

Physical growth and development characteristics of low-birth-weight infants

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Purpose. The analysis of low-birth-weight infants' physical growth and development indices (weight of body, length of body, head circumference) on standard curves for timely diagnosis and correction of their health changes.

Materials and methods. The retrospective analysis of 1389 children's development case histories (form № 112) was carried out. Physical growth and development indices (weight of body, length of body, head circumference) were estimated in 41 children who were born with a body weight between 1500–2499 grams and in 17 healthy children who at birth weighted 2500 and over. Four groups were formed: the I group – 10 premature children (32.9 ± 0.6 weeks of gestation) with body weight of 1500–1999 g (1775 ± 48.77 g); the II group – 14 premature children (34.43 ± 0.39 weeks of gestation) with birth weight of 2000–2499 g (2205.71 ± 37.71 g); the III group – 17 full-term newborn (38.00 ± 0.23 weeks of gestation) with intrauterine growth retardation with body weight of 2320.59 ± 42.99 g; the IV comparison group – 17 healthy children (39.00 ± 0.27 weeks of gestation) with birth weight of 3347.14 ± 84.12 g. For physical development of premature children assessment we used Fenton growth chart for preterm infants. Physical development assessment of full-term infants was carried out according to the World Health Organization recommendations.

Results. Children with intrauterine growth retardation made up a risk group for the physical disorders development (weight deficit or overweight). Dynamics of physical development indicators (monthly weight and length of body growth) in premature infants with birth weight of 1500–1999 g is similar to the ones of full-term healthy babies. The physical development of children born with a weight of more than 2000 g and children with intrauterine growth retardation was characterized by the same growth rate of body weight and length indicators within the first year of life.

Conclusions. In neonatologists, pediatricians and family doctors practice for valid assessment of children physical development born preterm with low birth weight, it is necessary to use the Fenton growth chart for preterm infants up to the age of 40 weeks in some cases up to 50 weeks.

Key words:

physical growth, body weight and measures, children.

Zaporozhye medical journal
2018; 20 (1), 91–96

DOI:
10.14739/2310-1210.
2018.1.122118

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Характеристика фізичного розвитку дітей першого року життя, які народжені з малою масою тіла

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Мета роботи – аналіз показників фізичного розвитку (маси тіла, довжини тіла, обводу голови) на першому році життя дітей, які народжені з малою масою тіла, для своєчасної діагностики та корекції змін стану їхнього здоров'я.

Матеріали та методи. Здійснений ретроспективний аналіз 1389 історій розвитку дітей (форма 112) та оцінені показники фізичного розвитку на першому році життя в 41 дитини, які народились із масою тіла 1500–2499 г, і 17 здорових дітей, які при народженні мали масу тіла 2500 г і більше. Сформували 4 групи: I – 10 дітей, які народжені передчасно на $32,9 \pm 0,6$ тижня гестації з масою 1500–1499 г ($1775 \pm 48,77$ г); II група – 14 дітей, які передчасно народжені на $34,43 \pm 0,39$ тижня гестаційного віку, з масою 2000–2499 г ($2205,71 \pm 37,71$ г); III – 17 доношених дітей, які народжені на $38,00 \pm 0,23$ тижня гестації з затримкою внутрішньоутробного розвитку та масою до $2320,59 \pm 42,99$ г; IV група порівняння – 17 доношених здорових дітей, які народжені на $39 \pm 0,27$ тижня гестації з масою $3347,14 \pm 84,12$ г. Для оцінювання фізичного розвитку передчасно народжених дітей ми використовували діаграми Фентона для недоношених дітей. Оцінювали фізичний розвиток доношених дітей відповідно до рекомендацій Всесвітньої організації охорони здоров'я згідно з клінічним протоколом медичного догляду за здоровою дитиною віком до 3 років (наказ Міністерства охорони здоров'я України від 20.03.2008 р. № 149).

Результати. Діти з затримкою внутрішньоутробного розвитку становили групу ризику щодо розвитку порушень фізичного розвитку (дефіциту маси або надмірної маси тіла). Динаміка показників фізичного розвитку (щомісячної прибавки маси та довжини тіла) дітей, які народжені передчасно з масою 1500–1999 г, подібна до показників доношених здорових дітей. Фізичний розвиток дітей, які народжені з масою понад 2000 г, і дітей із затримкою внутрішньоутробного розвитку характеризувався однаковими темпами зростання показників маси та довжини тіла на першому році життя.

Висновки. У практиці неонатологів, педіатрів і лікарів сімейної медицини для коректного оцінювання фізичного розвитку дітей, які народжені передчасно з малою масою тіла, треба використовувати діаграми Фентона до досягнення скорегованого віку 40–50 тижнів.

Ключові слова:

фізичний розвиток, маса тіла, довжина тіла, обвід голови, діти.

Запорізький медичний журнал. – 2018. – Т. 20, № 1(106). – С. 91–96

Характеристика физического развития детей первого года жизни, родившихся с низкой массой тела

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Цель работы – анализ показателей физического развития (массы тела, длины тела, окружности головы) на первом году жизни детей, родившихся с низкой массой тела, для своевременной диагностики и коррекции изменений состояния их здоровья.

Ключевые слова:

физическое развитие, масса тела, длина тела, окружность головы, дети.

