



DESIGN OF ADAPTED FUNCTIONAL PRODUCTS BASED ON THE ANTHROPOMORPHOLOGICAL PARTICULARITIES OF PREMATURE CHILDREN

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Abstract: *The article presents the results of studies on the analysis of anthropomorphological features of premature babies and aspects related to the design of clothing for premature babies in the intensive care unit. The aim of this research lies in the development of the following elements: the definition of prematurity groups and describing the data necessary initial design (anthropomorphological characteristics of the group of carriers). The anthropomorphological indicators taken by the medical professionals were identified and analysed. Finally, the aspects related to the elaboration of functional clothing products targeted for premature babies in medical incubators were presented, combining the comfort for the child and the support of the necessary medical procedures. The theoretical significance of the work performed resides in a study based on the research of the user's categories, of their degree of development. In order to solve the problems in the design of functional clothing adapted for premature infants, the study results will serve to develop the range of clothing for premature babies in the light of their characteristics morphofunctional development. This product will help reduce discomfort; to improve motor and cognitive activity; to improve the quality of life for a premature baby and his parents. The design of functional products adapted for premature babies based on initial scientifically substantiated data will have an ergonomic, economic and socio-human impact on this category of carriers.*

Key words: *prematurity, gestational age, functional clothing.*

1. INTRODUCTION

Designing clothing for premature babies compared to that for children born on term requires specialised knowledge, which includes studying the peculiarities of conformation, proportions and the degree of development in each period.

The World Health Organization (WHO) defines a premature birth as any birth before 37 weeks of gestation completed or less than 259 days from the first day of a woman's last period. That is further divided based on gestational age (GV) [1].

According to the International Classification, the lower limit for declaring a live birth is considered 500 g in weight or/and 22 weeks gestational age. This classification uses the weighted criteria to categorise new-borns: "low birth weight" (LBW - less than 2500 g), "very low birth



weight" (VLBW - up to 1500 g and 1000 g) and "extremely low birth weight" (ELBW - less than 1000 g).

2. DETERMINATION OF THE INITIAL DATA REQUIRED FOR THE DESIGNING OF FUNCTIONAL CLOTHING PRODUCTS FOR PREMATURE BABIES

Initial data required for the design of children's clothing products:

- ✓ information about the wearer - the anthropomorphological characteristic and the particularities of the physical development according to the prematurity group;
- ✓ information about the product - properties, functions and specific requirements imposed, the type of medical manipulation, equipment to which children are involved;
- ✓ information about the materials used.

Anthropomorphological characteristic of the carrier group

The assessment of neonatal maturity is a theoretical notion that relates the process of growth and differentiation to the temporal chronological criterion. The idea of maturity for gestational age is meant to achieve a certain somatic and functional development in relation to the accepted standards for that gestational age.

When are compared the somatic development of the children being assessed by the anthropometrical data (weight, waist, skull perimeter) and the chronological data, it was established that there is a correlation expressed through the intrauterine growth curves (fig. 2). On these graphs, the new-borns who developed according to the gestational age are placed between the 10th and 90th percentiles (± 2 standard deviations). Older children for gestational age are above the 90th percentile, and below the 10th percentile are young babies for gestational age (with intrauterine growth retardation). Older babies for gestational age are above the 90'th percentile, but below the 10'th percentile are young babies for gestational age (with intrauterine growth retardation).

Each clinical examination will mandatory include the growth monitoring by dynamic tracking of the cranial perimeter, weight and waist. The corresponding creation curves target the evaluation parameters. In the first two years of life, there are different patterns of growth between the full-term and premature new born; thus, at birth, we evaluate anthropometric data using Lubchenco curves and then use growth curves specific to preterm babies [2].

The Intergrowth-21 study proposes the use of growth curves for premature up to 64 weeks VPM, after which the WHO growth curves can be consulted [3]. Intrauterine growth curves (Fig. 1) [2] provide idealised guidelines for monitoring the growth of preterm babies. Premature birth has many variables that can affect growth. However, However, using the WHO International Growth Standard, it is suggested to adjust that postnatal growth to gestational age at birth, and all children assessed.

Each of these new-borns may have gestational age (AGA), small gestational age (SGA) or large gestational age (LGA) weight. For a correct assessment, respectively, the classification of the new born in the mentioned categories, the weight index (WI) will be calculated using the formula presented in table 1.

