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Assessment of the Physical Development of Children Born with Extremely Low Weight

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The development of a child, both physical, functional and neuropsychic, is a holistic process that consists of a set of many morphological and functional features in their dynamics and interconnection. The growth and development of children is influenced by a complex of factors, such as the type of feeding, child care technology, socio-economic, household and a number of others.
Keywords: health, premature babies, low body weight, extremely low body weight, physical development of children, feeding.

1. Introduction

The health of a child is determined both by the age possibilities of a growing organism and by the influence of a whole complex of hereditary-biological and social factors on it. Features of somatic pathology in premature infants (PI) born with very low and extremely low body weight (VLBW and ELBW), despite numerous studies, are of scientific interest and remain an important problem in pediatrics [1,4].

The published WHO report "... born too early ..." examines the global problem of having children with VLBW and ELBW. Every year in the world about 15 million children are born prematurely, i.e. premature. More than one million of them die shortly after birth, and many survivors become disabled [9,10].

The category of children with low body weight (LBW), according to the criteria recommended by WHO, includes newborns with birth weight from 1500 to 2500 g; if the weight of the child at birth is from 1000 to 1500 gr. he is in the very low birth weight (VLBW) group; children of

smaller parameters are children with extremely low body weight (ELBW).

Babies born prematurely fall into three categories:

- prematurely born in late pregnancy (80% of all ND) - these are babies born at a gestational age of 32-37 weeks. With proper care, most of these newborns survive.

Significantly preterm births are babies born at 28-32 weeks gestation. They need special care.

Extremely preterm babies are babies born at less than 28 weeks' gestation. They require special, expensive care. In low-income countries, only one in ten survive.

The frequency of preterm birth varies in many countries and does not always depend on the economic development of the country. However, it is noted that in low-income countries, on average, 12% of children are born prematurely, while in high-income countries this figure is somewhat lower at 9%. The highest rates of preterm birth (PR) per 100 births were recorded in Malawi 18%, Congo 16.7%, Zimbabwe 16.7%, Equatorial Guinea 16.5%, Pakistan 15.8% and other Central African and East Asian countries . However, in the United States, 12% of preterm births are recorded annually. Countries with a low level of PR include: Belarus - 4.1%, Latvia - 5.1%, Finland and Croatia 5.5% each, Lithuania and Estonia 5.7% each, Japan and Sweden 5.9% [1, 2].

According to WHO, the increase in the number of cases of PR in highly developed countries is largely associated with later motherhood, unreasonable early induction of labor and an increase in cases of caesarean section. In countries with low levels of development, infections and early pregnancies are more common.

A study carried out in 2011 by I.N. Strupovets [22] showed that at the birth of a premature baby, mothers in 50.0% had an infectious pathology (ARVI-23.3%; colpitis-20%; chronic pyelonephritis 6.6%) and an infectious process occurred in 93.3 % cases.

Another most common cause of preterm birth may be extragenital somatic pathology. According to I.V. Vinogradova [14], before the onset of pregnancy, the mother of ND in 4.3% of cases suffered from a severe form of hypertension; 3% of them suffered carditis; another 3% were obese; 10.1% were carriers of TORCH infections; 14.5% indicated a history of induced abortions, and 7.5% - spontaneous miscarriages. Pregnancy aggravated by various reasons was observed in all women who gave birth to children with ELBW. Thus, 69.6% of pregnant women had a threat of spontaneous abortion at various stages; 21.7% had severe preeclampsia; oligohydramnios or polyhydramnios was in 10.1%. Pathological placenta previa was detected in 11.6% of women, placentitis - in 5.8% of pregnant women, fetoplacental insufficiency - in 23.2% of patients.

Conducted in 2016 by O.V. Avilov [3 et al., a retrospective analysis of the case histories of children registered in the city office for catamnesis of premature babies showed that among mothers who had children with VLBW and ELBW there was not a single woman without any extragenital, gynecological or obstetric pathologies. In addition, the authors indicate that 17.8% of women with ND were born after the use of assisted reproductive technologies (in vitro fertilization) [7,9,13]

Thus, preterm birth is a polyetiological problem in the formation of which all systems of the mother's body are involved, to which a pathological response occurs from the placenta and

endometrium, leading to miscarriage and the birth of premature babies [8,11,25,28,].

