THE EVALUTION OF SOME PHYSCAL PARAMETERS WITH THE BIOELECTRIC IMPEDANCE ANALYSE AMONG THE MALE AND FEMALE BETWEEN THE AGES OF 12 AND 14

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ABSTRACT
Purpose.
The aim of this research is to evaluate some physical parameters of the students aged between 12-14 with Bioelectrical Impedance Analysis.
Method.
Total 301 private primary school students, 219 of which are male and 82 of which are female, took part in the research and these volunteers were chosen randomly. With the device of bioelectrical impedance analyses, the body fat, body mass index, basic metabolism rates, the rate of body fat, fat mass, fat free mass, total body water measurements of the students were determined and with band measure, the waist and hips are measured. The volunteers are evaluated according to their sex and their age group. Student test was implemented for the comparison between the statistical evaluations and independent groups while for the comparisons as to the age groups the variance analyses was used.0.05 was determined as the significance level.
Results.
When the physical parameters of the males and females are compared, statistical differences were realized between the age, body weight, fat free mass (p<0.01). At the same time statistical differences were seen between the height, Basal metabolic rate, the fat rate of the body, fat free mass and total body water rate and the rates of waist and hips between the female and male (p<0.001). When the male were compared according to their age groups the meaningful differences were seen in the values of height, body weight, the index of body mass, basal metabolic rate and the total body water (p<0.001), and (p<0.05) the meaningful differences were seen in the fat mass. No differences were found out in the values of the fat rate of the body, the fat free mass and the waist to hip ratio (p>0.05).
In the comparison of the female age groups, there have been considerable differences with the values of height, body weight, and fat–free body mass and in the total body water (p<0.001), and also in fat mass (p<0.05), as well as waist to hip ratio (p<0.01), but there has been no difference in the values of body mass index, basal metabolic rate and the body fat rate (p>0.05).
Conclusion.
Consequently; it has been found out that there is an increase in the values of height, body weight and body composition of the female with the age whereas the values of the male except height, body weight and body composition are stable or does not change much.
Key Words: BIA, Physical evaluation, Adolescence

Introduction

Today, it is necessary to determine the physical capacities of children and young people because of the negative effect of hypo kinesis in these age groups. Physical activity, nutrition and the physical convenience are the important elements affecting the health of children and adults. Especially in the adolescence period some differences in the level of the physical activity and some physical and physiological changes coming with the pubertal growing-up attack shows how important it is to determine the psychical conveniences of the children in this period (M. Çolak and M. Maya 2007).

There are some methods like The Index of Body Mass, the measurement of skin curls and Bioelectrical Impedance Analyses to identify the body composition. Bioelectrical Impedance Analysis, in which the resistance to this stream is scaled after giving a low electricity current level with a frequency of 50 kHz, is an easy, cheap, effective and portative method, (500µA-800µA) (bio impedance) (BIA) . With the

extra water and electrolytes included, (%73) the body tissues

purified from the fat is a good conductor for the electricity current, whereas the fat tissue including less water and electrolytes is a weak atmosphere in conducting the current of electricity. With this method it is possible to calculate body tissues purified from the fat, total body water and body fat ratio in the body. But the circumstances like the changes in the eating and drinking habits, dehydration, exercise and menstruation causing the changes in the body water rate may affect the BIA evaluations (S. Karakaş, F. Taşer, Yıldız Y. 2005).

In evaluating the BIA body composition, with the help of electrolytes alternative currents are implemented to the tissue bearing with the different frequencies and the decline in the voltage of the current is called as 'impedance'. Impedance is the resistance the tissue reacted to the current of electricity and it is inversely proportional with the conduction. The rich liquids from the electrolytes show more resistance than

the minerals in the fat and bone tissues. The high currents like 50 kHz shows the quantity of the body water by passing from cell membranes, the low currents of 1 kHz cannot pass from the cell membranes and they only show extra cellular liquid quantity. The placement of the impedance value in the fixed equation, the values such as fat rate of body, fat quantity of body, the of fat free body, water rate of body, water quantity of body, water index of body are calculated (A.Sifil, C. Çavdar, Çelik A, 2001). BIA method is a more preferred method than the other complex methods in the evaluation of determining the components of the body because it is easy to measure, mobile and reasonable and countable.BIA is used among children, young people and adolescences with confidence (O. Özçelik, R. Çolak, Ayan V, 2002).This method may be easily effected from the water quantity in determining compositions of bodies (B. Guida, R. Trio, Nastası A, 2004).