Table 1: Weight index in premature babies

$WI = \frac{\text{The weight (g)}}{\text{Talia}^3 \text{ (cm)}} \times 100$	<p align="center">AGA, IP =2,3-3 SGA, IP < 2 LGA, IP >2,3 Premature new born</p>
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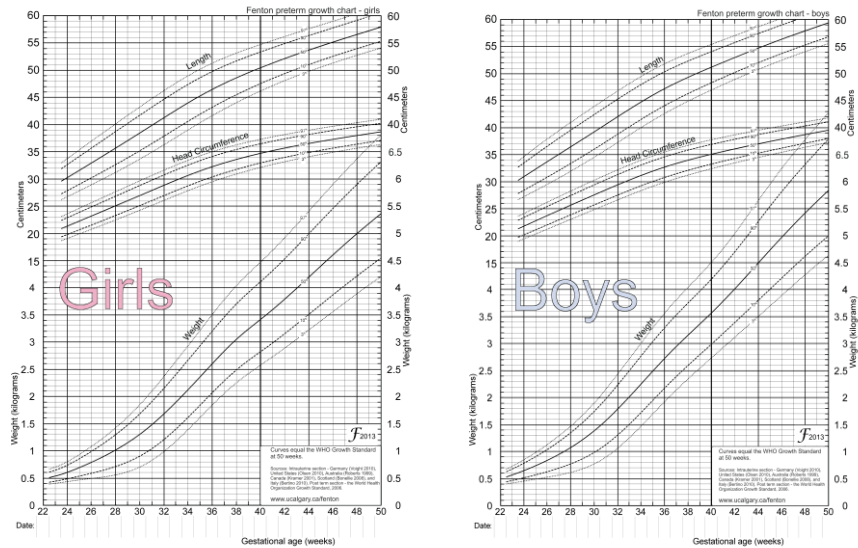


Fig. 1: Infant fetal growth curves for preterm infants

Source: <https://bmcpediatr.biomedcentral.com/articles/10.1186/1471-2431-3-13>

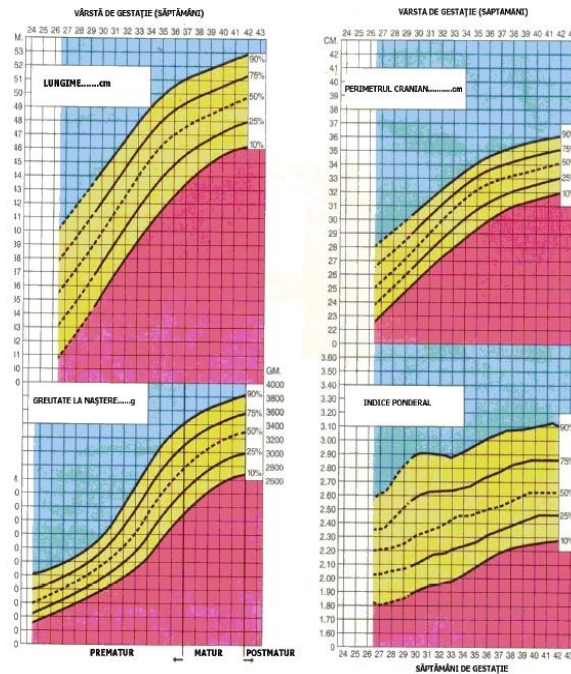


Fig. 2: Intrauterine growth curves (after Lubchenco)

Source: <http://legislatie.just.ro/Public/DetaliiDocumentAfis/132250>



3. RESEARCH METHODS USED

The research methodology focused on the analysis and examination of medical records and descriptions made by medical personnel, of the morphometric and physiological particularities of 500 premature babies. The importance of the collected data will serve for the design of ergonomic products adequate dimensionally to the user group.

4. EXPERIMENTAL RESEARCH

The body of the baby is subject to the effort of adaptation to a new living environment, with numerous transient phenomena. This involves a series of rapid changes, most of them predictable [4]. As indicators that characterise the physical development of the premature baby are the global morphological indicators: the waist, the perimeter of the chest and the body mass, which are supplemented by the indicator that establishes the cranial perimeter [5].

In case of a rapid postnatal (in urgent situations) estimation of gestational age is required, it is highly recommended that the neonatologist estimate VG using a fast score to assess the maturation of morphological features (Table 3) [6].

*Table 3: Rapid determination of gestational age using morphological features
(adapted from Gomella TL: Neonatology On-call problems)*

Gestational age	Plantar growth	Mammary gland areola dimensions)
GA < 36 weeks	One or two transverse plantar ridges, $\frac{3}{4}$ posterior leg without crests.	2 mm
GA 37-38 weeks	Create multiple on the previous $\frac{2}{3}$ of the plant, heel without ridges.	3-4 mm
GA > 39 weeks	The whole plant covered with ridges.	7 mm much more

Below is attached the anthropometric data presented by the medical institution „Spitalul Municipal Materinitatea Nr. 1” from Chisinau for the period 2015-2018. Their values were analysed and grouped according to the degree of prematurity.

Weight, length, head circumference and chest circumference were measured within 12 hours of birth. Anthropometric data were taken using methods and equipment recommended for this category of new-borns [7].

