Time Trends of Childhood Obesity in China from 1989 to 1997

Juhua Luo[1,2], Frank B Hu[3]

[1] Takemi Program, Harvard School of Public Health, Boston, MA

[2] Information Center of Public Health, Chinese Academy of Preventive Medicine, Beijing, China

[3] Department of Nutrition, Harvard School of Public Health, Boston, MA

Corresponding author: Dr. Frank B. Hu, Dept. of Nutrition, Harvard School of Public Health, 665 Huntington ave, Boston, MA, 02115

Tel: 617 432 0113

Fax: 617 432 2435

Email: Frank.hu@channing.harvard.edu

Abstract

Objective: To examine time trends of childhood obesity in China.

Design: This study was based on data from China Health and Nutrition Survey, a longitudinal survey from 1989 through 1997.

Subjects: For cross-sectional analysis, we included 944, 1058, 903 and 483 children aged 2-6 years in 1989, 1991, 1993 and 1997, respectively. For longitudinal analysis, we included 944 children and 3146 measurements during 4 time periods.

Measures: Overweight and obesity according to age-and sex-specific BMI cut-off points proposed by International Obesity Task Force.

Results: The overall prevalence of obesity increased from 4.2% in 1989 to 6.4% in 1997 among children aged 2-6 year. The increase largely occurred in urban areas, where the prevalence of obesity increased from 1.5% in 1989 to 12.6% in 1997 and prevalence of overweight increased from 14.6% to 28.9% at the same period. Longitudinal analysis shows BMI increased by 0.2kg/m^2 per year in urban areas and 0.1 kg/m^2 per year in rural areas. In multivariate analysis, overweight in early childhood (2-6 yrs), parental overweight, high income and urban areas independently predicted overweight at age 10-14 yrs.

Conclusion: A substantial increase in overweight and obesity among children aged 2-6 years was observed in urban areas in China from 1989 to 1997. Overweight in early childhood significantly predicted overweight during adolescence. Urgent public health strategies are needed to prevent childhood obesity in China.

Keywords: Body Mass Index; obesity; children; longitudinal analysis

Introduction

Marked increases in the prevalence of overweight and obesity have been observed in the last decades in both adults [1,2,3] and children [4-8] worldwide. Obesity is a major risk factor for coronary heard disease, diabetes, hypertension and certain types of cancer [9-13]. Obesity in childhood is also associated with high prevalence of blood pressure, diabetes, respiratory disease, and orthopedic and psychosocial disorders [14-18]. The most significant long-term consequence of childhood obesity is its persistence into adulthood, along with all the associated health risks [19].

With rapid growing economy and changing life styles in China, the prevalence of overweight and obesity is increasing rapidly in adults [20]. But to date, there is little information on the extent of obesity among children in China. Therefore, the aim of this study is to examine time trends of childhood obesity in China.

Subjects and Methods

China Health and Nutrition Survey (CHNS) design

The CHNS is a collaborative project of the Institute of Nutrition and Food Hygiene, Chinese Academy of Preventive Medicine, and the University of North Carolina at Chapel Hill. The first wave of the CHNS data were collected in 1989, and subsequently in 1991, 1993 and 1997 [http://www.cpc.unc.edu/china/home].

The CHNS covered eight provinces (Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Liaoning and Shangdong provinces in 1989, 1991, and 1993. Liaoning was replaced by Heilongjiang in 1997) that vary substantially in geography, economic development, public resources, and health indicators. A multistage, random cluster process was used to draw the sample surveyed in each of the provinces. Detailed information on the survey design and operation was described elsewhere [21-23].

Study population and measurements

Because Liangning province was replaced by HeilongJiang province in 1997, in order to keep the data comparable, we only analyzed data from the other 7 provinces (excluding Liangning and Heilongjiang provinces) in this study. Cross-sectional analysis included 944, 1058, 903 and 483 children in 1989, 1991, 1993 and 1997 respectively, aged 2-6 yrs in each survey year. The 944 children in 1989 and 3146 measurements were used in the longitudinal analysis. These included 944, 800, 762 and 640 children in 1989, 1991, 1993 and 1997, respectively. Of all, 570 (60.4%) children were measured four times, and 863(91.4%) subjects were measured at least two times. The 692 children who had measurements in both 1989 and 1997 were included in the predicting analyses.

