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ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA

Relationships between anthropometric measurements, leptin and IGF-1 levels in Turkish healthy newborns

Sağlıklı Türk yenidoğanlarda antropometrik ölçümlerin leptin ve IGF-1 seviyeleriyle ilişkisi

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ABSTRACT

Objective: The aim of the present study is to determine anthropometric measurements of a group of healthy newborns and evaluate their association with the serum levels of leptin and insulin-like growth factor 1(IGF-1).

Methods: Extremity lengths, skinfold thickness, body circumference measurements of 113 heathy newborns were taken by appropriate methods. Of the total 113 newborns, 55 were male and 58 were female. Serum leptin and IGF-1 levels were measured.

Results: Leptin levels had moderately positive correlations with body mass index (BMI), weight and suprailiac skinfold thickness ($p<0.05$). There was no significant relationship between anthropometric measurements and IGF-1 levels ($p>0.05$).

Conclusion: Anthropometric measurements of newborns will be of guidance for the growth and development of their future life. *J Clin Exp Invest 2015; 6 (3): 214-219*

Key words: Anthropometry, newborn, leptin, insulin-like growth factor 1(IGF-1)

ÖZET

Amaç: Bu çalışmanın amacı, sağlıklı yenidoğanların antropometrik ölçümlerini yapmak ve ölçümlerin serum leptin ve insulin benzeri büyüme faktörü 1(IGF-1) düzeyleriyle ilişkisini araştırmaktır.

Yöntemler: Toplam 113(55 erkek, 58 kız) sağlıklı yenidoğanda, ekstremite uzunlukları, deri kıvrım kalınlığı, vücut çevre ölçümleri uygun yöntemler kullanılarak ölçüldü. Serum leptin ve IGF-1 seviyelerine bakıldı.

Bulgular: Antropometrik ölçümlerden vücut kitle indeksi, vücut ağırlığı ve suprailiac deri kıvrım kalınlığı ile serum leptin seviyesi arasında orta düzeyde pozitif korelasyon saptandı ($p<0.05$). IGF seviyesi ve antropometrik ölçüm sonuçları arasında anlamlı bir ilişki saptanmadı ($p>0.05$).

Sonuç: Bebeklerin antropometrik ölçümleri gelecekteki büyüme ve gelişme düzeyleri konusunda rehberlik edecektir. Leptin büyüme üzerine etkili bir hormondur.

Anahtar kelimeler: antropometri, yenidoğan, leptin, insulin benzeri büyüme faktörü 1(IGF-1)

INTRODUCTION

Anthropometric measurements are non-invasive, easy to apply, and inexpensive techniques which help to evaluate body composition of all ages including newborns [1].

Abnormalities of limbs are important features of some syndromes recognizable at birth [2,3]. Measurements of skinfold thickness has shown to be a convenient and non-invasive method for the assessment of total body fat [4]. Newborn measurements of some anthropometric indices will be guidance for the growth and development of the future adult life. For instance, somatic growth and malnutrition assessments are possible by body weight, height and head circumference measurements [5].

Leptin is secreted from adipose tissue and plays an important role in obesity. During pregnancy, leptin is mainly produced by maternal adipose tissue, fetal adipose tissue and placenta. Early studies have shown that leptin is found in significant concentrations in umbilical cord blood and its effect to infant growth has attracted significant interest [6]. A number of studies using leptin levels in cord blood in correlation with neonatal anthropometric measures at birth such as birth weight, birth length, head and abdominal circumference [7].

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Likewise insulin-like growth factor 1(IGF-I) has a major role in the regulation of human growth and it was found to be correlated with fat-free mass [8,9]. Serum IGF-1 levels increase as the child grows, reach a peak value at puberty, and decrease with aging [9,10]. There is no data about correlation of leptin and IGF-1 levels with body compositions of Turkish newborns to our knowledge. Our goals are to provide data for anthropometric measurements of the Turkish normal newborns and to determine a possible correlation between anthropometric measurements and serum levels of leptin and IGF-1.