The measurements were recorded after being taken three times (with the error range for weight - 0.5g; length - 0.4cm; perimeter of the head - 0.4cm ; perimeter of the chest – 0.4cm) by two anthropometrists. The perimeter of the rib cage and the cranial perimeter are measured with the centimetre ribbon (fig. 3), having as reference points the axillary points and the nipples. The cranial perimeter is passed around the head at the level of the external occipital protuberance and the glabella. Values vary depending on the degree of prematurity.

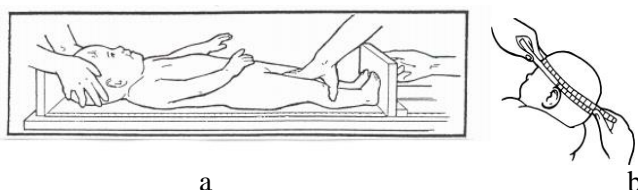


Fig. 3: How to take over the main anthropometric indicators:
a – perimeter of the chest, b – cranial perimeter

Body mass is determined using a children's scale (fig. 4). It is mentioned that during the follow-up period, it is recommended to weigh the child at the same time of day and in the same physiological state (preferably in the morning on an empty stomach). Before performing the measurements, the scale is balanced, a clean diaper is weighed, and the child is placed entirely naked on the scale, lying on his back.

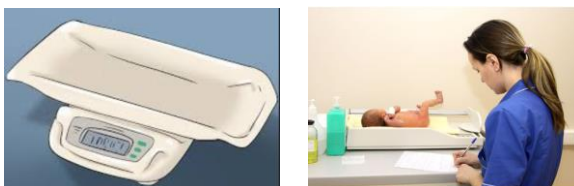


Fig. 4: How to correctly check the weight of the body

According to the analysis carried out for the period 2015 - 2018, the majority of the children born prematurely who have the birth weight between 2080-2660 g, with the body length of 42.8 - 50.6cm, with the perimeter of the head of 30.8 - 34.4cm and the chest perimeter of 31.8 - 35.4cm, which represents the gestational age category at week 32 - 37.

The main objective was achieved by identifying the anthropometric parameters, which are 4 in number: body weight(birth weight), body length, head perimeter and chest perimeter. The premature children with the highest birth weight are from the first group of prematurity according to the value weight of the dimensional characteristics for the analysed sample.

Premature babies with very low birth weight and extremely low birth weight especially new-borns less than 37 weeks gestational age. Those are characterized by a slower rate of body weight gain in the first two months of life, and the average rate is significantly lower compared to children aged gestational age 37 and older (Table 4).

Table 4: Dynamics of anthropometric indicators - body mass and body length in the first year of life in children born at different gestation levels

Age, months	GA > de 37 weeks		GA < 37 weeks	
	The length, cm	Body mass, gr.	The length, cm	Body mass, gr.
3	57,6±0,4	5320±90	51,2±1,3	3980±230
6	65,0±0,2	7350±90	58,5±1,3	6250±230
9	70,0±0,4	8820±100	67,0±1,4	7670±270
12	74,8±0,5	9710±100	71,5±1,8	9120±290

The change of body proportions in the process of raising the child occurs unevenly, so for premature babies are characterized by the following features of conformation and proportions: 1) physically disproportionate (relatively short neck and limbs, relatively large head); 2) predominance of the brain skull over the face; 3) the bones of the skull are soft, supple, the sutures and fountains



are open; 4) auricle underdevelopment; 5) lanugo abundant throughout the body, pronounced lubricant such as cottage cheese; 6) the umbilical ring is moved to the chest; 7) The external genitalia of girls and boys are not well-formed.

The analysis of the morphological features of premature babies served as a theoretical basis for the development of appropriate products for the analysed segment. Regarding the presented results, we conclude that there is a need for a new approach in the design of children's clothing with a flexible structure. Those will fit the following design principles: the principle of interchangeability of functional elements; the principle of universality of functional elements; the principle of multifunctionality of the elements; the principle of morphological transformation.

Thus, for the elaboration of functional products for premature children, the following aspects were taken into account: the dynamic modification by categories and degrees of prematurity of the anthropometric indicators; modification of the constructive parameters of the basic patterns for baby's clothing products depending on the dynamics of changes in dimensional indicators by gestational age; the compositional-constructive means of prolonging the life cycle of baby's clothing products.

5. CONCLUSION

The analysis of anthropometric data of premature babies is the primary source for the elaboration and development of standard constructions adapted to their needs. The clothing products are adapted to the needs of the wearer group, depending on the degree of prematurity. The primary purpose is to meet the requirements of safety, comfort, performance and easy access to the baby's body. Proper care through the easy use of medical devices, without disturbance and discomfort for premature babies, will be possible only through the use of these clothing units.

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