The components such as bone and tissue of fat the specific resistance of which are high aggravate the current of electricity, whereas the components like bone muscles and visceral organs with low resistance let current pass easily. All the changes in the body and in the impedance have to do with the composition of the tissues (L.A. Moreno, A. Sarria, Fleta J, 2001). Because of this, the formulas have been improved which relate impedances of tissue water, liquids and related fat-free soft tissues (R.N. Baumgartner et al. 1990). Impedance is generally measured in 50 kHz and corrected according with the height representing the length of electrical path (L.A. Moreno, A. Sarria, Fleta J, 2001). Reactance and resistance determine the impedance and some systems are designed for the separate measurement of these–electrical tissue characteristics (R.N. Baumgartner, W.C. Chumlea, Roche A.F, 1990). Although the systems are designed generally for the usage in 50 kHz for the analyses of the total body fat, multiple frequency measurements are also possible. In many researches the body composition is determined with the method of bio-impedance analyses because of its characteristics of being easy, practice, cheap. This is a method in predicting the water rate of the body in the base of conduction of electrolytes dissolved in body water. The body mass index (BMI: body mass index) is generally used as a sign of body composition. With the help of BMI, the formulas have been improved to calculate the body fat of man and woman. "All fat is not equal". As well as hip fats, the abnormal fat increase has a close relation with the complications of obesity (P.G. Kopelman and M. Dunitz 2003).

The individuals with normal body mass index have better and more qualified life durations than the ones with high body mass index. The relation between the body composition and cardio respiratory has been shown in the researches among the young people. The decline in the capacities of exercise and aerobic durability relating with the fat rate of the young people has been demonstrated (G. Koçoğlu, L. Özdemir, Sümer H, 2003).

In this research, it is aimed to evaluate the body weights, the body mass index, the basal metabolic rate, the fat rate of the body, total body water, the rates of waist-hip rates with the Bioelectrical Impedance Analysis among the children from the classes of 6, 7, 8. Aging between 12-14.

Method
The selection of subjects

In this study, the students who study in the classes of 6, 7, 8 in the primary school during 2007/2008 academic year in Kayseri. The volunteer students were chosen randomly. In this study it is determined that there are male(n=219), female volunteers (n=82).The distribution of the students as to their ages is ; the number of male students aged 12 : n=56, the number of female students are n=32, the number of male students aged 12 is n=68, the number of female students are n=29, the number of male students aged 14 is n=95, the number of female students is n=21 and totally the attendance were 301 volunteer students .

The weights, the total body index, the basal metabolic rate, the rate of body fat, the fat mass, the fat-free mass, total body water rates of the students were evaluated with the Analyses of Bioelectric Impedance and in measuring the waist-hip rates lineal meter were used.

The weight and body fat rate was evaluated with the bioelectrical impedance device (TANİTA BC-418 MA), the heights, sex, and fixed cloth tares (500 gr) were evaluated (500 gr) by taking them into analyzer only with their school uniform and with bare foot. Their height was measured with the tape on the wall. According to the VYY taken from BIA, to determine the overweight and obese children, the cardio vascular limits of children and adolescences and The standards declared by American Exercise Council was taken as standard (E. Zorba, 2005) According to this, in body fat percent values, the males 18-25, for female 25-30 is overweight, for males over 25, for female over 30 is accepted as fat.