Материалы и методы. Ретроспективно проанализировали 1389 историй развития детей (форма 112) и оценили показатели физического развития на первом году жизни у 41 ребенка, которые родились с массой тела 1500–2499 г, и у 17 здоровых детей, родившихся с массой тела 2500 г и более. Сформировали 4 группы: I – 10 преждевременно родившихся детей на 32,9 ± 0,6 недели гестации с массой 1500–1999 г (1775 ± 48,77 г); II группа – 14 преждевременно родившихся детей на 34,43 ± 0,39 недели с массой (2000–2499 г) 2205,71 ± 37,71 г; III группа – 17 доношенных детей, родившихся на 38,00 ± 0,23 недели гестации с задержкой внутриутробного развития и массой 2320,59 ± 42,99 г; IV группа сравнения – 17 доношенных здоровых детей, родившихся на 39 ± 0,27 недели гестации с массой 3347,14 ± 84,12 г. Для оценки физического развития преждевременно рожденных детей мы использовали диаграммы Фентона для недоношенных детей. Оценка физического развития доношенных детей проводилась согласно рекомендациям Всемирной организации охраны здоровья и клиническому протоколу медицинского наблюдения за здоровым ребенком до 3 лет (приказ Министерства здравоохранения Украины от 20. 03. 2008 г. № 149).

Результаты. Дети с задержкой внутриутробного развития составили группу риска по развитию нарушений физического развития (дефицита массы или чрезмерной массы тела). Динамика показателей физического развития (ежемесячная прибавка массы и длины тела) преждевременно родившихся детей с массой 1500–1999 г подобна показателям доношенных здоровых детей. Физическое развитие детей, родившихся с массой более 2000 г, и детей с задержкой внутриутробного развития характеризовалось одинаковыми темпами увеличения показателей массы и длины тела на первом году жизни.

Выводы. В практике неонатологов, педиатров и врачей семейной медицины для корректной оценки физического развития детей, родившихся преждевременно с низкой массой тела, необходимо использовать диаграммы Фентона до достижения скорректированного возраста 40–50 недель.

Introduction

Child welfare from birth remains one of the urgent pediatrics problems and the most important element of socio-economic and socio-cultural development of any country [1,2]. Special monitoring needs to be given to children born with low body weight, because even after the neonatal period morbidity rates are 2–10 times higher than the rates of children born with normal birth weight [2]. Newborn child with low body weight is a baby born with weight less than 2500 grams, regardless of gestational age at birth [3]. About 10 % of children are born with body weight below 2500 grams, and 50 % of these children were born prematurely, in other words a childbirth happens earlier than 37 weeks and 28.7 % is with intrauterine growth retardation or with low weight in relation to gestational age [4]. This category of children morbidity exceeds 3 times the morbidity of newborns with body weight at birth more than 2500 grams. Also, every third child who has such problems faces decrease in physical development in future [5]. That is why to assess physical development of such children, it is recommended to use Fenton growth chart for preterm infants [6]. It contains more accurate indicators of physical development of children up to 30 weeks and over 36 weeks of gestation and better reflects the growth rate of premature infants. And only after 10 weeks of postnatal age physical development of a child can be assessed by schedules of body length and weight in accordance to age, regulated in Ukraine by the Ministry of Health Care Order № 149 dated 20/03/2008 [7]. The influence of the physical development dynamics of children born with low body weight on their further development and morbidity is absolutely proved [8]. The level of physical development in childhood is one of the objective indicators of health condition, because it is a dynamic process of growth and biological maturation of child in a particular period of life. A deviation from the norm of physical development may be the first sign of a disease or functional impairment. The most reliable indicator of child physical development is measurement of body weight and length as well as of head circumference. Fenton growth chart for premature infants are used to evaluate the physical development of premature babies.

To assess the physical development of normal infants the recommendations of the World Health Organization are used [6,7]. Thus, the correct measurement of body weight, body length and head circumference with a mark of specified indexes on standard curves allows to perform appropriate monitoring and to detect child insufficient or excessive growth timely.

Purpose

The analysis of low-birth-weight infants' physical growth and development indices (weight of body, length of body, head circumference) on standard curves for timely diagnosis and correction of their health change

Materials and methods

The retrospective analysis of 1389 children's development case histories (form № 112) was carried out. Physical growth and development indices (weight of body, length of body, head circumference) in 58 children (28 boys and 30 girls) were studied: n 41 children who were born with a body weight between 1500–2499 grams and 17 healthy children who at birth weighted 2500 and over. Four groups were formed: the I group – 10 premature children (32.9 ± 0.6 weeks of gestation) with body weight of 1500–1999 g (1775 ± 48.77 g); the II group – 14 premature children (34.43 ± 0.39 weeks of gestation) with birth weight of 2000–2499 g (2205.71 ± 37.71 g); the III group – 17 full-term newborn (38.00 ± 0.23 weeks of gestation) with intrauterine growth retardation with body weight of 2320.59 ± 42.99 g; the IV comparison group – 17 healthy children (39.00 ± 0.27 weeks of gestation) with birth weight of 3347.14 ± 84.12 g. For physical development of premature children assessment we used Fenton growth chart for preterm infants. Weight and length of body, head circumference in children born premature were determined [6]. Physical development assessment of full-term infants was carried out according to the World Health Organization recommendations. We studied weight, body length and head circumference in infants every month [7].

