

FP04

Norm Values of Head Circumference in Turkish Children

Saime Sundus Uygun¹, Mehmet Akif Bakir², Haluk Yavuz³

¹Division of Neonatology, Department of Pediatrics, Selcuk University, Konya, Turkey;

²Department of Statistics of Faculty of Sciences, University of Gazi, Ankara, Turkey;

³Division of Pediatric Neurology, Department of Pediatrics, Necmettin Erbakan University, Meram Medical Faculty, Konya, Turkey

Introduction

Physical growth of babies and children is an important determinant of health and disease conditions.

Growth curves serve physician to determine at what point the child deviates from normal measurements. And also can provide information, whether the child needs to be examined, by considering the nutritional status and general health status (**Gökçay et al. 2008**).

Although head circumference measures skull size, it typically reflects overall brain volume and can be described as a “widely used indicator of neural growth and brain size”. Brain size out of normal values, is an important risk factor for cognitive and motor delay (**Harris 2015**).

Head circumference is a major diagnostic and prognostic marker used to help in identifying symmetric or asymmetric growth, microcephaly and macrocephaly. All of these items are associated with many reasons that require further evaluation. It is therefore essential that the clinician should be supported with trustworthy and representative reference growth curves (**Barbier et al. 2013**).

Materials and methods

Children included in the sample of this study have the following characteristics:

The child has no congenital deformity, chronic illness, or is not on medication.

The family’s income is high enough to meet the child’s basic needs.

The child’s gestational age should be 38-42 weeks if she/he is younger than 2 years old, and the child wasn’t born as a result of multiple pregnancies.

All measurements were performed by the same clinician using a same, calibrated, set tape measure.

A questionnaire sheet was also filled out by parents.

Ek 1: Bilgilendirilmiş Onam Formu (Questionnaire sheet)

Büyüme ve gelişmenin takibinde baş çevresi ölçümü önemli bir belirteçtir. Bu ölçümün uygun şekilde yapılması ve normal değerini ne olduğunun bilinmesi sağlıklı büyüme için önemlidir.

Bu çalışmada baş çevresi ölçümünü mezura kullanarak yapacağız. Bunun dışında size herhangi bir girişimde bulunulmayacaktır. Bu ölçümü yaptırmak istememeniz durumunda hastanede veya bizimle daha sonra karşılaşmanız durumunda herhangi bir olumsuzlukla karşılaşmayacaksınız. Katılıp katılmamakta serbestsiniz. Sizin gibi yaklaşık on bin civarında çocukta bu ölçümü yapacağız. Ayrıca isminizi kullanmadan genel sağlık durumunuzla ilgili bazı sorular soracağız.

Katılımınızdan dolayı teşekkür ederiz.

Bu konuyla ilgili sorunuz olduğu takdirde Meram Tıp Fakültesi Çocuk Servisinden Dr. Saime Sündüs Uygun a 2236879 numaralı telefondan ulaşabilirsiniz.

Annesi/Babası(imza):

Çocuk(imza):

SORULAR

- İsim: _____ Telefon: _____
 Cinsiyet: Kız Erkek Ölçüm: _____
 Doğum tarihi:../.../.... Ölçüm tarihi:../.../.... Yaş:..yıl..ay (Bu kısmı doktor dolduracak)
 Annenin memleketi: _____ Babanın memleketi: _____
 Ailenin aylık toplam geliri nedir?: _____
 Çocuğun sürekli hastalığı var mı? : Evet Hayır Varsa adı: _____
 Bu hastalık büyümeyi etkiler mi? : Evet Hayır (Bu kısmı doktor dolduracak)
 Sürekli kullandığı ilaç var mı?: _____
 Bebek Zamanında mı doğdu?: Evet Hayır
 Hayırsa kaç yıllık/haftalık doğdu?: _____
 Çoğul gebelikle mi dünyaya geldi?: _____
 Bebeğin doğum kilosu: _____
 Bebeğinizi ne ile besliyorsunuz?: Anne sütü Mama Ek gıda Karışık
 Gebelik esnasında evde sigar içildi mi?: _____
 Doğum sonrası evde sigara içildi mi?: _____
 Yakın akrabalarınızda başı küçük olan var mı?: _____
 Yakın akrabalarınızda başı büyük olan var mı?: _____
 Annenin bitirdiği okul: Okul bitirmedi İlkokul Ortaokul Lise Üniversite
 Babanın bitirdiği okul: Okul bitirmedi İlkokul Ortaokul Lise Üniversite
 Çocuğun okul başarısı: Takdir aldı Teşekkür aldı Başarılı Geçer Zayıf var