Of the detailed household and individual data collected, the most relevant for this study are the demographic data, physical examination data (including height, weigh), and socioeconomic factors (including household income, parents' education and other related data). The anthropometrical measurements were carried out by trained health workers following standard protocol. Body weight was measured in light indoor clothing to the nearest tenth of a kilogram with a beam balance scale. Height was measured without shoes to the nearest tenth of a centimeter, using a portable stadiometer.

Definition of childhood overweight and obesity

To define childhood overweight and obesity, we used age- and sex-specific BMI cut-off points proposed by international obesity task force (IOTF), which correspond to BMI of 25kg/m^2 and 30kg/m^2, respectively in 18 years old [24]. The IOTF references are provided only for 6-mo interval. To provide a more precise fit, we used a polynomial approach to fit the BMI cut-off points for overweight and obesity against the ages of the boys and girls. Each

curve had an almost perfect fit (R^2 >0.9999, and the sum of squared residuals was <0.03). An advantage of using the predicted values was that we could use ages rounded to 0.1 years [25].

Data Analyses

First, we conducted cross-sectional analyses among children aged 2-6 years in each survey year to examine the time trends in body composition (including height, weight, BMI) and rates of overweight and obesity by sex and region. To correct for changes in the age distribution over time, the results were age-adjusted by the direct method based on the total sample of the four surveys.

Second, we conducted longitudinal analyses to examine time trends in BMI, overweight and obesity among 944 children aged 2-6 years in 1989, and followed up in 1991, 1993, and 1997. The analyses were conducted using generalized estimation equation (GEE) implemented in Proc Genmod procedure in SAS[26]. In the models, we included the following covariables: age, height, gender, region (urban, rural), parental overweight (at least one parent with BMI>=23 kg/m^2), mother's education, household income (low, median, high) and child's baseline weight (normal, overweight). We tested interactions between time and region, gender, parental overweight and child's baseline weight to examine the different trends among different sub-populations.

Finally, we used logistic regression to predict overweight status in 1997 using variables assessed in 1989. These variables included age, gender, region, parental overweight, child's overweight at baseline and household income.

Results:

Cross-sectional analyses of childhood obesity among children aged 2-6 years

The distributions of age, gender and place of residence across time for children aged 2-6 yrs are shown in Table 1. There were no systematic changes in the proportion of boys or girls. However, the proportion of children in rural area increased slightly from 73.2% in 1989 to 78.1% in 1997. The distribution of age shifted toward older age group from 1989 to 1997.

Figure 1 shows the trends of weight and height over time by gender and region. Average weight and height all increased significantly over time, and the increase was similar for boys and girls. The mean weight and height in urban area were higher than in the rural area. The increase in weight was more evident in urban areas, whereas the increase in height was more evident in rural areas.

Trends in BMI and prevalence of overweight and obesity over time by region are shown in Figure 2. In urban areas, mean BMI increased from 15.8 kg/m^2 in 1989 to 17.5 kg/m^2 in 1997, the prevalence of overweight increased from 14.6% to 28.9%, and the prevalence of obesity increased from 1.5% to 12.6%. In rural areas, mean BMI values did not change substantially over time. The prevalence of obesity increased first from 5.2% in 1989 to 7.8% in 1993, then decreased to 4.8% in 1997.

Longitudinal analyses for the follow-up data

We modeled the trends in BMI over time, adjusting for age, height, gender, parental overweight status and region (Table 2). Overall, BMI increased significantly over time after adjusting for age and height. Boys were heavier than girls. Children whose parents were overweight were heavier than those whose parents were not overweight. In addition, from Models 2, 3, 4 in Table 2, significant interactions were found between time trend and region, parental overweight status, and child's overweight status at baseline. The mean BMI in urban area increased more quickly than in rural areas (0.20 $kg/m^2/y$ vs. 0.11 $kg/m^2/y$); and the BMI of children with an overweight parent increased more quickly than those without an

overweight parents (0.16 kg/m^2/y vs. 0.10 kg/m^2/y); and the BMI among children who were not overweight at baseline increased more quickly than children who were overweight at baseline (0.16 kg/m^2/y vs. –0.08 kg/m^2/y).

