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Sexual Differences in Body Composition and Distribution of Subcutaneous Fat Tissue in Newborns

I. Yankova, A. Nacheva

Institute of Experimental Morphology and Anthropology, Bulgarian Academy of Sciences, Sofia

The aim of the present study is to analyze and evaluate the sexual differences in the body composition and the topic distribution of subcutaneous fat tissue in newborns on the base of data about body weight and six standard skinfolds on body and extremities.

Totally 219 full-term and healthy newborns (110 boys and 109 girls) in the first 24 hours after birth are measured. The following six skinfolds: triceps, forearm, thigh, calf, subscapular and abdomen are measured by standard methods with the caliper of Holtain. The total thickness of the measured subcutaneous fat tissue as a sum from the six skinfolds is calculated in addition. The relative share of every skinfold is calculated regarding the sum of six skinfolds. The body composition is assessed by Guihard — Costa indexes.

It is established that the newborn boys have smaller quantity of subcutaneous fat tissue, but their body weight is bigger opposite to the newborn girls.

Key words: newborns; body composition; subcutaneous fat tissue.

Introduction

The body composition, body weight and subcutaneous fat tissue thickness are basic characteristics for human anthropometrical nutritional status and physical development [1, 5]. These characteristics are relatively well studied and estimated in children, adolescents and adults, when their evaluation in newborns is rare in the specialized literature.

Many authors [1, 6, 7, 8, 9] are working in the fields of physical development and methodological trends, and concrete results about metrical data for different ages, sexes, nationalities and other groups of children are published, as well. Studying the malnutrition during the last months of the intrauterine development, O w e n [4] reports that the thickness of subcutaneous fat tissue (SFT) gives more reliable information about malnutrition of newborns than body weight. G u i h a r d - C o s t a et al. [2] analyze the sexual differences in the subcutaneous fat tissue thickness in newborns and fetuses during the last months of pregnancy, as they search relation with body weight of the pregnant woman during this period. The authors use the ratio between thickness of two skinfolds (subscapular skinfold (SF) and triceps skinfold) and body weight for the estimation of well nutrition/malnutrition.

Guihard - Costa et al. [2] established, that the newborn boys have lower values for the two ratios compared to the newborn girls, i.e. they have smaller quantity of subcutaneous fat tissue per body weight unit. The authors found that the thickness of subcutaneous fat tissue on back is smaller in boys, than in girls, and the subcutaneous fat tissue thickness on arm is relatively equal for both sexes.

The aim of the present work is to estimate the body composition in newborns by the ratio thickness of subcutaneous fat tissue/body weight (SFT/BW) and to study the sexual differences in the quantity and distribution of subcutaneous fat tissue on their body and extremities.

Material and Methods

The data presented in the study are part of a detailed transversal anthropological investigation realized during the period April — May 2001. Totally 219 full-term (38 — 42 G. W.) and healthy newborns (110 boys and 109 girls) are studied during the first 24 hours after birth from the neonatal ward of the IInd Obstetrical Hospital "Sheinovo" in Sofia. The anthropometrical features are defined by the Martin-Saller [3] classical method and are measured by the first author in the present publication. The data about body weight and six standard skinfolds on body and extremities are analyzed. The body weight is measured in gram by a balance and the skinfolds — in mm by the standard method with Holtain caliper on the right side of the body. The body composition is estimated by using the two indexes introduced by Guihard - Costa et al. [2]:

Subscapular SF (mm x 10^3) / Body weight (g)

Triceps SF (mm x 10^3) / Body weight (g)

The authors mentioned above use as estimation criteria these indexes because subscapular and triceps skinfolds are in lowest relation with body weight ($r = -0,08$ and $-0,12$, respectively). This is very important requirement from mathematical point of view the compound features of indexes to be independent variables.

The total thickness of the measured subcutaneous fat tissue is calculated as a sum from six skinfolds. The relative share of every skinfold is determined regarding the sum of the six skinfolds. The sexual differences are assessed comparing the mean values of the investigated features and calculating the Index for sexual difference (ISD) by the formula: $ISD = X_{♀} \times 100 / X_{♂}$.

This index provides a possibility for a quantitative evaluation of the sexual differences. The values over 100 % show priority for girls and below 100 % — for boys. The metrical data are statistically analyzed by SPSS program and the reliability of the established differences is assessed by Students t-criterion at $P < 0,05$.

