

# Neonatal Anthropometric Charts: The Italian Neonatal Study Compared With Other European Studies

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## ABSTRACT

**Background and Objective:** This was a nationwide prospective study carried out in Italy between 2005 and 2007, involving 34 centers with a neonatal intensive care unit. The study reports the Italian Neonatal Study charts for weight, length, and head circumference of singletons born between 23 and 42 gestational weeks, comparing them with previous Italian data and with the most recent data from European countries.

**Patients and Methods:** Single live born babies with ultrasound assessment of gestational age within the first trimester, and with both parents of Italian origin. Only fetal hydrops and major congenital anomalies diagnosed at birth were excluded. The reference set consists of 22,087 girls and 23,375 boys.

**Results:** At each gestational age, boys are heavier than girls by about 4%. Later-born neonates are heavier than firstborn neonates by about 3%. The effects of sex and birth order on length and head circumference are milder. No differences were observed between babies born in central-north Italy and southern Italy. A large variability emerged among European neonatal charts, resulting in huge differences in the percentage of Italian Neonatal Study neonates below the 10th centile, which is traditionally used to define small-for-gestational-age babies. In the last 2 decades prominent changes in the distribution of birth weight emerged in Italy and in the rest of Europe, in both term and preterm neonates.

**Conclusions:** The existing European neonatal charts, based on more or less recent data, were found to be inappropriate for Italy. Until an international standard is developed, the use of national updated reference charts is recommended.

**Key Words:** birth weight, growth, length and head circumference, neonatal anthropometric charts, small-for-gestational-age

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In clinical practice, a neonate is classified as small-for-gestational-age (SGA), appropriate-for-GA, or large-for-GA on the

basis of threshold values derived from the distribution of a given anthropometric trait (eg, birth weight [BW]) in a population of neonates regarded either as standard or more often as a reference. A standard is based on highly restrictive criteria aimed at excluding all neonates exposed to any risk factor for fetal growth, thus describing “how growth should be.” In the absence of these exclusion criteria, a chart is considered a reference, which describes “how growth actually is.” At present, the large majority of neonatal charts in use are essentially references (1).

The heterogeneity of methods used to trace these charts, mainly in regard to the criteria adopted to select the neonates, results in wide differences between the threshold values, which do not necessarily reflect substantial differences between populations. The present trend is that each country produces or updates its own national charts (2). In Italy, the 6 charts based on data of babies born from 1979 to 2003 and published in the last decade (3–8) present large differences, mainly at low values of GA (eg, at 28 weeks the values of the 10th centile differ by up to 223 g in boys and 177 g in girls).

For this reason, the Italian Society of Neonatology, the Italian Society of Pediatric Endocrinology and Diabetology, and the Italian Society of Medical Statistics and Clinical Epidemiology promoted a multicenter survey with the aim to produce an Italian neonatal anthropometric reference fulfilling the set of criteria suggested in a previous study (9). The present study reports and discusses Italian Neonatal Study (INeS) charts for weight, length, and head circumference of singletons born between 23 and 42 gestational weeks, and compares them with previous Italian data and with the most recent data from European countries.

## PATIENTS AND METHODS

### Reference Set

The present study, which lasted from 2005 to 2007, involved 34 of the 125 Italian centers selected on a voluntary basis, having a neonatal intensive care unit, and trained to use standard instruments and measurement techniques. In the first year of the study, all of the neonates in participating centers were enrolled; in the second and third years, only preterm neonates were recruited to increase the number of babies born at low GAs. In accordance with the protocol of the study, single live-born babies delivered from 23 to 42 gestational weeks and with both parents of Italian origin were included in the reference set. GA, recorded in completed weeks plus days, was based on ultrasound assessment within the first trimester. Only 3% of neonates showed a discrepancy with the estimate derived from last menstrual period larger than 1 week; also in these cases the ultrasound assessment was used. Fetal hydrops and major congenital anomalies diagnosed at birth were excluded.

The reference set described above consists of 45,462 neonates: 22,087 girls and 23,375 boys (Table 1). The percentage of neonates coming from north-central Italy (72%) was slightly higher

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