THE PROCESS OF DESIGNING THE CHILDREN`S CLOTHES FOR TRAININGS ON ROLLER-SKATES

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Abstract: *The article deals with the ways of improvements in the process of designing the children`s clothes for trainings on roller-skates at the stages of determination the initial data for construction of the base design and development of modified design. It presents the results of anthropometric researches of children at the age of 4 – 5 years. The article describes the method of determination the location and size characteristics of protective elements, which has been proposed by the authors. It is proposed the methodology for development the model designs of multifunctional clothes for children who have trainings on roller-skates.*

Key words: *clothes for rollerbladers, designs-modifications, measures, multifunctional children`s clothes, protective elements.*

1   INTRODUCTION

In the market economy the primary objective of every businessman is the production of competitive products. A demand for children`s clothes is quite high due to a small period of its exploitation because of the rapid changes in anthropometric characteristics of the child`s body. Designing of children`s household garments with additional functions is the up-to-date trend. Such kind of clothing includes children`s clothes for trainings on roller-skates. Researches, which were conducted by the authors [1, 2], showed that parents began to teach their children skating on roller-skates at the age of 4 – 5 years and used for this purpose everyday clothes of sports style, which did not have protective properties against bumps when falling on the parts of the body that were not protected by means of individual protection. In such clothes children felt pain syndrome when falling and it caused a sensation of fear during the further trainings and unwillingness to continue their trainings at all. There are some special protective children`s clothes at the market, but such clothes are not so popular among the consumers because of the high price and narrowly focused purpose. Also its production is inefficient in terms of use of the energy and resources due to the predominance of the product life cycle on the cycle of its usage (the child is growing faster than the cloth of his/her size is wearing out). Therefore, an actual task is to create everyday clothes with enhanced additional functions. The authors consider that one of the main task in designing the children`s clothes for trainings on roller-skates is to create everyday clothes which can be transformed into the clothes with protective elements.

2   PREPARATION OF INITIAL DATA FOR DESIGNING OF MULTIFUNCTIONAL CHILDREN`S CLOTHES FOR TRAININGS ON ROLLER-SKATES

In actual practice the process of designing of the clothes can be divided conventionally into such stages [3]: informational and schematic design; determination of initial data; selection of methods and preliminary estimation of the design; construction of the base design; modeling the base design for obtainment of the draft of the designed model; quality control of the product design.

One of the most important stages in the clothing design process is the construction of a high-quality base design, on the basis of which design engineer through modeling can get the final patterns of the designed product in the future. The quality of the base design as the developed view of the human body depends on the correctness of the initial data (anthropometric characteristics of the human body) as well as on the correctly chosen method of construction and conducted calculations. These two factors affect the quality of the base design independently from the chosen design mode (manual or automated).

Determination of the base design is based on the anthropometric characteristics, which the design engineer determines using the effective normative and technical standards [4-9].

Designing of the children`s clothes is based on the classification of the child population according to the age. As the researches have shown [1, 2], the average age of the children who are starting to have trainings on roller-skates, is 4 – 5 years. This subgroup of consumers is included into the pre-school age group of typical form of children at

the age of 3 till 6.5 years. For children from pre-school age group it is recommended to construct the base design of a typical form: height – 110 cm; chest circumference III – 56 cm; waist circumference – 51 cm. The clothes for this group of children for mass production are designed in the diapason of the following measures: height – 98 ÷ 116 cm; chest circumference III – 52 ÷ 60 cm; waist circumference – 48 ÷ 54 cm. Such measure characteristics do not allow determining the basic anthropometric data for 4 – 5 years children. We can assume that dimensional features of this subgroup may be in the middle of diapason of measure characteristics of the whole group; however, we need to conduct the additional anthropometric researches to confirm such assumption.

Also there are researches [10], which show that anthropometric information loses its accuracy in 10 – 15 years due to the process of acceleration. As the abovementioned normative and technical standards were created and put into operation more than 15 years ago, their update for the purpose of designing the multifunctional children`s clothes is quite relevant.

