

## Physical Development of Newborns From Sofia at the End of the 20<sup>th</sup> and Beginning of the 21<sup>st</sup> Centuries

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The characteristics of the physical development of newborn infants in 2001 from Sofia are made by measuring four basic anthropometric features: stature, weight, head circumference and chest circumference. In this research 219 newborn infants (110 boys and 109 girls) are studied and the results compared with literature and retrospective data from the years 1907, 1955/57, 1960, 1981, 1990 and 2000. The newborn boys in 2001 have an average stature of 50,58 cm and weight of 3,390 kg. The girls have an average length of 50,13 cm and weight of 3,290 kg. The boys born in 2001 have average head and chest circumferences of 35,28 cm and 33,45 cm respectively, and girls of 34,55 cm and 33,17 cm respectively. The generalized evaluation of the secular changes shows a statistically significant difference only in stature.

*Key words:* physical development, newborn infants, secular trend.

### Introduction

The study of the physical development of infants has great theoretical and practical importance as an index characterizing their health status, the peculiarities of infant growth and the formation of their constitution.

Many eminent scientists have been working in the field of physical development in infants and many methodologies concerning these investigations have been published. Concrete results presenting the metrical data for different ages, sexes, nationalities etc. of groups of children have also been published [1, 2].

Many eminent Bulgarian scientists have published data for the trends in the physical development of Bulgarian children from the beginning of the 20<sup>th</sup> century until the present [4, 5, 6, 7].

During every period of childhood, the physical development has its own characteristics with respect to the rate of its growth and maturation. It is established that in the postnatal ontogenesis the most important growth processes occur during the first year of age.

The aim of the present study is to characterize the physical development of newborn infants from Sofia in 2001 by four basic anthropometric features: stature, weight, head and chest circumferences, and to assess the secular changes in comparison with available literature data and with our retrospective collected data.

## Material and Methods

The data for the present study was collected during April-May 2001. In total 219 full-term and healthy newborn infants (110 boys and 109 girls with body weight  $\geq 2.500$  kg) are measured in the first 24 hours after birth from the neonatological section of the 2nd Obstetric-Gynecological hospital "Shejnovo" were investigated. Thirty-eight anthropometric features were measured personally by the author for every newborn infant, using the Martin, Saller classical method [3]. Here we are presenting the results obtained by the statistical evaluation of four basic anthropometric features: stature, weight, head circumference and chest circumference. The sex differences were assessed on the basis of the differences in the absolute values and by the data from ISD, calculated by the formula:

$$ISD = \frac{X_{girls} \times 100}{X_{boys}} .$$

In the present work the data are compared with retrospective data collected by us for stature and weight of 7921 newborn infants (4170 boys and 3751 girls) in the years 1981 (1200 boys and 1118 girls), 1990 (1335 boys and 1187 girls) and 2000 (1635 boys and 1446 girls). These data were collected with the kind cooperation of the staff of the neonatological section of the 2nd Obstetric-Gynecological Hospital "Shejnovo".

For the assessment of secular changes, literature data from the investigations held in 1907, 1955/57, 1960 [4, 5, 7], and the mentioned above retrospective data from the years 1981, 1990 and 2000, were used.

## Results and Discussion

Both stature and weight are the most important anthropometric features, characterizing the physical development during each stage of the ontogenesis.

During childhood, the stature reflects the growth of the child in height. It is mainly genetically determined, and is influenced by environmental conditions. According to the Bulgarian Health Ministry standards valid at present, the mean values of stature for both sexes at birth vary between 49.0 cm and 52.0 cm [6].

The studied newborn boys in 2001 have an average stature of 50.58 cm. The lowest measured value of stature is 47.0 cm, and the highest is 54.0 cm. The girls born in the same year have an average stature of 50.13 cm. They are shorter than boys by 0.45 cm. The lowest measured value of stature in girls is 46.0 cm, and the highest is 55.0 cm. The differences between the sexes expressed by ISD show that newborn boys are longer than girls by 0.89 % and the absolute values are statistically significant ( $P < 0.05$ ) (Table 1; Fig.1).