Statistical Analyses

The data was shown as mean ±standard error of mean. In the statistical comparison of males and females, independent sample test was used and in the comparison of age groups variance analysis was tested (ANOVA).To find out the groups which are statistically different, Tukey HSD test was used. The significance level was 0.05.

Results

There have been found considerable statistical differences with the comparison of the parameters of age, weight, fat free mass of male and female students (p<0.01). There has been no statistical difference between the parameters of height, basal metabolic rate, body fat percentage, fat free mass, total body water and waist to hip ratio between the male and female students (p<0.001) (Table 1).

In the age groups of males aged 12–13–14 there have been differences on their heights and weights (p<0.001).There have been no considerable difference in the values of body mass index of male students between the ones aged 12-13 and 14-15 (p>0.05), but in the age group of 12–14 there has been

considerable differences (p<0.001), in the basal metabolic rate s there has been difference in the group of 12–14 ages (p<0.001). There has been found no difference between the ages 12–13 and 13–14 (p>0.05).In the percentage of body fat there has been no difference in three age groups (p>0.05). In the values of Fat Mass, there has been considerable difference between the ages 12–14 (p<0.05). No difference between the ages 12–13 and 13–14. (p>0.05). In the values of fat free body mass, there has been no difference in three groups (p>0.05). In the values of total body water there has been considerable statistical differences (p<0.001). In the values of waist-hip rates, there has been no statistical difference in three groups (p>0.05) (Table 2).

In the Table 3, it has been found out that there is considerable difference between the three age groups (p<0.001). In the weights there are differences between 12-14 ages (p<0.001), but in the ages of 12–13 and 13–14, there have been no difference (p>0.05). There has been no statistical difference in the body mass index, the basal metabolic rate and body fat rates of the females in the three age groups (p>0.05).

There have been differences in the fat mass, fat free mass and total body water of students aged between the ages 12–13 and 12–14 (p<0.05), whereas there has been no difference in the fat mass, fat free mass and total body water of the ones aged 13-14 (p>0.05).

In waist-hip rates, there have been no statistical difference between the ages 12-13 and 13-14 (p>0.05), whereas there have been difference in the age group of 12-14 (p<0.01) (Table 3).

Discussion and Conclusion

This study is aimed at measuring of bioelectrical impedance analysis, body weight, body mass index, basal metabolic rate, body fat percentage, fat-free weight, total body water, waist and hip ratio of elementary school students who are in the 12-13-14 age group.

The study shows that there is statically a considerable difference in the comparison of male and female body height parameter. (G. Massa 2002., A. Sherriff, C.M. Wright, Reilly J, 2009, M. Çolak and M. Kaya, 2007) have found statistically considerable differences between male and female body height parameter with their studies, in parallel with our study. Our study shows that male body weight is statistically more than female's. G. Koçoğlu, L. Özdemir, Sümer H, 2003, A. Sherriff, C.M. Wright, Reilly J, 2009) have observed statically considerable differences in the comparison of male and female body weight. The results in literature are similar with our results.

The study shows that there is not statistically a considerable difference between male and female mass body index. The other studies in literature show that there is statically a considerable difference between male and female mass body index (E.C. Rush, L.D.Plank, Davies P.S.W, 2003, M.Çolak and M.Maya 2007). According to us, this difference in literature may arise from regional and geographical differences.

Study results show that there is not statistically a considerable differences in the between-group comparison of basal metabolic rate parameter. B. Guida, R. Trio, Nastası A (2004) have not observed any considerable difference between basal metabolic rate of male children and female children's, in parallel with our findings.

With this study, it has been observed that there is statistically considerable difference between male body fat percentage and female's. In a similar study, N.Akış, K. Pala, İrgil E (2003) has observed that there is statically considerable difference between male body fat percentage and female's. This result shows that women have fattier body than men, and women are fattier than men at all ages, and this difference is not great until preadolescence.

Our study shows that there is not statically any considerable difference between parameter of male and female fat mass. G. Massa (2002), B. Guida, R. Trio, Nastası A (2004) has found statically a considerable difference in the comparison of male and female body fat mass. The study result is similar with concerning literature.