METHODS

A total of 113 newborns from the department of Child Health and Diseases of Adnan Menderes University Medical Faculty and Aydın Maternity Hospital were included in this study. Of the total 55 were male and 58 were female. All newborns included in the study were healthy, over 3,000 gr and were born between 38-40 weeks of gestation.

Prior to commencement of the study, approval was obtained from the Ministry of Health and local ethical committee. Written consents were obtained from the parents of the newborns. Measurements were carried out by trained personnel within 24 hours after birth. Newborns with hereditary disease, physical defects, premature birth, and birth weight lower than 3,000 grams were excluded from the study.

Anthropometric measurements

All the measurements were done while the newborn has been lying supine on the examining table and on the right side of its body. Lengths of total arm, upper arm, forearm, hand, total leg, upper leg, lower leg, foot and trunk were measured using a sliding caliper (Harpenden, Holtain, Bicondylar vernier, UK). Research staffs received specific training in the use of measuring equipment, which was calibrated each morning before measurements were taken according to Hall et al. Each baby was measured 30 minutes after being feed [11]. Birth weight (gr), length (cm), circumference measurements (cm), and skinfold thicknesses (mm) were recorded. Newborn anthropometric measurements were obtained within 24 hours of delivery. All the newborns were weighed naked on a spring type of weighing.

Weight: was measured to the nearest 0.01 kg by use of a Weylux beam balance (CMS Weighing Equipment Ltd, London, UK).

Circumference measurements

Circumference were measured at 3 sites (chest, mid-arm and abdomen) using an inelastic tape measure by one investigator. The measurements were taken during quiet respiration at least 30 minutes after feeding except for those who had not been commenced on enteral feeding.

Skinfold thicknesses

Skinfolds were measured at 6 sites to the nearest 0.1 mm (biceps, triceps, subscapular, abdominal, suprailiac, thigh) using a Holtain caliper by one investigator. Anthropometric data were recorded using a standardized data report form by one investigator [11,12].

Serum leptin and IGF-1

Serum leptin and IGF-1 were obtained from a cannulated with directly after birth. Venous blood was drawn immediately after birth from umbilical cord blood vessels by one investigator. After separating the serums from blood, serum samples were stored at -80°C until performing the analysis. Serum leptin measurements were done by using Leptin Serum EASIA(Enzyme Amplified Sensitivity Immunoassay) (Cat. No: KAP2281; Biosource Europe S.A; Nivelles, Belgium). IGF-1 measurements were done by using IGF-1-ELİSA (Enzyme-Linked ImmunoSorbent Assay) (Cat No: KAPB 2010 Biosource Europe S.A; Nivelles, Belgium) [13].

Statistical Analysis

The Kolmogorov-Smirnov test was used to assess the normality of numeric variables. For the numeric variables that were normally distributed, comparison between two groups was made by the independent sample t test. For the non-normally distributed variables, comparison between two groups was made by the Mann-Whitney U test. The results were expressed as mean plus minus standard deviation or median (25-75 percentiles). Statistical significance was defined as $p<0.05$.The correlation analysis was used to determine the relationship among the quantitative variables.

RESULTS

Our sample consists of 113 (55 male, 58 female) healthy term newborns in Aydin, Turkey.

Extremity lengths

Torso and upper leg length of girls were longer than boys whereas leptin levels were higher in boys. Details are shown on Table 1,4.

Circumferences and skinfold thicknesses

There was no significant difference between male and female newborns in circumferences measurements and skinfold thicknesses (p>0.05) Table 2 and 3.

Leptin and IGF-1

Leptin levels were higher in boys (p=0.036). There was no significant difference in the value of IGF-1 between male and female (p >0.05). Details are shown on Table 4.

Leptin levels were positively correlated with BMI, weight and suprailiac skinfold thickness Details are shown on Table 5. There was no correlation with anthropometric measurements and IGF-1 levels (Table 4).

