Adult Head Circumferences and Centiles

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In this study the head circumference (HC), height and weight of 408 adults were measured. An adult's HC was been shown to be affected by his/her height and weight. Our data suggest that absolute measurements of HC without regard to stature and weight are inadequate for demonstrating clinically significant abnormalities of head size. On average a male's head is 1.33 cm larger than that of a female. We produced centile charts for adult HCs to accurately detect relative abnormalities. The pediatric charts are also appropriate for use in adults of either sex. [Journal of Turgut Özal Medical Center 1997;4(3):261-264]

Key Words : *Adult, centile chart, head circumference, height, weight*

Erişkin baş çevresi ve sentilleri

Bu çalışmada; 408 erişkinin baş çevreleri, boyları ve kiloları ölçüldü. Baş çevresinin, boy ve ağırlıktan etkilendiği bilinmektedir. Sonuçlarımız; ağırlık ve boyu dikkate almadan yapılan baş çevresi ölçümlerinin, klinik yönden önemli baş çevresi değişmelerini göstermekte yetersiz olduğunu göstermiştir. Ortalama olarak, erkek baş çevresi, kadın baş çevresinden 1.33 cm daha büyüktü. Çalışma sonunda, baş çevresi anormalliklerini doğru olarak gösteren sentil kartları geliştirdik. Ayrıca, çocuklarda kullanılan kartlar, her iki cins için erişkinde de kullanılabilir.[Turgut Özal Tıp Merkezi Dergisi 1997;4(3):261-264]

Anahtar Kelimeler : *Erişkin, sentil kartı, baş çevresi, boy ağırlık*

INTRODUCTION

Measurement of occipitofrontal head circumference (HC) is an essential part of most pediatric medical examinations. There are many syndromes associated with microcephaly and macrocephaly (1-4). Since studies have shown that up to 50% of normal variation in head size is familial, the first thing we usually do when we are concerned about an infant with a big head is to decide whether a parent has a large head (5,6). The pediatric charts do not include head circumference references for persons older than 16 or 18 years of age. All that can be done is usually to measure the head sizes of the parents and guess whether they are large.

Here, we determine the correlation between HC, height, and weight in normal adults and offer standards for the relationship between these measurements.

MATERIALS AND METHODS

Data were collected on the age, sex, head circumference, height, and weight of 408 adult volunteers, whose children were attending the outpatient clinics of Pediatrics at Isparta.

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Of these, 66.4% (271/408) were females and 33.6% (137/408) were males. Parents with known growth abnormalities were not included. Head circumference was measured with a non-stretch tape held firmly, but without squeezing the skin, in the horizontal plane through the glabella and opisthocranion. Height and weight were measured directly in all of the subjects.

Correlation between HC, height, and weight was computed separately for normal males and females. Linear regression models were used to evaluate the relationship between the same determined parameters and to arrive at models for predicting. Head circumferences were assumed to be normally distributed and this was checked during the examination. Under this assumption the centiles were established using the regression models.

RESULTS

The median age of the subjects was 30 years (range 16-57). Head circumference was shown to be correlated with height in women ($r = 0.12$, $p < 0.05$) and men ($r = 0.33$, $p < 0.01$). HC was also correlated with weight in women and men ($r = 0.37$, $p < 0.001$ and $r = 0.45$, $p < 0.01$, respectively). No evidence was found on any effect of age.

Mean HC in men was 55.90 cm (SD=1.85), the mean height was 170 cm (SD=6.69), and the mean weight was 73.33 kg (SD=10.93). Corresponding values for women were 54.57 cm (SD=1.61), 157 cm (SD=6.42), and 63.76 kg (SD=11.71). The mean HC/height ratios were 0.33 (SD=0.014) in men and 0.35 (SD=0.017) in women.The mean HCs of males and females were seen to be on the 50th percentile of 16 and 18 year olds on the Tanner and Nellhaus charts of pediatric head circumferences (7). Cartesian graphics have shown that a linear relation was present between HC, height and weight.

The regression equations predicting HC from height were:

- for men : HC = 40.70 + (0.09 X height)

- for women : HC = 49.86 + (0.03 X height)

The regression equations predicting HC from weight were:

- for men : HC = 50.51 + (0.07 X weight)

- for women : HC = 51.34 + (0.05 X weight)

As it is seen from the regression equations predicting HC, the height variable causes 9% increase in men and 3% increase in women; the weight variable causes 7% increase in men and 5% increase in women.

After predicting HCs from regression line equations, predictive bands were produced at 95% confidence levels (Figures 1-4). For a given centile (i.e., 95%), an individual whose circumference falls outside of the predictive band has a HC more extreme than that predicted for 95% of persons of the same height or weight.