The study result shows that there is not statically any considerable difference between male and female fat free mass. In a similar study, G. Massa (2002) has found a considerable difference between male and female fat free mass. These acquired results are in parallel with G. Massa's (2002).

The study results show that there is a considerable difference between total body water of men and women's. B. Guida, R. Trio, Nastası A (2004) have found a considerable difference between fat mass parameter of male children and female children's, in parallel with our findings. It has been observed in the study that there is statically a considerable difference between male and female waist-hip ratio.

It has been observed that there is statically a considerable difference in the comparison of body weight and height of male students who are in the 12-13-14 age group. A. Sherriff, C.M. Wright, Reilly J (2009) has found that there is statically a considerable difference in the comparison of body weight and height of male students, parallel with our findings. Faster transition to adolescence and a faster growth period that male children in these age groups experience may be deemed as an evidence of the acquired result.

While a considerable difference has been observed in the rate of body mass index of male students who are in the 12-14 age group, there is not any considerable difference between 12-13, 13-14 aged male students'. In their study, E. Sivaslı, A. Bozkurt, Özçırpıcı B (2006) has found that there is a considerable difference between body mass index of 12-14 aged male students. The difference between the ages of 12 and 14, age 12 is in the period of preadolescence and 14 age in adolescence, can be important for body mass index.

While a considerable difference has been observed in the basal metabolic rate of male students who are in the 12-14 age groups, there is not any considerable difference between 12-13, 13-14 aged male students'. In a similar study, T. Sturmer, K.P.

Gunther, Brenner H (2000) has observed a considerable difference between basal metabolic rate of 12-14 aged male students. This result is similar with our findings. This difference between 12-14 ages may arise from adolescence and preadolescence of male children in these ages.

Any considerable difference has been not found between rates of body fat percentage of male students in these there age groups. In their study, E. Sivaslı, A. Bozkurt, Özçırpıcı B (2006) have not found statically considerable difference between rates of body fat percentage of male students in the 12-14 age groups. It has been thought that any difference cannot be found in the rates of their body fat percentage in that testosterone and testosterone derivative hormones that are produced in the period of males' adolescence support mostly an increase of muscle weight.

A considerable difference has been found between total body water rates of male students in these there age groups. In a similar study, L.A. Moreno, et. al (2001) have found statically considerable difference in the comparison of parameter of total body water rates of male students' age groups. Our study results are similar with this result in literature.

While a considerable difference has been observed in the fat mass of male students who are in the 12-14 age groups, there is not any considerable difference between 12-13, 13-14 aged male students'. F. Şimşek, B. Ulukol, Berberoğlu M (2005) have found a considerable difference between fat mass of 12-14 aged male students, with a similar results to our study results.

A considerable difference has been not found between fat- free body mass and waist hip ratio of male students in these there age groups. In a similar study, L.A. Moreno, A. Sarria, Fleta J (2001)have not found statically considerable difference in the parameter of fat free mass of male students' age groups. It may be said that there is an increase in fat free mass during the transition to adolescence. In a similar study, L.A. Moreno, A. Sarria, Fleta J (2001) have statically found a considerable difference in the parameter of fat free mass of children. It can been said that there is an increase in fat free mass in the period of transition to adolescence. A considerable difference has been found in the comparison of body height of female students in these there age groups.

While a considerable difference has been observed in the parameter of body weight of female students who are in the 12-14 age groups, there is not any considerable difference between 12-13, 13-14 aged female students'. In a similar way, the reported result

(N.Akış, K. Pala, İrgil E 2003) of the study on elementary school reveals that ratio of being overweight of female's children increases along with growth, and this report supports our findings.