Table 3 shows the results from a multivariate model using overweight or obesity as the dependent variables. The prevalence of obesity decreased with increasing age, and a strong positive association was seen between parental overweight and their children's obesity. A significant interaction was observed between time and region. A increasing time trend of obesity was observed in China urban areas (it increased about 27% per year), but no increase was observed in rural areas. Results were similar for overweight; it increased about 12% per year in urban areas.

Predicting overweight status in 1997

In a multivariate logistic model, children's overweight status in early childhood (2-6 yrs), parental overweight, high income, and urban area independently predicted overweight at age 10-14 yrs (table 4). The risk of overweight at age 10-14 was 2.2 times higher among children who were overweight at baseline than those children who were not overweight at the same age. The risk of overweight was about 4 times greater among children with an overweight parent than those whose parents were not overweight. The risk of overweight in median or high household income level was about 2 times higher comparing to low income level, although this estimate was not statistically significant.

Discussion

Rapid increase in childhood obesity has been observed in developed countries during the past decade. In the US, the prevalence of overweight (defined by 85th percentile of weight-for

height) among 5- to 24-year-olds from a biracial community of Louisiana (total n=11564) increased approximately twofold between 1973 and 1994 [27]. Similar increasing trends have been observed in many developing countries [28-33]. The prevalence of obesity among school children aged 6-12 years in Thailand (diagnosed by weight-for-height>120% of the Bangkok reference), rose from 12.2% in 1991 to 15.6% in 1993 [29]. Ding [32] also reported that the prevalence of obesity among children of 0-7 years in China increased from 0.91% in 1986 to 2.0% in 1996. These estimates were much lower than our findings, partly because different obesity standards and populations were used.

Our study found a dramatic increase in the prevalence of overweight and obesity among preschool children in China urban areas from 1989 to 1997, the prevalence of overweight increased from 14.6% to 28.6%, and the prevalence of obesity increased from 1.5% to 12.6%. In rural areas, both height and weight have increased over time. Because the increase in height was more rapid, the prevalence of overweight and obesity has not increased appreciably in rural areas. After controlling for potential confounders, there was a significant increasing trend in BMI in urban areas (0.2 $kg/m^2/y$) and the prevalence of obesity increased 27% per year in urban area.

Defining obesity or overweight for children and adolescents is difficult due to different rates of maturation and growth, and there is no generally accepted definition of obesity or overweight for children and adolescents. A variety of criteria for overweight and obesity have been used to evaluate prevalence and trends among children and adolescents [34-37], which has made comparisons between studies difficult. Thus it is critical to have an international standard to define childhood obesity. The IOTF standard was proposed recently [23]. It use percentile curves which were drawn at age 18 years passed through the widely used cut off points of 25 and 30 kg/m2 for adult overweight and obesity. We used this standard because it can be used for both children and adolescents, and it can facilitate international comparisons.

But some have argued [38] that the standard may not be appropriate for Asian and pacific children who grow and mature very differently from some of the reference populations (Brazil, Great Britain, Hong Kong, the Netherlands, Singapore, and the United States). Thus, the rates of overweight and obesity shown here should be viewed as conservative estimates. The actual prevalence could have been considerably higher if a leaner reference population has been used. However, this limitation should not have affected the assessment of trends.

Numerous studies have shown that increased energy intake and sedentary lifestyle are the two characteristics most strongly associated with the increased prevalence of obesity worldwide [39]. In developed countries, especially in the US, television viewing and snacking are considered as important factors of childhood obesity, because snacking while viewing TV tends to result in a higher energy intake and lower energy expenditure [40]. Similar relationship between the prevalence of obesity and television watching was observed in Chinese children [41].