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A US cohort study of 61 infants with a birth weight of 500-700 g. born showed that viability depends on the sex of the baby, since the survival rate of girls (survival by 71.4%) was 3.9 times higher than that of boys (survival by 18.2%).

However, despite modern methods of providing medical care to children born with VLBW and ELBW, they account for up to 90% in the structure of neonatal causes and up to 50% in the structure of infant mortality.

According to I.V. Vinogradova (2012) among the dead children with ENMT, 41.1% die in the first hours of life, and 36.9% in the first three days of life. The second burst of early neonatal mortality in children with ENMT is observed on the 14th-20th day of life. In the structure of mortality in children with ENMT, the first ranking places are occupied by respiratory disorders and hypoxic intraventricular hemorrhages, 30.1% each, and intrauterine infections are in third place, 23.9%. In children with NMT, intrauterine infections occupy the first place - 34.4%, followed by congenital malformations - 25.0%, and intraventricular hemorrhages are in third place - 21.8%.

Mortality rates in children with ELBMT have declined significantly over the past twenty years. According to the Quint Boenker Preemie Survival Foundation and the March of Dimes, the survival rate of premature babies, depending on the gestational age, is: at 23 weeks - 17%; at 24 weeks - 39%; at 25 weeks - 50%; at 26 weeks - 80%; at 27 weeks - 90%; at 28-31 weeks - 90-95%; at 32-33 weeks - 95% and with a period of more than 34 weeks, the probability of survival is like that of a full-term baby.

The reasons for the birth of a premature baby are diverse, and it is not always possible to separate the main factors from the secondary ones. The most common risk factors, according to many authors, are maternal, which include: the age of the mother, the harmfulness of the mother's profession, the outcomes of previous pregnancies, concomitant diseases, diseases suffered during pregnancy, complications of this pregnancy [18,19].

The survival rate of children born very prematurely, on average for different countries, is about 85%. Providing assistance to such children is a long, painstaking and very expensive process that requires high-tech types of assistance and long-term support of vital functions.

Considering the health care costs of nursing ND with VLBW and ELBW, it should be noted that only according to the US National Center for Health Statistics, nursing one premature baby costs tens to hundreds of times more than the cost of treating full-term babies. Overall,

the United States spends $11.9 billion annually on nursing babies born before 37 weeks of gestation and $25 billion on medical care for all other births.

Therefore, prevention of the birth of children with low body weight is so important. The first stage of rehabilitation measures, according to many authors, should begin even in the antenatal period with a quality medical examination and perinatal care for a pregnant woman, especially at risk (age up to 17 and after 35 years, with gynecological and general somatic diseases, especially infectious nature, smokers with a complicated obstetric history, etc.).

Screening for monitoring the development of the fetus makes it possible to identify various pathologies in the fetus and intrauterine growth retardation syndrome (SZVUR) even during pregnancy. The presence of SZVUR not only indicates the unfavorable condition of the fetus in the prenatal period, but also largely "programs" insufficient body weight gain, at least in the first months of life, an unfavorable course of postnatal adaptation, and the development of pathology of organs and systems in the neonatal period.

In addition, SZVUR provokes premature birth. Thus, 31.9% of children with VLBW and 45.7% with ELBW had signs of SZVUR at birth. In the group of children with ELMT, the diagnosis of SZVUR II degree was significantly more common.

The provision of medical, specific care at the prenatal stage, both for the mother and the fetus, can prevent not only the birth of a child with NMT, reduce the incidence of newborns and prevent the economic damage to the state for the treatment and maintenance of people with disabilities since childhood.

The second stage of rehabilitation is carried out in the maternity hospital. A number of studies conducted in the United States have been devoted to studying the ability of neonatologists to correctly predict the viability of newborns in the zone of viability limit (LLZ) and, in accordance with this, determine the appropriateness of resuscitation in the delivery room. The most important criteria for PHR were: patient viability, positive response to primary resuscitation, and perceived quality of life. It was found that the life expectancy in newborns corresponds to a birth weight of 500-600 g and BW of 23-24 weeks. The question of the appropriateness and extent of resuscitation in a particular child with NMT should be decided by neonatologists directly in the delivery room, depending on the condition of the patients and their response to primary care.

