Simultaneous Stunting and Obesity in Egypt's Children

Abstract

With changes in economic and social structures in developing countries in recent years, the diets and lifestyles of populations have evolved, resulting in a greater incidence of obesity for children. However, problems with undernutrition still exist, and in some countries a significant proportion of these children have had to grapple with being chronically undernourished in the past, and overnourished in the short term. They are therefore both stunted and obese. This paper explores the incidence of concurrent stunting and obesity among children under five years of age in Egypt, using data from the 2005 Egypt Demographic and Health Survey. Results indicate that simultaneous stunting and obesity is spread across all social and economic classes and its relationship with socioeconomic and demographic factors is a complex one. Further study needs to be done to tease out the factors that influence stunting and obesity and the pathways via which they operate.

Introduction

Although the nutritional status of children has been heavily studied, little attention has been paid to the simultaneous affliction of stunting and obesity. Increasingly, especially in developing countries, children suffer from this double burden of malnutrition (e.g. Mamabolo et. al, 2005; Mukuddem-Petersen and Kruger, 2004; Popkin et al. 1996). In addition to the ailments and conditions that affect undernourished children, including diarrhoeal diseases, respiratory and other infections, such children are predisposed towards the co-morbidities of obesity, such as high blood pressure, diabetes, respiratory diseases, orthopaedic and psychosocial disorders.

The limited existing research on simultaneous stunting and obesity is mainly conducted by biomedical scientists who have tended to concentrate either on the prevalence in the population or on the physiological precursors of the phenomenon; lower metabolic rates, lower fasting fat oxidation rates and lower energy expenditure among others (see, for example, Hoffman et. al., 2000). The questions that have been asked therefore concentrate on the prevalence, magnitude and root of the condition, to the preclusion of demographic and socioeconomic precursors of the phenomenon. Yet, the question of '*who may be prone to being both stunted and obese*' is critical for policy and planning in the area of preventive public health and allocation of often limited national budgetary resources for health. These issues are particularly salient in developing countries where stunting remains a major problem, and childhood obesity is rapidly increasing. Further, this question: '*who may be prone to this 'double burden*' in the economically emerging developing countries is all the more interesting in the face of recent nutritional and development transitions in those countries. To this end, this paper examines the relationship between children's socioeconomic and demographic circumstances and the simultaneous incidence of stunting and obesity in Egypt, a middle-income African country.

Background to the study

The focus of research and policy in many developing countries is still overwhelmingly on undernutrition. Yet, in economically advancing developing countries, growing economies and attendant behavioural responses contribute to the growth in the prevalence of obesity, as parents (and families) mimic fast food regimes of developed countries. For children in wealthier developing nations, simultaneous stunting and obesity has become an emergent problem over the past two decades. This was first observed and studied amongst older children and adolescents. Popkin *et al.* (1996) found an association between stunting and overweight in children aged 3 to 9 years in four countries (Russia, Brazil, the Republic of South Africa and China) undergoing transitions in development, with concomitant changes in nutrition and lifestyle. Similar patterns have been observed in Brazil (Sawaya *et al*., 1995) in Senegal (Benefice *et al*., 2001) and also, by Faber *et al.* (2001) and Steyn *et al*. (2005) in South Africa amongst others.

Officially, Egypt is classified as a middle income country (with GDP per capita in 2006 of $4,953), even though great inequalities in income and resource distribution persist (Population Reference Bureau, 2007; UNDP, 2008). Indicators of population health have improved in congruence with the increasing wealth of the country. Within 1995 and 2005, the infant mortality rate fell by about half, from 62/1000 to 33/1000 and the child mortality rate fell from 83/1000 to 42/1000 (El Zanaty et al., 1995, 2006), and overall levels of stunting in children reduced from 30% in 1995 to 18% in 2005 (El Zanaty *et al.,* 2006). In contrast, levels of obesity in children have been gradually rising. Between 1976 and 1995/96, the rate of obesity in children aged 0-5 rose from 2.2 to 8.6% (Ebbeling *et al*, 2002).

