



PHYSICAL DEVELOPMENT OF CHILDREN BORN THROUGH THE USE OF ASSISTED REPRODUCTIVE TECHNOLOGIES

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ABSTRACT

The study is based on survey data from 59 children born through ART from a singleton pregnancy (main group) and 50 children born from natural conception. All children underwent a general clinical examination with detailed collection of anamnestic data, measurement of height and body weight at the time of examination, and retrospective collection of anthropometric data for previous years of life. The study included children from 2 months to 5 years.

Relevance of the study: in the Republic of Uzbekistan, according to statistical data for 2022, over 25 thousand women and 7 thousand men are diagnosed with infertility under dispensary observation. Currently, an increase in the number of infertility is being recorded, both among women and among men, which contributes to an increase in the number of births of children born with the help of assisted reproductive technologies. In this connection, the study of their physical and somatic status is an urgent problem [7, 8].

In the modern world, over 5 million children are born as a result of the use of assisted reproductive technologies (ART): in vitro fertilization (IVF) and intraplasmic sperm injection (ICSI) [3, 11].

Being a socially oriented state, the Republic of Uzbekistan pays serious attention to protecting the reproductive health of citizens. In 2009, the republic adopted Presidential Resolution No. 1096 "On additional measures to protect the health of mothers and children, the formation of a healthy generation" and created the Republican Center for Reproductive Health. In accordance with this, citizens of the republic have the right to infertility treatment using safe and effective methods, as well as using assisted reproductive methods and technologies [1]. In the Republic of Uzbekistan, the procedure for implementing assisted reproductive technologies was approved by order of the Minister of Health of the Republic of Uzbekistan (No. [3217](#) dated February 6, 2020).

Recent scientific research has conflicting results regarding the health of children born using assisted reproductive technology (ART). Some scientists point to a high incidence of infectious diseases, congenital malformations (CM) and chromosomal abnormalities, cerebral palsy, as well as an increased risk of perinatal pathology, intrauterine growth retardation and prematurity in these children [9, 10]. At the same time, other researchers present results that indicate that there are no differences in the



physical development of children conceived through artificial insemination compared to natural conception [4, 5, 6].

Purpose of the study: to study the physical health of children born through ART.

Materials and methods: the study is based on examination data of 59 children born through ART from a singleton pregnancy (main group) and 50 children born from natural conception. All children underwent a general clinical examination with detailed collection of anamnestic data, measurement of height and body weight at the time of examination, and retrospective collection of anthropometric data for previous years of life. The study included children from 2 months to 5 years.

To assess the growth and development of children using growth curves according to WHO standards, a monitoring questionnaire was developed and approved by Order of the Ministry of Health of the Republic of Uzbekistan No. 145 dated March 30, 2007. Anthropometric indicators: body height, body weight and BMI. BMI was calculated using the formula: body weight (kg) / height (m²). For a comparative assessment of height, body weight and BMI of children depending on gender and age, Z-scores were calculated according to the method proposed by WHO (2007), with an assessment of its clinical significance. [2].

The obtained data were subjected to statistical processing using programs developed in the EXCEL package using a library of statistical functions with the calculation of the arithmetic mean (M), standard deviation (σ), standard error (m), relative values (frequency, %), Student's test (t) with calculation of the probability of error (P). Differences in mean values were considered significant at a significance level of $P < 0.05$.

Results of the study : during the anamnestic analysis, it was found that in the main group, 64.4% (38 out of 59) of mothers had pregnancy against the background of a burdened obstetric and gynecological history. Estragenal pathology was characterized in 30.5% of cases (18 out of 50) by endocrine diseases (obesity and overweight, hypothyroidism, gestational diabetes mellitus), in 6.8% (4 out of 59) - cardiovascular diseases, in 16.9 % (10 out of 59) - diseases of the genitourinary system, in 45.8% (27 out of 59) cases - gynecological diseases. In the control group, extragenital pathology in mothers and newborn children occurred in 34% (17 out of 50 women), which is 1.9 times lower than in the main group (OR=1.9; 95% CI (2.14-4.89)).

In 10.2% of women in the main group, the course of pregnancy was complicated by toxicosis; in 6.8% of cases, pregnancy occurred against the background of oligohydramnios; and 20.3% of women had gestosis. Toxicosis in the control group occurred in 8% of cases, which is 2.5 times less common (RR = 2.5; 95% CI – 1.6 – 3.25)

The average gestational age in the main group was 38.1 ± 1.7 weeks; in the control group – 39.0 ± 1.4 weeks ($p < 0.05$). Children from the main group were statistically more likely to be born by cesarean section compared to children from the control group (69.5% and 28.0%, respectively, $p < 0.05$; OR=1.5; 95% CI 0.5-5.02).