The comparative analysis between our data and the literature and retrospective data shows that the studied newborn boys and girls in 2001 are shorter than these born at the beginning of the 20<sup>th</sup> century by 0.3 cm and 0.07 cm respectively. The highest average of stature in the newborn infants from both sexes is found in the infants from 1955/57, 1960 and 2000. The newborns in 1981 from both sexes have the lowest stature (Table 1; Fig. 2).

**Table 1. Stature (cm)**

Years	Boys						Girls						ISD (%)
	<i>n</i>	<i>X</i>	SD	min	max	<i>V</i>	<i>n</i>	<i>X</i>	SD	min	max	<i>V</i>	
1907	219	50.9		47.0	57.0		200	50.2		47.0	57.0		98.62
1955/57		51.5						50.8					98.64
1960	131	51.4*	2.20	36.0	56.0	4.28	122	50.48	2.27	43.0	55.0	4.50	98.1●
1981	1200	50.38	1.49	45.0	57.0	2.96	1118	49.7*	1.37	45.0	54.0	2.75	98.8●
1990	1335	50.71	1.60	45.0	56.0	3.16	1187	50.28	1.43	45.0	54.0	2.84	99.1●
2000	1632	51.2*	1.79	45.0	58.0	3.50	1446	50.5*	1.66	46.0	58.0	3.28	98.7●
2001	110	50.58	1.50	47.0	54.0	2.97	109	50.13	1.65	46.0	55.0	3.29	99.1●

\* Statistically significant differences ( $P < 0.05$ )

● Statistically significant sex differences

**Table 2. Weight (kg)**

Years	Boys						Girls						ISD (%)
	<i>n</i>	<i>X</i>	SD	min	max	<i>V</i>	<i>n</i>	<i>X</i>	SD	min	max	<i>V</i>	
1907	223	3.350			5.100		203	3.260			4.500		97.31
1955/57		3.450						3.340					96.81
1960	132	3.390	0.46	2.040	4.460	13.57	122	3.250	0.46	1.980	4.240	14.15	95.8
1981	1200	3.47*	0.43	2.500	5.000	12.39	1118	3.330	0.40	2.500	4.700	12.01	96.0
1990	1335	3.390	0.43	2.500	5.100	12.68	1187	3.270	0.39	2.500	4.650	11.93	96.5
2000	1635	3.390	0.42	2.500	5.100	12.39	1446	3.270	0.39	2.500	5.000	11.93	96.5
2001	110	3.390	0.38	2.600	4.550	11.21	109	3.290	0.38	2.600	4.400	11.55	97.0

\* Statistically significant differences ( $P < 0.05$ )

● Statistically significant sex differences

The assessment of the secular changes shows that the stature increases until the middle of the 20<sup>th</sup> Century. During the 1980s average stature begins to decrease. After this period low secular increase of stature was observed until 2000, but decrease of stature in both sexes is established in 2001 (Fig. 2).

The body weight is another important feature, which is also genetically determined, but it is influenced predominantly by environmental conditions. According to the present standards of the Bulgarian Health Ministry, the mean values of body weight for both sexes at birth vary between 3.400 kg and 3.500 kg. The observed differences between individuals vary from 2.500 kg to 4.300 kg [6].

The studied boys born in 2001 have an average weight of 3.390 kg. The measured minimum value is 2.600 kg and the maximum 4.550 kg. The girls born in the same year have an average weight of 3.290 kg. They are less heavy than the newborn boys by 0.1 kg. The measured minimum and maximum values are 2.600 kg and 4.400 kg respectively. The data of the ISD show that the newborn boys are heavier than the newborn girls by 2.95% and the sexual differences are statistically significant ( $P < 0.05$ ) (Table 2; Fig. 1).