Table 1. Extremity length measurements

	Male (n=55)			Female (n=58)			p
	Mean ±SD, Median (25-75 pp)	Min	Max	Mean ±SD, Median (25-75 percentiles)	Min	Max	
Height (cm)	50 (50-51)	45.0	54.0	50 (50-50)	48.0	55.0	0.694
Weight (gr)	3472 ± 324	3010	4300	3423 ± 301	3000	4480	0.414
Sternal length (mm)	53.56 ± 8.18	40.0	77.0	51.14 ± 7.93	25.6	67.0	0.113
Torso length (mm)	15.60 (15.20-16.80)	12.5	18.5	16.80 (15.35-17.529)	12.6	18.8	0.016
Total upper extremity (cm)	16.25(15.37-18.12)	12.2	20.3	15.15(13.64-18.77)	11.5	22.0	0.440
Upper arm length (mm)	86.01 ± 10.05	66.0	104.0	85.30 ± 9.04	61.0	98.0	0.696
Lower arm length (mm)	76.3 (71.1-79.2)	58.0	90.0	77.20 (72.95-80.32)	54.0	89.3	0.361
Hand length (mm)	53.9 (50.0-6180)	42.0	67.0	54.20 (51.95-57.50)	37.0	69.9	0.877
Total lower extremity (cm)	19.6 ± 1.76	15.0	23.0	19.53 ± 1.81	14.0	24.0	0.745
Upper leg length (mm)	107.0 (93.0-115.6)	73.0	136.0	112.00 (105.62-118.4)	72.0	135.0	0.015
Lower leg length (mm)	108.4 (97.0-12360)	63.0	138.3	118.0 (105.0-124.2)	66.0	142.2	0.122
Foot length (mm)	73.12 ± 6.28	60.0	87.1	74.34 ± 5.55	60.0	83.4	0.274

SD: Standard deviation, Min: Minimum, Max: Maximum

Table 2. Skinfold thicknesses

	Male (n=55)			Female (n=58)			p
	Median (25-75 percentiles)	Min	Max	Median (25-75 percentiles)	Min	Max	
Triceps (mm)	5.0 (4.0-6.0)	2.5	8.0	5.0 (4.5-5.5)	3.0	7.0	0.924
Biceps (mm)	4.0 (3.0-4.1)	1.1	6.0	3.5 (3.0-4.5)	2.2	6.0	0.785
Subscapular (mm)	4.5 (4.0-5.0)	2.0	8.0	5.0 (4.0-5.5)	2.0	8.0	0.083
Suprailiac (mm)	3.1 (2.5-4.2)	1.5	7.5	3.0 (2.8-3.5)	1.5	7.0	0.135
Thigh (mm)	6.00 (5.0-7.0)	3.0	13.0	6.0 (5.0-6.2)	3.5	9.0	0.901
Abdomen (mm)	4.0 (3.0-4.5)	1.5	6.0	4.0 (3.0-4.0)	2.0	6.0	0.538

Min: Minimum, Max: Maximum

Table 3. Circumference measurements

	Male (n=55)			Female (n=58)			p
	Median (25-75 percentiles)	Min	Max	Median (25-75 percentiles)	Min	Max	
Occipito-frontal (cm)	35.0 (34.0-36.0)	32.0	37.0	33.5 (34.0-35.0)	32.0	38.50	0.198
Chest (cm)	34.0 (33.0-35.0)	30.0	37.0	33.0 (32.8-34.5)	31.0	37.00	0.272
Upper arm (cm)	11.0 (10.5-12.0)	8.5	13.0	11.0 (10.4-11.5)	9.0	12.00	0.063
Abdominal (cm)	31.0 (30.0-33.0)	28.0	36.0	31.0 (31.0-3200)	22.0	34.00	0.970

Min: Minimum, Max: Maximum

Table 4. Serum leptin and IGF-1 levels

	Male (n=55)			Female (n=58)			p
	Mean ±SD, Median (25-75 percentiles)	Min	Max	Mean ±SD, Median (25-75 percentiles)	Min	Max	
Leptin (ng/mL)	13.2 (11.2-14.5)	3.2	37.1	12.1 (11.1-13.4)	2.6	14.6	**0.036**
IGF-1	179.6 ± 88.4	54.1	472.7	194.4 ± 98.1	63.3	461.9	0.416