Another possible explanation for the increased childhood obesity is the rapid change in dietary pattern in China children [42]. Western fast food has become very popular in large cities of China. Fast foods are high in fat and calorie and low in fiber; frequent consumption of fast food will probably increase the intakes of fat and total energy.

The study has several limitations. First, substantial proportions of the children were lost to follow-up. However, we found no significant differences in prevalence of overweight and obesity and other characteristics at baseline between dropouts and those who remained in the study. Also, the dropout should not affect the cross-sectional analysis of obesity prevalence at each survey for children aged 2-6 yrs old. Second, the CHNS did not collect information on physical activity. It is unclear whether activity levels have increased or decreased over time. Despite these limitations, the CHNS is a unique dataset and provides an

unprecedent opportunity to conduct both cross-sectional and longitudinal analyses of childhood obesity in China.

In conclusion, we found a substantial increase in childhood obesity in China, especially in the urban areas. Our study revealed the risk of overweight among children aged 10-14 years increased 2.2 times if the children were overweight at aged 2-6 years. Thus, preventive efforts should start at early age.

Acknowledgement

This study was supported by Takemi Program at Harvard School of Public Health and the Chinese Academy of Preventive Medicine. We thank Drs. Walter C. Willett, Barry M. Popkin and Youfa Wang for their helpful comments. The China Health and Nutrition Survey data were collected through P01HD2807601 from National Institutes of Health. The survey is a collaborative project between researchers from the Chinese Academy of Preventive Medicine, directed by Dr. Keyou Ge and Dr. Fengying Zhai; and a research group from University of North Carolina at Chapel Hill and the Carolina population center, directed by Barry M. Popkin.

Table 1. Characteristics of sampled Chinese children aged 2-6 years over time

	1989		1991		1993		1997	
	N	%	N	%	N	%	N	%
Age group								
2	239	25.3	193	18.2	119	13.2	91	18.8
3	219	23.2	212	20.0	148	16.4	63	13.0
4	175	18.5	237	22.4	187	20.7	97	20.1
5	158	16.7	227	21.5	209	23.2	105	21.7
6	153	16.2	189	17.9	240	26.6	127	26.3
Gender								
male	507	53.7	561	53.0	485	53.7	255	52.8
Region								
Rural	691	73.2	788	74.5	710	78.6	377	78.1
All	944		1058		903		483	

Table 2. Longitudinal analysis of BMI based on 944 children aged 2-6 yrs in 1989, and 800, 762 and 640 children during follow-ups in 1991, 1993 and 1997 respectively.

	Model 1		Model 2		Model 3		Model 4	
	β	p-value	β	p-value	β	p-value	β	p-value
Age (year)	0.37	<.0001	0.38	<.0001	0.38	<.0001	0.37	<.0001
Time (year)	0.13	0.0005	0.11	0.0041	0.10	0.0118	0.16	<.0001
Height (cm)	-0.06	<.0001	-0.07	<.0001	-0.06	<.0001	-0.06	<.0001
Gender (0=girls, 1=boys)	0.27	0.0035	0.27	0.0032	0.27	0.0036	0.26	0.0046
Region (0=rural, 1=urban)	0.23	0.0455	0.01	0.9328	0.23	0.0420	0.21	0.0615
Parental overweight (0=no,1=yes)	0.63	<.0001	0.63	<.0001	0.42	0.0016	0.62	<.0001
Baseline overweight (0=no, 1=yes)	1.91	<.0001	1.92	<.0001	1.91	<.0001	2.50	<.0001
Region*time			0.09	0.0095				
Parental overweight*time					0.06	0.0527		
Baseline overweight*time							-0.24	<.0001

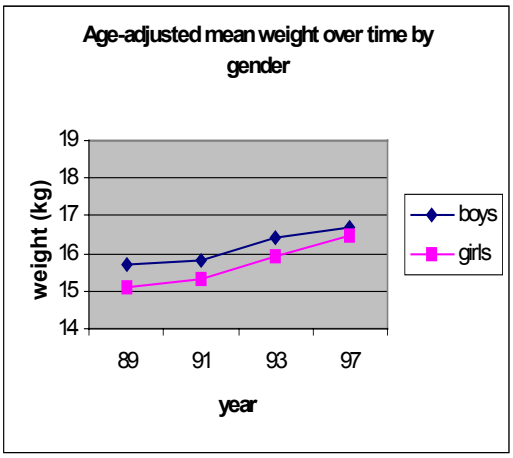
Table 3. Longitudinal analysis of overweight and obesity based on 944 children aged 2-6 yrs in 1989, and 800, 762, 640 children during follow-ups in 1991, 1993, and 1997, respectively