Statistical review

In this study, the growth curves were estimated by LMS method suggested in Tim Cole's article 'Smoothing reference centile curves: The LMS method and penalized likelihood', published in 1992 (Cole and Green 1992).

The partial correlation coefficients were calculated with Spearman's Rho formula by controlling child's age to investigate the relationship between HC and the demographic and physical characteristics of the child and the child's family.

Stata 13 package program was used for final statistical analysis.

Findings

The statistical analyze was conducted by using totally 5522 head circumference measurements. 2961 of this group were boys (53.6%); while the number of girls was 2561 (46.4%).

The percentage distributions according to gender and age of the children in the survey are given in **Table 1** and **Table 2**, respectively. The estimated HC growth curves for percentiles from 1% to 99% are given in **Figures 1** and **2** for children in all ages (0-19 years).

Table 1: Percentile values of boys by age

Age	P 1	P 3	P 5	P 10	P 25	P 50	P 75	P 90	P 95	P 97	P 99
0-15 days	32.4	33.0	33.3	33.8	34.5	35.3	36.1	36.8	37.2	37.4	37.9
1 months	33.6	34.2	34.5	35.0	35.7	36.5	37.3	38.0	38.3	38.6	39.0
1.5 months	34.5	35.1	35.5	36.0	36.7	37.6	38.3	39.0	39.4	39.6	40.1
2 months	35.2	35.9	36.2	36.8	37.6	38.4	39.3	40.0	40.4	40.6	41.1
2.5 months	35.9	36.6	37.0	37.5	38.4	39.3	40.1	40.8	41.2	41.5	42.0
3 months	36.5	37.2	37.6	38.2	39.1	40.0	40.9	41.6	42.0	42.3	42.8
3.5 months	37.0	37.8	38.2	38.8	39.7	40.7	41.6	42.3	42.8	43.1	43.6
4 months	37.5	38.3	38.7	39.3	40.3	41.3	42.2	43.0	43.4	43.7	44.2
4.5 months	37.9	38.8	39.2	39.8	40.8	41.8	42.8	43.5	44.0	44.3	44.8
5 months	38.4	39.2	39.7	40.3	41.3	42.3	43.2	44.0	44.5	44.7	45.3
5.5 months	38.8	39.6	40.0	40.7	41.6	42.7	43.6	44.4	44.9	45.2	45.7
6 months	39.2	40.0	40.4	41.1	42.1	43.1	44.1	44.9	45.3	45.6	46.2
7 months	40.0	40.8	41.2	41.9	42.8	43.8	44.8	45.6	46.0	46.3	46.9

