# Anthropometric measurements of a group of newborns in a teaching hospital in Baghdad

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## ABSTRACT

**Objectives:** To show the normal standards of trunk and limbs anthropometric measurements in a group of normal full term newborns in Al-Kadhimiya Hospital, Baghdad, and to use the above mentioned standards (as a reference) in the evaluation of newborns, mainly those with dysmorphic features.

**Methods:** A cross-sectional study was carried out in the Obstetric Department, Al-Kadhimiya Teaching Hospital, Baghdad, Iraq, involving 300 full term newborns (within the first 24 hours of birth) delivered in the delivery room, from January 1, 2002 through December 31, 2004. Ten anthropometric measurements were studied.

**Results:** The mean weight (±SD) was 3.5 ± 0.46 Kg, with a median of 3.6 Kg, ranging from 2-4.75 Kg. The mean length (±SD) was 48.45 ± 2.17 cm, with median of 49 cm, ranging from 33-54 cm. Results showed that the mean head circumference (±SD) was 35 ± 1.47 cm, ranging from 31.5-38.5 cm. Very trivial (if any) differences were found between males and females. The mean weight for age Z score (±SD) was 0.6063 ± 1.0737, with a median of 0.67. The mean height for age Z score (±SD) was -0.8144 ± 0.983, with a median of -0.7.

**Conclusion:** This preliminary survey showed that almost all measurements in our newborns were less than the previously published data in other populations. For the time being, these measurements can be used as a rough guide to detect some congenital anomalies.

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Anthropometry has become an important tool in the study of genetic conditions, particularly as a diagnostic aid for the clinical geneticist. However, many practicing physicians do not perform anthropometry of patients for several reasons such as, appropriate measurements in a given situation are unknown, normative reference data are unavailable, or analysis and interpretation of the data are confusing.[1] Dysmorphology is the subset of genetics that deals with the study of structural defects that alter appearance.[2] Thus, playing an important role in evaluating an infant with unusual physical findings and clinical malformations.[3] With the help of normal standard measurements of trunk and limbs, the clinician can identify normal individuals from those who have dysmorphic features.[1] In evaluation of measurements we need 3 conditions: Standard landmarks, simple methods utilizing standard equipment, and normal standard curves for age and gender.[4] The ultimate goal in evaluating a child with structural defects is making a specific overall diagnosis, when this is achieved, appropriate recurrence risk, counseling for the parents, accurate prognostication about the child's future developments, and appropriate plans to help the child reach his or her potential are possible.[5] Lastly, the parents are likely to have anxiety and guilt upon

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learning of the existence of a congenital anomaly and require sensitive counseling after confirming the diagnosis.[6] This study was conducted to show the normal standards of trunk and limbs anthropometric measurements in a group of newborns in Al-Kadhimiya Hospital, Baghdad, and to use the above mentioned standards (as a reference) in the evaluation of newborns, mainly those with dysmorphic features.

**Methods.** A cross-sectional study was carried out in the Obstetric Department, Al-Kadhimiya Teaching Hospital. The data collection started from January 1, 2002 through December 31, 2004, involving 300 newborns delivered in the delivery room. A convenient method of sampling was used for gathering the sample by using: Inclusion criteria: Full term newborn Iraqi infants. Exclusion criteria: Twins, infants of diabetic, or hypertensive mothers, and infants with congenital anomalies, also those with caput succedaneum or cephalohematoma that interferes with length and head circumference measurements. The gestational age was taken from mothers according to the first day of the last menstrual period or the expected date of delivery. It was also determined from ultrasound reports if they were available and confirmed by clinical assessment.[7] The measurements included the following: Length, weight, head circumference, chest circumference, and length of hand, middle finger, palm, little finger and foot. Also, the penile length for male newborns was considered. The length is the measurement of the supine body on a hard table with the feet hold together and dorsiflexed vertically, the occiput, back, and heel touching the table and the eyes looking straight. Readings were taken to the nearest 0.1 cm.[8] The weight was taken using a standard mechanical scale, the newborns were weighed naked. The head and chest circumferences were taken using a standard non-stretchable tape measure, with the measurement taken to the nearest 0.1 cm. The occipito-frontal head circumference was measured at maximum point (occipital protuberance) posteriorly and a point 2.5 cm above the glabella anteriorly.[8] The chest circumference was measured at the level of the nipples. The hand length measured from the palmar aspect is the distance from the distal crease at the wrist to the tip of the middle finger. The middle finger length was measured from proximal crease of the base of the finger to the tip. The little finger length was measured from the flexion crease at the base of the finger to the tip. The palm length was measured from the distal crease of the wrist to the proximal crease at the base of the middle finger. The foot length was measured from an imaginary line tangential to the posterior prominence of the heel to the tip of the longest toe (the first or second toe).[4] The penile length was measured using a transparent plastic ruler applied to the gently stretched penis. All measurements were taken by the same instrument.