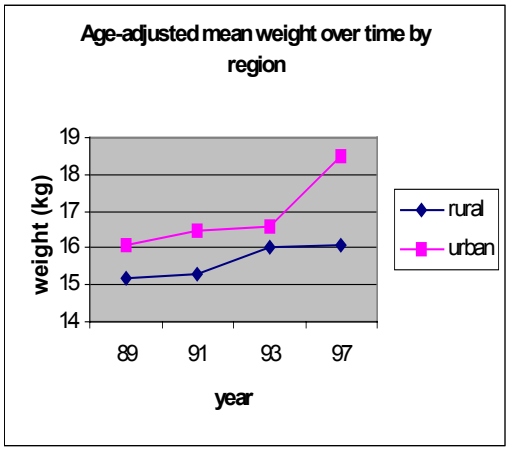
	Overweight				Obesity			
			95% confidence interval				95% confidence interval	
	Estimate	OR	Low	Upper	Estimate	OR	Low	Upper
Age (year)	-0.18	0.83	0.75	0.92	-0.23	0.79	0.66	0.96
Time (year)	-0.07	0.93	0.83	1.05	0.00	1.00	0.81	1.22
Gender (0=girls, 1=boys)	-0.11	0.90	0.69	1.17	-0.35	0.71	0.46	1.09
Region (0=rural, 1=urban)	-0.06	0.94	0.65	1.37	-0.86	0.42	0.21	0.83
Parental overweight (0=no,1=yes)	0.46	1.59	1.21	2.09	0.57	1.77	1.14	2.75
Region*time	0.12	1.12	1.01	1.25	0.24	1.27	1.08	1.49

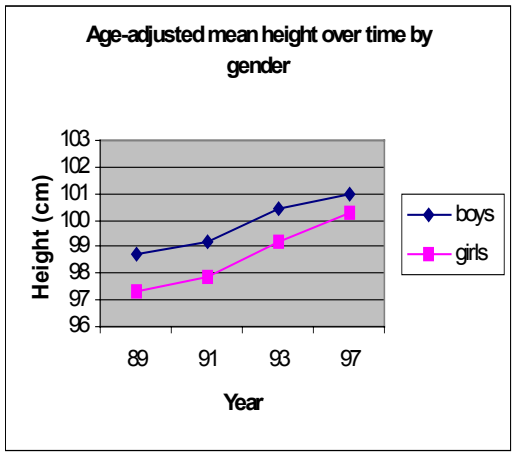
Table 4. Logistic model for tracking of overweight from 1989 to 1997 among 692 children aged 2-6 in 1989

		95% confidence interval	
	OR	Low	Upper
Age (year)	0.86	0.66	1.12
Gender (0=girls, 1=boys)	0.99	0.49	2.01
Region (0=rural, 1=urban)	1.46	0.64	3.31
Baseline overweight (0=no,1=yes)	2.21	1.01	4.85
Parental overweight (0=no,1=yes)	3.86	1.63	9.16
Median vs. low income	2.20	0.81	6.02
High vs. low income	2.23	0.80	6.19