Shaheen, Hathout and Tawfik (2004), working in eight of the twenty-six administrative governorates of Egypt found that 2.3 percent of stunted male and 3.7 percent of stunted female two to six-year-olds were obese; this was nearly double the prevalence of obesity in children of normal height (1.2 percent of males and 2.1 percent of females). Also, about 6 percent of stunted male and female preschool children were overweight, compared with 2.3 percent of male and 2.9 percent of female normal-height children. The unique situation of Egypt therefore presents an opportunity to examine the socioeconomic and demographic precursors of simultaneous stunting and obesity and compare these to the precursors of stunting only, or obesity only.

Data and Methods

The data for this study come from the Egypt Demographic and Health Survey (DHS) of 2005. The DHS programme primarily funded by the United States Agency for International Development (USAID) and implemented by Macro International, helps developing countries collect data on population characteristics, maternal and child health. Data collection took place between April and July 2005. In all, a nationally representative sample of 19474 ever-married women between the ages of 15 to 49 was interviewed. Data on the socioeconomic and demographic characteristics of mothers and households with children under age five, as well as anthropometric measurements and demographic characteristics of the children are used in this study. After removal of children whose anthropometric measurements were considered outside the normal range (attributable to measurement or recording errors), 12200 children are included in these analyses.

The nutritional status of the children is measured using z-scores, which are obtained by comparing anthropometric measurements with the 1977 standard growth reference curves of the United States Centre for Health Statistics, Center for Disease Control and World Health Organization (Dibley *et al.,* 1987). A child is regarded as stunted or wasted if his or her height-for-age or weight-for-age z-score is less than two standard deviations from the median of the reference population for the relevant sex and age group. Conversely, a child is considered obese if his or her weight-for-height z-score is greater than two standard deviations from the median of the reference population for the relevant sex and age group. A child who is simultaneously stunted and obese has a height-for-age z-score less than two standard deviations from the median of the reference population and a weight-for-height z-score greater than two standard deviations from the median of the reference population for the relevant sex and age group. A normal child has both a height-for-age z-score and a weight-for-height z-score within two standard deviations from the median of the reference population for the relevant sex and age group. Height-for-age nutritional status is a measure of the chronic (long-term) nutritional status of a child. Stunting indicates chronic malnutrition and stunted children have greater susceptibilities to infections, lower learning capacities and poor growth in general compared to children of normal height. Weight-for-height nutritional status measures a child's acute (short-term) nutritional status. A high weight-for-height results in obesity, whilst a low weight-for-height results in wasting. Height-for-age and weight-for-height thus discriminate between different biological processes (de Onis and Blossner, 2000; McMurray, 1996; et al., 2004).

The dependent variable, nutritional status, is in five categories: stunted and obese; obese only; stunted only; wasted; or normal. These groups are used to facilitate comparison of the precursors of simultaneous stunting and obesity with those of stunting only, or obesity only. Wasting is not discussed in this paper even though wasted children are included in analyses.

After preliminary descriptive analysis, multinomial logistic regression was used to find the log odds and odds ratios of being in one of the five categories of the dependent variable for each of the independent variables. Children who were normally nourished were used as the reference. In the discussion, each of the three groups of interest (stunted and obese, obese only and stunted only) is compared to 'normal' children, that is, children of normal weight and height for their age. The final model was arrived at after fitting a series of nested models. The first model was with the age of the child only, and fit in different ways- as a continuous variable; in aggregate groups of months of age (the final choice); and as a quadratic variable (mean deviation of age squared), and with the best fitting form chosen. Further, gender, birth order, preceding and succeeding birth intervals of children were added on to the first model. Next, the educational attainment of mothers and their work status in the year preceding the survey were added on; and finally, household wealth quintile and region of residence were added on to the model. Variables originally tested but subsequently dropped from the model due to non-significance include duration of breastfeeding, age of mothers and urban/rural residence. Most analysis was done with Statistical Package for Social Sciences (SPSS), version 16.0. Predicted probabilities for being in each of the five nutritional categories were calculated in Microsoft Office Excel 2007 and used for some of the graphs.