Statistical processing of data was carried out using conventional variational statistical methods using a licensed software package Statistica for Windows 6.1.RU, serial number AXXR712D833214SAN5. We checked the distribution of quantities using the Shapiro–Wilk test. We used parametric statistical methods for normal distribution: the mean (M) and standard deviation (SD) or standard error of mean (m), the Student's t-test; nonparametric statistical methods: the «2 × 2 Table», the χ^2 criterion, the Mann–Whitney U-test. Differences $P < 0.05$ were considered statistically significant [9].

Results and discussion

Also indexes of premature children physical development were evaluated according to the Fenton growth chart for preterm infants [6]. Assessment in accordance with the Fenton growth chart has been carried out up to the post-conceptual children's age of 50 weeks. Children of the first group have been assessed by the Fenton growth chart up to three months of calendar age, children of the second group have been assessed up to two months of calendar age.

Thus, after born, 100 % of children of the I group at birth had normal weight according to gestation period. In the II group it has been observed that 85.71 % of children had normal weight, 7.14 % had accelerated growth and 7.14 % had physical developmental impairment. Also, we made an assessment of children physical growth using the World Health Organization (WHO) recommendations for medical supervision of a healthy child under the age of 3 years (Weight at Age, Girls and Weight at Age, Boys) [7]. Thus, 100 % of the I observation group children had extremely low body weight at birth (the mass of body below 3 standard deviations); 92.86 % of the II group children had low weight (the mass of body below 2 standard deviations) and 7.14 % had normal weight. Mass normalization among children of the I group took place at 8 months and among children of the II group took place at 4 months (Table 1, 2).

Among children of the III group 52.94 % had lack of weight at birth, 11.77 % had extremely low birth weight, 35.29 % had normal weight at birth. 88.24 % of the III group children had body weight within the age norm at 12 months, about 6 % had lack of weight and 5.88 % made up a risk group for excess weight development (Table 3).

Table 1. Comparative characteristics of physical growth of children born with body weight between 1500–1999 grams

Age (month)	Fenton growth chart for preterm infants			The recommendations for healthy child		
	Delay postnatal growth	Norm	Accelerated growth	Norm	Low growth	Very low growth
0	0 %*	100 %*	0 %	0 %*	0 %	100 %*
1	0 %*	90 %*	10 %	0 %*	71.42 %*	28.57 %
2	0 %*	100 %	0 %	71.43 %	14.29 %	14.29 %
3	0 %*	100 %	0 %	75 %	8.33 %	16.67 %
4	–**	–**	–**	87.5 %	12.5 %	0 %
5	–**	–**	–**	80 %	20 %	0 %
6	–**	–**	–**	80 %	20 %	0 %
7	–**	–**	–**	80 %	20 %	0 %
8	–**	–**	–**	100 %	0 %	0 %
9	–**	–**	–**	100 %	0 %	0 %
10	–**	–**	–**	100 %	0 %	0 %
11	–**	–**	–**	100 %	0 %	0 %
12	–**	–**	–**	100 %	0 %	0 %

*: comparison of children physical growth method of evaluation ($P < 0.05$);

** : assessment in accordance with the Fenton growth chart had been carried out up to the postconceptual children's age of 50 weeks.

Table 2. Comparative characteristics of physical growth of children born with body weight between 2000–2499 grams

Age (month)	Fenton growth chart for preterm infants			The recommendations for healthy child		
	Delay postnatal growth	Norm	Accelerated growth	Norm	Low growth	Very low growth
0	7.14 %*	85.71 %*	7.14 %	7.14 %*	92.86 %*	0 %
1	0 %*	100 %*	0 %	72.73 %*	27.27 %*	0 %
2	0 %	100 %	0 %	100 %	0 %	0 %
3	–**	–**	–**	90 %*	10 %	0 %
4	–**	–**	–**	100 %	0 %	0 %
5	–**	–**	–**	100 %	0 %	0 %
6	–**	–**	–**	100 %	0 %	0 %
7	–**	–**	–**	100 %	0 %	0 %
8	–**	–**	–**	100 %	0 %	0 %
9	–**	–**	–**	100 %	0 %	0 %
10	–**	–**	–**	100 %	0 %	0 %
11	–**	–**	–**	100 %	0 %	0 %
12	–**	–**	–**	100 %	0 %	0 %

*: comparison of method of evaluation of physical growth of children ($P < 0.05$);

** : assessments in accordance with the Fenton growth chart had been carried out up to the postconceptual children's age of 50 weeks.