3 RESULTS OF THE EXPERIMENTAL RESEARCHES OF ANTHROPOMETRIC DATA FOR DESIGNING THE CHILDREN`S CLOTHING FOR TRAININGS ON ROLLER-SKATES

The purpose of the experimental researches was to select the limited number of typical forms of the children at the age of 4 – 5 years according to the measures for designing clothes for trainings on roller-skates. This will ensure the high level of satisfaction of consumers demand.

Anthropometric researches were conducted by a contact method, using measuring tape and a set of rulers by the methodology of taking standard measures in accordance with the requirements of normative and technical standards [6, 7]. The children at the age of 4 – 5 years, who live in Kyiv region and attend educational institutions for children of pre-school age, took part in the anthropometric survey.

As the result of such research, it was determined that the abovementioned methodology of taking measures of the human body did not consider the psychological and age characteristics of children from the pre-school age group. So, in this age children show a specific ability for active movable way of communication with the world of adults due to their anatomical and physiological characteristics. Based on the above, it is recommended during the conduction of the anthropometric researches of children of pre-school age group: firstly, to divide all children into small groups of three people; secondly, to use three instruments with the same

accuracy class for measures to avoid the accidental errors during the measurement of one value; thirdly, to spend no more than 3 – 5 minutes for taking measures of one child with breaks for taking measures of other members of the group; fourthly, the measures on one value by one measurement instrument should be carried out at least twice; fifthly, before every measurement you should answer all questions, which the child has and allow to hold all instruments which you are planning to use during the measurements if the child wishes so.

The implementation of such recommendations will improve significantly the convenience and accuracy of conduction of the anthropometric researches of children of pre-school age group.

During the process of anthropometric studies 400 children (50% - boys, 50% - girls) were admeasured, the results of such measurements were processed by methods of mathematical statistics. As a result, it was found that 48% of girls at the age of 4 – 5 years have the height of 104 cm; 33% – 100 cm; 50% have chest circumference III 56 cm; 41% – 52 cm; 38% have waist circumference 51 cm; 31% – 48 cm; 44% of boys at the age of 4 – 5 years have the height of 110 cm; 37% – 104 cm; 68% have chest circumference III 56 cm; 24% – 60 cm; 41% have waist circumference 51 cm; 35% – 54 cm.

Those results made it possible to identify the measures of the typical forms, which were the closest to the most frequently encountered measures of children at the age of 4 – 5 years (Tables 1, 2).

Table 1 Fragment of classification of typical forms of girls [4]

Age group (age, years)	Width group	First one		
	Chest circumference III	52	56	60
	Waist circumference	48	51	54
Pre-school (3.0 – 6.5)	*Height*	98	98	
		104	104	
		110	110	110
			116	116

Table 2 Fragment of classification of typical forms of boys [5]

Age group (age, years)	Width group	First one		
	Chest circumference III	52	56	60
	Waist circumference	48	51	54
Pre-school (3,0 - 6,5)	*Height*	98	98	
		104	104	104
			110	110
			116	116

Note. The frame encircles the typical forms, on the basis of which the product for mass production is designed. Gray color highlights the typical measures, which are the closest to the measures of children at the age of 4 – 5 years according to the results of the researches

4 CONSTRUCTION OF THE DESIGN OF MULTIFUNCTIONAL CHILDREN`S CLOTHES WITH THE PROTECTIVE ELEMENTS

In order to construct the base designs of children`s clothes for trainings on roller-skates, well-known methods of designing, which are offered by many authors, are used. A feature of the construction of the model designs is the necessity to take into consideration not only aesthetic requirements, but also ergonomic ones (for example, place of location of the protective elements for protection of the child`s body when falling, size of details for easy movement, etc.). Therefore, the improvement of the process of designing the model designs of multifunctional children`s clothes with protective functions from the pain at falling for trainings on roller-skates is relevant and in the future will allow to create a competitive children`s garment products of mass production.

To obtain a high-quality design of multifunctional children`s clothes, where all ergonomic requirements are taken into account [2], it is necessary to identify the location of anthropometric points on the child`s body, which take the impact forces at falling, and determine the method of their transferring to the model of the clothes. For this purpose the authors proposed the method of direct contact of production prototypes of the clothes on the child`s body with the surface, which creates the impact forces during the trainings on roller-skates.