Results

The results begin in Table 1, with an overview of the proportions of children suffering from the different forms of malnutrition and children who are normally nourished.

Table 1: Percent Distribution and Mean Z-scores for Nutritional Status Categories

Nutritional Status Category	N in category (%)	HAZ mean (s.d.)	WHZ mean (s.d.)
Stunted	1738(14.2)	-2.8746 (0.83359)	- - -
Wasted	436(3.6)	- - -	-2.6534(0.52478)
Obese	657(5.4)	- - -	2.8703(0.83370)
Stunted and Obese	431(3.5)	-3.2941(1.02419)	2.8289(0.76017)
Normal	8938(73.3)	-0.2953(1.27153)	0.0863(0.87215)

HAZ- Height-for-age z-score WHZ- Weight-for-height z-score

Data from EDHS 2005, Children between the ages of 0 and 5. (N=12200)

A little over 70% of Egyptian children are normally nourished and almost 30% of them are malnourished. Stunting is still the most prevalent form of malnutrition. It affects over half (14%) of malnourished children in Egypt. In terms of prevalence, obesity is next, followed by wasting and simultaneous stunting and obesity. Mean z-scores in the table reveal that children who are simultaneously stunted and obese have, on average, lower height-for –age z-scores than children who are only stunted. The weight-for-height z-scores of these simultaneously stunted and obese children are however, about the same as those of children who are only obese.

Table 2 shows the proportion of children in different age groups and of either sex who are in each nutritional status category. Overall, the prevalence of malnutrition is highest among 12 to 23 month-olds and lowest among 48 to 59 month-olds.

Table 2: Proportions of Males and Females in Nutritional Status Categories by Age

	Percent in Nutritional Status Category									
Age	**Stunted and Obese**		**Obese**		**Stunted**		**Wasted**		**Normal**	
(months)	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Under 6	4.9	5.6	12.4	14.1	11.1	4.2	5.9	7	65.7	69.1
6-11	7.2	6.4	5	8.8	17.7	10.8	3.9	5.2	66.2	68.8
12-23	3.4	4.4	4.4	8	20.8	16.7	4.1	4.7	67.3	66.2
24-35	2.4	3.4	2.1	2.8	16.5	14.4	3.4	3.6	75.5	75.4
36-47	2.5	3.6	4.5	4.3	13.9	13	2.5	2.3	76.5	76.9
48-59	1.9	1.6	4.2	4.7	12.9	11.2	2.6	1.8	78.5	80.7
All ages	**3.2**	**3.8**	**4.7**	**6.1**	**15.8**	**12.7**	**3.5**	**3.7**	**72.8**	**73.8**

Greater proportions of boys in all age groups are stunted than girls are. At almost all ages, more girls are obese than boys. The prevalence of simultaneous stunting and obesity is slightly higher amongst boys than girls.

From the multinomial logistic regression model specified, the age of a child, sex and preceding birth interval; the educational attainment and work status of a mother; and the household wealth quintile and region of residence of the family are significant predictors of a child's nutritional status. Duration of breastfeeding, birth order, succeeding birth interval, age of a mother and residence in a rural or urban area are not significant predictors of children's nutritional status. Table 3 presents the results of the regression.