13 children (22.0%) were born prematurely before 38 weeks of gestation in the main group, while in the control group - 4 children, which amounted to 8% and was 2.8 times less common than in the main group ($P < 0.05$).



11.9% of children (7 out of 59) of the main group were diagnosed with intrauterine growth retardation, while in the control group - 4% (2 out of 50 children), which is 2.9 times less common ($P < 0.01$).

The average birth weight in the main group was 3120.2 ± 12.3 g, while in the control group it was 3356.9 ± 10.8 g. The average height at birth was 50.3 ± 1.1 cm, and in the control group - 51.8 ± 1.5 cm. As can be seen from the presented data, the average body weight and height at birth in children born through ART were significantly did not differ, but tended to decrease.

Analysis of weight and height indicators of children in the main group included data from 30 children under the age of 1 year, 16 children aged from 1 to 3 years, and 13 children aged from 3 to 5 years; in the control group - 24, 17 and 9 children, respectively.

In a comparative aspect, according to WHO standards, when assessing the growth of children, it was revealed that the level of normal indicators in boys of the main group was observed in 70.5%, in girls normal indicators were recorded in 68.3%. In children in the control group, growth rates within normal limits were observed in boys and in 75% of girls. As can be seen from Table 1, in the children of the main group, in most cases, growth indicators were within the normative values, according to WHO standards; these indicators were slightly higher in children of the control group.

Short stature occurred in 16.7%, extremely short stature was observed in 1 (3.4%) boys of the main group, while among boys in the control group, short stature was also observed in 15.3%, extremely short stature was not observed, which was not significant value ($P < 0.05$).

Among girls in the main group, short stature occurred in 14.6%, while in the control group - 12.5%; the reliability of the data was not recorded. At the same time, there is a significantly high frequency of occurrence of deviations in the median CO3-, which corresponds to extremely low growth among girls in the main group ($6.7 \pm 4.6\%$ versus $4.2 \pm 4.1\%$; $P < 0.05$).

Table 1

Percentage of examined children according to the correspondence of body height to standard deviations according to WHO (n= 109)

	Main group (n =59)				Control group (n =50)			
	Boys (n =29)		Girls (n =30)		Boys (n =26)		Girls (n =24)	
	Abs.	%	Abs.	%	Abs.	%	Abs.	%
CO3-	1	3.4 ± 1.9	2	6.7 ± 4.6	0	0 ± 0.0	1	$4.2 \pm 4.1^*$
CO2-	3	10.3 ± 2.6	3	10.0 ± 5.5	4	$15.3 \pm 5.2^*$	3	12.5 ± 6.7
CO1-	10	34.5 ± 3.7	7	23.3 ± 6.7	2	$7.7 \pm 4.6^*$	7	29.2 ± 9.3
med	6	20.7 ± 3.4	6	20.0 ± 5.9	10	38.5 ± 7.9	7	29.2 ± 9.3
CO1+	5	17.2 ± 3.3	4	13.3 ± 5.5	5	19.2 ± 6.2	2	$8.3 \pm 5.6^*$
CO2+	3	10.3 ± 2.3	5	16.7 ± 5.1	4	$15.4 \pm 6.2^*$	2	8.3 ± 5.6
CO3+	1	3.4 ± 1.5	3	10.0 ± 4.1	1	$3.8 \pm 5.2^*$	2	8.3 ± 5.6

Note: * - reliability of data between groups ($P < 0.05$)



The indicator of high growth within CO₂⁺ is more often recorded in children of the control group. Depending on gender, we found that high growth within CO₂⁺ was recorded more often among boys in the control group compared to boys in the main group (10.3±2.3% versus 15.4±6.2%), but among girls in the main group these indicators tended to prevail, but did not reach reliable values (16.7±5.1% versus 8.3±5.6%).

Tallness within the CO₃⁺ range is observed with almost the same frequency in both the main group and the control group. A similar trend is observed among girls; tallness is most often observed among girls in the main group compared to the control group (8.3±5.6% versus 10.0±4.1%; P<0.05).

According to WHO weight/age standards, we identified the following characteristic patterns, so it was found that among boys in the main group, increased body weight within the CO₂⁺ range was recorded in 10.3% of cases, while among girls this percentage was 16.7%. Among children in the control group, body weight within the CO₂⁺ range was 2.3% higher among boys (P<0.05), while among girls it was 8.4% higher (Table 2).

table 2

Percentage of examined children according to their body weight for age according to WHO standard deviations (n = 109)