Figure 1. Trends of weight and height over time by gender and region







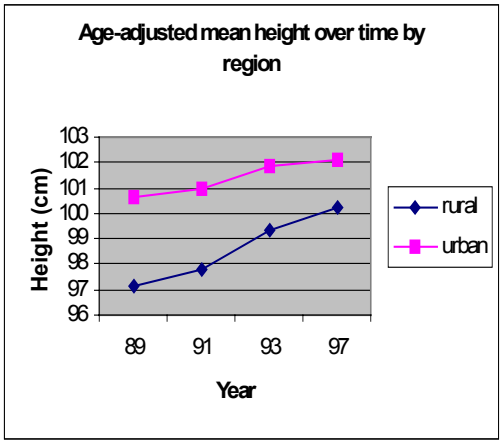
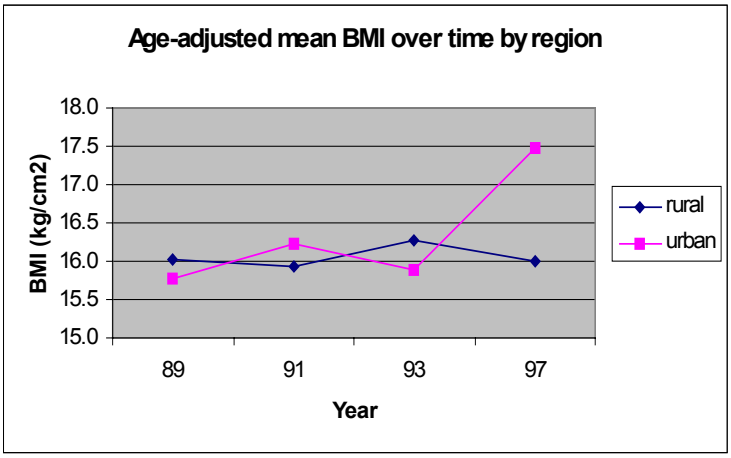
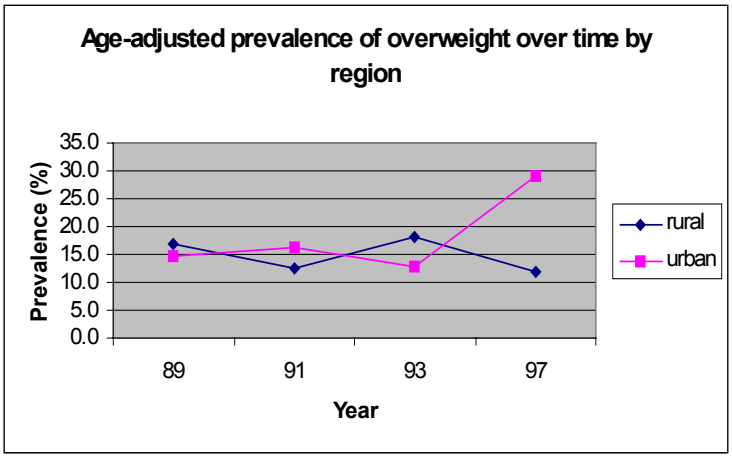
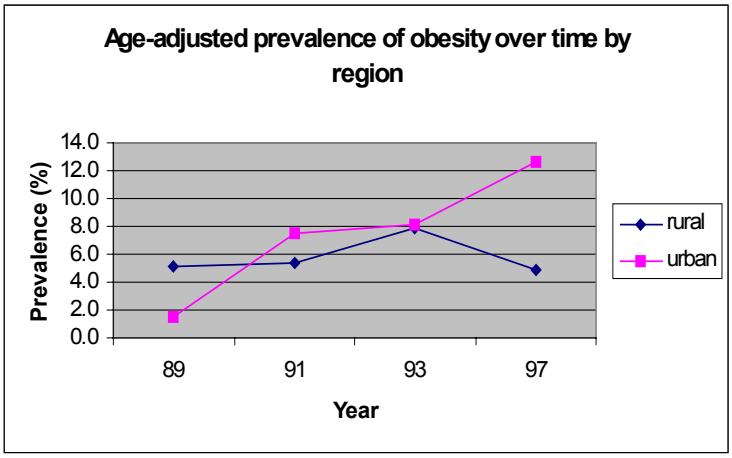


Figure 2. Trends of BMI, overweight and obesity over time by region







References

[1] Galuska DA, Serdula M, Pamuk E, Siegel PZ, Byers T. Trends in overweight among US Adults from 1987 to 1993: A Multistate Telephone Survey. *AM J Public Health* 1996; 86: 1729-1735.