Table 3: Multinomial logistic regression parameter estimates for children's nutritional status, 2005 Egypt Demographic and Health Survey

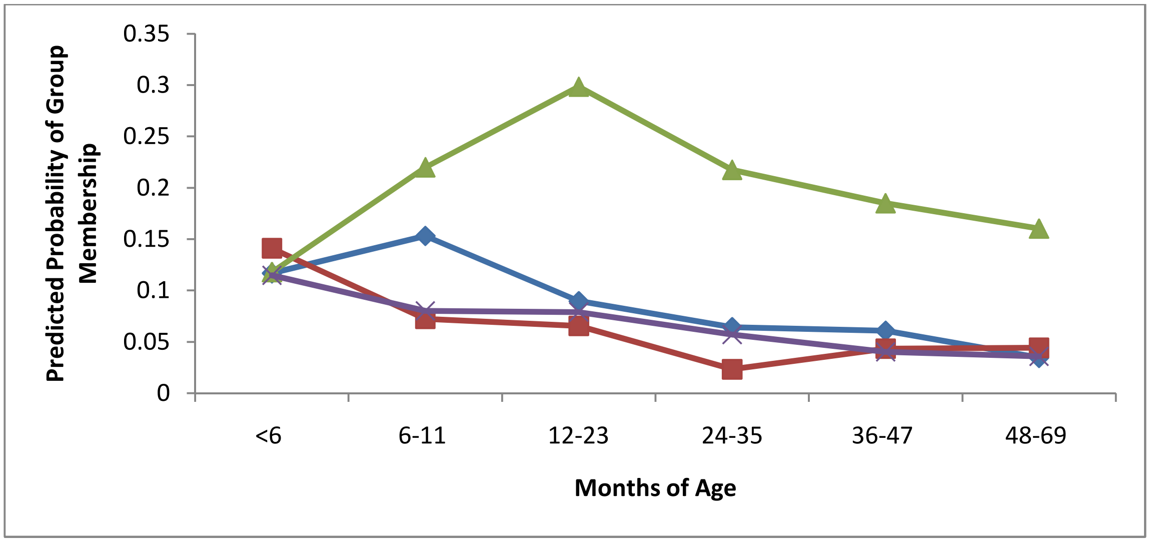
		Stunted and obese	Obese	Stunted	Wasted
		Exp β (S.E)	Exp β (S.E)	Exp β (S.E)	Exp β (S.E)
Age of Child	48-59 Months	0.295(0.228)**	0.313(0.153)**	1.359(0.139)*	0.312(0.208)**
	36-47 Months	0.520(0.195)**	0.307(0.144)**	1.568(0.134)**	0.351(0.192)**
	24-35 Months	0.550(0.184)**	0.165(0162)**	1.844(0.130)**	0.497(0.170)**
	12-23 Months	0.767(0.175)	0.465(0.127)**	2.530(0.127)**	0.689(0.162)*
	6-11 Months	1.310(0.181)	0.513(0.148)**	1.865(0.143)**	0.699(0.188)
	<6 Months(Ref)	1.000	1.000	1.000	1.000
Sex of Child	Female	1.168(0.100)	1.320(0.083)**	0.788(0.054)**	1.033(0.099)
	Male(Ref)	1.000	1.000	1.000	1.000
Birth Order	4^{th} or Higher Order Birth	1.415(0.551)	0.098(1.565)	1.198(0.336)	0.070(2.269)
	2^{nd} or 3^{rd} Birth	1.460(0.534)	0.098(1.561)	1.286(0.328)	0.077(2.265)
	1^{st} Birth(Ref)	1.000	1.000	1.000	1.000
Preceding Birth Interval	1^{st} Birth	1.885(0.532)	0.115(1.560)	1.298(0.327)	0.088(2.264)
	<24 Months	1.266(0.147)	0.959(0.133)	1.207(0.076)*	1.583(0.138)**
	24 months or more(Ref)	1.000	1.000	1.000	1.000
Succeeding Birth Interval	Last Birth	1.176(0.156)	1.265(0.130)	1.085(0.074)	1.280(0.158)
	Subsequent Birth	1.000	1.000	1.000	1.000
Mother's Education	Higher Education	0.547(0.236)**	1.042(0.176)	0.738(0.128)*	0.996(0.212)
	Secondary Education	0.841(0.135)	1.056(0.120)	0.854(0.072)*	1.129(0.143)
	Primary Education	0.791(0.175)	1.244(0.141)	0.015(0.085)	0.817(0.195)
	No Education(Ref)	1.000	1.000	1.000	1.000
Mother's Work Status	Worked in last year	1.557(0.127)**	1.298(0.107)*	1.193(0.073)*	1.111(0.137)
	Not worked in last year(Ref)	1.000	1.000	1.000	1.000
Household Wealth Quintile	Fifth	0.828(0.200)	1.094(0.165)	0.627(0.113)**	1.132(0.194)
	Fourth	0.536(0.186)**	0.879(0.149)	0.658(0.095)**	0.732(0.183)
	Third	0.854(0.154)	0.759(0.143)	0.781(0.084)**	0.776(0.171)
	Second	0.680(0.155)*	0.828(0.137)	0.787(0.079)**	0.612(0.175)**
	First(Ref)	1.000	1.000	1.000	1.000
Region of Residence	Urban/ Frontier Governorate	1.496(0.153)**	0.897(0.122)	1.436(0.090)**	2.422(0.138)**
	Upper Egypt	1.054(0.116)	0.589(0.097)**	1.688(0.063)**	1.280(0.123)*
	Lower Egypt	1.000	1.000	1.000	1.000