According to S.V. Aborina et al. (2017) in ND with VLBW and ELBW, the leading pathological syndrome in a maternity hospital or perinatal center is cerebral depression associated with the predominance of inhibition mechanisms as a protective reaction of CNS damage. Manifestations, which are violations of the regulation of breathing, inhibition of the sucking reflex, which makes it necessary to use invasive methods of respiratory support, tube feeding and infusion therapy.

Numerous sources confirm the need for the use of respiratory support with artificial lung ventilation (ALV) in newborns with very low birth weight. This is due to the underdevelopment of the bronchial tree and alveoli at a low stage of breastfeeding.

The experience of economically developed foreign countries shows that if children with VLBW and ELBW are cared for in specialized, well-equipped perinatal centers, mortality in the first week of life is no more than 35%. And among the survivors, 54% of children have no

serious consequences.

It should be noted that the efforts of neonatologists of perinatal centers aimed at providing perinatal care in the optimal volume: prevention of critical conditions, development and implementation of optimal treatment programs for newborns with ELBW and VLBW, adequate correction of hemodynamic adaptation in the first days of life can save lives and reduce the risk of developing chronic pathologies in this group of patients.

However, the health of the child is largely determined by the capabilities of the growing organism, as well as the influence on it of a whole complex of factors of a hereditary-biological and social nature. Therefore, the stage of postnatal care for ND at the age of up to one year, from one to three years and beyond is so important. Currently, there is a significant gap between the high achievements of technologies for nursing very preterm infants in peri- and neonatal centers and the subsequent observation of ND in the outpatient network.

After discharge from the ND hospital, especially children with NMT, they have multiple functional, and often organic, lesions of organs and systems: the central nervous system; sensory organs (retinopathy, hearing impairment); respiratory organs (immaturity of lung tissue, immaturity of the central regulation of respiration, BPD); disorders of the circulatory system (cardiopathy, rhythm disturbances); posthypoxic nephropathy; gastrointestinal dysfunction, immaturity of endocrine regulation; violation of phosphorus-calcium metabolism; muscle weakness, etc.

As a result of the lack of information and lack of knowledge among doctors of healthcare facilities in the PHC zone on the management of children with NMT at birth, some doctors exaggerate, while others underestimate the health status of children born prematurely. This often leads to overdiagnosis of pathological conditions and unreasonable prescribing of long courses of treatment, which, on the contrary, can slow down the development of ND. In the opposite case, late diagnosis of a developmental disorder leads to a delay in the start of special treatment. The existing disunity in the outpatient monitoring of such children between family doctors, pediatricians and narrow specialists (neurologists, gastroenterologists, nephrologists, etc.) is associated with the appointment of children with a lot of drugs, sometimes antagonistic series.

To optimize the monitoring of children in the first year of life born with VLBW and ELBW, catamnesis departments are being created in primary health care facilities. The algorithm for monitoring ND in them includes monthly examinations by a pediatrician, neurologist, ophthalmologist, scheduled examinations by an orthopedist and otolaryngologist, monitoring of laboratory blood and urine tests, monitoring of neurosonography, echocardiography, electrocardiography, and electroencephalography. If necessary, other specialists may be involved: endocrinologist, surgeon, cardiologist. Carrying out rehabilitation measures and examination of the child is optimal in a day hospital at the catamnesis department [16,17].

As in the treatment of any pathologies, all measures for the rehabilitation of very preterm infants in the postnatal period can be divided into drug and non-drug. A wide range of drugs are prescribed to treat neurological disorders, anemia, rickets, BPD, various infections, retinopathy, and other conditions. A wide variety of drugs, even with individually selected drug therapy, is very difficult to control due to the peculiarities of pharmacodynamics in ND.

