The Comparative Study of Body Mass Index Distribution Among Preschool Children in a 7 Years Period in North of Iran

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Abstract: The main objective of this study is the comparison of Body Mass Index distribution among preschool children between 1997 and 2004. Using cluster and simple sampling chose 20 villages and 20 persons completed the questionnaires and measured their weight and height. The sample size was 3154 (stage 1 = 1585 cases and stage 2 = 1569 cases). Data of two stages was added to the file and was analyzed by spss.win soft-war. NCHS standard was used for comparison. The BMI percentiles by NCHS standard were used to classify subjects as follows: under weight, <5th BMI percentiles; healthy weight, 5th-84th BMI percentiles; overweight, 85th-94th BMI percentiles; or obese, 95th = BMI percentiles. Gorgan a capital city and located in north of Iran and south east of Caspian Sea. In spite of boy's weight increased about 0.1 kg, but height increased about 3.4 cm in second stage and t-test is significant between two stage by height (p<0.001). Girl's weight didn't have any change, but height increased about 2.7 cm. t-test is significant between two stages by height (p<0.001). The prevalence of obesity and overweight declined 17.36 and 4.7% respectively after 7 years. There is a statistical significant between two stages by obesity index (p<0.05). The most outstanding results of this study is unvarying of weight and dramatically improving of height. The prevalence of obesity and overweight significantly declined after 7 years. Some health strategy that carried out by health managers in this area can caused this situation. Other studies are necessary for following the physical growth pattern in future.

Key words: Children, BMI, village, Gorgan, Iran

INTRODUCTION

Protein-energy malnutrition in young children and obesity are two major problems in many developing countries, including Iran (Azizi et al., 2001). To counter obesity in a population, it is important to know its incidence, trend and differentials. The nutritional status of an individual or of a population can be assessed with clinical, biochemical and anthropometric measures. Of these, anthropometry has the advantage because it is easy to perform and requires simple apparatus.

Several studies (Sanna et al., 2006; Valerio et al., 2006; Ogden et al., 2006; Shields, 2006) showed that Pediatric overweight and obesity are becoming an epidemic worldwide, which indicates the need for formulating preventive programs and policies during a child's early years. Some agents have an affect on obesity, low physical activity, high TV watching, users computer playing, high calorie diet and high income (Ng et al., 2006; Kang et al., 2006; Sanigorski, 2005; Shields, 2006; Frank et al., 2006; Wang and Zhang, 2006; Deleuze et al., 2005; Maffeis et al., 2006). Several micronutrients, like

zinc, iron, iodine, selenium, vitamin A, B12 and B9 take part in component of some enzymes and hormones and their activity. Lack of mentioned nutrients can change the body metabolism and physical growth pattern (Marreiro et al., 2002; Brown et al., 2003; Singh et al., 2004; Pinhas-Hamiel et al., 2003, 2006).

Many anthropometric indexes are defined in this essay are considered to be indicators of the nutritional status of children. Currently, the most widely used anthropometric index is Body Mass Index (BMI), weight-for-height.

Sayari et al. (2001) among under 5 children showed that Golestan province children were in the first category on based of weight and in the 13th category on base of height among 28 provinces in Iran. He reported that there is not any concord between height and weight growth patterns. Another study (Veghari et al., 2003) in this area showed that children suffer from stunting in comparison with wasting. Health supervisors in this area established a high quantity and high quality of Primary Health Care (PHC) services, food fortification during last years. It was necessary that a survey would be down about nutritional

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variety after many years in Gorgan area and we designed this study for find out physical growth pattern among 2-5 years old children by antheropometric method and compared results of two studies in 1997 and 2004. Gorgan district located in mountain-side in north of Iran and south east of Caspian Sea. There is the capital city of Golestan Province and according to the report of Iranian Statistical Center (SCI, 2006) have a population of more than 400000 and is one of the agricultural region of Iran. On the basis of above report the villages population in this town is about 46% as whole, which are mainly engaged in agricultural occupation. The most objective of this study is the comparison of the BMI composition among preschool rural children between 1997 and 2004 in this area.