Exp β – Odds Ratio S.E. – Standard Error (Ref) – Reference Category ** - significant at α= 0.01 *- significant at α= 0.05
The reference category for the dependent variable the group of children who have both "normal" weight-for-height and "normal" height-for-age nutritional status

The significant predictors of simultaneous stunting and obesity are age of a child, mother's educational attainment, mother's work status in the year preceding the survey and the household wealth quintile. Conversely, age of child, sex, preceding birth interval, educational attainment of mother, work status of mother and region are all significant predictors of stunting only, whilst age of child, sex, work status of mother and region of residence are significant predictors of obesity only.

Figure 1 shows the probability of being in any of the nutritional status groups by age, whilst Figure 2 shows the probability of group membership by household wealth quintile.

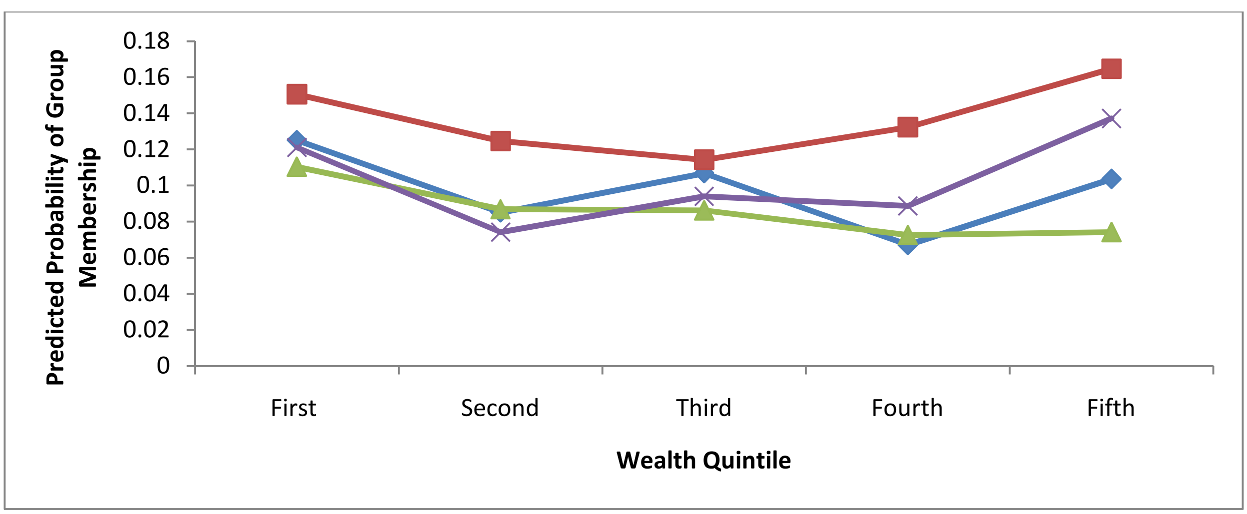
Figure 1: Probability of Group Membership by Age



