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Three yearly variations of some anthropometric measurement and body composition of children in the different socio-economic status

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Abstract

The aim of the study is to investigate 3 yearly variations on body fat, BMI, and some anthropometric measurements of children in the different socio-economic status. Longitudinal survey including tree yearly measurements was used. Totally 397 children (192 female, 205 male) participated in this study Weight, height, some skinfold thickness (triceps, biceps, subscapula, calf and suprailliac), some diameter (biacromion, femur, humerus, biiliac), some circumference (biceps, femur, calf) was measured. Socio-economic status was determined according to settled area of school and level of income children's family. It was found that there was a significant difference in femur, humerus, biiliac diameters between girls and boys children at all years ($p<0,01$). In both girl and boys who have low and high socio-economic status, there were significant differences between first and second and third years measurements ($p<0,01$). **Conclusions:** Both girls and boys in the high socio-economic status have fatter and higher values of BMI and % body fat than both girls and boys in the low socio-economic status.

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Keywords: Body fat %, socio-economic status, children, BMI;

1. Introduction

Please Growth and development are intrinsic characteristics of childhood. Growth is the increase in size of a child, while development is the progressive acquisition of physical (motor), cognitive (thought), linguistic (communication) and social (emotional) skills and/or attributes. Progress in growth and developmental processes are related to age, and have a normal pattern. However, there is a range in age at which certain body sizes are attained and developmental processes completed. Several factors, acting singly or in combination, influence the rate and pattern of growth and development. These factors include biological, psychological and social factors (Oyewale et al. 2010). Children between the ages of 5 and 12 years of age are vulnerable due to their rapid growth rate. Their physical and mental development needs more attention and care (Prabir et al., 2011)

Restricted social and economic resources have been associated with poor growth and poor developmental outcomes. The few studies that address the relationship between socioeconomic factors, growth, and psychomotor development consistently report significant relationships between all three variables (Bradley & Corwyn, 2002, O'Donnell & Grippo, 2004, Abubakar et al. 2008).

A study by Vijver et. al. (2008) states that children with lower socioeconomic statuses (SES) had worse anthropometric state prevalence and had lower psychomotor development rates, than children of higher

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socioeconomic statuses. Children with lower SES experience a higher prevalence of poor anthropometric statuses and show less advanced psychomotor development than children from higher SES (Abubakar et al. 2008). It is known that socioeconomic conditions play an important role in obesity and excessive weight (Wang, 2002, McVeigh et al. 2004).

While children and adolescents from lower socioeconomic statuses in developed countries are more obese, the reverse is true in developing countries. In order to prevent health problems that may arise in the future, it is necessary to examine primary school children carefully

2. Material and method

Subjects: Four different primary schools in Antalya were selected for the socioeconomic statuses of their student (Antalya [private], Abdulkadir Özkan [private], and the Sefa Akın and Turgut Reis Primary Schools [public]). The first year female (age: 6.60±0.49 years) and male (age: 6.63±0.43 years) students in these schools formed the measurement group. Socioeconomic statuses were determined by income level and the statuses of the schools. Questionnaires concerning the socioeconomic statuses of the children were filled out by their parents, and the same set of measurements were made in November of the first, second and third years

2.1. Measurements

Height: Height was measured with a wall scale using the distance between the floor and the vertex point of the head with the head in a perpendicular, Frankfort position and heels together. *Weight:* Weight was measured using a Tanita TBF-300 electronic scale with 0.1 cm accuracy, with the subjects wearing light clothes and no shoes. *Skinfold:* Skinfold was measured twice on the right side using a Holtain skinfold caliper for the triceps, biceps, sub scapula and suprailiac areas. The third measurement was not taken since the difference between two initial measurements was more than 0.4mm. The average of the nearest two measurements was calculated and recorded. *Diameters:* Biacromion, femur, humerus and biiliac diameters were measured using a caliper on the left and right sides, and the larger value was recorded. Biceps, femur and calf circumferences were also measured and recorded (Özer, 1993).

