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The longitudinal study of obesity prevalence in different socio-economic status for school children: a case study of obesity prevalence for school children in antalya region

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Abstract

Purpose of Study: to investigate the obesity prevalence among school children in accordance with their gender and socio-economic levels during one year period. Four schools were chosen in accordance with their social-economic levels determined by the Ministry of National Education Directorate in Antalya for this study. Descriptive data were calculated for all variables. BMI was computed as kg/m^2 . Skinfold thickness (triceps, biceps, subscapula and suprailliac) variables were measured to calculate fat (%) during one year for 7-8 years old school children. Each measurement was taken at the beginning of fall semester. Repeated measurements ANOVA and independent t test were used for statistical analyses. Girls had higher fat percentages than boys ($p < .01$). Students with high socio-economic status had higher BMI, fat (%), and body weight than students with low socio-economic status ($p < .01$). Except fat (%), all variables significantly increased during one year period. Recent studies showed higher child obesity prevalence in developing countries compared to the developed countries. However, the same situation was not observed for Turkey.

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1. Introduction

Welfare is constantly increasing in parallel with the technological developments and causes people in the developed and developing societies to become less active. An important part of adults (30%) and children (15%) are reported to be obese in the developed societies (Malina, et al, 2004). Overweight and obesity are global health problems and leading disorders resulting from inactivity (Canning et al 2004, Wang, 2002, Troiano and Flegal, 1998, WHO, 1998, Melkik et al, 1998, Ogden et al, 1997). More than half of adult men (57%) and also an important part of women (35%) in Canada are reported to be obese. In addition, obesity rate is reported to be increasing among children and youth. In Canada, 15% of school children were reported to be obese in 1981, while this rate increased by 29.2% and 35.4% until 1996. According to the data collected between 1985 and 1995 in Australia, obesity rate

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increased from 10.7% to 20.0 in male children aged 7-15 years, and from 11.8% to 21.5% in female children. Similar increases were reported by United Nations and these rates continue to increase at present (Canning et al 2004). Obesity is alone accepted as a disease, and also known as the reason for many other diseases (Melkik et al, 1998). Overweight children are more prone to chronic disorders. They are under high risk of diseases like diabetes mellitus, coronary heart disorders etc. when they grow up. Obese children have also certain psychological problems like lack of self-reliance and they are reported not to participate in social events (Malina, et al, 2004, Melkik et al, 1998).

Socio-economic conditions are also reported to play important roles in obesity and overweight (Burke et al 2001, Ramachandran et al, 2002, McCarthy 1997, McVeigh et al, 2004). Obesity is reported to be more prevalent among children and adults with low socio-economic level in developed countries, while the exact opposite situation is true for developing societies (McCarthy 1997).

There are only a limited number of studies in Turkey about the physical aptitudes, activity levels and obesity status of children. The studies have generally considered adolescence period. The primary education corresponds to a period when children can easily be shaped for the future. Activity and balanced nutrition habits are acquired in this period. Ages between 15 and 18 years (adolescence and pre-adulthood) are the period when physical activity level decreases and obesity is most prevalent. Children who are overweight and obese during these ages are reported to be more inclined to be overweight and obese in the future (Tapsell and Batterham, 2002, Whitaker et al, 1997, Kemper et al, 2001). Children at primary school ages should be carefully investigated to prevent health problems that could be encountered in the future. The present project started two years earlier to investigate primary school children for physical aptitude will be continued until the 8th grade of primary education. This study includes the height-weight relations and percentage fat values of the first and second years of the project.

2. Material and Method

Subjects: Four different primary schools in Antalya were determined concerning socio-economic status (two Private and two public schools), and the first year female (n= 182; age=6.60±0.49 y) and male (n=195; age= 6.63±0.43 y) students in these schools formed the measurement group. Socio-economic status was determined by income level and the status of schools. Questionnaire forms examining the socio-economic status of children were filled out by parents and the same measurements were taken in November of the 1st and 2nd years.

2.1. Measurements

Height, Weight, Skinfold (Triceps, biceps, subscapular and suprailiac) measurements were conducted according to Anthropometric Standardization Manual (Lohman et al 1988). Body Density estimation was obtained using Durnin-Womersley's equation ($D=1.1620-0.0630*X$; $X=\text{triceps}+\text{supscapula}+\text{biceps}+\text{suprailiac}$). The percent fat calculated using Siri's formula ($4.95 / D-4.5$)*100; Lohman et al 1988).

2.2. Statistics

Descriptive statistics and distributions of both groups were calculated. The repeated measurements (ANOVA) were used to determine differences between the first and second measurements, paired T-test was used to examine significance of the changes between measurements and independent T-test was used to determine differences between genders and groups.