Results and Discussion

Regardless the body weight data are not subject of independent discussion in the present work, we should emphasize that the investigated newborn boys have average body weight of 3390 g and they are heavier than girls, who have average body weight of 3290 g (Table 1). It is established that the values of both body composition indexes in the investigated newborns are lower for boys compared to girls (Table 2, Fig. 1). The sexual differences in newborns investigated by Guihard-Costa et al. [2] are identical. These results show a presence of sexual differences in the body composition of the investigated newborns. The newborn boys have

T a b l e 1. Data about skinfolds and body weight of newborns (2001)

Features	Boys, n = 110				Girls, n = 109				t ♂/♀	ISD (%)
	mean	SD	Sx	V	mean	SD	Sx	V		
Subscapular SF (mm)	4.6	0.9	0.4	20.0	5.0	1.0	0.5	20.2	3.08*	108.70
Abdomen SF (mm)	4.4	0.7	0.4	16.7	4.6	0.8	0.4	17.9	2.0*	104.55
Triceps SF (mm)	4.9	0.9	0.4	18.5	5.2	1.0	0.4	18.5	2.31*	106.12
Forearm SF (mm)	5.1	0.8	0.4	16.1	5.3	0.9	0.4	17.3	1.82	103.92
Thigh SF (mm)	6.2	1.2	0.5	19.5	6.7	1.2	0.5	17.4	3.57*	108.06
Calf SF (mm)	5.8	0.9	0.4	15.9	6.3	0.9	0.4	14.8	4.17*	108.62
Sum of 6 SF (mm)	31.0	-	-	-	33.1	-	-	-	-	-
Body weight (g)	3390	0.38	0.0	11.2	3290	0.38	0.0	11.6	1.95	97.05

* Statistically significant differences (P<0.05)

T a b l e 2. Body composition according to the ratio SFT / BW

Sex	Body Weight (g) mean	Subscapular SF (mm . 10^3) mean	Triceps SF (mm . 10^3) mean	Sc SF/ BW mean	Tric.SF/ BW mean
Boys	3390	46.00	49.00	13.57	14.45
Girls	3290	50.00	52.00	15.20	15.81

smaller quantity of subcutaneous fat tissue, but their body weight is bigger opposite to the newborn girls.

The SFT thickness determined by the skinfolds gives specific information about the type of anthropometrical nutritional status in newborns.

The absolute values of thickness of the measured six skinfolds and their sum give general idea about the investigated thickness of the SFT layer on body and extremities in newborns.

The sum of the six skinfold thickness, which characterize the total quantity of the studied SFT have bigger values in the newborn girls — 33.1 mm, than in newborn boys — 31.0 mm. Since the six skinfolds characterize the SFT thickness on every body and extremities area (on back, abdomen, upper extremities and lower extremities) we can make the conclusion, that the newborn girls have thicker layer of SFT, than boys (Table 1, Fig. 2). Identical are also the sexual differences in the thickness of the six measured skinfolds separately. All skinfolds with the exception of the forearm SF thickness are statistically significant thicker in the newborn girls than in the newborn boys.

The evaluation of the sexual differences about the every skinfold thickness by ISD shows that the newborn girls have thicker SFT layer by 8 % — 9 % on back, thigh and calf, and by 4,5 % — 6 % on triceps and abdomen compared with the newborn boys. The sexual differences are smallest in the forearm SFT thickness, where the priority for the girls is approximately 4 % (Table 1, Fig.3).

Objective notion about distribution of SFT on the different parts of body and extremities are received by calculating the relative share of every SF thickness. Our data shows comparatively slight sexual differences (Table 3, Fig. 4). Nevertheless, it should be marked that in newborn girls the relative share of the SFT thickness is