8 months	40.7	41.4	41.8	42.4	43.3	44.4	45.3	46.2	46.7	47.0	47.6
9 months	41.2	41.9	42.3	42.9	43.9	44.9	45.9	46.7	47.2	47.5	48.1
10 months	41.6	42.3	42.7	43.3	44.3	45.3	46.3	47.2	47.7	48.1	48.7
11 months	42.0	42.8	43.1	43.7	44.6	45.7	46.7	47.5	48.0	48.4	49.0
12 months	42.4	43.2	43.5	44.1	45.0	46.0	47.0	47.8	48.3	48.6	49.2
13-14 months	42.8	43.5	43.9	44.5	45.4	46.4	47.3	48.2	48.7	49.0	49.6
15-16 months	43.6	44.2	44.5	45.1	45.9	46.9	47.8	48.7	49.2	49.5	50.1
17-18 months	44.2	44.8	45.1	45.6	46.4	47.3	48.3	49.1	49.6	49.9	50.5
19-20 months	44.7	45.3	45.6	46.0	46.8	47.7	48.6	49.5	50.0	50.3	51.0
21-22 months	45.2	45.7	46.0	46.5	47.2	48.1	49.0	49.8	50.3	50.7	51.3
23-24 months	45.6	46.1	46.4	46.8	47.5	48.4	49.3	50.1	50.6	51.0	51.6
2 years 3 month	46.0	46.4	46.7	47.1	47.8	48.6	49.5	50.4	50.9	51.2	51.9
2.5 years	46.4	46.9	47.2	47.6	48.3	49.1	49.9	50.8	51.3	51.6	52.3
2 years 9 month	46.9	47.3	47.6	48.0	48.6	49.4	50.3	51.1	51.6	52.0	52.6
3 years	47.2	47.7	47.9	48.3	49.0	49.7	50.6	51.4	51.9	52.2	52.9
3 years 3 months	47.5	47.9	48.2	48.5	49.2	50.0	50.8	51.6	52.1	52.4	53.1
3.5 years	47.7	48.2	48.4	48.8	49.4	50.2	51.0	51.8	52.3	52.6	53.2
3 years 9 months	48.0	48.4	48.6	49.0	49.6	50.4	51.2	52.0	52.4	52.7	53.4
4 years	48.2	48.6	48.8	49.2	49.8	50.6	51.4	52.1	52.6	52.9	53.5
4 years 3 months	48.4	48.8	49.0	49.4	50.0	50.8	51.5	52.3	52.7	53.0	53.6
4.5 years	48.5	49.0	49.2	49.5	50.2	50.9	51.7	52.4	52.9	53.2	53.8
4 years 9 months	48.7	49.1	49.3	49.7	50.3	51.0	51.8	52.5	53.0	53.3	53.8
5 years	48.8	49.2	49.4	49.8	50.4	51.1	51.9	52.6	53.1	53.4	53.9
5.5 years	48.8	49.3	49.5	49.9	50.5	51.2	52.0	52.7	53.1	53.4	53.9
6 years	49.0	49.5	49.7	50.0	50.7	51.4	52.1	52.8	53.3	53.5	54.1
6.5 years	49.1	49.6	49.8	50.2	50.8	51.5	52.3	53.0	53.4	53.6	54.2
7 years	49.3	49.7	50.0	50.3	51.0	51.7	52.4	53.1	53.5	53.7	54.2
7.5 years	49.4	49.9	50.1	50.5	51.2	51.9	52.6	53.2	53.6	53.9	54.3
8 years	49.5	50.0	50.3	50.7	51.3	52.0	52.8	53.4	53.8	54.0	54.5
8.5 years	49.6	50.2	50.4	50.8	51.5	52.2	52.9	53.6	53.9	54.2	54.6
9 years	49.7	50.3	50.6	51.0	51.7	52.4	53.1	53.7	54.1	54.3	54.8
9.5 years	49.8	50.4	50.7	51.1	51.9	52.6	53.3	53.9	54.3	54.5	54.9
10 years	49.9	50.5	50.8	51.3	52.0	52.8	53.5	54.1	54.5	54.7	55.1
10.5 years	49.9	50.6	50.9	51.4	52.2	53.0	53.7	54.3	54.6	54.8	55.2
11 years	50.1	50.8	51.1	51.6	52.4	53.2	53.9	54.5	54.8	55.0	55.4
11.5 years	50.2	50.9	51.3	51.8	52.6	53.3	54.1	54.6	55.0	55.2	55.6
12 years	50.4	51.1	51.4	52.0	52.7	53.5	54.2	54.8	55.1	55.4	55.7
12.5 years	50.6	51.3	51.6	52.2	52.9	53.7	54.4	55.0	55.3	55.5	55.9
13 years	50.8	51.5	51.9	52.4	53.1	53.9	54.6	55.2	55.5	55.7	56.1
13.5 years	51.0	51.7	52.1	52.6	53.3	54.1	54.8	55.4	55.7	55.9	56.3
14 years	51.3	52.0	52.3	52.8	53.5	54.3	55.0	55.6	55.9	56.1	56.5
14.5 years	51.6	52.2	52.5	53.0	53.7	54.5	55.2	55.7	56.1	56.3	56.6
15 years	51.8	52.5	52.8	53.2	54.0	54.7	55.3	55.9	56.2	56.4	56.8
15.5 years	52.1	52.7	53.0	53.5	54.2	54.9	55.5	56.1	56.4	56.6	57.0
16 years	52.4	53.0	53.3	53.7	54.4	55.1	55.7	56.3	56.6	56.8	57.1
16.5 years	52.7	53.3	53.6	54.0	54.6	55.3	55.9	56.4	56.7	56.9	57.3
17 years	53.0	53.5	53.8	54.2	54.8	55.5	56.1	56.6	56.9	57.1	57.4
17.5 years	53.3	53.8	54.0	54.4	55.0	55.7	56.3	56.8	57.1	57.2	57.6
18 years	53.5	54.0	54.2	54.6	55.2	55.8	56.4	56.9	57.2	57.4	57.7
18.5 years	53.7	54.2	54.4	54.8	55.3	55.9	56.5	57.0	57.2	57.4	57.7
19 years	53.8	54.3	54.5	54.9	55.4	56.0	56.5	57.0	57.2	57.4	57.7
19.5 years	54.0	54.4	54.6	54.9	55.4	56.0	56.5	56.9	57.2	57.4	57.7

