing world differs from past experiences!', *Public Health Nutrition*, Vol. 5, pp.205–214.

Rocchini, A.P. (2002) 'Childhood obesity and a diabetes epidemic', *N Engl J Med*., Vol. 346, pp.854–855.

Royal College of Physicians (RCP) (2005) *Anti-Obesity Drugs. Guidance on Appropriate Prescribing and Management*, London: Royal College of Physicians of London.

Sarafino, E. (Ed.) (1996) *Principles of Behavior Change. Understanding Behavior Modification Techniques*, New York: John Wiley and Sons.

Schutte, A.E., Huisman, H.W., van Rooyen, J.M., de Ridder, J.H. and Malan, N.T. (2003) 'Associations between arterial compliance and anthropometry of children from four ethnic groups in South Africa: the THUSA BANA study', *Blood Press*, Vol. 12, pp.97–103.

Steyn, N.P., Labadarios, D., Maunder, E., Nel, J. and Lombard, C. (2005) 'Secondary anthropometric data analysis of the National Food Consumption Survey in South Africa: the double burden', *Nutrition*, Vol. 21, pp.4–13.

St-Onge, M.P., Keller, K.L., Steven, B. and Heymsfield, S.B. (2003) 'Changes in childhood food consumption patterns: a cause for concern in light of increasing body weights', *Am J Clin Nutr*., Vol. 78, pp.1068–1073.

Sturm, R. (2005) 'Childhood obesity – what we can learn from existing data on societal trends, part 2', *Prev Chronic Dis*., Vol. 2, No. 2, p.A20.

Tewfik, I. (2008) 'Childhood Obesity Prevention (CHOP) programme: a conceptual framework for nutrition intervention', *Int. J. Food Safety, Nutrition and Public Health*, Vol. 1, No. 1, pp.16–32.

Whitaker, R.C., Wright, J.A., Pepe, M.S., Seidel, K.D. and Dietz, W.H. (1997) 'Predicting obesity in young adulthood from childhood and parental obesity', *New Eng J Med*., Vol. 337, pp.869–873.

World Health Organization (WHO) (1998a) 'Life in the 21st century: a vision for all', The World Health Report 1998, Geneva: WHO.

World Health Organization (WHO) (1998b) 'Obesity: preventing and managing the global epidemic', WHO Technical Report Series, Geneva: WHO, No. 894.

World Health Organization (WHO) (2000a) *A Global Agenda for Combating Malnutrition: Progress Report*, Geneva: WHO, document WHO/NHD/00.6.

World Health Organization (WHO) (2000b) 'Obesity: preventing and managing the global epidemic', Report of a WHO Consultation, WHO Technical Report Series, Geneva: WHO, No. 894.

World Health Organization (WHO) (2002a) *Childhood Nutrition and Progress in Implementing the International Code of Marketing of Breast-milk Substitutes*, Geneva: WHO, document A55/14.

World Health Organization (WHO) (2002b) *Diet, Physical Activity and Health*, Geneva: WHO, documents A55/16 and A55/16 Corr.1.

World Health Organization (WHO) (2002c) *Programming of Chronic Disease by Impaired Fetal Nutrition: Evidence and Implications for Policy and Intervention Strategies*, Geneva: WHO, documents WHO/NHD/02.3 and WHO/NPH/02.1.

World Health Organization (WHO) (2002d) 'Resolution WHA53.23. Diet, physical activity and health', *Fifty-fifth World Health Assembly, Geneva, 13–18 May 2002*, Vol. 1: *Resolutions and Decisions, Annexes*, Geneva: WHO, pp.28–30, document WHA55/2002/REC/1.

World Health Organization (WHO) (2002e) *The World Health Report 2002: Reducing Risks, Promoting Healthy Life*, Geneva: WHO.

World Health Organization (WHO) (2003) *Global Strategy on Diet, Physical Activity and Health*, WHO.

World Health Organization (WHO) (2006) *Obesity and Overweight: Factsheet*, Geneva, No. 3011.

Zametkin, A.J., Zoon, C.K., Klein, H.W. and Munson, S. (2004) 'Psychiatric aspects of child and adolescent obesity: a review of the past 10 years', *J Am Acad Child Adolesc Psychiatry*, Vol. 43, pp.134–150.