Table 3. Physical growth of small-for-gestation age infants

Age (month)	The recommendations for healthy child				
	Norm	Low growth	Very low growth	Possible excessive growth	Excessive growth
0	35.29 %	52.94 %	11.77 %	0 %	0 %
1	35.29 %	58.82 %	5.88 %	0 %	0 %
2	52.94 %	42.18 %	5.88 %	0 %	0 %
3	58.82 %	35.29 %	5.88 %	0 %	0 %
4	76.47 %	17.66 %	5.88 %	0 %	0 %
5	94.11 %	0 %	5.88 %	0 %	0 %
6	82.35 %	11.77 %	0 %	0 %	0 %
7	82.35 %	0 %	5.88 %	11.77 %	0 %
8	82.35 %	0 %	5.88 %	11.77 %	0 %
9	88.24 %	0 %	0 %	5.88 %	5.88 %
10	94.11 %	0 %	0 %	5.88 %	0 %
11	88.24 %	0 %	5.88 %	5.88 %	0 %
12	88.24 %	0 %	5.88 %	5.88 %	0 %

Table 4. Mean (M) of weight gain (g), standard error (±m)

Age (month)	Groups			
	I	II	III	IV
1	1164.28 ± 84.09 ^{3*,4*}	1200.0 ± 79.48 ^{3*,4*}	950.67 ± 96.32 ^{1*,2*,4*}	1065.71 ± 97.51 ^{1*,2*,3*}
2	1014.0 ± 241.30 ^{2*,3*,4*}	1050.0 ± 113.07 ^{1*,4*}	1038.28 ± 103.40 ^{1*,4*}	933.3 ± 44.95 ^{1*,2*,3*}
3	1055.00 ± 261.44 ^{2*,3*,4*}	650.0 ± 230.05 ^{1*,3*,4*}	790.83 ± 53.11 ^{1*,2*}	755.83 ± 55.15 ^{1*,2*}
4	770.00 ± 271.85 ^{3*,4*}	850.0 ± 113.03 ^{1*,4*}	891.82 ± 92.66 ^{1*,4*}	583.33 ± 64.35 ^{2*,3*}
5	670.0 ± 50.66 ^{2*,3*,4*}	500.0 ± 61.01 ^{1*,4*}	516.0 ± 173.51 ^{1*,4*}	538.89 ± 42.31 ^{1*,2*,3*}
6	325.0 ± 275.00 ^{1*,3*,4*}	600.0 ± 86.02 ^{1*,4*}	775.45 ± 95.48 ^{1*,4*}	555.56 ± 65.32 ^{1*,2*,3*}
7	320.0 ± 53.54 ^{2*,4*}	500.0 ± 114.54 ^{1*,3*,4*}	410.11 ± 114.30 ^{2*}	445.46 ± 71.49 ^{1*,2*}
8	393.33 ± 38.44 ^{2*,3*}	300.0 ± 96.69 ^{1*,3*,4*}	576.67 ± 95.32 ^{1*,2*,4*}	375.03 ± 68.79 ^{2*,3*}
9	436.32 ± 75.06 ^{2*,3*}	200.0 ± 69.72 ^{3*,4*}	254.44 ± 155.74 ^{2*,4*}	462.50 ± 88.01 ^{2*,3*}
10	310.06 ± 75.03 ^{3*}	400.0 ± 119.02 ^{4*}	448.0 ± 311.05 ^{1*,2*,4*}	292.87 ± 85.56 ^{2*,3*}
11	490.98 ± 168.55 ^{2*,3*}	200.1 ± 76.32 ^{3*,4*}	168.2 ± 67.07 ^{1*,4*}	510.0 ± 176.35 ^{2*,3*}
12	310.87 ± 98.78 ^{3*,4*}	350.0 ± 150.0 ^{3*,4*}	293.33 ± 44.85 ^{1*,2*}	250.0 ± 104.08 ^{1*,2*}

1*, 2*, 3*, 4*: comparison of the 1st, 2nd, 3rd, 4th groups of children (P < 0.05).

Table 5. Mean (M) of weight (g), standard error (± m)

Age (month)	Groups			
	I	II	III	IV
0	1775.0 ± 48.77 ^{2*,3*,4*}	2205.71 ± 37.71 ^{1*,3*,4*}	2320.58 ± 42.99 ^{1*,2*,4*}	3347.14 ± 84.00 ^{1*,2*,3*}
1	2964.28 ± 97.51 ^{2*,3*,4*}	3316.15 ± 62.41 ^{1*,3*,4*}	3296.66 ± 108.51 ^{1*,2*,4*}	4485.71 ± 127.03 ^{1*,2*,3*}
2	4655.72 ± 225.77 ^{2*,3*,4*}	4430.0 ± 156.92 ^{1*,3*,4*}	4176.66 ± 158.71 ^{1*,2*,4*}	5412.50 ± 171.01 ^{1*,2*,3*}
3	4960.67 ± 225.77 ^{4*}	5313.64,0 ± 202.94 ^{4*}	5090.66 ± 167.82 ^{4*}	6230.00 ± 178.48 ^{1*,2*,3*}
4	5601.67 ± 220.76 ^{2*,3*,4*}	5947.27 ± 128.23 ^{4*}	5738.18 ± 213.80 ^{4*}	6729.16 ± 210.56 ^{1*,2*,3*}
5	6366.67 ± 425.57 ^{4*}	6385.71 ± 145.86 ^{4*}	6479.16 ± 352.34 ^{4*}	7215.00 ± 216.28 ^{1*,2*,3*}
6	6608.33 ± 162.49 ^{2*,3*,4*}	7022.73 ± 219.23 ^{1*,4*}	7096.92 ± 301.53 ^{1*,4*}	7769.23 ± 194.68 ^{1*,2*,3*}
7	6916.0 ± 141.73 ^{2*,3*,4*}	7722.22 ± 180.11 ^{1*,4*}	7742.72 ± 308.89 ^{1*,4*}	8265.38 ± 197.61 ^{1*,2*,3*}
8	7585.0 ± 385.78 ^{2*,3*,4*}	7925.0 ± 180.77 ^{4*}	7895.45 ± 339.21 ^{4*}	8675.00 ± 226.59 ^{1*,2*,3*}
9	7896.67 ± 187.33 ^{2*,3*,4*}	8188.89 ± 202.38 ^{3*,4*}	8543.00 ± 348.66 ^{2*}	8880.00 ± 285.89 ^{1*,2*}
10	8203.33 ± 249.69 ^{2*,3*,4*}	8450.1 ± 273.52 ^{1*,3*,4*}	8858.57 ± 506.08 ^{1*,2*}	9465.00 ± 275.68 ^{1*,2*}
11	8210.0 ± 178.45 ^{2*,3*,4*}	8607.14 ± 150.00 ^{1*,4*}	8475.00 ± 418.22 ^{1*,4*}	9720.00 ± 396.73 ^{1*,2*,3*}
12	8840.0 ± 471.81 ^{2*,3*,4*}	9215.0 ± 156.36 ^{1*,4*}	9376.25 ± 400.54 ^{1*,4*}	9984.61 ± 242.80 ^{1*,2*,3*}