***Statistical analysis.*** The statistical package for social sciences (SPSS) version 11 was used for data entry and analysis. The 3rd, 50th (median), and the 97th centiles were measured by the use of the SPSS program. Z scores values were measured using the EPI6 computer program. Microsoft Excell (2003) and SPSS were used for plotting figures and graphs.

**Results.** Three hundred newborns were studied. Males constituted 46.3% (139), and females constituted 53.7% (161). The mean weight (±SD) was 3.5 ± 0.46 Kg, with a median of 3.6 Kg, ranging from 2-4.75 Kg. The mean length (±SD) was 48.45 ± 2.17 cm, with median of 49 cm, ranging from 33-54 cm. Results showed that the mean head circumference (±SD) was 35 ± 1.47 cm, ranging from 31.5-38.5 cm. When analyzing the above mentioned parameters according to gender, the differences between males and females figures were very trivial, and sometimes exactly the same figures were detected for males and females. **Table 1** shows that the gestational age of 120 (males and females) newborns out of 300 was 38 weeks, and the gestational age of 83 newborns was 37 weeks. The 3rd, 50th (median), and the 97th centiles, range and mean for male and female are also presented in the **Table 1**.

The mean±SD for theweight for age Z score was 0.6 ± 1.07 (**Table 2**) and for the height for age Z scores was 0.81 ± 0.88 (**Table 3**).

**Discussion.** The World Health Organization (WHO) convened an expert committee to reevaluate the use of anthropometry of different ages for assessing health, and nutrition. For fetal growth, the committee recommended an existing gender-specific multiracial reference.[9] This study showed preliminary normal values for head, trunk, and limb anthropometric measurements of a sample of normal full-term Iraqi newborns. The length, weight, and head circumference are parameters of intrauterine growth. These measurements are less than the measurements obtained by other studies such as the study that was carried out by Al-Frayh and Haque in Saudi Arabia in 1993.[10] The mean body weight of newborns in our study was also less than that found in a Scottish study.[11] The hand measurements are less than the previously published data in an American study.[12] The hand measurements are important in the evaluation of newborns with malformation syndrome, particular syndromes with acrometric shortening, for example,