Any considerable difference has been not statistically found in the analysis of body mass index, basal metabolic rate and body fat percentage of female students in these there age groups. B. Guida, R. Trio, Nastası A (2004) have not found any considerable difference in the body fat percentage of female children, in parallel with our findings. Moreover, P. Deurenberg, J.J.L.Pieters, Hautwast C (1990) have found a considerable difference in fat mass, fat-free weight and total body water of females in the period of adolescence. It is possible to say that there is not any change body mass index, basal metabolism and body fat percentage among female children in this age group. While a considerable difference has been not statistically observed in the rate of fat mass of female students who are in the 13-14 age groups, there is a considerable difference between 12-13, 13-14 aged female students. In their study, B. Guida, R. Trio, Nastası A (2004) have found a considerable difference in the parameter of fat mass quantity of females. Permanent increase of fat mass quantity along with growth may deemed as the reason of this difference.

The study result shows that there is statistically a considerable difference in the parameters of fat free mass and total body water of females. P. Deurenberg, J.J.L.Pieters, Hautwast C (1990) have found a considerable difference in the parameter of fat mass, fat free mass and total body water of females who are in the period of preadolescence or first adolescence. It can be deemed that these differences arise from the period of adolescence and hormonal changes depending on menarche that is the first menstruation period.

While a considerable difference has been not statistically observed in the parameter of waist-hip ratio of female students who are in the 12-14 age groups, there is not a considerable difference between 12-13, 13-14 aged female students'. Increase of waist-hip ratio along with growth may deemed as the reason of this difference.

As a conclusion, while there is an increase in the height, weight and body composition along with growth, the rate of males do not change and are stable, except height, body weight and fat free mass. It has been concluded that especially females in these ages groups experience a faster growth and development than males do.

Table 1: The comparison of physical characteristics of male and female

Variables	Sex	n	$X \pm S_x$	t	p
Age (year)	Male	219	13.18±0.05	2.98	0.003**
	Female	82	12.87±0.09		
Height (cm)	Male	219	161.76±0.72	4.14	0.000***
	Female	82	156.44±0.85		
Weights (kg)	Male	219	56.06±1.01	2.87	0.004**
	Female	82	50.81±1.27		
Body mass index (kg/m^2)	Male	219	21.15±0.28	1.23	0.221 [ns]
	Female	82	20.50±0.45		

		n		X±Sx		P
Basal Metabolic Rate (kcal)	Male	219		1710.52±38.80	3.85	0.000***
	Female	82		1431.12±57.64		
Body fat (%)	Male	219		19.98±0.45	-5.68	0.000***
	Female	82		24.76±0.66		
Fat Mass (kg)	Male	219		12.29±0.63	-0.74	0.459 ns
	Female	82		13.11±0.64		
Fat-Free Mass (kg)	Male	219		45.56±1.58	3.00	0.003**
	Female	82		37.70±0.72		
Total Body Water (kg)	Male	219		32.37±0.49	5.56	0.000***
	Female	82		27.56±0.53		
Waist-to-hip ratio	Male	219		0.81±0.00	8.17	0.000***
	Female	82		0.74±0.01		

Values are expressed as mean±standard error of mean (SEM) ($X \pm S_x$) **P<0.01 ***p<0.001 ns: not significant

Table 2: The comparison of psychical characteristics of male according to the age groups