1*, 2*, 3*, 4*: comparison of 1st, 2nd, 3rd, 4th group of children (P < 0.05).

As a part of the study the following results were obtained: the children of the I group at 1 month of life had normal weight according to postconceptual age in 90 % of cases and 10 % had accelerated growth, and at 2 and 3 months 100 % of children had body weight within normal limits. Among the children of the II group normal weight at birth was registered in 85.71 % of cases, accelerated growth

was in 7.14 % of cases, physical developmental impairment was in 7.14 % of children, but at 1 and 2 months of life all children had normal weight.

Statistical difference between the number of boys and girls and the indicators of their physical development (body weight, length of body, head circumference) has not been found. The children were breast-fed up to the age of six months.

Results of children's weight study are presented in the Tables 4, 5 and Fig. 1.

Children born prematurely (the I and II groups) at the first month of life had significantly bigger body weight than normal newborn of the IV group (1164.28 ± 84.09 g and 1200.0 ± 79.48 g against 1065.71 ± 97.51 g; P < 0.05). Small-for-gestation age infants (the III group) had significantly less weight gain (950.67 ± 96.32 g). At the second month of life normal newborn of the IV group had the smallest weight gain (933.3 ± 44.95 g against 1014.0 ± 241.30 g and 1050.0 ± 113.07 g and 1038.28 ± 103.40 g; P < 0.05).

At the third month of life children from the II group have significantly lower body weight gain in comparison with the I, III and IV groups children (650.0 ± 230.05 g against 1055.00 ± 261.44 g and 790.83 ± 53.11 g and 755.83 ± 55.15 g; P < 0.05). At the fourth month the I and IV groups and II and III groups children were observed to have identical weight gain and prematurely born children with weight ranging from 2000 g to 2499 g and children with intrauterine growth and development retardation had significantly less weight gain. At the fifth month the I and IV groups children gained body weight significantly greater than children of the II and III groups (670.0 ± 50.66 g and 538.89 ± 42.31 g against 500.0 ± 61.01 g and 516.0 ± 173.51 g; P < 0.05). Children of the I and II groups were registered to have almost the same weight. Infants born with weight less than 2000 g gained weight significantly in the sixth month (325.0 ± 275.00 g). Among the II and III groups there were no differences in children weight gain. The weight gain in infants of the I group and in healthy infants was less than in infants of the II and III groups (325.0 ± 275.00 g and 555.56 ± 65.32 g against 600.0 ± 86.02 g and 775.45 ± 95.48 g; P < 0.05). During the seventh month the lowest weight gain was in infants of the I group (320.0 ± 53.54 g) and the greatest weight gain was in infants of the II group (500.0 ± 114.54 g; P < 0.05). There was no fairly significant difference in weight gain between children of the III and IV groups. Children of the II observation group gained the lowest weight during the eighth month (300.0 ± 96.69 g against 393.33 ± 38.44 g and 576.67 ± 95.32 g and 375.03 ± 68.79 g; P < 0.05).

The small-for-gestation age infants gained weight more than those who were born premature with weight less than 2000 g, but gained weight less than normal infants. During the ninth month children of the II group gained weight least of all, and healthy infants gained weight the most. However, small-for-gestation age infants had less weight gain than healthy infants, but higher than premature babies. During the tenth month children of the III group had greater weight gain than children of the I and IV groups (448.0 ± 311.05 g against 310.06 ± 75.03 g and 292.87 ± 85.56 g; P < 0.05). But 11-month-old infants of

the II and IV groups gained weight more than children of the I and III groups (200.1 ± 76.32 g and 510.0 ± 176.35 g against 490.98 ± 168.55 g and 168.2 ± 67.07 g; $P < 0.05$). During this age the small-for-gestation age infants had the least weight gain. During the twelfth month the greatest body weight gain was observed among children of the I and II groups, the smallest – among children of the III and IV groups.

One-year-old infants of the II and III groups had approximately equal weight (9215.0 ± 156.36 g and 9376.25 ± 400.54 g), that was significantly greater than weight of the IV observation groups children (9984.61 ± 242.80 g) and the smallest weight had children of the I groups (8840.0 ± 471.81 g).

