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STUDY REGARDING THE IDENTIFICATION OF THE ANTHROPOMETRIC DATA OF CHILDREN BORN PREMATURE

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Abstract. *The paper presents the one-dimensional statistical processing of anthropometric data following a study carried out in the period 2014-2018, within a neonatal therapy ward at the "Gheorghe Paladi" Municipal Clinical Hospital in Chisinau, Republic of Moldova, with a volume of 505 subjects. Medical records were analyzed from which data were taken that were later used as basic variables in the research: body mass (Mc), body length (Lc), head circumference (Pc), chest circumference (Pt). The analysis of the anthropometric data was carried out by means of the SPSS specialized statistical data processing program [1]. Based on the interpretation of the values of the statistical parameters, certain conclusions can be made regarding the dimensional characteristics of the clothing products that meet the functional requirements specific to this group of wearers. From the previously presented data, it can be seen that each anthropometric indicator changes its value depending on the growth and development of prematurely born children. This fact proves to us that the clothing products to be designed must take into account the degree of prematurity of the group of wearers and be functionally and ergonomically adapted to meet the needs and requirements of these wearers. Following the results obtained, through the statistical analysis of the data, the following aspects can be highlighted: the obtained values of the anthropometric indicators used can serve as initial data for the design of the proposed clothing products.*

Keywords: *values, anthropometric indicators, statistical processing, regression equations.*

1. INTRODUCTION

One of the strategic directions of the work focuses on the identification of the anthropometric parameters that are the basis for the development of functional adaptive clothing products capable of generating direct benefits including at the social level, which will contribute to increasing the quality of life of premature children [2-3]. It should be noted that the implementation of these products in intensive care units will have a considerable impact on the duration and manner of care for children with special needs (premature). The direct link with clinical parameters is made difficult by the fact that the therapeutic measures, consultations and medical help offered to children are different. Despite these limitations, it can be noted that there is no indicator (statistically calculated, clinically verified or standardized) that militates against the use of functional clothing. Thus, the designed products allow their integration into the safety of the health condition and the provision of immediate medical help. Overall, functional clothing products will help solve multiple simple problems, such as:

- reducing the heat loss of the child's body in the therapy ward;
- carrying out medical procedures without pain;
- giving a more pleasant and well-groomed appearance to the premature child;
- supporting a positive emotional state of parents.

In order to solve the problem of providing premature children with functional-adaptive clothing products, it is necessary to elaborate the dimensional typology. The solution to this problem is achieved by taking the anthropometric characteristics on representative samples of children's bodies with subsequent statistical

processing of the measurement results. The results of anthropometric research are used in the development of new anthropometric standards for the manufacture of clothing products for children born prematurely.

The analysis of scientific works by researchers from the Research Institute of Anthropology of Moscow State University shows that the optimal model of the anthropometric standard should be based on the knowledge of the correlation between the leading and subordinate characteristics [4-5]. Thus, a clear understanding of the nature of variability is very important when choosing a strategy for developing an anthropometric standard.

2. EXPERIMENTAL PART

The one-dimensional statistical processing of the anthropometric data collected following the analysis of medical records from the Municipal Hospital Public Institution "Gh. Paladi" from Chisinau, Republic of Moldova, the Care of Premature Children section, was the basis for obtaining standardized values that will serve as anthropometric indicators for the design of adaptive functional clothing intended for children born prematurely.

The studies carried out confirm the need to take over the anthropometric characteristics of children born prematurely, in order to analyse the nature of their changes in order to improve the quality of the adaptation of clothing products for premature children, as well as to create a new dimensional typology for this specific group of wearers. Through the statistical processing of the retrieved data, regression equations were established, based on which the anthropometric characteristics were analysed and compared with those from international standards (Alvanon).

The following parameters, included in the subjects' medical records, were used as basic variables in the research: body mass (Mc), body length (Lc), head circumference (Pc), chest circumference (Pt). For each anthropometric characteristic, the main statistical parameters characterizing the size and variability of the characteristic in the sample, the degree and nature of the correlation between the anthropometric characteristics were determined. The analysis of the anthropometric data was carried out by means of the SPSS specialized statistical data processing program [4]. The anthropometric data were subjected to one-dimensional statistical-mathematical processing, the following stages being completed:

- ✓ Calculation of the values of the following statistical parameters: The minimum number of the value n; Maximum number of value n; Amplitude of parameter variation in selection A; Mean value M; Mean selection error eM; Mean square deviation S; Selection variance, S2x; Skewness asymmetry coefficient; Kurtosis excess coefficient.
- ✓ Analysis of the variation of values for each mentioned indicator.
- ✓ Verification of the normality of the distribution of values calculated according to the legitimacy given by the Gauss-Laplace analytical relationship.
- ✓ Graphical representation and analysis of Gauss-Laplace normal distribution curves (probability distribution function graph) for the anthropometric parameters studied.
- ✓ Interpretation of the results of one-dimensional statistical processing.

