

ORIGINAL ARTICLE

Do the somatic parameters in slovak newborn on the 1st day of life overlap the Fenton curve?

Jana BRUCKNEROVÁ¹, Lucia LAUKOVÁ¹, Michal TRNKA², Ingrid BRUCKNEROVÁ³

¹ Faculty of Medicine Comenius University in Bratislava, Slovakia

² Institute of Medical Physics, Biophysics, Informatics and Telemedicine, Medical Faculty, Comenius University in Bratislava

³ Neonatal Department of Intensive Medicine, Medical Faculty, Comenius University in Bratislava and National Institute of Children's Diseases

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ABSTRACT

Gestational age, birth weight and birth length are basic somatic characteristics of each newborn. To compare the obtained data with the weight and growth curves according to Fenton 2013 (Fenton, 2013) and to analyze the occurrence of some risk factors (nicotinism, hypertension, gestational diabetes and diabetes mellitus) in mothers. The monitored group of newborns consisted of 2331 newborns admitted to the Neonatal Department of Intensive Medicine in 2012-2016 (n=2331). The number of premature newborns was 1061 and term newborns were 1270 (mean birth weight: boys – 2645.2 g, girls – 2443.79g; average birth length: boys – 45.82 cm, girls – 44.71 cm; spontaneous delivery: 1282 newborns, delivery of caesarean section: 1049 newborns). We found that both graphical representations overlap each other. We did not notice significant differences in the values of the monitored parameters. In our group of prenatally hypertrophic newborns above 97th percentile in 72 newborns were confirmed 8 cases of diabetes mellitus or gestational diabetes in the mother. In the analysis of the prenatal hypotrophic newborns below the 3rd percentile we found 71 hypotrophic newborns (6 cases with severe hypertension, 7 cases with multifetal pregnancy, 3 mothers during pregnancy smoked more than 20 cigarettes daily). The obtained result is based on the fact that data from the European population of newborns were also the basis for drawing up the Fenton graphs. We have confirmed the difference in birth weight and gender.

KEY WORDS: newborn; birth weight; birth length; charts

Introduction

The development of an individual, since its prenatal age, has been studied for many years. Somatic factors are influenced by the development of humanity and by the individual's living conditions. Gestational age, birth weight and birth length are basic characteristics of each newborn.

The term newborn weighs 3200grams on average, newborns weighing less than 2500grams are referred to as newborns with low birth weight and neonates over 4000grams are referred to as hypertrophic. After birth, a physiological weight loss occurs between 100 and 300grams (5–10%). The weight gain occurs within 2 weeks.

The length of newborn is 45 to 50cm with a median of 50.5 cm for boys and 49.9cm for girls. During the first year, the height will increase by about half the birth length, in the second year it will increase by 12 cm per year, up to five years about 7 cm per year and later 5 to 6 cm per year until puberty.

We can use different physical methods for measurement of the length and weight. To assess individual growth and development we use standards, the average values obtained by examining a larger set of healthy children. Norms are obtained using two mathematical-physical methods: obtaining average values and standard deviation or percentile method. Based on the data obtained from the statistical evaluation of large groups of children, tables and diagrams are produced. Tables with the so-called the standard deviation score (standard deviation, SDS or Z score) uses the average and standard deviation method. The deviation is a measure of the scatter of the examined character in the array around the diameter, and indicates how much the values may differ from the mean to still be considered normal. Values outside this variance are

Correspondence address:

prof. Ingrid Brucknerová, MD., PhD.

Neonatal Department of Intensive Medicine,
Comenius University in Bratislava and
National Institute of Children's Diseases
Limbova 1, 833 40 Bratislava, Slovakia
E-MAIL: ingrid.brucknerova@fmed.uniba.sk

considered to be below or above average. We compare the value of the tracer with the average value for the age in the tables and divide the difference between them by the standard deviation given in the tables for that age. We use growth/weight charts in the percentile network for long-term growth tracking (Košťalová & Kovács, 2005).

The percentile method is a method for assessing somatic indicators. The given dimension is expressed in percentages appropriate for a certain age (value 3rd, 16th, 25th, 50th, 75th, 84th, 97th percentiles, or integer 10 and 90 instead of 16 and 84). The percentile method is based on the evaluation of the set of children. On the one side the graph/table starts with the lowest values of the character and on the other side it ends with the highest values of the monitored character. The interval of the 3rd to the 97th percentile corresponds to the value of the mean $\pm$ 2 sigma. Every gender has its own tables.