Also weight of normal infants was significantly higher than weight of other children groups every month. However, infants weight of the I, II and III groups also did not differ significantly at the third and at fifth months of life.

Results of children's length study are presented in the Table 6, 7 and Fig. 2.

Every month the healthy babies had body length significantly greater than all children, born with low body weight. Children of the I group had significantly the lowest rates of body length within the first four months of life, but starting from the fifth month of life these children caught up with children of the II and III groups. In the first half of the first year (from the 1st up to 6th month of life) body length of full-term infants increased significantly slower than body length of children from other groups. Children with intrauterine growth and development retardation aged 7 months of life had significantly lower body length gain than other groups children (1.0 ± 0.45 cm against 2.0 ± 0.25 cm and 2.0 ± 0.5 cm and 2.0 ± 0.51 cm; $P < 0.05$). However, it should be mentioned that at this age children of the I, II and IV groups had equal body length gain. At the eighth month of life children of the II group were registered to have the largest body length gain (2.3 ± 0.44 cm) and the smallest length gain was among children born prematurely with a weight less than 2000 g and healthy children (1.5 ± 0.9 cm and 1.5 ± 0.75 cm). Significantly greater gain in body length at the ninth and tenth month of life was registered among healthy babies, in comparison with children born prematurely with low body weight. At the eleventh month, significantly the highest body length gain was observed among children of the I observation group (1.6 ± 0.67 cm) than among other groups, and significantly the lowest length gain was among children with intrauterine growth retardation (1.25 ± 0.43 cm). At twelve months, the indicators of body length gain were significantly the greatest among children of the III group and the smallest among prematurely born infants with weight from 2000 g to 2499 g (3.50 ± 1.1 cm against 2.78 ± 0.98 cm; $P < 0.05$).

At 1 year old the normal infants of the IV groups had the largest body length (75.0 ± 0.978 cm) and small-for-gestation age infants of the III group had the smallest body length (73.22 ± 0.82 cm).

Results of the head circumference study are presented in the Table 8 and Fig. 3.

In the first two months of life prematurely born infants with weight less than 2000 grams had the smallest head circumference. Significantly greater head circumference

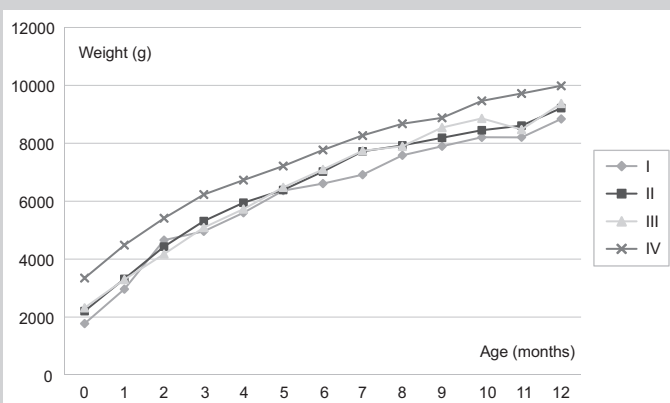


Fig. 1. Physical Growth schedule: Weight to Age.

Table 6. Mean (M) of gain in length (cm), standard error (\pm m)

Age (month)	Groups			
	I	II	III	IV
1	$3.35 \pm 0.55^{2,4}$	$6.0 \pm 0.09^{1,3,4}$	$3.5 \pm 0.48^{2,4}$	$2.24 \pm 0.92^{1,2,3}$
2	$6.0 \pm 1.53^{3,4}$	5.5 ± 1.2^4	$5.0 \pm 0.93^{1,4}$	$4.75 \pm 1.07^{1,2,3}$
3	$2.5 \pm 0.95^{2,4}$	$3.5 \pm 0.85^{1,3,4}$	$3.0 \pm 0.33^{2,4}$	$2.25 \pm 0.85^{1,2,3}$
4	$4.0 \pm 0.67^{2,3,4}$	$2.87 \pm 0.56^{1*}$	$2.75 \pm 0.8^{1*}$	$2.5 \pm 0.48^{1,2,3}$
5	3.0 ± 1.1^4	3.0 ± 0.41^4	2.5 ± 0.91^4	$1.5 \pm 0.5^{1,2,3}$
6	$3.0 \pm 1^{3,4}$	$2.0 \pm 0.5^{1,4}$	$2.5 \pm 0.56^{1,4}$	$2.0 \pm 0.43^{1,2,3}$
7	2.0 ± 0.25^3	2.0 ± 0.5^3	$1.0 \pm 0.45^{1,2,4}$	2.0 ± 0.51^3
8	$1.5 \pm 0.9^{2,3}$	$2.3 \pm 0.44^{1,3,4}$	$2.0 \pm 0.56^{1,2,4}$	$1.5 \pm 0.75^{2,3}$
9	$2.3 \pm 0.87^{3,4}$	$2.5 \pm 0.48^{3,4}$	$1.79 \pm 0.27^{1,2,4}$	$3.0 \pm 1.0^{1,2}$
10	2.89 ± 0.95^4	$1.5 \pm 0.5^{3,4}$	$1.25 \pm 0.63^{2,4}$	$3.0 \pm 0.88^{1,2}$
11	$1.6 \pm 0.67^{2,3}$	$1.34 \pm 0.34^{1,3}$	$1.25 \pm 0.43^{1,2,4}$	1.50 ± 0.5^3
12	$2.78 \pm 0.98^{2,3,4}$	$3.23 \pm 1.0^{1,3,4}$	$3.50 \pm 1.1^{1,2,4}$	$3.0 \pm 1.0^{2,3}$

^{1,2,3,4}: comparison of the 1st, 2nd, 3rd, 4th groups of children ($P < 0.05$).