In men, individuals with HC values between

$$40.70 + (0.09 \text{ X height}) \pm 1.65 \left(0.150 + 1.75 \sqrt{(height - 170)^2 / 6083}\right)$$

and in women, individuals with HC values between

$$49.86 + (0.03 \text{ X height}) \pm 1.65 \left(0.097 + 1.60 \sqrt{(height - 157)^2 / 11132}\right)$$

have normal HCs for their height.

In men, individuals with HC values between

$$50.51 + (0.07 \text{ X weight}) \pm 1.65 \left(0.143 + 1.67 \sqrt{(weight - 73.33)^2 / 16254}\right)$$

and in women, individuals with HC values between

$$51.34 + (0.05 \text{ X weight}) \pm 1.65 \left(0.091 + 1.50 \sqrt{(weight - 63.76)^2 / 37044}\right)$$

have normal HCs for their weight.

DISCUSSION

There are many anthropometric assessments conducted in adults (2,6-10). Adult values for anthropometric measurements reflect inherited genetic potentials, secular trends, childhood stresses of malnutrition and disease, lifetime accomodation to available nutrients in diet, and physical labor. Speaking generally, females are shorter and lighter than males.

Studies dealing with the correlation between head circumference and height in adults are not so many (2,8). However weight is not considered in these studies. Our work makes it clear that eventhough the

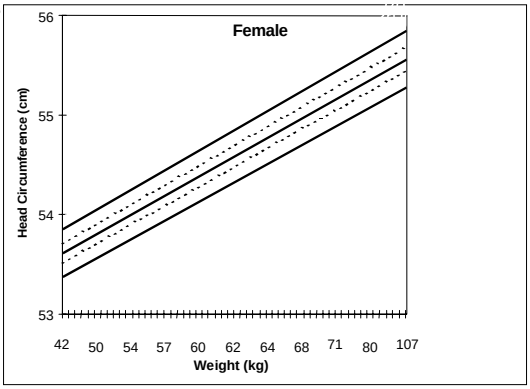

Figure 1. Centile chart for head circumference against weight for use in women.

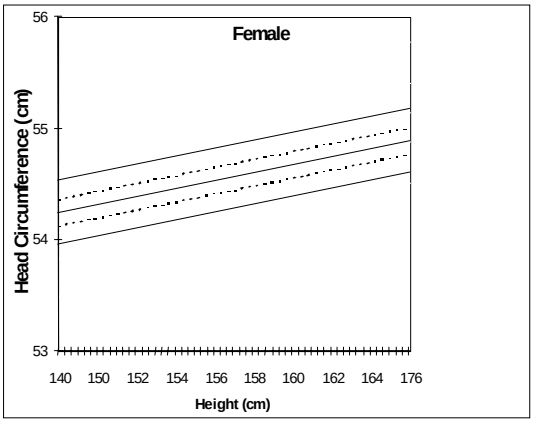

Figure 2. Centile chart for head circumference against height for use in women.

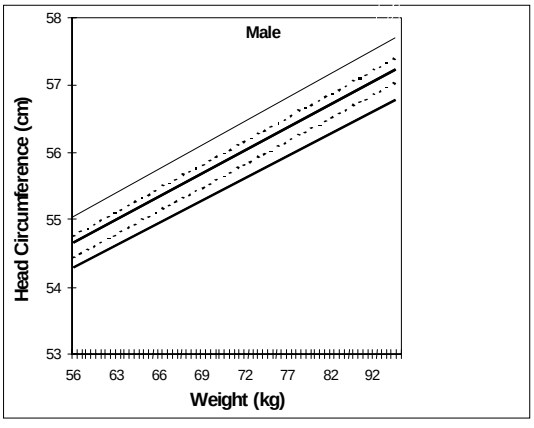

Figure 3. Centile chart for head circumference against weight for use in men.

Figure 4. Centile chart for head circumference against height for use in men.

height variable causes 9% and 3% increase, the weight variable also causes 7% and 5% increase in HCs of men and women, respectively. Weight seems to be more important in women. So, height along with weight must be considered when we are in doubt of the normality of head circumference. Head circumference of males was found to be 1.33 cm larger than that of females and this difference of size is similar as seen in England (8).

The ability to accurately recognize relative abnormalities of head size serves us in delineation of syndromes, diagnosis, and investigation of cause. We have produced centile charts for adult HCs based on measurements from 408 adult volunteers, to attain this goal. Our data support a correlation between HC, height, and weight and suggest that absolute measurements of HC without regard to stature and weight are inadequate for demonstrating clinically significant abnormalities of head size.

Bushby et al. state that the pediatric charts are inappropriate for use in adult males (8). In contrast to them, we found that it is not misleading to use the end of the pediatric charts to plot parental head sizes, even in adult males. Farkas et al state that most of the head measurements mature at 15 years of age in males, and this is also in conformity with our findings (9).

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