In maintaining the health of a baby born with NMT of all degrees, non-drug methods of influence are important, which, compared with drug therapy, are characterized by a more gentle load on the body. For children of the first year of life, it is recommended: a long stay near the mother "the kangaroo method", therapeutic massage and gymnastics, development of the digital apparatus, exercises in water, Voight therapy, light therapy, etc. In the complex of rehabilitation measures, physiotherapy is often used. Rehabilitation treatment of a premature baby can be effective if it is started in a timely manner, adequately, comprehensively and continuously.

The results of numerous studies conducted in various countries of the world convincingly show that many technologies used in medicine turned out to be ineffective, but their application still takes place [1,10]. One of the important causes of morbidity and mortality in children is the centuries-old stereotype of the need to fix the limbs of the child, this helps to limit the excursion of the diaphragm, reduce blood circulation and, as a result, increase the tendency to frequent respiratory diseases [20,21]. Limb immobilization is also strongly associated with a high risk of sudden infant death syndrome.

Another important reason for the increase in the incidence of children is the stereotype associated with the refusal of frequent bathing, due to the fear of hypothermia, infection of the umbilical cord or other disorders [3,6]. However, according to studies, frequent bathing of children with the use of herbs helps to relax the nervous system, which is very important for its diseases. It also reduces susceptibility to infections and intoxication in the development of respiratory diseases [5,7].

With frequent use of soap, a violation of the normal biocenosis of the skin develops, and its dryness increases. Unscrupulous marketing, without complying with international codes, increases the use of various kinds of physiological stool adsorbents, especially in medical institutions. First of all, they prevent the baby from feeling the processes of urination and defecation, and also lead to disruption of the rhythms of urination and the development of the genitourinary system.

Feeding a premature baby plays a huge role in the success and effectiveness of the therapy. The optimal supply of nutrients to children with LBW is negatively affected by such factors as: functional immaturity and damage to the gastrointestinal tract (decreased tone of the cardiac and pyloric sphincters, small volume of the stomach, gastroesophageal and duodenogastric reflux, hypokinetic type of motility) due to hypoxia, intoxication, adrenal insufficiency; imperfection of the immune system (high risk of developing necrotizing enterocolitis); immaturity of the excretory system, lability of water-salt metabolism, severe nephropathy, increased sensitivity to nutritional osmolarity.

Feeding premature babies born with VLBW and ELBW is divided into 2 stages - nutrition in the early postnatal period (parenteral; early enteral) and nutrition in the late postnatal period (late enteral) [12,23,24,27].

As a result of the studies, a stable correlation was found between weight gain in the postnatal period and the outcomes of physical and psychomotor development in the future. Maintaining a daily weight gain of at least 15 g / kg per day, as well as achieving physical development indicators characteristic of full-term newborns at the fortieth week of PCV, is the main goal

of neonatologists.

Studies conducted by Elliot K. G. et al., (1997) have shown a relationship between the amount of psychological help a child receives, his height and nutritional status. In addition, there are many published works that demonstrate a direct relationship between the level of education of caregivers and the health and nutritional status of their children [29].

A number of studies have found that not breastfeeding affects mental development and cognition. According to a meta-analysis of twenty randomized trials (Betty R. Vohretal., 2006) conducted on 10,000 children aged 6 months to 16 years, comparing differences in the development of cognitive abilities of children who were breastfed and children who were fed infant formula showed significantly higher levels of cognitive development in breastfed infants and these differences were stable over time. Cognitive abilities increased with the duration of breastfeeding up to 2 years or more [8,12,24].

Purpose of the study

To assess the physical development and health dynamics of children born with extremely low birth weight, depending on the care and type of feeding.

2. Material and methods

We have studied the indicators of mass, height and mass-height index in 356 children from birth to 5 years of age. In 284 children in the main group, who received various types of feeding, the modern principles of care recommended by WHO were applied: refusal to use nipples, free position of the child, frequent daily bathing with herbs (chamomile, string, motherwort, St. John's wort). In the control group, 72 children received care based on traditional ideas - fixation of limbs, rare bathing with soap. The dynamics of body weight gain was studied by us in a differentiated way, where for each type of feeding, depending on the care used, in order to study the direct influence of the principles of care on the physical development of children.