**Table 1 -** Centile distribution of the study sample by weeks of gestation.

| Weeks of gestation | 3rd centile Range (mean) | | 50th centile Range (mean) | | 97th centile Range (mean) | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female | Male | Female |
| ***Weight (Kg)*** | 2.1-3.8 | 2.3-3.9 | 3.3-4.1 | 3.5-4.1 | 3.8-4.7 | 3.8-4.2 | **139** | **161** |
| 37-42 | (2.92) | (2.91) | (3.804) | (3.8) | (4.204) | (4.073) | | |
| ***Length (cm)*** | 45-50 | 44-48 | 47-50 | 47-50 | 51.5-53.5 | 51.3-52 | **139** | **161** |
| 37-42 | (46.23) | (46.092) | (48.95) | (49.01) | (51.5) | (50.97) | | |
| ***Head circumference (cm)*** | 31.9-37 | 31.6-34 | 34.-37.4 | 34-37.1 | 36.3-38 | 36.3-38 | **139** | **161** |
| 37-42 | (33.6) | (33.29) | (35.57) | (35.84) | (37.48) | (37.45) | | |
| ***Chest circumference (cm)*** | 30.7-36 | 30.5-35.1 | 33.5-36 | 33.2-36.1 | 36-36.5 | 35.8-37.6 | **139** | **161** |
| 37-42 | (32.811) | (34.86) | (34.70) | (35.04) | (36.033) | (36.78) | | |
| ***Little finger length (cm)*** | 1.9-2.8 | 1.8-2.5 | 2.05-2.85 | 2-2.7 | 2.9-3.6 | 2.84-2.9 | **139** | **161** |
| 37-42 | (2.2) | (2.06) | (2.583) | (2.41) | (3.025) | (2.78) | | |
| ***Middle finger length (cm)*** | 2.5-3.3 | 2.4-3 | 2.7-3.3 | 2.-3.2 | 3.3-3.8 | 3-3.5 | **139** | **161** |
| 37-42 | (2.9) | (2.72) | (3) | (2.99) | (3.39) | (3.3) | | |
| ***Palm length (cm)*** | 2.8-4 | 3-3.9 | 3.5-4 | 3.5-4 | 3.7-4.2 | 3.8-4.2 | **139** | **161** |
| 37-42 | (3.39) | (3.18) | (3.85) | (3.68) | (4.03) | (4.036) | | |
| ***Hand length (cm)*** | 5.8-7.3 | 5.6-6.5 | 6.2-7.35 | 6.1-7.1 | 6.65-7.4 | 6.5-7.4 | **139** | **161** |
| 37-42 | (6.45) | (6.1) | (6.858) | (6.64) | (7.17) | (7.07) | | |
| ***Foot length (cm)*** | 6.5-9 | 6-8.3 | 7.8-9 | 7.6-8.9 | 8.6-9.1 | 8.8-9 | **139** | **161** |
| 37-42 | (7.52) | (6.776) | (8.6) | (8.22) | (8.937) | (8.90) | | |
| ***Penile length (cm)*** | 1.68-3.2 | | 2.65-3.5 | | 3.7-4.2 | | **139** | |
| 37-42 | (2.37) | | (3.2) | | (4) | | | |

**Table 2 -** Distribution of the sample by weight for age Z score.

| Distribution | n | (%) |
|---|---|---|
| Lowest through -3.01 | 2 | (0.7) |
| -3 through -2.01 | 2 | (0.7) |
| -2 through -1.01 | 20 | (6.7) |
| -1 through 1 | 155 | (51.7) |
| 1.01 through 2 | 109 | (36.3) |
| 2.01 through 3 | 12 | (4) |
| **Total** | **300** | **(100)** |

**Table 3 -** Distribution of the sample by height for age Z score.

| Distribution | n | (%) |
|---|---|---|
| Lowest through -3.01 | 3 | (10) |
| -3 through -2.01 | 24 | (8) |
| -2 through -1.01 | 80 | (26.7) |
| -1 through 1 | 190 | (63.3) |
| 1.01 through 2 | 3 | (1) |
| **Total** | **300** | **(100)** |

skeletal dysplasia; long fingers or big hands, for example, Mar fans syndrome.[13] The little finger length is important in clinical diagnosis of Down syndrome and Cornelia de-Lange syndrome.[14] On average the foot length is shorter than the foot length measured in some previously published studies.[13,14] The foot length is important in the evaluation of newborns with certain malformation syndromes, for example, pyknodysostosis (long toes) or hypo plastic toes.[15] Although the penile length was similar to the data from Jordanian newborns,[14] there was a broader normal range in our newborns. The penile length is important in the evaluation of males with hypogonadism and also with suspected hypopituitarism (although its importance in the newborn period is doubtful) and some syndromes, for example, Robinow syndrome, Laurence-Moon-Biedl syndrome.[16] As a rough guide, however, it can be said that newborns who fall outside the area between the 5th and 95th percentile should be regarded with suspicion or as unhealthy unless proved otherwise.[17,18] Generally speaking, almost all measurements in our newborns are slightly less than the previously published data in other populations.[12,14] This is probably due to either population variability, and for that reason we carried out this study to

create our own references, and could be due to the imposed sanction on Iraq that affected the nutritional status of mothers and retarded growth of their newborns, also parents BMI can provide valuable complementary information to the findings of the child anthropometric measurements.[19,20] For the time being these measurements can be used as a rough guide to detect some congenital anomalies. So, the availability of normative standards does not obviate the needs for additional work of large number of newborns and need a multi-center study in Baghdad to create our own standards of growth parameters as many of the reported standards for particular measurements are available for certain racial or ethnical population only, and not necessarily have a wide applicability to all populations.[9]