By the assessment of the secular changes of body weight from the beginning of the 20<sup>th</sup> century until 2001 it was established that the newborn boys and girls in 2001 have relatively equal body weight with the ones from 1907. During the 1950s and 1980s a slight increase of weight of the newborn compared with these from the beginning of the 20<sup>th</sup> century is observed (Table 2; Fig. 3).

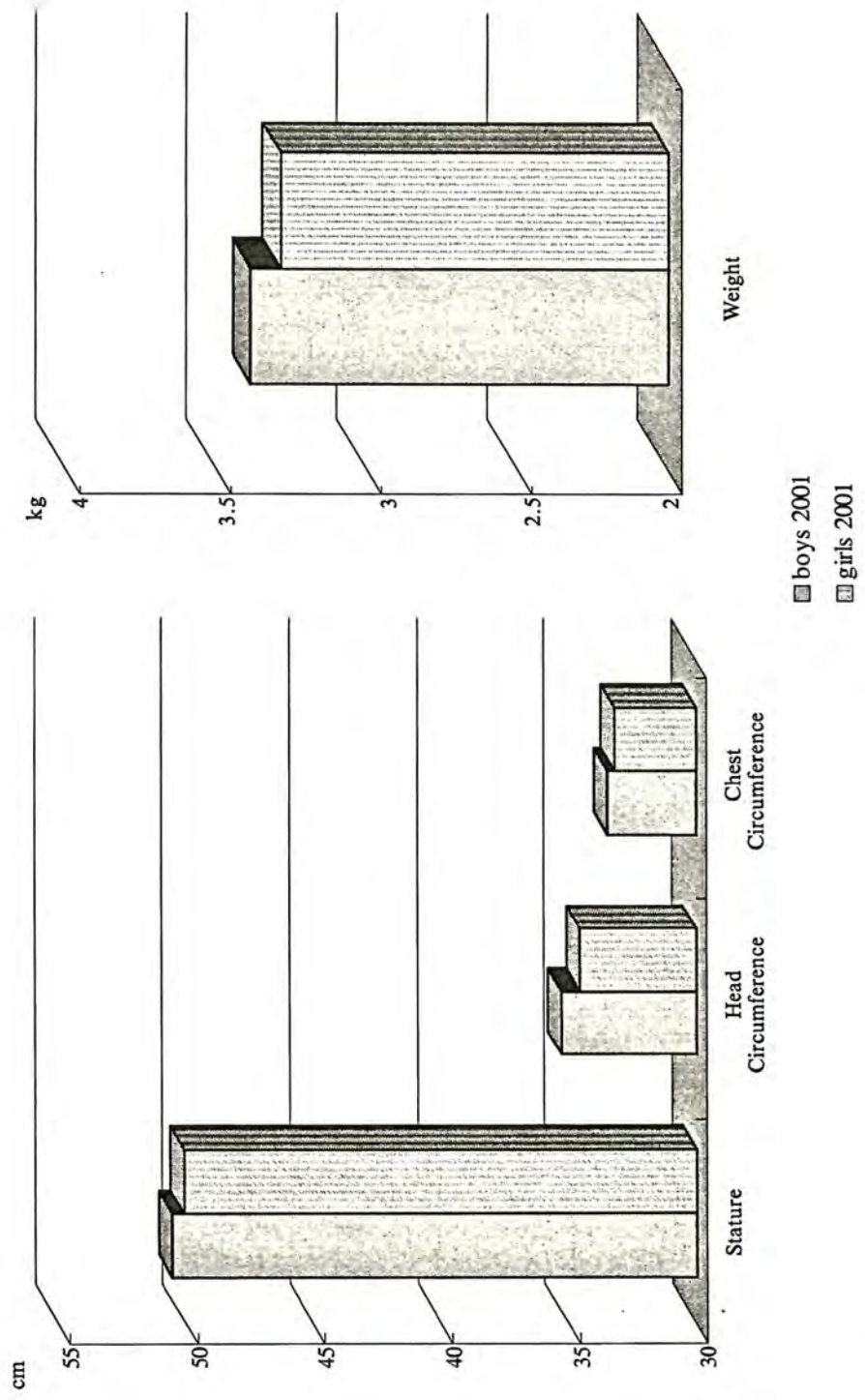


Fig. 1. Basic anthropometrical data for newborn infants from Sofia (2001)