A gestational week affects the development of a newborn and his/her somatic factors. Scientists have long been comparing the results of an individual's development at different locations in the world (Schack-Nielsen *et al.*, 2006; Odland *et al.*, 2003; Skjaerven *et al.*, 2003). Generally accepted standards comprehensively list charts according to Fenton (Fenton, 2003; Fenton, 2013). The time update, which data were collected from 1991–2007, was published in April 2013. The group of children consisted of 3 986 456 newborns ranging from the 20th week of gestation to the term individuals. This sample was composed only of healthy newborns from Germany, Australia, Canada, the United States of America, Italy and Scotland (Fenton, 2013). The goal of creating Fenton charts was to unify the growth and weight curves with World Health Organization (WHO) growth standards and for better expression of the gestational week (Fenton, 2013).

Material and methods

The monitored group of newborns consisted of 2331 newborns admitted to the Neonatal Department of Intensive Medicine at the Faculty of Medicine of Comenius University in Bratislava (NKIM LF UK) in 2012–2016 (n=2331).

Selected somatic signs (birth weight in grams, birth length in centimetres, gestational age in weeks) were obtained by retrospective analysis of newborn redundancy reports. We used the pivot tables and charts for the

analysis and summary. The aim of our work was to compare the obtained data with the weight and growth curves according to Fenton 2013 (Fenton, 2013). Statistically, we processed the data file in Microsoft Excel.

Results

The monitored set consisted of 2331 newborns, of which premature newborns were 1061 and term newborns were 1270 (mean birth weight: boys- 2645.2 g, girls- 2443.79 g, average birth length: boys- 45.82 cm, girls- 44.71 cm; spontaneous delivery: 1282 newborns, delivery of caesarean section: 1049 newborns) (Figures 1, 2). The division of newborns according to their maturity and gender is shown in Table 1.

In a detailed analysis of the hypertrophic newborns over the 97th percentile for age and gender according to Fenton we confirmed 72 hypertrophic newborns (in 8 cases, diabetes mellitus or maternal gestational diabetes was confirmed).

In a detailed analysis of prenatal hypotrophic infants below the 3rd percentile for age and gender according to Fenton, we found 71 hypotrophic newborns (6 cases had severe hypertension in 7 cases- multifoetal pregnancy, in 3 cases- nicotine in mother).

Discussion

The prenatal development is a significant period of human life. Development of the newborn may be accompanied by various complications reflected on its health and selected somatic parameters such as birth weight and birth height.

Fenton charts express the interdependence between birth weight and height and gestational age of the newborn, and are then divided by gender (Fenton, 2013).

We compared the data on the birth weight and the birth length with the weight and growth curves according to Fenton from 2013. We found that both graphical representations overlap each other. We did not notice significant differences in the values of the monitored parameters. We assume that the obtained result is based on the fact that data from the European population of newborns were also the basis for drawing up the Fenton graphs. We have confirmed the difference in birth weight and gender.

Table 1. Division of newborns according to maturity.

	Premature newborns				Term newborns	
	late term ($\geq 36+6 - < 37$ g.w.)	late preterm ($\geq 31 - < 36$ g.w.)	very premature ($\geq 27 - < 31$ g.w.)	extremely premature (< 27 g.w.)	term delivery ($\geq 37 - < 41$ g.w.)	postterm delivery (≥ 41 g.w.)
boys	93	255	155	88	691	77
girls	65	226	113	66	451	51
total	158	481	268	154	1142	128