Legend: Stunted and Obese Obese Stunted Wasted

The probability of malnourishment decreases with age for obesity and wasting. The probability of being stunted and obese seems to increase between birth and 24 months of age though this is not a significant effect. It however significantly steadily declines thereafter. The probability of stunting rises between birth and 23 months and then declines.

Figure 2: Probability of Group Membership by Household Wealth



Legend: Stunted and Obese Obese Stunted Wasted

The relationship between wealth and malnutrition is generally not linear. Except for stunting, malnutrition seems to be highest amongst the poorest and the richest households.

Stunted and obese children

The results of the regression models run show that concurrent stunting with obesity decreases with increasing age of a child, with a significant decrease noticed after 24 months of age. Children whose mothers have higher than secondary education are significantly less likely to be stunted and obese (OR= 0.547). The likelihood of being stunted and obese is the same though for children of mothers with no education, primary or secondary education only. Compared to children of mothers who did not work in the year preceding the survey, children whose mothers worked are significantly more likely to be stunted and obese (OR= 1.557). These same children are also more likely to be obese only (OR= 1.298), and more likely to be stunted only (OR=1.193).

Children in the second and fourth wealth quintiles are significantly less likely to be stunted and obese compared to children in the first (lowest) wealth quintile (OR's = 0.680 and 0.536 respectively). There is no significant difference between the likelihood of simultaneous stunting and obesity for children in the first, third and fifth quintiles. Children in Urban and Frontier Governorates are significantly more likely to be both stunted and obese (OR=1.496), more likely to be wasted (OR=2.422) and more likely to be stunted (OR=1.436); whilst children in Upper Egypt are significantly more likely to be wasted (OR=1.280), more likely to be stunted, (OR=1.688) but less likely to be obese (OR= 0.589) than children in Lower Egypt.

Additional models were run to test for interaction effects between sex and age, sex and household wealth quintile, and household wealth quintile and region. Sex-age and household wealth quintile-region interactions were significant, but only in predicting the probability of stunting for different groups of children. There were no significant interactions between simultaneous stunting and obesity and the included background characteristics.

Discussion

The double burden of malnutrition seems to affect children of all social and economic groups in Egypt. There is a clear indication that certain demographic variables, namely age and geographical location have more of an influence in determining whether a child suffers this double burden than socioeconomic status. Further, other variables such as birth order, preceding and succeeding birth intervals and sex of a child are not significant determinants of suffering from simultaneous stunting and obesity. This is analogous to the findings of Wagstaff and Wantanabe (1999), who, in a study of socioeconomic inequalities in child malnutrition in developing countries reported that in Egypt, unlike most other developing countries the prevalence and distribution of stunting was almost equally distributed across all wealth quintiles.

The increased likelihood of a child who lives in an Urban or Frontier Governorate or in Upper Egypt being malnourished may be explained by the agricultural geography of the country. The socioeconomic profiles of Upper and Lower Egypt are similar, however, Lower Egypt is located in the Nile Delta, where most agricultural production takes place (about 90%) whilst Upper Egypt has much less agricultural land (FAO, 2003).