	Main group (n =59)				Control group (n =50)			
	Boys (n =29)		Girls (n =30)		Boys (n =26)		Girls (n =24)	
	Abs.	%	Abs.	%	Abs.	%	Abs.	%
CO ₃ -	1	3.4±1.3	2	6.7±3.4	1	3.8±5.8*	2	8.3±5.6
CO ₂ -	3	10.3±2.4	5	16.7±5.9	4	15.4±5.8*	6	25.0±8.8
CO ₁ -	6	20.7±3.3	6	20.0±6.2	5	19.2±4.6*	3	12.5±6.8
med	7	24.1±3.4	5	16.7±5.9	8	30.8±6.6	9	37.5±9.9*
CO ₁ ⁺	7	24.1±3.6	7	23.3±6.7	5	19.2±5.2*	2	8.3±5.6*
CO ₂ ⁺	4	13.8±2.8	5	16.7±5.9	3	11.5±6.6	2	8.3±5.6*
CO ₃ ⁺	1	3.4±1.9	0	0.0±0.0	0	0.0±0.0	0	0.0±0.0

Note: * - reliability of data between groups (P<0.05)

Body weight within the CO₃⁺ range was observed in 3.4% of boys in the main group, while it was not observed in the control group. I would like to note that among girls, both in the main group and in the control group, body weight indicators within the CO₃⁺ range were not recorded.

Insufficiency of body weight within the deviations CO₃⁻ was registered with almost the same frequency in boys both in the control group and in the comparison group, while in girls from the control group there was a tendency to increase the percentage in relation to girls in the main group (8.3± 5.6% versus 6.7±3.4%, respectively).

Body weight indicators within the CO₂⁻ deviations were recorded more often in children of the control group in relation to their peers from the main group , both among girls and among boys, however, without reaching reliable values (P>0.05).

Thus, children born through ART are 1.9 times less likely to have low body weight compared to their peers from the control group (17.9 versus 33.3%; P <0.05). However,



the incidence of increased body weight tended to increase in children of the main group (17.4% versus 11.7%; $P>0.05$), without reaching significant values.

The most reliable indicator in the harmonious development of children is body mass index (BMI). Regarding the indicators of deviations from WHO standards, we found that among children in the main group, normal BMI indicators were found in 71.6% of cases, while in the control group - 81.7%.

As can be seen from the data presented in Table 3, PEM occurs in 6 children of the main group, which is 15.3%. In children of the control group, the incidence of PEM tended to decrease and amounted to 8.0% (4 out of 50 children). I would like to note that in 3.3% of girls in the main group, PEF was within CO3-, while in the control group it was not observed. The highest percentage of occurrence of PEM in girls was observed within CO2-, while a significant difference was established between groups with a prevalence in the main group ($6.7\pm3.8\%$ versus $4.2\pm4.1\%$, $P<0.05$). The occurrence of PEM within the CO2- deviations in boys was almost the same ($10.3\pm2.7\%$ versus $11.5\pm5.2\%$, respectively).

High BMI indicators within the range of CO2+ and CO3+ were most often recorded in children of the main group and amounted to 19.4%, while in the control group – 10.0%.

Table 3

Percentage of examined children according to their BMI for age according to WHO standard deviations (n = 109)

	Main group (n =59)				Control group (n =50)			
	Boys (n =29)		Girls (n =30)		Boys (n =26)		Girls (n =24)	
	Abs.	%	Abs.	%	Abs.	%	Abs.	%
CO3-	0	0.0±0.0	1	3.3±1.9	0	0.0±0.0	0	0.0±0.0
CO2-	3	10.3±2.7	2	6.7±3.8	3	11.5±5.2	1	4.2±4.1*
CO1-	6	20.7±3.2	4	13.3±4.2	eleven	42.3±8.3*	4	16.7±7.6
med	8	27.6±3.7	12	40.0±4.5	5	19.2±6.2	12	50.0±10.2
CO1+	7	24.1±3.4	8	26.7±4.3	4	15.4±6.2	5	20.8±8.3*
CO2+	3	10.3±2.6	3	10.0±3.8	2	7.7±4.6	2	8.3±5.6
CO3+	2	6.9±1.9*	0	0.0±0.0	1	3.8±2.7	0	0.0±0.0

Note: * - reliability of data between groups ($P<0.05$)

In girls both in the main group and in the comparison group, CO3+ was not observed, while CO2+ was 1.5 times more likely to be observed in girls in the main group (10.0 ± 3.8 versus $8.3\pm5.6\%$, respectively).

Among boys, CO3+ was found significantly more often in the main group ($6.9\pm1.9\%$ versus $3.8\pm2.7\%$, respectively), as well as CO2+ (10.3 ± 2.6 versus $7.7\pm4.6\%$).

Conclusions:

Differences in the physical health of children born as a result of ART and natural conception are due to the adverse effects of factors associated with the presence of a



burdened obstetric and gynecological history in 64.4% of cases and a complicated pregnancy in 45.3% of cases. The average body weight and height at birth in children born through ART did not differ significantly, but tended to decrease. The physical development of children born through ART in 15.3% of cases was characterized by the presence of PEM, and in 19.4% there were high BMI rates within the range of CO2+ and CO3+.

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