Table 1
The values of the statistical parameters for Mc, Lc, Pc, Pt

The name of the statistical parameter	**Anthropometric dimensions/Statistical parameter values**			
	Mc (g)	**Lc** (cm)	**Pc** (cm)	**Pt** (cm)
Minimum value	650,00	30,00	20,00	21,80
Maximum value	2800,00	55,00	38,00	39,80
Amplitude of variation A	2150,00	25,00	18,00	18,00
The average M value	1937,33	43,70	30,84	32,64
Mean selection error eM	19,52	0,17	0,11	0,11
The mean square deviation S	438,59	3,79	2,39	2,39
Selection dispersion, S2x [u.m.2]	1923,2	14,38	5,74	5,74
Skewness asymmetry coefficient	-0,72	-0,80	-0,91	-0,91
Kurtosis excess coefficient	-0,35	0,41	1,46	1,46

From the data presented, it is found that each anthropometric indicator changes in value depending on the growth and development of children born prematurely. This fact proves to us that the clothing products to be designed must take into account the group of wearers and be functionally and ergonomically adapted to meet the needs and requirements of these wearers.

In order to increase the quality of clothing products for premature children, it is necessary to solve the problem of proportionality of manufactured products, the correspondence of their sizes with the anthropometric characteristics of children's bodies. At the same time, the values of subordinate anthropometric characteristics are calculated using the updated coefficients of the regression equation, determined on the basis of statistical processing of the results of anthropometric studies.

The purpose of the study is to ensure that the frequency estimates of the variants are as close as possible to the characteristic frequencies of the bodies of premature children, for which clothing products will be developed according to anthropometric standards. 20 anthropometric characteristics taken by the direct contact method were measured. The anthropometric characteristics were selected as a result of the analysis of the existing methods of designing children's products.

Since the optimal typology should take into account the variations of anthropometric characteristics due to various factors, the maximum correlation method was chosen as the main method of correlation of dependencies in the totality of characteristics [5]. The system of maximum correlations is used when developing an anthropometric standard. To obtain a system of maximum correlations, the pairwise coefficients for 20 anthropometric characteristics were studied. As a result, each of the anthropometric features included in the set was found to be connected with at least one feature, and the entire set was divided into groups of features interconnected by maximal connections. Taking into account the system of maximum correlations makes it possible to determine the areas of the child's body whose variability is maximally coordinated with each other, for a certain factor structure, and to make a qualitative assessment of the general form of variability. The values of the linear correlation coefficient are in the range (-1, 1).

In order to describe the intensity and the analytical form of the interdependencies between the studied variables, a series of regression relationships between various characteristics were specified. The choice of regression equations for the calculation of body type parameters of the child population is difficult due to the fact that the direction of the relationships changes in the process of raising children. To obtain a relatively simple form of dependence, the values of subordinate characteristics are calculated separately, in each of the selected groups of type bodies, called growth figures [4].

The regression equation in this case has a linear dependence of the form:

$$y = a + bx,$$

where: y - is a subordinate characteristic, x is the determining characteristic, b is a regression coefficient expressing the proportionality between the two variables, a is a free term.

Regression equations were established to determine the values of the subordinate anthropometric characteristics. In tables 2 and 3, the regression equations expressing the connections between the anthropometric characteristics studied, with the related correlation coefficients, were systematized.
Chest circumference is the independent variable identified for the following anthropometric characteristics: circumferences and widths. Body length is the independent variable for the anthropometric characteristic's lengths and springs.

Table 2
Analysis of anthropometric characteristics according to the independent variable: Chest circumference (p1= 32,60 cm)

Anthropometric characteristic	Notation	Regression relationship	R	F	Sig (F)	t	Sig (t)	DW
Head circumference	l1	l1= -1,8+1,00*p1	1,000	,	,	,	,	0,015
Waist (abdomen) circumference	p2	p2= 10.206+0,592*p1	0,579	24,761	,000	4,976	,000	1,892
Gluteal circumference	p3	p3 = 10,206+0,592*p1	0,579	24,761	,000	4,976	,000	1,892

Neck circumference	p5	p5 = 10,206+0,592*p1	0,433	11,325	,001	3,365	,001	1,616
Back width (shoulder points)	ls	ls = 14,186+0,02*p1	0,112	0,628	,432	0,792	,432	1,219
Hand joint circumference	p4	p4 = 5,167+0,177*p1	0,441	11,875	,001	3,443	,001	1,732
Arm circumference (biceps)	pm	pm = 7+0,104*p1	0,671	40,223	,000	6,342	,000	2,140
Thigh circumference	pc	pc = 15,251+0,089*p1	0,353	6,967	,011	2,640	,011	1,160

Table 3

Analysis of anthropometric characteristics according to independent variables: Body length (L = 43,90 cm)