Egypt has short durations and low levels of infant breastfeeding. According to the Egypt DHS, 2005, the median duration of exclusive breastfeeding was 1.7 months and that of predominant breastfeeding, that is, breast milk and only non-milk liquids, was 4.3 months (El-Zanaty et al., 2006). These are much shorter than the six months recommended by the WHO. This may explain in part the rapid decline in children's nutritional status with age, a supposition supported by the findings of Saleh and El-Sherif (1993), el-Deeb et al., (1995) and El-Sayed et al. (2001) among others. Early introduction of complementary feeding and the subsequent reduction or cessation of breastfeeding exposes children to unhygienic feeding practice and thus the risk of infections. Also, these foods may not be nutrient -rich enough to nourish the child properly. Finally, changes in lifestyle patterns of the population may explain why childhood obesity cuts across all socioeconomic classes. It may be that the rich eat the now popular 'western diets' of sodas and other junk food whilst the poor eat poor quality foods high in carbohydrates and fats. Both types of diets predicate one to putting on excess body fat.

There are several potential limitations of this study. Including children under six months of age has two potential drawbacks. First, it is quite difficult to measure the lengths of such children, and so there is the potential for errors in the nutritional status figures gotten from such measurements. Second before children are six months old, one may not see yet the full effect of stunting on them because stunting is a result of long term energy deficiency. However, running these same analyses on the sample without children less than six months of age did not change the significance or pattern of the results. In addition to these, according to international consensus, any z-score greater than 6 or less than -6 for height-for-age nutritional status and weight-for-age nutritional status, as well as any z-score greater than 6 or less than -4 for weight-for-height nutritional status is not considered plausible and is flagged because it is assumed that such results are a result of errors either in age reporting of the children by their caregivers or errors in the taking of weight and height measurements. Out of the total number of 12958 children, 758 (5.6%) of the total had z-scores that were therefore removed from the sample. It is possible that though there may have been real errors in anthropometric measurements or age recording, some children who had authentic results but fell beyond the cut-offs for flagging may have been removed from the data. If this were so, then the most malnourished children on either end of the spectrum would have been removed from the data and this would mask the real prevalence of malnutrition within the study population.

Conclusion

The double burden of malnutrition (simultaneous stunting and obesity) seems to be spread across all social and economic groups in Egypt. It may be that changes in culture and practices, for example, increase in wanting to eat like in western societies, low levels of breastfeeding and similar issues may account for the propensity to being malnourished amongst children in the population. Also, this inclination for children to be malnourished amongst all socioeconomic groups suggests that over and under nutrition are more likely caused by environmental factors rather than social or economic ones in this context. It is important that more study is done on the complex relationship between socioeconomic and demographic factors and children's nutritional status in the light of the nutrition transition occurring in Egypt. This will enable policy makers and individuals to effectively plan and implement policies, interventions and programmes to address the double burden of malnutrition that is being faced by Egypt and many other developing countries.

References

Benefice, E., Garnier D., Simondon, K. B. & Malina, R. M. (2001) Relationship between stunting in infancy and growth and fat distribution during adolescence in Senegalese girls. *European Journal of Clinical Nutrition* **55**, 50–58.

de Onis, M. & Blössner, M. (2000) Prevalence and trends of overweight among pre-school children in developing countries. *American Journal of Clinical Nutrition* 72, 1032-1039.

Dibley, M. J., Goldsby, J. B., Staehling N, W. & Towbridge, F., L. (1987) Development of Normalized curves for the international growth reference: historical and technical considereations. *American. Journal of. Clinical Nutrition* 46, 736-748

Ebbeling, C. B., Pawlak, D. B., and Ludwig, D. S. (2002) Childhood obesity: public-health crisis, common sense cure. *Lancet* 360, 473-482.

El-Zanaty, F., Sayed, H. A. A., Zaky, H. & Way, A. (1996) Egypt Demographic and Health Survey 1995. Calverton, MD: National Population Council, Arab Republic of Egypt and Macro International.

El-Zanaty, F. & Way, A. (2006) *Egypt Demographic and Health Survey 2005*. Cairo, Egypt: Ministry of Health and Population, National Population Council, El-Zanaty and Associates, and ORC Macro.