[2] Popkin BM and Doak CM. The obesity epidemic is a worldwide phenomenon. *Nutrition Reviews* 1998; 56: 106-114

[3] Mokdad AH, et al. The spread of the obesity epidemic in the United States, 1991-1998. *JAMA* 1999; 282: 1519-1522.

[4] Loughlin JO, Paradis G, Meshefedjan G and Gray-Donald K. A five-year trend of increasing obesity among elementary schoolchildren in multiethnic, low-income, inner-city neighborhoods in Montreal, Canada. *International Journal of Obesity* 2000; 24: 1176-1182.

[5] Troiano RP, Flegal KM, Kuczmarski RJ, Campbell SM and Johnson CL. Overweight Prevalence and Trends for Children and Adolescents: The National Health and Nutrition Examination Surveys, 1963 to 1991. *Arch Pediatr Adolesc Med* 1995; 149: 1085-1091.

[6] Bundred P, Kitchiner D and Buchan I. Prevalence of overweight and obese children between 1989 and 1998: population based series of cross sectional stidies. *BMJ* 2001; 322:1-4.

[7] Lewis CE, Smith DE, Wallace DD, Williams OD, Bild DE and Jacobs DR. Seven-year Trends in Body Weight and Associations with Lifestyle and Behavioral Characteristics in Black and White Young Adults: The CARDIA Study. *American Journal of Public Health* 1997; 87: 635-642.

[8] Chinn S, Hughes JM and Rona RJ. Trends in growth and obesity in ethnic groups in Britain. *Archives of Disease in Childhood* 1998; 78: 513-517.

[9] Pi-sunyer FX. Health implications of obesity. *Am J Clin Nutr* 1991; 53: 1595s-1603s

[10] Must A, Spadano J, Coakley EH, Field AE, Colditz G, Dietz WH. The disease burden associated with overweight and obesity *JAMA* 1999; 282: 1523-1529

[11] Lee ZS, Critchley JA, Chan JC, Anderson PJ, Thomas GN, Ko GT, Young RP, Chna TY, Cockram CS, Tomlinson B. Obesity is the key determinant of cardiovascular risk factors in the Hong Kong Chinese population: cross-sectional clinic-based study. *Hong Kong Medical Journal* 2000; 6:13-23.

[12] Hu FB, Wang BY, Chen CZ, Jin YT, Yang JH, Stampfer MJ and Xu XP. Body mass index and cardiovascular risk factors in a rural Chinese population. *Am J Epidemiol* 2000; 151: 88-97

[13] Stoll BA. Adiposity as a risk determinant for postmenopausal breast cancer.[review]. *International Journal of Obesity & Related Metabolic Disorders* 2000 ; 24:527-533.

[14] He Q, Ding ZY, Fong DY, Karlberg J. Blood pressure is associated with body mass index in both normal and obese children. *Hypertension* 2000; 36: 165-170.

[15] Figuermo-Colon R, Franklin FA, Lee JY, Aldridge B, Alexander L. Prevalence of obesity with increased blood pressure in elementary school-aged children. *Southern Medical Journal* 1997; 90: 806-13.

[16] Young TK, Dean HJ, Flett B, Wood-Steiman P. Childhood obesity in a population at high risk for type 2 diabetes. *Journal of Pediatrics* 2000; 136: 365-369.

[17] Erickson, SJ. Are overweight children unhappy? Body Mass Index, Depressive Symptoms, and Overweight Concerns in Elementary School Children. *Archives of Pediatrics & Adolescent Medicine* 2000; 154: 931-935.

[18] Braet C, Mervielde I, Vandereycken W. Psychological aspects of childhood obesity: a controlled study in a clinical and nonclinical sample. *Journal of Pediatric psychology* 1997; 22:59-71.

[19] Kotani K et al. Two decades of annual medical examinations in Japanese obese children: Do obese children grow into obese adults? I*nternational journal of obesity and related metabolic disorders* 1997; 21: 912-921.

[20] Popkin BM, Paeratakul S, Zhai F, and Ge K. Body weight patterns among the Chinese: results from 1989 and 1991 China Health and Nutrition Surveys. American Journal of Public Health 1995; 85: 690-694.