MATERIALS AND METHODS

This is a cross-sectional study that carried out in villages of Gorgan (North of Iran) in 1997 and 2004. We have chosen 20 of 118 villages by using cluster and simple sampling. All of the 2-5 years old children in this area were chosen as a sample. A health system worker from any villages was instructed to collect the data. Questioners in two stages were the same. Sample size was 3154 (the first stage = 1585 and the second stage = 1569). Height, weight and birth date were recorded. The height was measured in a standing posture without shoe and 4 parts of body (heel, scapula, back of the head) attached to the wall and was recorded

to the nearest 0.5 cm. The weight, with fewer clothes, has been measured with scales confirmed by WHO and was recorded to the nearest 0.5 kg. Scale were calibrated daily. The exact age has been recorded from health records in health house. In addition, total of data was merged and analyzed by anthropometrics and statistical software. χ^2 test and t-test were used to compare two groups.

The National Centers for Health Statistical (NCHS) (Ogden *et al.*, 2002; WHO, 1983) was used for comparison of the groups. The BMI percentiles (Leonard *et al.*, 2004; Krebs *et al.*, 2003) were used to classify subjects as follows: under weight, <5th BMI percentiles; healthy weight, 5th-84th BMI percentiles; overweight, 85th-94th BMI percentiles; or obese, ≥95th BMI percentiles. Gorgan district located in mountain-side in north of Iran and south east of Caspian Sea. The most people living in this area are farmers.

RESULTS

Mean of boy's weight increased 0.1 kg in 2004 compare to 1997. Mean of boy's height increased 3.4 cm in 2004 in comparison with 1997. T.test is not significant between two stages by weight but there is significant difference by height in all of age groups and all (p<0.001). Mean of boy's BMI was declined 1.3 kg m^{-2} in 2004 in comparison with 1997 and statistical differences is significant between two stages in all of age groups an all (p<0.001) (Table 1).

Table 1: The comparison of mean and standard deviation of weight and height among boy's children in villages of Gorgan between 1997 and 2004

Age	1997				2004			
(months)	Weight (kg)	Height (cm)	BMI (kg m^{-2})	No.	Weight (kg)	Height (cm)	BMI (kg m^{-2})	No.
25-30	12.5±1.4	83.8±6.2	17.9±2.4	122	12.8±1.5	87.1±4.5	16.9±1.5	121
31-36	13.9±2.1	89.1±5.2	17.6±3.6	117	13.8±1.6	92.2±5.3	16.2±1.4	165
37-42	14.2±2.0	92.2±5.8	16.8±2.4	98	14.4±1.6	95.3±5.5	15.9±1.4	125
43-48	15.1±1.5	93.3±7.3	17.6±3.7	136	15.3±1.6	98.1±5.8	16.0±1.7	167
49-54	15.7±1.9	97.2±7.0	16.7±2.3	126	15.9±1.8	101.2±5.8	15.5±1.3	101
55-60	16.5±1.6	101.6±6.3	16.1±1.9	124	16.8±1.7	105.3±4.8	15.1±1.3	127
Total	14.7±2.1	92.9±8.6	17.2±2.9	723	14.8±2.1	96.3±9.2	15.9±1.6	86

t-test is significant between two stages on base of height an BMI indexes in all of age groups an all (p<0.001) but there is no statistical significant on base of weight

Table 2: The comparison of mean and standard deviation of weight and height among girl's children in villages of Gorgan between 1997 and 2004