El-Deeb, B., Abd El-Moneim, A. & Abdalla, G. M. (1995) "The determinants of children's nutritional status" In: CDC 24th Annual Seminar on Population Issues and the Challenges in the 21st Century in the Middle East, Africa and Asia. CDC Annual Seminar, 1994. Cairo Demographic Centre. Cairo, Egypt, 870-894. (Cairo Demographic Centre Research Monograph Series No. 24)).

El-Sayed, N., Mohamed, A. G., Nofal, L., Mahfouz, A., & Zeid, H. A. (2001) Malnutrition among Pre-school Children in Alexandria, Egypt. *Journal of Health, Population and Nutrition.* 19 (4), 275-280.

Food and Agriculture Organisation (FAO) (2003) Nutrition Country Profile of Egypt.

Faber, M., Jogessar, V. B. & Benade, A. J. S. (2001) Nutritional status and dietary intakes of children aged 2–5 years and their caregivers in a rural South African community. *International Journal of Food Sciences and Nutrition* 52, 401–411.

Hoffman, D. J., Sawaya, A. L., Verreschi, I. Tucker, K. L., & Roberts. S. B. (2000) Why are nutritionally stunted children at increased risk of obesity? Studies of metabolic rate and fat oxidation in shantytown children from São Paulo, Brazil. *American Journal of Clinical Nutrition* 72(3), 702-707.

Mamabolo, R. L., Alberts, M., Steyn, N. P., Delemarre-van de Waal, H. A. & Levitt, N. S. (2005) Prevalence and determinants of stunting and overweight in 3-year-old black South African children residing in the Central Region of Limpopo Province, South Africa. *Public Health Nutrition* 8 (5), 501-508.

McMurray, C. (1996) Cross-sectional Anthropometry: What can it tell us about the Health of Young Children? *Health Transition Review* 6, 147–168.

Monir, Z., Koura A., Erfan, M., Abd El Aziz, A., Mansour, M. (2004) Anthropometric Parameters in Relation to Nutritional Status in School Children. *Egypt Medical Journal,* 5(7),15-39.

Mukuddem-Petersen, J. & Kruger, H.S. (2004) Association between stunting and overweight among 10-15-year-old children in the North West Province of South Africa: the THUSA BANA Study. *International Journal of Obesity Related Metabolic Disorders* 28, 842-851

Popkin, B. M., Richards, M. K. & Montiero, C. A. (1996) Stunting is associated with overweight in children of four nations that are undergoing the nutrition transition. *Journal of Nutrition* 126, 3009-3016

Population Reference Bureau. (2007) 2006 World Population Data Sheet

Saleh, S. M. & El Sherif, M. A. (1993) Growth and nutritional status of rural preschool children in El Mina Governorate. *New Egyptian Journal of Medicine* 8(3), 820-823.

Sawaya, A. L., Dallal, G., Solymos, G., de Sousa, M. H., Ventura, M. L., Roberts, S. B. & Sigulem, D. M. (1995) Obesity and malnutrition in a shanty town population in the city of Sao Paulo, Brazil. *Obesity Research* 3(suppl),107–115.

Shaheen, F. M., Hathout, M. & Tawfik, A. A. (2004) *National Survey of Obesity in Egypt. Final report*. Cairo, National Nutrition Institute.

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

United Nations Development Program (2008) *Human Development Report 2007/2008*. New York: Oxford University Press

Wagstaff, A. & Watanabe, N. (1999). Socioeconomic Inequalities in Child Malnutrition in the Developing World. World Bank Policy Research Working Paper No. 2434

Acknowledgments

I am grateful for the guidance of Dr.'s Melissa Hardy and Deborah R. Graefe for their guidance in developing an earlier version of this paper as a poster presentation at the Population Association of America's 2008 Annual Meeting.

I am also grateful to Dr. Francis Dodoo for helpful criticism and comments on earlier drafts of this paper.