Variables	age	n	$X_{Min}-X_{Max}$	$X \pm S_x$	P
Height (cm)	12	56	140-173	152.84±1.07[a]	0.000***
	13	68	140-181	160.04±1.04[b]	
	14	95	145-190	168.24±0.92[c]	
Weight (kg)	12	56	28.90-74.40	45.94±1.50[a]	0.000***
	13	68	35-91.30	54.65±1.60[b]	
	14	95	32.40-103.50	63.03±1.49[c]	
Body mass index (kg/m²)	12	56	13.70-31	19.57±0.55[a]	0.001***
	13	68	14.80-33.50	21.13±0.47[ab]	
	14	95	15.30-34	22.09±0.41[cb]	
Basal Metabolic Rate (kcal)	12	56	1216-1898	1486.96±24.19[a]	0.001***
	13	68	1262-7259	1711.24±86.74[ab]	
	14	95	1223-6782	1841.78±59.27[cb]	
Body fat (%)	12	56	9.90-34.60	19.78±0.93[a]	0.639 ns
	13	68	9-43.40	20.61±0.89[a]	
	14	95	8.10-36.20	19.64±0.62[a]	
Fat mass (kg)	12	56	2.90-25.70	9.69±0.72[a]	0.021*
	13	68	3.90-35.40	11.99±0.86[ab]	
	14	95	3.40-110.60	14.03±1.23[cb]	
Fat-Free Mass (kg)	12	56	3.70-355	41.43±5.80[a]	0.052 ns
	13	68	28.60-61	42.68±0.93[a]	
	14	95	29-70.30	50.06±0.95[a]	
Total body water (kg)	12	56	19-37.60	26.53±0.66[a]	0.000***
	13	68	20.90-44.70	31.25±0.68[b]	
	14	95	21.20-51.50	36.63±0.70[c]	
Waist-to-hip ratio	12	56	0.73-0.94	0.82±0.01[a]	0.209 ns
	13	68	0.69-0.94	0.81±0.01[a]	
	14	95	0.67-0.94	0.80±0.01[a]	

abc' The difference between the values in the same column with different letters is important.
Values are expressed as mean±standard error of mean (SEM) ($X \pm S_x$) *p<0.05 **p<0.01 ***p<0.001 ns: not significant, X_{min}: Minimum value-X_{max}: Maximum value

Table 3: The comparison of psychical characteristics of female according to the age groups

Variables	Age	n	$X_{Min}-X_{Max}$	$X \pm S_x$	p
Height (cm)	12	32	135-165	152.31±1.39[a]	0.000***
	13	29	145-168	157.28±1.21[b]	
	14	21	155-173	161.57±1.15[c]	
Weight (kg)	12	32	27.40-68.10	45.73±1.77[a]	0.001***
	13	29	33.50-80.30	52.04±2.29[ab]	
	14	21	41.90-79.10	56.86±2.07[cb]	
Body Mass Index (kg/m²)	12	32	4.60-28	19.33±0.76[a]	0.080 ns
	13	29	14.70-28.80	20.88±0.73[a]	
	14	21	17.40-30.10	21.78±0.77[a]	
Basal Metabolic Rate (kcal)	12	32	1025-1627	1306.53±26.50[a]	0.187 ns
	13	29	1110-5837	1549.38±157.45[a]	

	14	21	1239-1681	1457.67±27.85[a]	
Body fat (%)	12	32	13.70-38.90	23.54±1.09a	
	13	29	16.30-37.50	25.14±1.09[a]	0.287 [ns]
	14	21	19.20-39.30	26.10±1.24[a]	
Fat mass (kg)	12	32	3.80-22.70	11.25±0.91[a]	
	13	29	5.60-26.80	13.59±1.11[b]	0.038*
	14	21	8-31.10	15.27±1.28[cb]	
Fat-Free Mass (kg)	12	32	23.70-45.70	34.49±0.99[a]	
	13	29	27.90-55.80	38.42±1.33[b]	0.000***
	14	21	33.90-48	41.60±0.96[cb]	
Total Body Water (kg)	12	32	17.40-33.50	25.25±0.72[a]	
	13	29	20.40-40.90	28.02±0.98[b]	0.000***
	14	21	24.80-35.10	30.46±0.71[cb]	
Waist-to-hip ratio	12	32	0.60-0.89	0.77±0.01[a]	
	13	29	0.65-0.86	0.74±0.01[ab]	0.004**
	14	21	0.63-0.85	0.72±0.01[cb]	

abc; The difference between the values in the same column with different letters is important.

Values are expressed as mean±standard error of mean (SEM) (X±Sx) *p<0.05 **p<0.01 ***p<0.001 ns: not significant, X_{min}: Minimum value-X_{max}: Maximum value

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