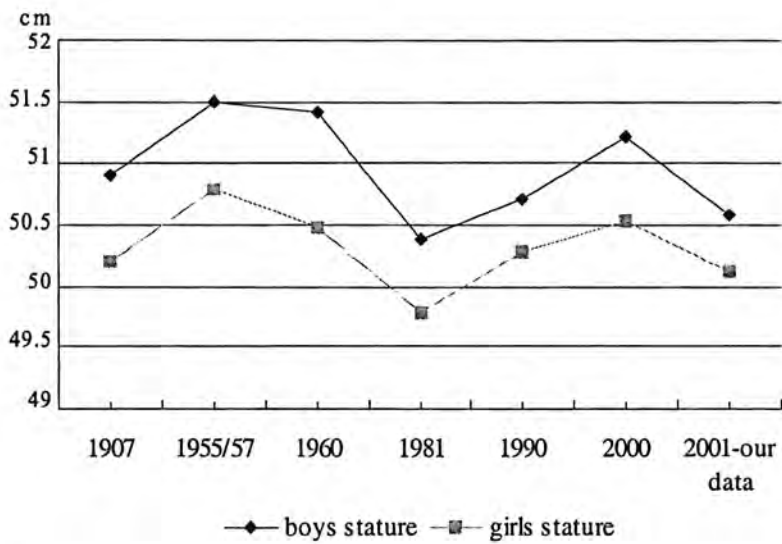


Fig. 2. Secular changes in stature

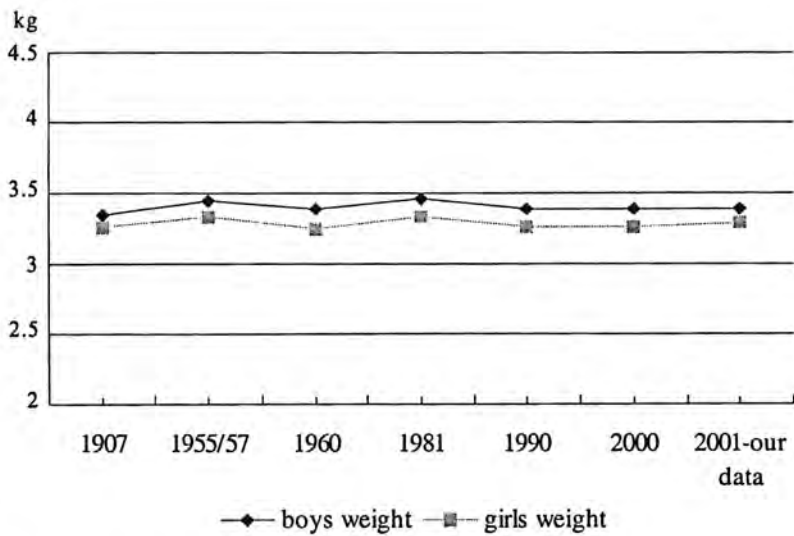


Fig. 3. Secular changes in weight

The ratio between head circumference and chest circumference is important to help establish the body development proportions in pediatric practice. Stanchev (1980) [6] announced that at birth the head circumference is, on average, 34.0 – 35.0 cm and it is bigger than the chest circumference by about 2 cm. The chest circumference of newborns is about 33.0 cm. The ratio between the two features is greater than 1 until four months of age. After that it is less than 1.