Table 7. Mean (M) of length (cm), standard error (\pm m)

Age (month)	Groups			
	I	II	III	IV
0	$42.38 \pm 0.64^{2,3,4}$	$45.38 \pm 0.82^{1,3,4}$	$47.06 \pm 0.43^{1,2,4}$	$52.53 \pm 0.68^{1,2,3}$
1	$46.58 \pm 0.8^{2,3,4}$	$49.25 \pm 0.88^{1,4}$	$49.67 \pm 0.92^{1,4}$	$53.75 \pm 1.75^{1,2,3}$
2	$51.67 \pm 0.8^{2,3,4}$	$54.75 \pm 0.89^{1,4}$	$54.89 \pm 0.62^{1,4}$	$58.50 \pm 1.0^{1,2,3}$
3	$54.29 \pm 1.0^{2,3,4}$	$57.45 \pm 0.7^{1,4}$	$57.28 \pm 0.67^{1,4}$	$61.30 \pm 0.76^{1,2,3}$
4	$57.50 \pm 1.1^{2,3,4}$	$60.00 \pm 1.07^{1,4}$	$59.39 \pm 0.47^{1,4}$	$63.60 \pm 1.23^{1,2,3}$
5	61.25 ± 0.75^4	62.50 ± 0.96^4	62.37 ± 1.1^4	$65.66 \pm 1.45^{1,2,3}$
6	$63.33 \pm 0.42^{3,4}$	$64.44 \pm 0.95^{3,4}$	$64.7 \pm 0.9^{1,2}$	$66.31 \pm 0.79^{1,2,3}$
7	$65.50 \pm 0.5^{3,4}$	$66.60 \pm 1.6^{3,4}$	$66.56 \pm 0.68^{1*}$	$66.56 \pm 0.67^{1,2,3}$
8	$67.50 \pm 1.2^{2,4}$	$66.9 \pm 1.47^{1,3,4}$	$67.5 \pm 0.52^{2*}$	$69.0 \pm 1.73^{1,2,3}$
9	$68.52 \pm 0.57^{3,4}$	$68.28 \pm 0.97^{3,4}$	$69.38 \pm 0.66^{2,4}$	$70.3 \pm 0.97^{1,2,3}$
10	$70.33 \pm 0.37^{3,4}$	$69.05 \pm 1.53^{3,4}$	$71.25 \pm 0.81^{2,4}$	$73.42 \pm 1.81^{1,2,3}$
11	$71.56 \pm 0.46^{3,4}$	$70.5 \pm 2.5^{3,4}$	$71.43 \pm 0.59^{2,4}$	$74.0 \pm 2.65^{1,2,3}$
12	$74.60 \pm 0.33^{2,3,4}$	$73.62 \pm 0.98^{1,3,4}$	$73.22 \pm 0.82^{1,2,4}$	$75.0 \pm 0.978^{1,2,3}$

^{1,2,3,4}: comparison of the 1st, 2nd, 3rd, 4th groups of children ($P < 0.05$).

was observed among healthy babies during the 6 month of life. At one year old the indicators of head circumference among prematurely born infants who had weight less than 2000 g at birth and healthy children were 46.7 ± 0.58 cm and 46.5 ± 0.65 cm. The head circumference in children born with weight of more than 2000 g and children with intrauterine growth retardation was characterized by the same indicators.

Table 8. Mean (M) of head circumference (cm), standard error (\pm m)