Anthropometric characteristic	Notation	Regression relationship	R	F	Sig (F)	t	Sig (t)	DW
Waist length in front	lt1	lt1 = 10,416+0,005*L	0,028	,040	,843	,199	,843	1,879
Back waist length	lt2	lt2 = 10,734+0,02*L	0,138	,957	,333	,978	,333	1,890
Upper limb length	lm1	lm1 = -13,836+0,804*L	0,578	24,647	,000	4,965	,000	1,363
Side length from waist to knee	lt	lt = 3,725+0,053*L	0,273	3,957	,052	1,989	,052	1,812
Lower body arch	A	A = 9,967+0,207*L	0,533	19,436	,000	4,409	,000	2,475
The outer length of the lower limb	lp1	lpl = 12,637+0,119*L	0,257	3,468	,069	1,862	,069	1,864
Inside length of member	lp2	lp2 = 12,774+0,057*L	0,250	3,259	,077	1,805	,077	1,884
The length of the sole of the foot	tp	tp = 2,067+0,114*L	0,215	2,383	,129	1,544	,129	1,959

Legend: *R - correlation coefficient; F - File test; Sig - coefficient of significance; t - Student's test; DW - Durbin Watson test*

By substituting the values of the independent variables - the main anthropometric parameters (chest circumference, body length) in the regression equations, the values of the secondary anthropometric characteristics can be calculated, which are later used in the design of clothing for premature babies. The values of the secondary anthropometric parameters, calculated by the established regression equations, characterize the typical body parameters of premature children.

The obtained values of the correlation coefficients were subjected to validation processes based on the Student's test, so that only the specific regression relationships with significances that exceed the probability threshold of 0.95 were exclusively retained, so that it can be claimed that the obtained equations can be applied when calculating the values of the secondary dimensional characteristics, when a new dimensional typology is developed. A comparative analysis of the values of the anthropometric characteristics calculated according to the obtained regression equations and the data from the Alvanon standards [7] was also performed, which showed the nature of the differences between the dimensional characteristics retrieved and statistically processed. The values of the dimensional characteristics of the typical bodies of prematurely born children obtained according to the regression equations were compared with the values of the typical bodies of children from the Alvanon anthropometric standards for various geographical areas: Asia, the USA and North America, which are presented in table 4.

Table 4.

Comparative analysis of the anthropometric characteristics of the bodies of premature children obtained by regression equations and those presented in the Alvanon anthropometric standards

No. crt.	Anthropometric characteristic	Standard ASIA (Alvanon)	Standard US ASTM (Alvanon)	Standard North America (Alvanon)	Regression relationship
1	Body length	44	44,5	43,2	43,90
2	Waist length in front	10,75	11,25	10,2	10,64
3	Back waist length	11,75	12,25	11,7	11,61

4	Upper limb length	22	23	23,2	21,46
5	Side length from waist to knee	-	-	-	6,05
6	Lower body arch	17,5	19,5	19,4	19,06
7	The outer length of the lower limb				17,86
8	Inside length of member	15	13	14,6	15,28
9	The length of the sole of the foot	-	-	-	7,07
10	Chest circumference	31,75	35	33,3	32,60
11	Head circumference	33	35	30,8	30,80
12	Waist (abdomen) circumference	31,75	35,5	34,3	29,50
13	Gluteal circumference	30	35,5	32,1	29,50
14	Neck circumference	17,25	18,25	18,7	19,11
15	Back width (shoulder points)	13,75	15	15,2	14,84
16	Hand joint circumference	-	-	-	10,94
17	Arm circumference (biceps)	10,5	10,25	10,8	10,39
18	Thigh circumference	17	19,5	19,4	18,15

Following the results obtained, through the statistical analysis of the data, the following aspects can be highlighted: the calculated values of the anthropometric indicators used can serve as initial data for the design of the proposed clothing products. The comparative analysis of the data presented in various standards, with the data obtained by the authors, according to the established regression equations, serve as an argument that the dimensional parameters of the examined children fall within the world trends. The identification of dimensional parameters for this category of carriers and the functional design of adaptive products will ensure their correspondence with prematurity groups and their requirements.

3. CONCLUSIONS

The identification of the morphological, conformational, functional and ergonomic characteristics of prematurely born children serve to design adaptive functional products intended for this group of wearers. Through the study conducted on a sample of 505 children born prematurely between 2014 and 2018, the values of the main anthropometric indicators taken by the medical staff and entered in the medical records of each child were analysed. This study aimed to establish the values of anthropometric characteristics that can be included in anthropometric standards, which are necessary to obtain functional products adapted to the body shape and dimensions corresponding to premature babies.

The anthropometric data taken from the medical records were processed by means of the SPSS specialized program. After the statistical-mathematical processing of the data, through the SPSS system, it was identified that they represent important indicators for calculating the indicators of longitudinal and transverse proportions that are useful for substantiating the specific mathematical relationships of the geometric method of 2D design of clothing product patterns.

Therefore, the data obtained from the statistical-mathematical processing will be used to develop the basic patterns of the new functional products proposed for prematurely born children.

The studies were carried out according to the methodology of anthropometric investigation of the group of carriers, respecting the general prescriptions and basic principles, the accuracy of measurement, the way of marking the anthropometric points, the way and the place of storage of the collected data.

Based on the interpretation of the values of the statistical parameters, certain conclusions can be made regarding the dimensional characteristics of the clothing products that meet the functional requirements specific to this group of wearers.

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