A group of children at the amount of 5 persons with the recommended measures (waist circumference – 51 cm, chest circumference III – 56 cm) (see Tables 1, 2) was selected for the experiment. Using the known method, the base design of trousers and outerwear shoulder clothes was constructed for the form: height – 104 cm; chest circumference III – 56 cm with the minimum additions; waist circumference – 51 cm. After that 10 samples of the children`s clothes (trousers and jackets) from prototyping cotton fabric were produced, in which children had trainings on roller-skates on asphalt platform with pre-coated graphite coating (Figure 1).

Figure 1 Photo of the child in prototype sample, after the experiment

After the conducted experiment the details of the prototypes were put on the paper construction and the places of the most intensive contaminations (Figure 2) were transferred on the construction by the method of splitting (Figure 3). The values of the tests of every sample were processed by the methods of mathematical statistics and, as a result, the minimum sizes of the protective elements and their optimal location on the details of design were identified (Figure 3).
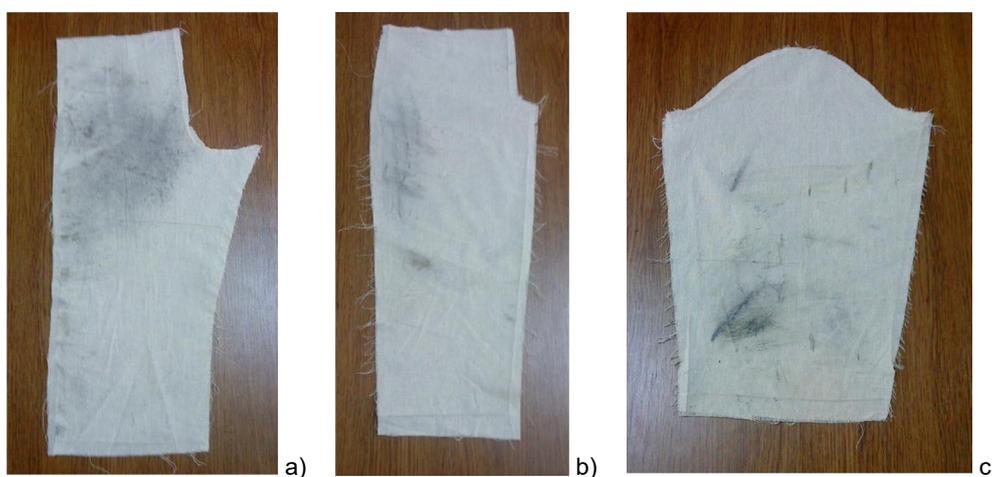

a)   b)   c)

Figure 2 Details of prototypes of the children`s clothes with the graphite contamination in the places where child`s body in the prototyped clothes contacted with the impact surface: a) back half of the trousers; b) front half of the trousers; c) sleeve
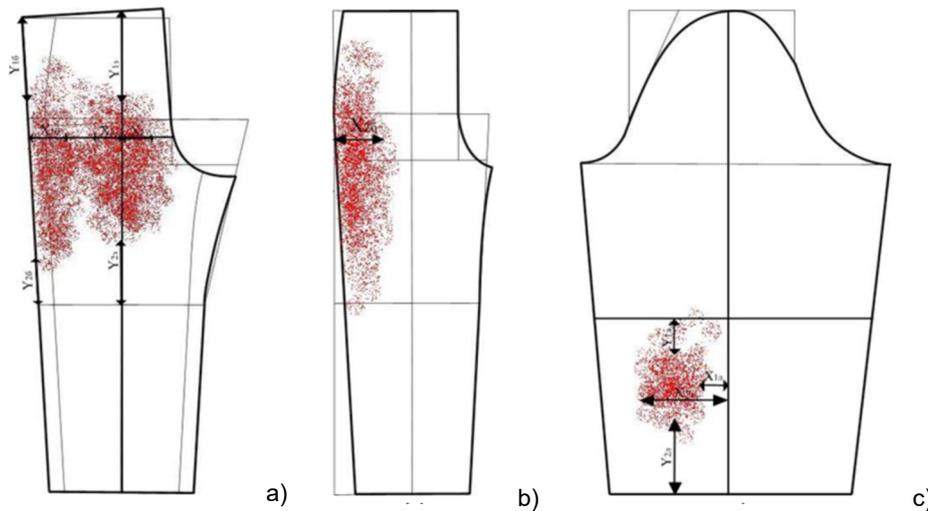
Figure 3 The topography of allocation of areas of contamination at the details of base design of the children`s clothes with obtained segments for its modification: a) back half of the trousers; b) front half of the trousers; c) sleeve

The topography of allocation of areas of contamination at the details of base design of the children`s clothes allowed to get the size characteristics of the protective elements, which are presented in Table 3.