Age (month)	Groups			
	I	II	III	IV
0	29.44 \pm 0.63 ^{2,3,4*}	31.0 \pm 0.27 ^{1,3,4*}	32.12 \pm 0.33 ^{1,2,4*}	34.0 \pm 0.36 ^{1,2,3*}
1	33.79 \pm 0.73 ^{2,3,4*}	35.0 \pm 0.56 ^{1,4*}	35.10 \pm 0.36 ^{1,4*}	37.0 \pm 0.66 ^{1,2,3*}
2	35.8 \pm 0.37 ^{2,3,4*}	38.0 \pm 0.83 ^{1,4*}	37.5 \pm 1.44 ^{1,4*}	39.0 \pm 0.36 ^{1,2,3*}
3	38.08 \pm 0.55 ^{2,3,4*}	38.0 \pm 0.58 ^{1,3,4*}	38.23 \pm 0.42 ^{1,2,4*}	40.0 \pm 0.34 ^{1,2,3*}
4	38.9 \pm 0.67 ^{2,3,4*}	39.5 \pm 0.77 ^{1,3,4*}	38.68 \pm 1.75 ^{1,4*}	41.0 \pm 0.38 ^{1,2,3*}
5	39.67 \pm 0.46 ^{3,4*}	40.5 \pm 0.98 ^{1,4*}	39.0 \pm 0.98 ^{1,4*}	41.0 \pm 0.58 ^{1,2,3*}
6	41.23 \pm 0.5 ^{2,3,4*}	41.0 \pm 0.33 ^{1,3,4*}	42.5 \pm 0.66 ^{1,2*}	43.0 \pm 0.35 ^{1,2,3*}
7	41.78 \pm 0.4 ^{2,3,4*}	42.0 \pm 0.6 ^{1,4*}	42.75 \pm 0.74 ^{1,4*}	42.25 \pm 0.25 ^{1,2,3*}
8	42.83 \pm 0.6 ^{2,3*}	43.11 \pm 1.5 ^{1,4*}	43.76 \pm 0.67 ^{1,4*}	42.15 \pm 0.15 ^{1,2,3*}
9	43.4 \pm 0.7 ^{3,4*}	43.67 \pm 0.67 ^{3,4*}	44.0 \pm 0.38 ^{1,2,4*}	43.0 \pm 0.34 ^{1,2,3*}
10	45.44 \pm 0.55 ^{2,3,4*}	44.21 \pm 1.0 ^{1,4*}	44.5 \pm 0.45 ^{1,4*}	44.0 \pm 0.88 ^{1,2,3*}
11	46.2 \pm 0.37 ^{3,4*}	44.67 \pm 0.50 ^{4*}	45.0 \pm 0.33 ^{1,4*}	44.5 \pm 0.5 ^{1,2,3*}
12	46.7 \pm 0.58 ^{2,3*}	45.0 \pm 0.73 ^{1,4*}	45.5 \pm 0.46 ^{1,4*}	46.5 \pm 0.65 ^{2,3*}

^{1,2,3,4*}: comparison of the 1st, 2nd, 3rd, 4th groups of children (P < 0.05).

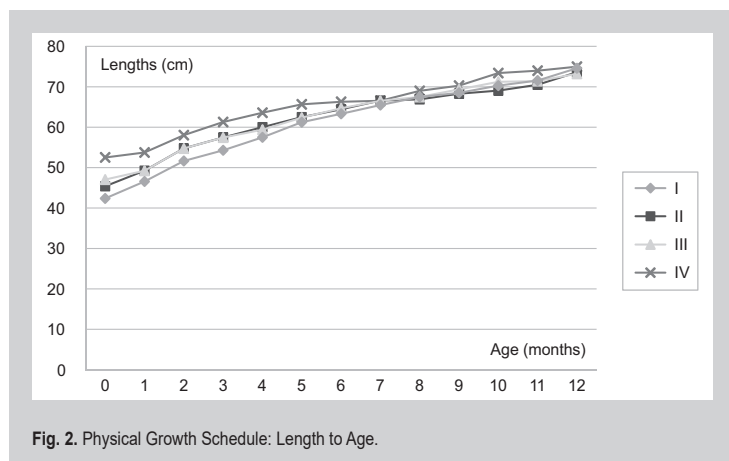


Fig. 2. Physical Growth Schedule: Length to Age.

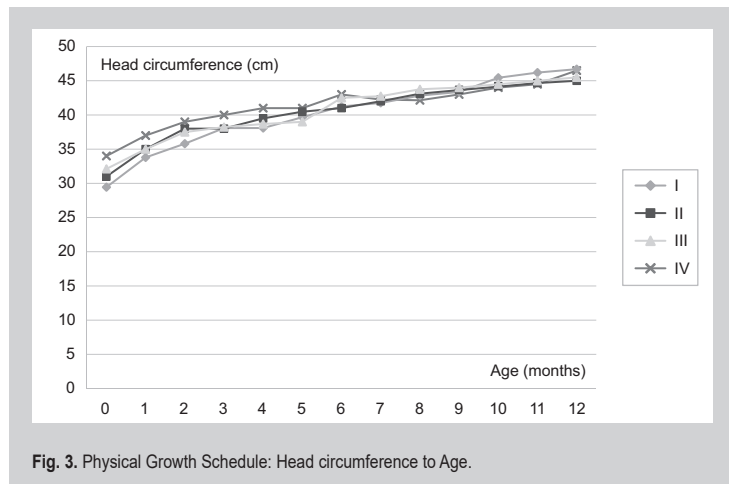


Fig. 3. Physical Growth Schedule: Head circumference to Age.

Conclusions

1. Children with intrauterine growth retardation made up a risk group of physical growth (weight deficit or overweight) disorders development.
2. Dynamics of physical development indicators (monthly body weight and length gain) in infants born prematurely with a weight between 1500–1999 grams is similar to that in normal newborns.
3. The physical development of children born with a weight of more than 2000 grams and children with intra-

uterine growth retardation was characterized by the same growth rate of body weight and length indicators in the first year of life.

4. In neonatologists, pediatricians and family doctors practice for valid assessment of children physical development born preterm with low birth weight, it is necessary to use the Fenton growth chart for preterm infants up to the age of 40 weeks in some cases up to 50 weeks.

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Conflicts of Interest: authors have no conflict of interest to declare. **Конфлікт інтересів:** відсутній.

Надійшла до редакції / Received: 25.08.2017
Після доопрацювання / Revised: 04.09.2017
Прийнято до друку / Accepted: 08.09.2017