## References


1. Meaney FJ, Farrer LA. Clinical anthropometry and medical genetics: A compilation of body measurements in genetic and congenital disorders. ***AMJ Med Genet*** 1986; 25: 343-359.
2. Stephen SA. Genetic and metabolic disorders. In: Behrman RE, Kleigman R, editors. Nelson Essentials of Pediatrics. 4th edition. Philadelphia (PA): WB Saunders Company; 1990. p. 122.
3. Lepig KA, Werter MM, Cann CL. Predictive values and their association with major malformations. ***J Pediatr*** 1987; 110: 531-533.
4. Hall JG, Iskenius FUG, Allanson JE. Handbook of normal physical measurements. New York (NY): Oxford University Press; 1989.
5. Shapiro L. Human genetics. In: Behrman RE, Kleigman R, Arvin AM, editors. Nelson textbook of pediatrics. 16th edition. Philadelphia (PA): WB Saunders Company; 2000. p. 313-321.
6. Seaver LH, Hoywe HE. Tetralogy in pediatric practice. ***Pediatr Clin N Am*** 1992; 39: 111-112.
7. Alexander GR, Allen MC. Conceptualization, measurement, and use of gestational age. Clinical and public health practice. ***J Perinatol*** 1996; 16: 53-59.
8. Wright K, Freuchel G. Postnatal measurement of growth parameters. ***Int Pediatr J*** 1993; 91: 922-925.
9. Anthropometric reference data for international use: Recommendations from a WHO expert committee. Available from: URL: www.who.int/nutgrowthdb/about/introduction/en/index8.html
10. Al-Frayh AS, Haque KN. Intrauterine and fetal growth standards for Saudi Arabia and gulf region. ***Saudi Med J*** 1993; 14: 33-37.
11. Hutchison JH, Cockbura F, editors. Practical Pediatric Problems. 6th ed. London (UK): Lloyd-Luke Ltd; 1980. p. 12.
12. Sivan Y, Merlob P, Reiner SH. Upper limb standards in newborns. ***Am J Dis Child*** 1993; 137: 829-832.
13. Merlob P, Sivan Y, Reisner SH. Anthropometric measurements of newborn infants (27-41 gestational weeks). ***Birth Defects Original Series*** 1984; 20: 1-5.
14. El-Shanti H, Al-Lahham M, Bateha A. Normal standards of the trunk and limb anthropometric measurements in Jordanian newborns. ***Saudi Med J*** 1988; 19: 702-706.
15. Wiedemann K, Grosse K, editors. Characteristic syndrome. London (UK): Wolfe Medical Publications Ltd; 1986. p. 136.
16. Bishop NJ, King FJ, Alucas S. Linear growth in the early neonatal period. Archives of the disease in childhood. ***J Br Pediatr Assoc*** 1990; 7: 707-708.
17. Mason S, Swash M, editors. Examination of children. In: Hutchison's Clinical Methods. 18th ed. London (UK): ELBS with W.B. Saunders Co. Ltd; 1980. p. 456-473.
18. Hull D, Derek IJ, editors. Essential Pediatrics. 3rd ed. New York (NY): Churchill Livingstone; 1997. p. 46.
19. Rahman M, Roy SK, Ali M, Mitra AK, Dlam A, Akbar MS. Maternal nutritional status as a determinant of child health's. ***Trop Paediatr Apr*** 1993; 39: 86-88.
20. Hassan MK, Al-Hamadani FF. Factors affecting growth in children aged 6-36 months in Basrah. ***J Comm Med*** 2002; 15: 14-19.