Table 2: Percentile values of girls by age

Ages	P 1	P 3	P 5	P10	P 25	P 50	P 75	P 90	P 95	P 97	P 99
0-15 days	32.0	32.7	33.0	33.4	34.1	34.8	35.4	35.9	36.2	36.4	36.7
1 month	32.7	33.5	33.8	34.3	35.1	35.9	36.6	37.2	37.5	37.7	38.1
1.5 months	33.4	34.1	34.5	35.1	35.9	36.8	37.6	38.2	38.6	38.8	39.2
2 months	34.2	34.9	35.3	35.8	36.7	37.6	38.5	39.2	39.6	39.8	40.3
2.5 months	35.1	35.7	36.1	36.6	37.5	38.4	39.3	40.1	40.5	40.8	41.3
3 months	35.9	36.5	36.8	37.4	38.2	39.1	40.1	40.9	41.4	41.7	42.3
3.5 months	36.6	37.2	37.5	38.0	38.8	39.8	40.7	41.6	42.1	42.5	43.1
4 months	37.1	37.7	38.0	38.6	39.4	40.4	41.3	42.2	42.8	43.1	43.8
4.5 months	37.5	38.2	38.5	39.0	39.9	40.9	41.9	42.7	43.3	43.6	44.3
5 months	37.9	38.6	38.9	39.4	40.3	41.3	42.3	43.2	43.7	44.1	44.7
5.5 months	38.2	38.9	39.2	39.8	40.7	41.7	42.7	43.5	44.1	44.4	45.0
6 months	38.6	39.3	39.6	40.2	41.1	42.1	43.1	44.0	44.5	44.8	45.5
7 months	39.5	40.1	40.4	41.0	41.8	42.8	43.8	44.7	45.2	45.6	46.2
8 months	40.2	40.8	41.1	41.6	42.5	43.4	44.4	45.3	45.9	46.2	46.9
9 months	40.8	41.4	41.7	42.1	42.9	43.8	44.8	45.7	46.2	46.5	47.2
10 months	41.2	41.8	42.1	42.6	43.4	44.3	45.3	46.2	46.7	47.1	47.8
11 months	41.6	42.2	42.5	42.9	43.7	44.7	45.6	46.5	47.1	47.5	48.2
12 months	42.1	42.6	42.9	43.4	44.2	45.1	46.0	46.9	47.4	47.8	48.5
13-14 months	42.5	43.0	43.3	43.7	44.5	45.4	46.4	47.3	47.9	48.2	49.0
15-16	42.9	43.4	43.7	44.2	45.0	45.9	46.9	47.8	48.3	48.7	49.4
17-18 months	43.2	43.8	44.1	44.6	45.4	46.3	47.3	48.2	48.7	49.1	49.8
19-20 months	43.8	44.3	44.6	45.1	45.8	46.7	47.7	48.6	49.1	49.4	50.1
21-22 months	44.2	44.7	45.0	45.5	46.2	47.1	48.0	48.9	49.4	49.8	50.5
23-24 months	44.6	45.1	45.4	45.8	46.6	47.5	48.4	49.2	49.8	50.1	50.8
2 years 3 months	45.0	45.5	45.8	46.2	46.9	47.8	48.7	49.5	50.0	50.4	51.0
2.5 years	45.5	46.0	46.3	46.7	47.4	48.2	49.1	49.9	50.4	50.8	51.5
2 years 9 months	46.0	46.5	46.7	47.1	47.8	48.6	49.5	50.3	50.8	51.1	51.8
3 years	46.4	46.8	47.1	47.5	48.2	49.0	49.8	50.6	51.1	51.4	52.1