IGF-1: Insulin-like growth factor 1, Sd: Standard deviation, Min: Minimum, Max: Maximum

Table 5. Correlation with leptin and IGF-1 values and skinfold thickness, circumference measurements

	Leptin			IGF-1	
	r	p		r	p
Body Mass Index(kg/m^2)	0.530	0.001	Lover arm length (mm)	0.202	0.032
Weight	0.666	0.001	Hand length (mm)	0.227	0.016
Triceps skinfold thickness	0.311	0.001	Lower leg length (mm)	0283	0.002
Biceps skinfold thickness	0.304	0.001	Foot length (mm)	0.232	0.013
Suprailiac skinfold thickness	0.666	0.002	Abdominal circumference	0.221	0.019
Thigh skinfold thickness	0.263	0.005	Suprailiac skinfold thickness	0.246	0.009
Abdominal skinfold thickness	0.197	0.003	Thigh skinfold thickness	0.197	0.036
Occipital-frontal circumference(cm)	0.340	0.001			
Chest circumference(cm)	0.374	0.001			
Upper arm circumference	0.374	0.001			
Abdominal circumference	0.433	0.001			

IGF-1: Insulin-like growth factor

DISCUSSION

Our results reveal that there were correlations between leptin levels and some anthropometric measurements. Furthermore there are several anthropometric measurement differences in terms of gender in addition to leptin and IGF-1. There is no literature to our knowledge, including comprehensive evaluation about association of anthropometric measurements with leptin and IGF-1 in Turkish newborns.

An increase in the levels of leptin increases energy expenditure. Because the energy balance in a growing fetus must be positive, a low concentration of serum leptin is physiologically suitable for fetal growth. Some investigators indicate that there is no difference between gender and leptin levels [14-17]. However we found that boys had higher leptin levels than girls. In contrast to our results, Savino F. et al. report that leptin values were higher in girls [18].

Many studies have found positive correlation between leptin and body mass index (BMI), weight, height, skinfold thicknesses and circumference measurements [19,20,21,22,23]. We also found positive correlation between leptin levels and birth weight and BMI in addition to some skinfold thickness measurements. Pathmaperuma et al. did not find any correlation with IGF-1 levels and any of the anthropometric indices which is similar to our results [24].

In general, upper extremities in newborns are longer than the trunk and lower extremities. In newborns, it is reported that the forearms are longer than the arms. Male infants have longer forearms and arms compared to females [25]. In addition Fok et al indicate that there is no difference between torso length among boys and girls [26]. In contrast to these studies we did not find any difference between boys and girls in terms of arm lengths whereas torso length was higher in girls. Hadler et al. did not find any difference between upper extremity lengths of boys and girls [27].

Laccerda reported that they did not find any difference between boys and girls which is similar to our results [28]. No difference was found for chest circumference between girls and boys [24,27]. However many studies have found positive correlation between chest circumference and weight [26,29,30].

We also found that there was positive correlation between height and chest circumference whereas chest, upper arm and abdominal circumference were positively correlated with weight. In addition many studies report that upper arm circumference positively correlated with weight [31,32,33]. There is conflicting results about upper arm circumference no difference among boys and girls. There are many studies which did not find any difference between boys and girls [26,29] There is also conflicting results about abdominal circumference and gender differences [34]. We did not find any difference between boys and girls.

Some studies indicate that gender differences among skinfold thickness are related to hormonal differences between boys and girls [35].

Furthermore many studies mention that skinfold thicknesses of girls are higher than boys in each gestational age [36]. However, there are some studies, which did not find any difference for triceps and subscapular skinfold thicknesses which is similar to our results [35].

Anthropometric measurements of newborns and gender differences were widely studied even though there is no comprehensive data about Turkish newborns. However there is no data to our knowledge about association of anthropometric measurements and leptin and IGF-1 levels of newborns. We concluded that there are several anthropometric measurement differences in newborns in terms of gender. Furthermore there is association between leptin and IGF-1 levels and some anthropometric measurements in addition to gender.

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