abbreviations: g. t. – gestational week

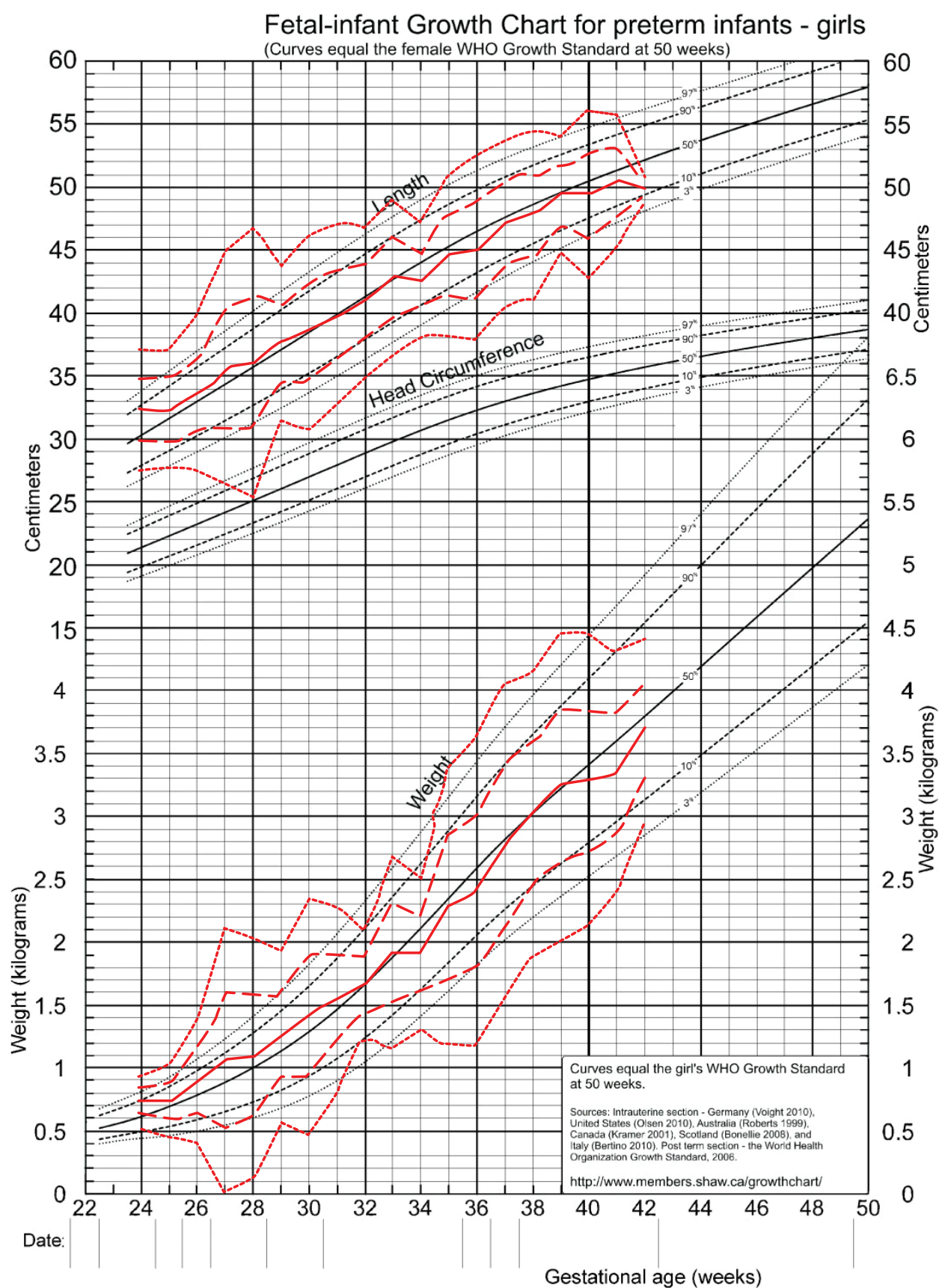


Figure 1. Comparison of results with Fenton's chart for girls

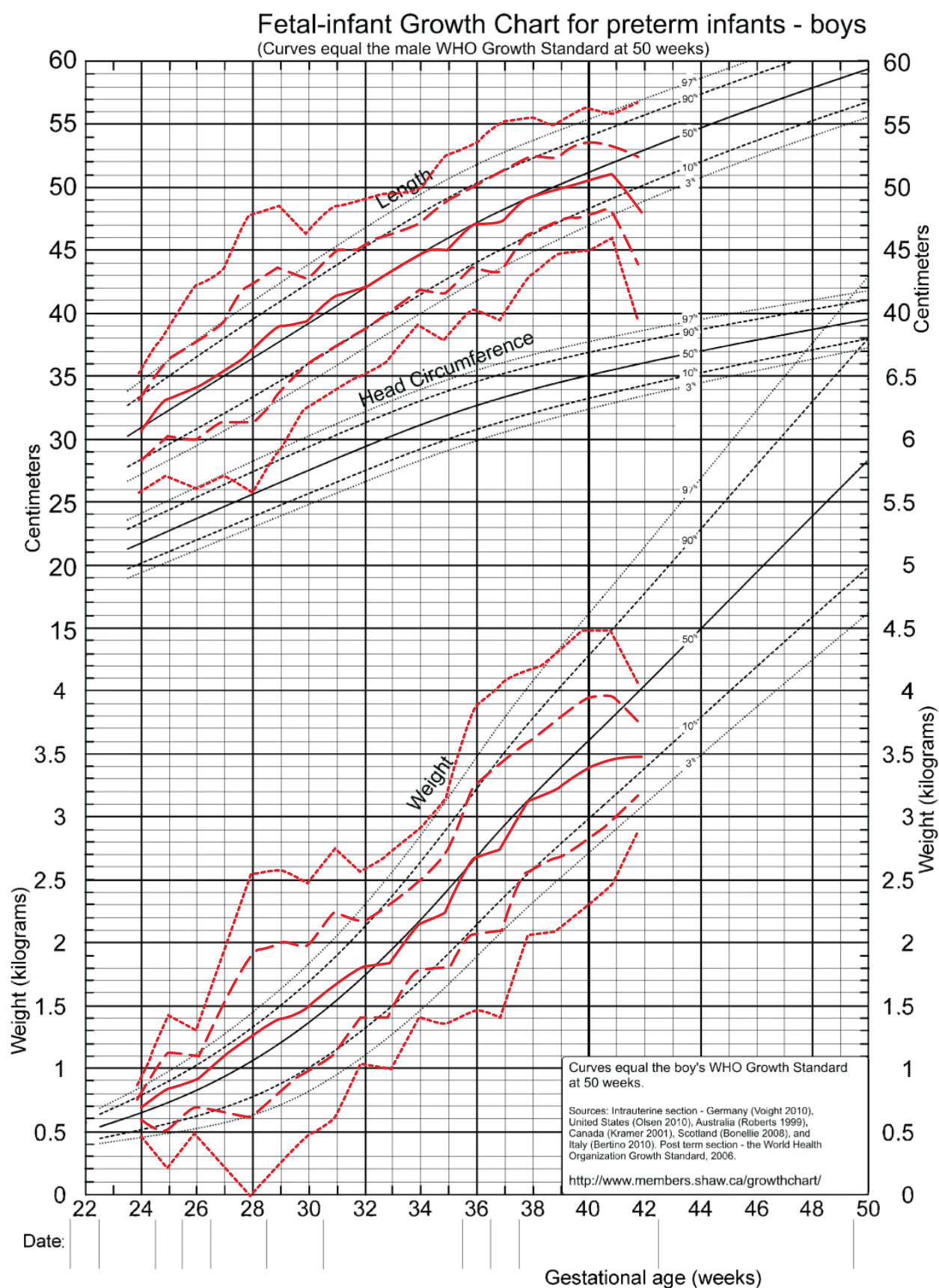


Figure 2. Comparison of results with Fenton's chart for boys

Risk factors can significantly affect an individual's development. Fetal growth during intrauterine development is affected by a number of factors: genetic features of each individual, racial and ethnicity, external factors of the environment (radiation, social conditions), maternal diet (nutrition, diet), maternal disease (diabetes mellitus, chromosome anomalies, multifetal pregnancy, infection, hormones, different blood groups and Rh factor), placenta (too small placenta, insufficient function, reduced oxygen, vitamins and nutrients supply).

In our work we analyzed the occurrence of some risk factors: nicotine, hypertension, gestational diabetes and diabetes of mothers, which could be the cause of severe prenatal hypertrophy or hypotrophy. Our findings of the incidence of risk factors for prenatal hypertrophy are identified with results of Brucknerová (Brucknerová, 2014). In our group of prenatally hypertrophic newborns above 97th percentile for age and gender according to Fenton, in 72 newborns were confirmed 8 cases of diabetes mellitus or gestational diabetes in the mother. Gestational diabetes mellitus occurs most often at the intersection of the second and third trimesters. A normal amount of insulin is present in the blood and with a pregnancy course it is more difficult for insulin to pass into the cells. It is caused by the increased levels of pregnancy hormones produced by the placenta. Diabetes mellitus belongs into other risk factors. The condition of maternal metabolic compensation during pregnancy affects fetal growth.