3 years 3 months	46.8	47.2	47.4	47.8	48.5	49.3	50.1	50.9	51.4	51.7	52.4
3.5 years	47.1	47.6	47.8	48.2	48.8	49.6	50.4	51.1	51.6	52.0	52.6
3 years 9 months	47.5	47.9	48.1	48.5	49.1	49.8	50.6	51.4	51.9	52.2	52.9
4 years	47.8	48.2	48.4	48.7	49.3	50.1	50.8	51.6	52.1	52.4	53.1
4 years 3 months	48.1	48.5	48.7	49.0	49.6	50.3	51.0	51.8	52.3	52.6	53.3
4.5 years	48.3	48.7	48.9	49.2	49.8	50.4	51.2	52.0	52.5	52.8	53.5
4 years 9 months	48.5	48.9	49.1	49.4	49.9	50.6	51.4	52.1	52.6	52.9	53.6
5 years	48.7	49.0	49.2	49.5	50.1	50.7	51.5	52.2	52.7	53.0	53.7
5.5 years	48.8	49.2	49.4	49.7	50.2	50.9	51.6	52.3	52.8	53.1	53.8
6 years	49.1	49.4	49.6	49.9	50.5	51.1	51.8	52.6	53.0	53.4	54.0
6.5 years	49.3	49.6	49.8	50.1	50.6	51.3	52.0	52.7	53.2	53.5	54.2
7 years	49.4	49.8	50.0	50.3	50.8	51.5	52.2	52.9	53.4	53.7	54.3
7.5 years	49.5	49.9	50.1	50.4	51.0	51.6	52.4	53.0	53.5	53.8	54.3
8 years	49.6	50.0	50.2	50.5	51.1	51.8	52.5	53.2	53.6	53.9	54.4
8.5 years	49.7	50.1	50.3	50.6	51.2	51.9	52.6	53.3	53.7	54.0	54.5
9 years	49.7	50.2	50.4	50.7	51.4	52.1	52.8	53.4	53.8	54.1	54.5
9.5 years	49.8	50.2	50.5	50.9	51.5	52.2	52.9	53.5	53.9	54.2	54.6
10 years	49.9	50.4	50.6	51.0	51.7	52.4	53.1	53.7	54.1	54.3	54.7
10.5 years	50.0	50.5	50.8	51.2	51.9	52.6	53.3	53.9	54.2	54.4	54.8
11 years	50.1	50.7	51.0	51.4	52.1	52.8	53.5	54.1	54.4	54.6	55.0
11.5 years	50.2	50.8	51.2	51.6	52.3	53.1	53.7	54.3	54.6	54.8	55.1
12 years	50.4	51.0	51.4	51.8	52.5	53.3	53.9	54.5	54.8	55.0	55.3
12.5 years	50.6	51.2	51.6	52.0	52.8	53.5	54.1	54.7	55.0	55.2	55.5
13 years	50.8	51.5	51.8	52.3	53.0	53.7	54.4	54.9	55.2	55.4	55.8
13.5 years	51.0	51.7	52.0	52.5	53.3	54.0	54.7	55.2	55.5	55.7	56.0
14 years	51.2	51.9	52.3	52.8	53.5	54.3	54.9	55.4	55.7	55.9	56.3
14.5 years	51.4	52.2	52.5	53.0	53.8	54.5	55.2	55.7	56.0	56.2	56.5
15 years	51.6	52.3	52.7	53.2	54.0	54.7	55.4	55.9	56.2	56.4	56.7
15.5 years	51.8	52.5	52.9	53.4	54.1	54.9	55.5	56.1	56.4	56.6	56.9
16 years	52.0	52.7	53.0	53.5	54.3	55.0	55.7	56.2	56.5	56.7	57.1