2.2. Calculations

Body mass index was calculated using the following equation: Body Mass Index (BMI) = Weight/Height (kg/m^2). Durnin-Womersley's age correlated body density was measured using skinfold thickness values in the following equation: (D=1.1620-0.0630*X) (X=triceps+sub scapula+biceps+suprailiac). The body density obtained was used in Siri's equation (4.95 / D-4.5)*100) to calculate values for percentage of body fat (Özer, 1993, Lohman et. al. 1988).

2.3. Statistics

The descriptive statistics and distributions of both groups were analyzed. The significance of the changes between measurements was determined by repeated measurements ANOVA, and after determining the significant time-dependent changes between groups, the differences between measurements were evaluated using the paired T-test. Differences between socioeconomic statuses were evaluated by an independent T-test

Table 1. Measurements over three years of height, weight, body fat Percentages and BMI

	1st YEAR n=180F, 196M		1-2	2nd YEAR n=176F, 184M		2-3	3rd YEAR n=150F, 154M		1-3
Gen.	A.M	SD	p	A.M	SD	p	A.M	SD	p

Height (cm)	F	120.45	5.19	++	125.19	5.58	++	132.03	5.92	++
	M	120.06	5.58		125.16	5.77		131.63	5.91	
Weight (kg)	F	23.48	4.53	++	26.56	5.30	++	30.70	6.97	++
	M	23.36	4.44		26.75	5.61		30.74	7.35	
Fat (%)	F	21.56	4.43		21.96	4.96	++	24.35	5.73	++
	M	14.65	4.76	**	14.82	5.28	**	17.33	6.72	**
BMI (kg/m^2)	F	17.23	3.29		16.85	2.54	+	17.48	3.11	+
	M	16.90	3.07		16.96	2.59		17.60	3.28	

*/+ P<0.05 **/++ p<0.01 (*Differences by gender and + differences in measurements)

When the height and the weight values of the three years were examined, it was found that there was a significant statistical difference for the yearly increase ($p<0.01$), and that it did not correspond to gender ($p>0.05$). It was observed that there was not a significant statistical difference between the first and the second measurements of body fat percentages ($p>0.05$), while it increased between the second and the third measurements, as well as the first and the third ($p<0.01$). It was also found that females had higher values than the males throughout the three years' measurements (table1).

Table 2. Measurements over three years of the circumferences (biceps, thigh, calf) and diameters (biacromion, humerus and femur).

		1st YEAR n=180F, 196M		1-2	2nd YEAR n=176F, 184M		2-3	3rd YEAR n=150F, 154M		1-3
	Gen.	**A.M**	**SD**	**p**	**A.M**	**SD**	**p**	**A.M**	**SD**	p
F	17.41	1.88	+	18.14	2.81	+	20.49	3.32	++	
M	17.32	2.13		18.03	2.71		19.91	2.90		
F	32.28	3.29	++	34.89	4.51	++	37.85	5.57	++	
M	31.36	3.73		34.14	4.56		36.78	5.66		
F	24.63	2.48	+	25.87	3.18	+	28.09	3.30	++	
M	24.14	2.54		25.34	3.12		27.88	3.37		
F	25.67	1.42	+	26.44	1.46	+	28.10	1.87	++	
M	25.58	1.55		26.52	1.52		27.95	1.48		
F	4.49	0.33	*	4.55	0.58	*	4.82	0.45	* +	
M	4.61	0.33		4.69	0.45		4.99	0.41		
F	6.92	0.40	*	6.94	0.59	**	7.52	0.66	* +	
M	7.10	0.42			7.27	0.57		7.77	0.58	

*/+ P<0.05 **/++ p<0.01 (*Differences by gender and + differences in measurements)

All circumference and diameter measurements increased over the three years of measurements, and that this increase was statistically significant ($p<0.05$ and $p<0.01$). Differences in measurements specific to gender over the three years were only found in humerus and femur circumferences (table 2).