In the detailed analysis of the prenatal hypotrophic newborns below the 3rd percentile for age and gender according to Fenton, we found 71 hypotrophic newborns, 6 cases with severe hypertension, 7 cases with multifetal pregnancy and 3 mothers during pregnancy smoked more than 20 cigarettes daily. Smoking of a pregnant woman negatively affects the development and health of the fetus directly, through the transplacental transfer of chemical substance nicotine, as well as indirectly through adverse changes in the physiological functions of the future mother, mainly by the decreased supply of oxygen to the placenta with the possibility of fetal hypoxia. This is due to the tight binding of CO to hemoglobin, which prevents the transfer of oxygen (Pregnancy and Postpartum Smoking Cessation, webpage). Maternal hypertension affects the size of blood flow through the placenta.

Several studies have shown that smoking in pregnant woman increases the risk of spontaneous abortion by

up to 28%, as well as of premature birth. Children of smoker mothers have a lower birth weight (Pregnancy and Postpartum Smoking Cessation, webpage), with a negative correlation with smoking intensity. On average, one cigarette daily reduces the weight of the newborn by about 12 grams, i.e., smoking of 16 cigarettes a day leads to a reduction in the child's birth weight by about 200 grams (Wald & Hackshaw, 1996). In this respect, smoking is the most harmful in the second and third trimesters indicating the importance of ending smoking at the beginning of pregnancy. Congenital birth defects are more common compared to non-smokers, proportionately to the amount of mother's smoked cigarettes during pregnancy.

The most accurate comparison would be based on diagrams and curves for a given country, given many differences among countries in nutrition as well as between races and continents. We are currently using charts based on data processing of over 3.5 million healthy newborns from 3 continents and 6 countries. In the future, we would like to develop Slovak standards that best reflect the real characteristics of born newborns.

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