The newborn boys and girls in 2001 have an average head circumference of 35.28 cm and 34.55 cm respectively. The range is 32.0 – 37.9 cm (boys) and 31.8 – 38.0 cm (girls). In 2001 the mean value of the chest circumference of the newborn boys is 35.45 cm and 33.17 cm in girls. The measured minimum and maximum values are 30.0 – 37.2 cm (boys) and 29.0 – 37.0 (girls) (Table 3, 4; Fig. 1).

Comparing the head circumference to the chest circumference of newborn boys and girls in 2001 it is established that in the both sexes this ratio is over 1: boys – 1.05 and girls – 1.04.

The data of the intersexual differences for the two circumferential features calculated by ISD show that the mean value of the head circumference of the newborn boys is significantly higher by 0.73 cm (2.07%) than this in newborn girls ( $P < 0.05$ ). Chest circumference in boys is higher than this in girls by 0.28 cm (0.84%), but this difference is not statistically significant (Table 3, 4; Fig. 1).

The assessment of the secular changes of head circumference is made on basis of the data from 1907, 1960 and 2001. These data does not show any acceleration changes of these features in newborns (Table 3).

The chest circumference of the boys and girls born in 2001 is smaller than that of newborns in 1960 (Table 4).

**T a b l e 3.** Head Circumference (cm)

Years	Boys						Girls						ISD (%)
	<i>n</i>	<i>X</i>	SD	min	max	<i>V</i>	<i>n</i>	<i>X</i>	SD	min	max	<i>V</i>	
1907	194	35.1					190	34.6					98.58
1960	129	35.2	1.4			3.98	119	34.5	1.0			2.90	98.01 ●
2001	110	35.28	1.19	32.0	37.9	3.37	109	34.55	1.18	31.80	38.0	3.42	97.93 ●

- Statistically significant sex differences

**T a b l e 4.** Chest Circumference (cm)

Years	Boys						Girls						ISD (%)
	<i>n</i>	<i>X</i>	SD	min	max	<i>V</i>	<i>n</i>	<i>X</i>	SD	min	max	<i>V</i>	
1960	129	33.83	1.64	29.0	37.5	4.85	119	33.50	1.77	29.0	38.0	5.28	99.02
2001	110	33.45	1.58	30.0	37.2	4.72	109	33.17	1.48	29.0	37.0	4.46	99.16

## Conclusion

The results of this study show that in the beginning of the new century the newborn boys have significantly bigger stature, weight and chest circumferences than in girls. Chest circumference has relatively equal size in both sexes.

The generalized evaluation of the secular changes shows that:

- the stature of the newborn infants increases until the middle of the 20<sup>th</sup> century; a slow tendency to deceleration is observed in the 1980s and a slow secular increase of stature is observed to the end of the century again.

- there are not significant secular changes in weight of the newborn infants throughout the 20<sup>th</sup> century.

## References

1. Folkner, F., J. M. Tanner. Human growth. New York, Plenum Press, 1987, 1–537.
2. Gerver, W. J. M., R. DE. Bruin. Paediatric Morphometrics. Utrecht, Netherlands, 1996, 1–262.
3. Martin, R., K. Saller. Lehrbuch der Anthropologie in systematischer Darstellung. Bd. I. Stuttgart, Gustav Fisher Verlag, 1957, 322–324.
4. Ватев, С. Антропология на българите. — С., 1939, 12–49.
5. Матеев, Д. Възрастова морфология и физиология на човека. С., Медицина и физкултура, 1958, 72–73.
6. Станчев, Здр., Ж. Желев. Физиология и патология на растежа. С., Медицина и физкултура, 1980, 13–74.
7. Янев, Б., П. Щерев, П. Боев, Р. Семерджиева, Д. Сепетлиев. Физическо развитие и дееспособност на населението в България от раждане до двадесет и шест години. Том I. Таблици. С., БАН, 1965, 31–44.