Table 3. p Values of the socioeconomic level differences and three years' measurements

	1st YEAR n=191 L, 187 H			2nd YEAR n=181 L, 179 H			3rd YEAR n=147 L, 157 H		
SES	**A.M**	**SD**	**p**	**A.M**	**SD**	**p**	**A.M**	**SD**	**p**

Height (cm)	**Low**	118.69	5.12	**	123.09	5.32	**	129.63	5.59	**
	High	121.86	5.20		127.27	5.24		134.22	5.40	
Weight (kg)	**Low**	21.65	3.65	**	24.70	4.69	**	28.16	6.03	**
	High	25.26	4.52		28.63	5.48		33.50	7.36	
Fat (%)	**Low**	15.87	4.97	**	15.92	5.42	**	17.63	6.46	**
	High	20.08	5.74		20.72	6.13		23.32	6.76	
BMI (kg/m^2)	**Low**	15.26	1.69	**	16.20	2.07	**	16.63	2.59	**
	High	18.92	3.30		17.62	2.81		18.51	3.52	

*p<0.05 **p<0.01 (L: low SES, H: High SES)

The three years' values of the height, weight, body fat percentage and body mass index reveal a statistically significant difference of p<0.01 between the students of lower and higher socioeconomic levels in all the measurements made over the three years (table 3).

Table 4. Measurement of circumferences (biceps, thigh, calf) and diameters (biacromion, humerus and femur) and SES over three years.

		1st YEAR n=191 L, 187 H			**2nd YEAR n=191 L, 187 H**			**3rd YEAR n=147 L, 157 H**		
	Gen.	**A.M**	**SD**	**p**	**A.M**	**SD**	**p**	**A.M**	**SD**	p
Biceps	**Low**	16.65	1.75	**	17.32	2.72	**	19.04	2.92	**
	High	18.09	2.01		18.86	2.58		21.77	3.32	
Thigh	**Low**	31.04	3.38	**	32.94	4.32	**	34.32	4.11	**
	High	32.57	3.56		36.09	4.23		39.82	5.52	
Calf	**Low**	23.55	2.26	**	24.33	2.66	**	26.05	2.49	**
	High	25.22	2.50		26.88	3.12		29.64	3.09	
Biacromion	**Low**	25.09	1.27	**	26.16	1.45	**	27.69	1.66	**
	High	26.17	1.51		26.81	1.47		28.33	1.66	
Humerus	**Low**	4.50	0.32		4.59	0.38		4.91	0.45	
	High	4.62	0.33		4.66	0.63		4.91	0.42	
Femur	**Low**	6.98	0.43		7.11	0.48		7.60	0.70	
	High	7.05	0.41		7.12	0.71		7.68	0.57	

*p<0.05 **p<0.01 (L: low SES, H: High SES)

When all the circumference and diameter measurements, except for the humerus and femur, were examined, it was found that all the yearly measurements show a difference between the lower and the higher socioeconomic statuses (p<0.01) (table 4).

3. Results and discussion

Our study included 376 students from the first grade of four different primary schools of two different socioeconomic statuses (SES). The second measurement of those students saw 360 students participate, whereas in the third year the study was completed with the measurement of 304 students. The repeated measurements reveal that height, weight, body fat percentage and body mass index increased in the third year (p<0.05, p<0.01) (table 1). While height and weight showed a linear increase year by year, body fat percentage and body mass index values showed a significant increase between the second and the third years. The literature about child development leads us to expect an increase of height and weight in children. When we looked at differences specific to gender, we found that there was a significant difference in favor of the male students only in body fat percentage over the three

years measurements ($p<0.01$). In each period, female students had higher body fat percentage than male students. Differences specific to gender in the measurements of circumferences and diameters were only observed in the femur and humerus (table 2). In this respect, our findings coincide with those of the literature (Pinar, 2003, Galleu, 2003).

When the socioeconomic status differences in the study were examined (table 3 and table 4), it was observed that there was a significant difference for almost all values. Only between humerus and femur diameters showed no significant difference (table 4). The students of lower socioeconomic status were slightly shorter than the children of higher socioeconomic status, but they had lower body fat percentages and body mass indices, which is in their favor. The effects of socioeconomic status have noted in many studies. Our study findings concur with those of the studies conducted in developed and developing societies.

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