16.5 years	52.1	52.8	53.2	53.6	54.4	55.1	55.8	56.4	56.7	56.9	57.2
17 years	52.3	53.0	53.3	53.8	54.5	55.3	56.0	56.5	56.9	57.1	57.4
17.5 years	52.6	53.2	53.5	53.9	54.7	55.4	56.1	56.7	57.0	57.2	57.6
18 years	52.8	53.3	53.6	54.1	54.7	55.5	56.2	56.8	57.1	57.3	57.7
18.5 years	53.0	53.5	53.7	54.1	54.8	55.5	56.2	56.8	57.2	57.4	57.8
19 years	53.1	53.6	53.8	54.2	54.8	55.4	56.1	56.8	57.2	57.4	57.9
19.5 years	53.3	53.7	53.9	54.2	54.8	55.4	56.1	56.8	57.2	57.4	58.0

Figure 1: The head circumference curves limited to 1-99% for boys of all ages

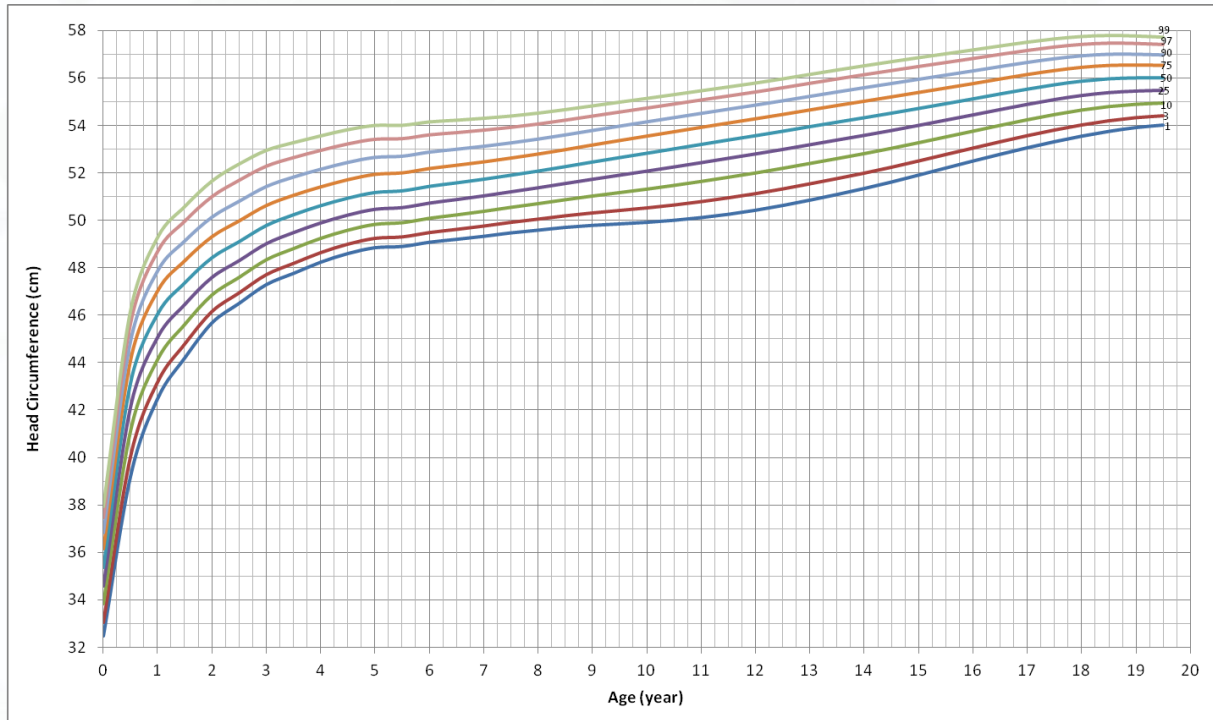


Figure 2: The head circumference curves limited to 1-99% for girls of all ages