Anthropometric data of children were evaluated: weight measurement in grams on the scales "Zalimp (Warszawa) Nr 2732" and height measurement in centimeters using a stadiometer. Measurement of physical development parameters was carried out at birth, on the 15th and 30th day of each month at the age of a child up to 1 year, quarterly up to 3 years, every 6 months up to 5 years. The mass-height index of children was calculated by the formula: the ratio of body weight in kilograms (kg) to the square of body length (height) in m2.

Statistical processing was performed using the standard Excel-2003 software package.

3. Results and discussion

Analysis of the results of the study showed that in the examined children, the average birth weight was 3395.4 ± 450.9 g, and the height was 52.3 ± 3.1 cm. who received different types of feeding, is presented in table 1.

Table 1. Dynamics of MRI in children who received exclusive breastfeeding from 0 to 60 months, depending on the principles of care used

Subgroups	6 months	12 months	36 months	60 months
Main	17,2±0,05***	17,0±0,05***	15,4±0,04**	15,5±0,04
Control	16,8±0,16	16,2±0,15	14,8±0,17	15,3±0,18

Note:* differences relative to the data of the control group are significant (** - P<0,01, *** - P<0,001)

The results of the study showed that MRI indicators in children in the main group who received artificial breastfeeding (IHF) and implemented care were comparable to the average indicators of the mass-height index characteristic of this age in the population, and in some periods even exceeded them. Children in the control group had MRI below the average values characteristic of this population, however, the MRI values did not go beyond two standard deviations.

The values of MRI in children who received predominantly breastfeeding (PHF), when using implemented care, were below the average statistical value, but did not go beyond two standard deviations. However, MRI indicators in children with PGV in the control group were below two standard deviations from the average statistical value, which indicates a moderate degree of malnutrition of these children in this category.

Table 2. Dynamics of MRI in children who received predominantly breastfeeding from 0 to 60 months, depending on the principles of care used

Subgroups	6 months	12 months	36 months	60 months
Main	16,4±0,27	16,3±0,21	15,0±0,20*	14,8±0,23
Control	16,0±0,20	15,9±0,18	14,4±0,21	14,2±0,19

Note:* differences relative to the data of the control group are significant (* - P<0,05)

When studying the height-weight index in children who received mixed breastfeeding (GFS), it was found that its values were the lowest among all children, and even with the use of implemented care, the MRI values were at the lower limit of two standard deviations from the average value, and with the use of traditional care in some age periods is even lower (Table 3).

Table 3. Dynamics of the body mass index of children who received mixed feeding from 0 to 60 months, depending on the principles of care used

Subgroups	6 months	12 months	36 months	60 months
Main	16,0±0,24**	15,6±0,17*	14,7±0,20	13,8±0,17
Control	15,1±0,14	15,0±0,15	14,1±0,16	13,1±0,12

Note:* differences relative to the data of the control group are significant (** - P<0,01, *** - P<0,001)

A low MRI value may reflect the effects of long-term exposure to malnutrition and indicate chronic malnutrition in children who are deficient in essential nutrients. It can also be associated with lack of proper care and repeated infections.

The most variable, with sharp fluctuations in the dynamics of MRI, was observed in children with artificial feeding (Table 4), in some age periods, exceeding, sometimes reaching the lower limit of two standard deviations from the average values.

Table 4. Dynamics of MRI of the body of children who received artificial feeding from 0 to 60 months, depending on the principles of care for them

Subgroups	6 months	12 months	36 months	60 months
Main	17,7±0,27**	17,6±0,35***	16,6±0,23	16,6±0,22
Control	18,8±0,30	17,8±0,23	16,9±0,26	17,1±0,26

Note:* differences relative to the data of the control group are significant (** - P<0,01, *** - P<0,001)

When studying the dynamics of MRI in children with artificial feeding without differentiation into types of care, a general tendency to overweight was revealed (MRI values at the upper limit of two standard deviations from the average value). When differentiating groups, it was found that with traditional care, children had the indicators of the mass-height index are higher than with the implemented care. Sharp fluctuations in MRI in this group may be due to the high incidence of children.

Thus, the results of this study show how significant the contribution of the modern nature of care for young children, recommended by WHO, is to the improvement of the parameters and harmony of their physical development.

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