3. Tables

Table 1. Descriptive statistics (AM, SD) of all female and male students attending 1st and 2nd year measurements regarding height, weight, fat (%), body mass index (BMI) and fat free mass (FFM) and comparison results of both genders (F/M)

	Gen.	1 st YEAR				2 nd YEAR			
		n	A.M	SD	p	n	A.M	SD	p
Height (cm)	F	182	120,41	5,19	0,56	177	125,17	5,58	0,97
	M	195	120,09	5,57		184	125,19	5,77	
Weight (kg)	F	182	23,45	4,53	0,87	177	26,53	5,31	0,65
	M	195	23,38	4,44		184	26,78	5,60	
Fat (%)	F	182	21,52	4,45	0,00	177	21,94	4,95	0,00
	M	195	14,65	4,77		186	14,83	5,30	
BMI (kg/m ²)	F	182	17,21	3,29	0,37	177	16,83	2,54	0,60
	M	195	16,92	3,08		184	16,97	2,59	
FFM (kg)	F	182	18,50	3,10	0,00	177	20,49	2,98	0,00
	M	195	19,85	2,76		184	22,56	3,30	

Table 1. shows means, standard deviations and comparison values between genders regarding height, weight, percentage of fat, BMI and fat free mass (FFM) of all students (female and male) prior to socio-economic distinction. The comparison between genders revealed a statistically significant difference only between fat (%) and FFM on both the 1st and 2nd year measurements (p<0.01). When the first and second year results of female students are compared by low and high socio-economic levels, a statistically significant difference was detected for all values (p<0.01). These values were found higher in children with high socio-economic levels compared to those with low high socio-economic levels (Table 1).

Table 2. Arithmetic Mean (A.M), Standard Deviation (SD) and Comparison Results (p) regarding the First and Second Year Height, Weight, Fat (%), and Fat Free Mass (FFM) of Low and High Socio-Economic Status of Female Students

Female	Socio.	1 st year			2 nd year				
		n	AM.	SD	p	n	AM.	SD	p
Height (cm)	Low	86	118.50	4.93	0,00	79	122.70	5,06	0,00
	High	96	122.11	4.84		98	127.15	5,19	
Weight (kg)	Low	86	21.28	3.44	0,00	79	24.20	4,25	0,00
	High	96	25.40	4.52		98	28.40	5,34	
Fat %	Low	86	19.44	3.31	0,00	79	19.69	3,91	0,00
	High	96	23.38	4.54		98	23.76	4,98	
BMI (kg/m ²)	Low	86	15.04	1.65	0,00	79	15.98	1,92	0,00
	High	96	19.14	3.19		98	17.51	2,77	
FFM (kg)	Low	86	17.30	2.43	0,00	79	19.32	2,69	0,00
	High	96	19.57	3.26		98	21.44	2,88	

A statistically significant difference was detected for all values (p<0.01) in the comparison of the first and second year results of female students by low and high socio-economic levels. These values were found higher in children with high socio-economic levels than those with low high socio-economic levels (table 2).

The examining of the categorical distribution of students with low and high socio-economic levels by body mass index revealed that overweight and obesity rates were higher among children with high socio-economic level (Table 3). This result was parallel with developing countries on the contrary to developed countries

Table 3. Arithmetic Mean (A.M), Standard Deviation (SD) and Comparison Results (p) regarding the First and Second Year Height, Weight, Fat (%), and Fat Free Mass (FFM) of Low and High Socio-Economic Status of Male Students.

Male	Socio.	n	1 st year			2 nd year			
			A.M	SD	p	n	A.M	SD	p
Height (cm)	Low	106	118.83	5.28	0.00	102	123.39	5.51	0.00
	High	89	121.59	5.58		82	127.43	5.31	
Weight (kg)	Low	106	21.94	3.81	0.00	102	25.09	5.00	0.00
	High	89	25.10	4.54		82	28.89	5.63	
Fat %	Low	106	13.02	4.17	0.00	104	13.11	4.63	0,00
	High	89	16.59	4.74		82	17.01	5.31	
BMI (kg/m ²)	Low	106	15.44	1.70	0.00	102	16.37	2.18	0.00
	High	89	18.68	3.41		82	17.72	2.86	
FFM (kg)	Low	106	19.00	2.48	0.00	102	21.61	3.05	0.00
	High	89	20.86	2.76		82	23.74	3.24	

Table 4. Categorical Distribution of Students with Low and High Socioeconomic Status by BMI

		1 st year				2 nd year			
		LOW		HIGH		LOW		HIGH	
		N	%	N	%	N	%	N	%
Females	NORMAL	63	94,0	29	35,4	60	89,6	50	61,0
	OVERWEIGHT	3	4,5	25	30,5	4	6,0	20	24,4
	OBESE	1	1,5	28	34,1	3	4,5	12	14,6
Males	NORMAL	99	93,4	42	47,2	79	86,8	46	63,0
	OVERWEIGHT	3	2,8	28	31,5	6	6,6	19	26,0
	OBESE	4	3,8	19	21,3	6	6,6	8	11,0