Age	1997				2004			
(months)	Weight (kg)	Height (cm)	BMI (kg m^{-2})	No.	Weight (kg)	Height (cm)	BMI (kg m^{-2})	No.
25-30	12.0±1.3	83.4±5.3	17.4±2.6	107	12.0±1.5	85.5±6.1	16.4±1.8	105
31-36	13.7±4.3	86.4±5.9	18.4±6.4	119	12.8±1.5	89.4±6.6	16.3±4.3	159
37-42	13.5±1.9	89.6±7.1	16.9±2.4	114	13.9±1.7	93.7±5.6	16.7±3.2	125
43-48	14.7±1.8	93.9±5.2	16.8±2.3	122	14.7±1.8	96.7±6.8	15.9±2.9	141
49-54	15.0±2.1	96.1±7.9	16.4±2.7	132	15.6±1.9	100.8±6.0	15.3±1.4	114
55-60	16.2±1.7	100.3±6.2	16.3±2.0	147	16.3±2.5	103.9±6.6	15.1±1.7	119
Total	14.3±2.7	92.2±8.6	17.0±3.4	741	14.3±3.9	94.9±8.8	16.0±3.4	763

t-test is significant between two stages on base of height an BMI indexes in all of age groups an all (p<0.001) but there is no statistical significant on base of weight

Table 3: The comparison of BMI distribution among boys children in villages of Gorgan between 1997 and 2004 on base of NCHS percentiles

| Age (months) | BMI | | | | | | | | | |
| | 2004 | | | | | 1997 | | | | |
	<5%	5-84%a	85-95%	95% ≤b	No	<5%	5-84%a	85-94%	95%≤b	No
24-30	5(4.1)	85 (70.3)	22(18.2)	9 (7.4)	121	8(6.1)	71(53.7)	18(13.7)	35(26.5)	132
31-36	16(9.7)	124 (73.9)	15 (9.1)c	12(7.3)	167	8(6.6)	57(46.7)	26(21.3)c	31(25.4)	122
37-42	16(12.8)	94 (85.2)	9 (7.2)	6(4.8)	125	15(14.2)	57(53.7)	8(7.6)	26(24.5)	106
43-48	13(7.8)	123 (73.6)	14(8.4)	17 (10.2)	167	15(10.1)	65(44)	18(12.1)	50(33.8)	148
49-54	10(9.9)	73 (72.3)	14 (13.8)	4(4)	101	13(9)	78(54.2)	20(13.9)	33(22.9)	144
55-60	22(17.3)	91 (71.7)	13(10.2)	1(0.8)	127	20(14.7)	84(61.8)	15(11)	17(12.5)	136
Total	82(10.1)	590 (73.0)	87(10.8)	49(6.1)	808	79(10)	412(52.3)	105(13.3)	192(24.4)	788

a, b : χ^2 test is significant between two stages in all of age groups and all (p<0.05). c: χ^2 test is significant between two stages (p<0.05). Values in parentheses show percentage

Table 4: The comparison of BMI distribution among girls children in villages of Gorgan between 1997 and 2004 on base of NCHS percentiles

| Age (months) | BMI | | | | | | | | | |
| | 2004 | | | | | 1997 | | | | |
	<5%	5-84%a	85-95%	95% ≤b	No	<5%	5-84%a	85-94%	95%≤b	No
24-30	6 (5.7)	84 (80)	8 (7.6)c	7(6.7)	105	8 (7.1)	59 (52.2)	19 (16.8)c	27 (23.9)	113
31-36	10 (6.3)	124(78)	12(7.5)d	13 (8.2)	159	6(4.6)	64(48.8)	19 (14.5)d	42(32.1)	131
37-42	6 (4.8)	95 (75.8)	17 (13.8)e	7(5.6)	125	5(4.2)	62 (51.6)	22(18.4)e	31 (25.8)	120
43-48	13 (9.2)	102 (72.4)	16(11.3)	10(7.1)	141	9(7)	70(54.2)	21(16.3)	29(22.5)	129
49-54	12 (10.5)	83 (72.4)	18 (16)	1 (1.1)	114	13(9.2)	79(55.6)	24(16.9)	26(18.3)	142
55-60	11(9.2)	93(78.2)	11 (9.2)f	4(3.4)	119	10(6.2)	97(59.8)	35(21.7)f	20 (12.3)	162
Total	58(7.6)	581 (76.1)	82(10.8)j	42(5.5)	763	51(6.4)	431(54.1)	140(17.6)j	175(21.9)	797

a, b: χ^2 test is significant between two stages in all of age groups and all (p<0.05). c, d, e, f, j: χ^2 test is significant between two stages (p<0.05). Values in parentheses show percentage

Mean of girl's weight did not vary in 2004 in comparison with 1997 but Mean of height increased 2.7 cm in 2004 in comparison with 1997. T.test is not significant between two stages by weight but there is significant difference by height in all of age groups an all (p<0.001). Mean of girl's BMI declined about 1 kg m^{-2} in 2004 compare to 1997 and statistical differences is significant between two stages in all of age groups an all (P<0.001) (Table 2).