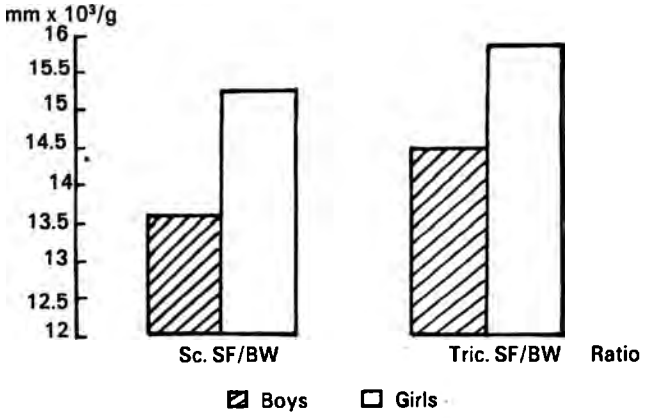

Fig. 1. Ratio SFT / BW

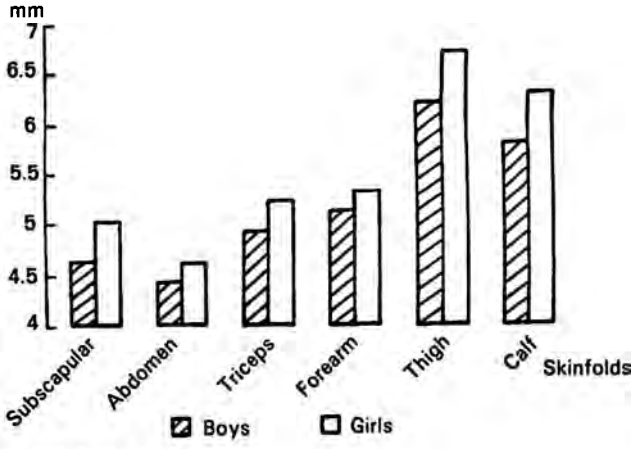

Fig. 2. Skinfold thickness

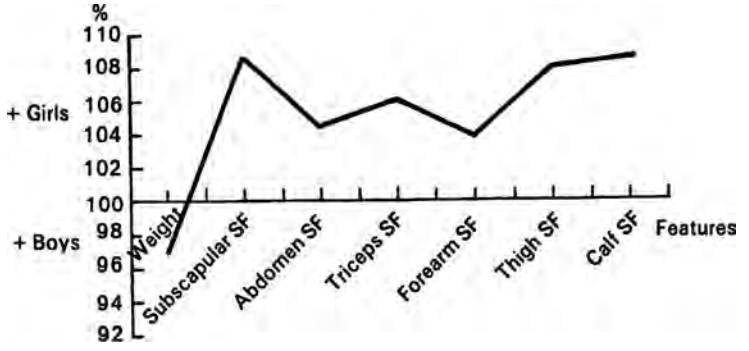

Fig. 3. Sex differences according to the ISD data

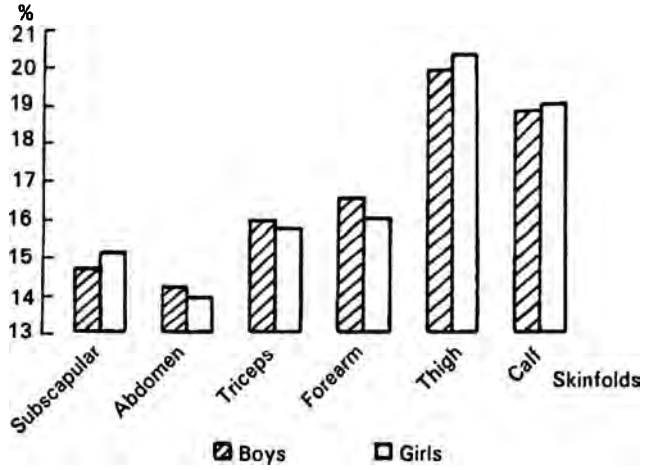

Fig. 4. Percentage fat distribution

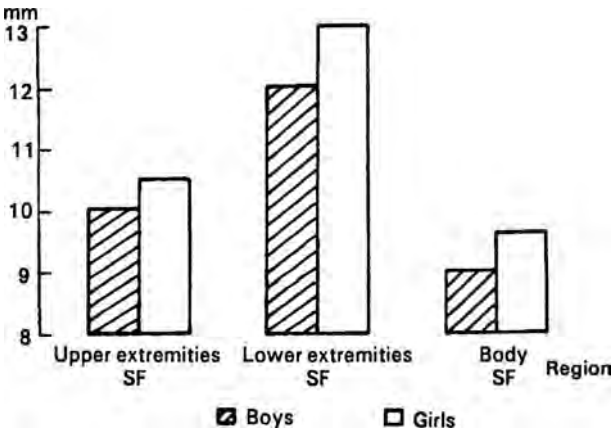

Fig. 5. Regional fat distribution

bigger on thigh, calf and back, and in newborn boys the relative share of the SFT thickness is bigger on triceps, forearm and abdomen.

A general notion about the type of anthropometrical nutritional status could be obtained by the assessment of the relative share of the two skinfolds on the upper extremity, the two skinfolds on the body and the two skinfolds on the lower extremity (Table 4, Fig 5). Our data shows slightly expressed sexual differences in the type of anthropometrical nutritional status. For both sexes the relative share of SFT thickness on body is equal (29 %), on upper extremities in the newborn boys it is 32.3 %, and in the newborn girls it is lower with 0.6 % (31.7 %). On lower extremities the ratio is opposite — the newborn boys have 39.3 % from the measured quantity of SFT, and the newborn girls — 38.7 % (i.e. lower with 0.6 %). These data show that the relative share of SFT thickness on lower extremities dominate in girls and— on upper extremities in boys.

T a b l e 3. Percentage fat distribution according to the sum of 6 skinfolds

Skinfolds	Boys (%)	Girls (%)	t ♂/♀
Subscapular	14.8	15.1	0.07
Abdomen	14.2	13.9	0.14
Triceps	15.8	15.7	0.10
Forearm	16.5	16.0	0.07
Thigh	20.0	20.3	0.15
Calf	18.7	19.0	0.16

T a b l e 4. Percentage of regional fat distribution

Region	Boys		Girls	
	mean	%	mean	%
Upper extremities SF	10.0	32.3	10.5	31.7
Lower extremities SF	12.0	38.7	13.0	39.3
Body SF	9.0	29.0	9.6	29.0

Conclusion

- The results obtained show that even by birth exist underlined sexual differences of the body composition, the thickness and the relative share of subcutaneous fat tissue.
- The newborn boys have thinner subcutaneous fat layer, but their body weight is bigger opposite to the newborn girls in whom the subcutaneous fat layer is thicker and the body weight is lower.
- The newborn girls have statistically significant thicker skinfolds than the newborn boys have.
- Concerning the topical distribution of subcutaneous fat tissue on body and extremities, the relative share of subcutaneous fat tissue on upper extremities and abdomen is bigger in the newborn boys, and it is bigger on lower extremities and back in the newborn girls.

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