4. Discussion

In the evaluation of students' all data regardless of socio-economic level and in terms of gender, a statistically significant difference was detected between female and male students considering fat (%) and FFM values both in the 1st and 2nd year measurements ($p < 0.01$). In the literature, females are reported to have slightly more fat percentage than males in all ages and this difference is reported to gradually increase in adolescence period. Thus, it is an expected outcome that fat free mass is higher in males than females as it is calculated by fat percentage of body (Malina et al 2004). Females have higher body fat percentage than males in all ages. Body fat more rapidly increases in females and continues to increase in adolescence period, as well. Increase in body fat percentage is evident in middle childhood and adolescence period in males. Body fat percentage begins to decrease in the early years of adolescence and the low body fat percentage is maintained during adolescence (Malina et al 2004).

In the comparison of the 1st and 2nd year measurements of male students by low and high socio-economic levels, a statistically significant difference was detected in all parameters ($p < 0.01$) (table 2). In light of these results, male students with high socio-economic level were determined to have higher values similar to female students. In literature, it is reported that BMI categories are categorized for boys as normal < 17.92 , overweight $17.75 - 20.50$, and obese > 20.50 . Accordingly, male students were found overweight in the 1st year, while they were concluded within the normal limits in the 2nd year. In this regard, the findings of the present study are compatible with the reports in literature (McCarthy, 1997). In the comparison of the 1st and 2nd year measurement pairs of female students with low socio-economic level, it was determined that height increased by 3.82% ($p < 0.01$), weight by 13.91% ($p < 0.01$), body mass index (BMI) 5.58% ($p < 0.01$) and fat free mass by 12.79% ($p < 0.01$), while body fat rate decreased by 2.07% ($p > 0.05$). On the other hand, in the comparison of the 1st and 2nd year measurement pairs of female students with high socio-economic level, it was determined that height increased by 4.64% ($p < 0.01$), weight

by 14.38% ($p < 0.01$), fat free mass by 11.78% ($p < 0.01$), and body fat rate by 2.07% ($p > 0.05$), while body mass index (BMI) decreased by 7.86% ($p < 0.01$).

In the comparison of the 1st and 2nd year measurement pairs of male students with low socio-economic level, it was determined that height increased by 3.59% ($p < 0.01$), weight by 14.13% ($p < 0.01$), body mass index by 6.36% ($p < 0.01$), and fat free mass by 13.51% ($p < 0.01$), while body fat rate decreased by 0.10% ($p > 0.05$) (table 6). On the other hand, in the comparison of the 1st and 2nd year measurement pairs of male students with high socio-economic level, it was determined that height increased by 4.69% ($p < 0.01$), weight by 14.65% ($p < 0.01$), fat free mass by 13.20% ($p < 0.01$), and body fat rate by 2.52% ($p > 0.05$), while body mass index decreased by 5.89% ($p < 0.01$). The changes observed in the 1st and 2nd year measurements of female and male students with low socio-economic level were similar to each other, and the same was true for female and male students with high socio-economic level. However, the changes in parameters differed between students with low and high socio-economic levels. BMI values of female students with low socio-economic level increased, while they decreased for female students with high socio-economic level. Malina (2004) reported that BMI followed a gradually decreasing course from infancy to early childhood, and the minimum value occurred in 5-6 years of age and then started to increase linearly. Gender-related difference is reported to be quite small in childhood, but the difference becomes more evident in adulthood. It is used as an indicator for children's body fatness, and it is highly related to total body fat (Malina et al 2004). In this regard, the findings of the present study are partly compatible with literature.

BMI higher than normal level was more prevalent among female (overweight 24.4% and obese 14.6%) and male (overweight 26.0% and obese 11%) students with high socio-economic level compared to those with low socio-economic level. Accordingly, 39% of female students and 37% of male students with high socio-economic level were found overweight and obese. On the other hand, BMI rates lower than normal level was quite low among female (10.5%) and male (13.2%) children with low socio-economic level (Table 4).

The investigation of the categorical distribution of students with low and high socio-economic levels by body mass index revealed that overweight and obesity rates were higher among children with high socio-economic level. This result was parallel with developing countries on the contrary to developed countries.

Hiroki et al. (2004) investigated the factors effective on body mass indices of 3994 female and 4176 male children aged between 3 and 6 years. Consequently, they concluded that both environmental and vital habits are quite effective for lifestyle and body mass index.

Storey et al. (2003) examined the relations between BMI values, lifestyle (gender, age, family, nutritional habit, TV watching) and demographic characteristics of children aged between 6 and 11 years, and as a result, they found no relation between these factors. However, a linear relation was detected between TV watching and BMI.

This study aims to collect information about the obesity status of primary school children aged 7-8 years, determine troubled children, raise consciousness level of children and their families, and make them physically more active.

In conclusion, children at primary school age with high socio-economic level were determined to have higher overweight / fat percentage in the measurements of both years.

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