[21] Popkin BM, Paeratakul S, Zhai F, Ge K. Dietary and Environmental Correlates of Obesity in a Population Study in China. *Obesity Research* 1995; 3(Supplement): 135s-143s.

[22] Zhai F, Guo X, Popkin BM, Ma L, Wang Q, Yu W, Jin S, and Ge K. The evaluation of the 24-hours individual recall method in China. *Food Nutr Bull* 1996; 17: 154-161.

[23] Wang Y, Poplin BM, Zhai F. The nutritional status and dietary pattern of Chinese adolescents, 1991 and 1993. *Eur J Clin Nutr* 1998; 52: 908-916.

[24] Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *British Medical Journal* 2000; 320:1240-

[25] Wang Y, Ge K, Popkin BM. Tracking of body mass index from childhood to adolescence: a 6-y follow-up in China. *Amj Clin Nutr* 2000; 72: 1018-1024

[26] SAS/STAT User's Guide, Version 6, Fourth Edition, Volumes 1 and 2. Cary, NC: *SAS Institute Inc*.

[27] Freedman DS, Srinivasan SR, Valdez RA, Williamson DF, Berenson GS. Secular increases in relative weight and adiposity among children over two decades; the Bogalusa Heart Study. *Pediatrics* 1997; 99: 420-426

[28] De onis M and Blossner M. Prevalence and trends of overweight among preschool children in developing countries. *Am J Clin Nutr* 2000; 72:1032-1039

[29] Sakamoto N, Wansorn S, Tontisirin K and Marui E. A social epidemiologic study of obesity among preschool children in Thailand. *International Journal of Obesity* 2001; 25: 389-394.

[30] Mo-suwan L, Junjana C, Puetpaiboon A. Increasing obesity in school children in a transitional society and the effect of the weight control program. *Southeast Asian Journal of Tropical Medicine and Public Health* 1993; 24: 590-594

[31] Boldori L, Marelli A. Monitoring the trend of overweight children in Cremona. *Minerva Pediatrica* 2000; 52:21-27.

[32] Ding ZY, He Q, Fan ZH, et al. National epidemiological study on obesity of children aged 0-7 years in China 1996. *National Med J China* 1998; 78: 121-123.

[33] Martorell R, Khan K, Hughes ML and Grummer-Strawn LM. Overweight and obesity in preschool children from development countries. *Int J Obes* 2000; 24: 959-967.

[34] WHO expert Committee. Physical status, the use and interpretation of anthropometry. *World Health Organ Tech Rep Ser* 1995; 854: 161-31.

[35] Barlow SE, Diets WH. Obesity evaluation and treatment: expert committee recommendations. *Pediatrics 1998;* 102: 626-

[36] Himes JH. Dietz WH. Guidelines for overweight in adolescent preventive services: recommendations from an expert committee. The Expert Committee on Clinical Guidelines for overweight in Adolescent preventive Services. *American Journal of Clinical Nutrition* 1994; 59: 307-16.

[37] Poskitt EM. Defining children obesity: the relative body mass index (BMI). European Childhood Obesity group. *Acta Paediatrica* 1995; 84: 961-3.

[38] Wang et al. Standard definition of child overweight and obesity worldwide (letters). *BMJ* 2000; 321: 1158

[39] Obesity: Preventing and managing the global epidemic. *Report of a WHO Consultation on Obesity*. Geneva, 3-5 June 1997.

[40] Gortmaker SL et al. Television viewing as a cause of increasing obesity among children in the United States, 1986-1990. *Arch Pediatr Adolesc Med* 1996; 150: 356-362

[41] Yang NH, Zhou YZH, Mao LM. Survey on prevalence and affecting factors of obesity of schoolchildren in Wuhan. *Proceeding of Danone Institute China 3rd Annually Symposium*. Beijing, 2000; 62-65.

[42] Popkin, BM, Ge K, Zhai, F, Guo X, Ma, H, and Zohoori N. The Nutrition transition in China: A Cross-Sectional Analysis. European Journal of Clinical Nutrition 1993; 47: 333-346