Prevalence of overweight and obesity of boys decreased about 2.5 and 18.3%, respectively in 2004 in comparison with 1997. χ^2 test is significant by normal weight and obesity in two stages (p<0.05). Overweight only in 31-36 months age group is significant between two stages (p<0.05) (Table 3).

Prevalence of overweight and obesity among girls decreased 6.8 and 16.8%, respectively in 2004 in comparison with 1997. χ^2 test shows significant differences by normal weight and obesity index in two stages (p<0.05). χ^2 test is significant among 5 of 7 age groups by overweight between two stages (p<0.05) (Table 4).

Prevalence of underweight and obesity in boys are more than in girls but, this differentiation is not significant between two genus. The girls are more than boys in normal weight range, but this difference is not significant. In two genus, the prevalence of overweight and obesity was declined 4.7 and 17.36% in 2004 in comparison with 1997, respectively.

DISCUSSION

Despite of overweight and obesity boost in world but one of the outstanding results of this study is significant decrease of overweight, obesity, constancy of weight and markedly raising of height after 7 years in Gorgan district.

Other studies showed that Gorgan children suffer from stunting than underweight. Sayari (2001) study on the under 5 years old children showed that Golestan province (this area) has the 1st and 13th position based on mean of weight and height respectively, among 28 provinces of Iran. Veghari (2003) showed that children in this region suffer from stunting than underweight. After mentioned studies, experience of Iranian ministry of health announced that Protein Energy Malnutrition (PEM) and trace elements deficiency such as iron, zinc, folic acid probably caused this situation. These studies confirm results of present study.

Batista and Rissin (2003) reported that children height deficit improved in urban and village regions 72 and 54.4%, respectively in Brazil and obesity rates doubled or tripled in a 20 years period. Grummer et al. (1996) among preschool children between two stages showed that height deficit decreases from 28 to 22% and weight deficit decreased from 1 5 to 10.5%. Pinchinat et al. (2004) in Senegal reported that after 23 years nutritional intervention, in spit of decreasing of mortality, weight growth pattern has not changed.

Sheikholeslam *et al.* (2004) in Iran, showed that after nutritional intervention among under 5 years old children in three provinces, height and weight growth pattern improved significantly. Other studies (Brown, 2003; Singh *et al.*, 2004; Gopaldas, 2005; Brown *et al.*, 2002; Malekafzali *et al.*, 2000) showed that food fortification and nutritional intervention can improve the secular The prevalence of obesity in boys is higher than girls in both 1st and 2nd stages. Sanna *et al.* (2006) Valerio *et al.* (2006) and Azizi *et al.* (2001) reported like results.

We did not have any nutritional intervention in this area after 1st stage, but local health managers employed some activities such as health education, improvement of Primary Health Care, extension of vaccination, prevention of infectious disease and food fortification to improve public health. These applications may change the secular growth among children.

In the last study (2004) in this area, the prevalence of obesity was 5.8% and that is more than Gross *et al.* (2006) study in Peru (4.6%) and Duran *et al.* (2006) study in Latin America and Caribean (4.3%) but it is less than Fernald and Neufeld (2007) in Mixico (10%) and Mamabolo *et al.* (2005) study in South Africa (24%).

Briefly, this study shows that the prevalence of obesity and overweight declined after 7 years (1997 to 2004) and height growth improved considerably in comparison with weight growth. Some health strategy that carried out by health managers in this area can cause this situation. Other studies are necessary to fallow the physical growth among children in this region.

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