The studies provided the information, which made it possible to develop the sequence of modification of the base construction of the children`s clothes, taking into account ergonomic requirements (place and optimal sizes of the protective elements).

The constructed design is presented at Figure 4 by the full line.

Protective elements from the pain at falling, which exist in the clothes nowadays, due to their qualitative and structural characteristics may be divided into three main groups: 1 – multilayered package of traditional materials for clothes; 2 – new composite materials; 3 – cushioning materials for household and industrial purposes. They can be used as removable elements or as structural parts of the clothes.

Table 3 Size characteristics of the protective elements of children`s clothes

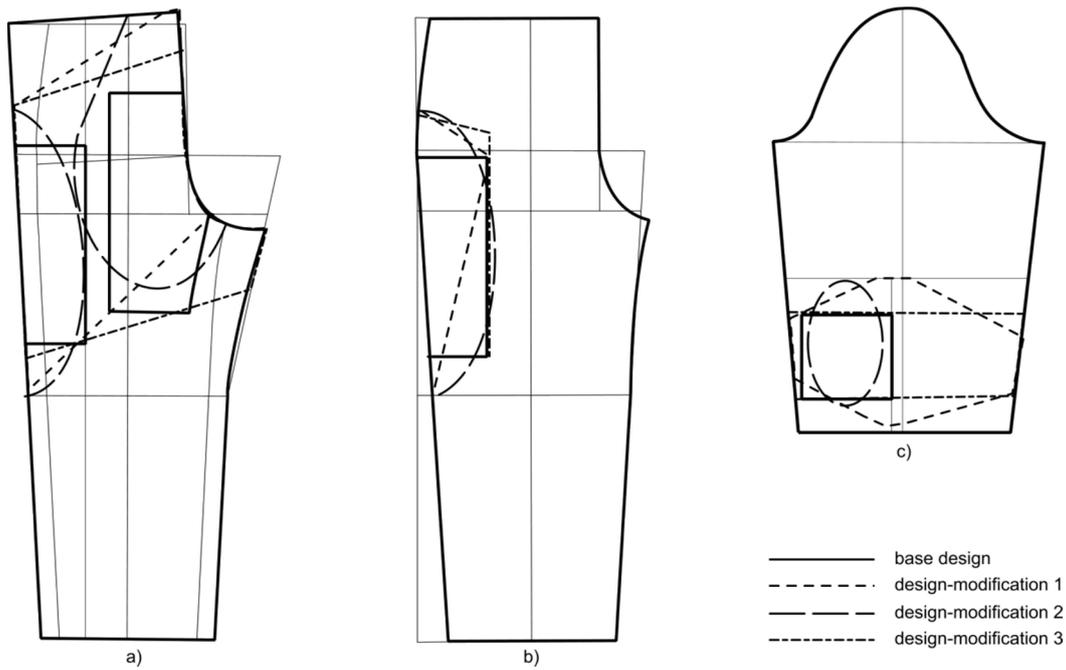| Name of the elements	Size of the elements	Image of the elements
Protective element of the elbow part of the sleeve	a = 6.0 b = 6.5	
Side protective element of the trousers	a = 14.0 b = 9.0	
Back protective element of the trousers	a = 15.0 b = 8.0 b$_1$ = 6.0	

Figure 4 Modified base design of the children`s clothes for trainings on roller-skates with protective elements and modeling of designs-modifications: a) back half of the trousers; b) front half of the trousers; c) sleeve

Using modified design of children`s clothes for trainings on roller-skates, designed by means of constructive modeling (Figure 4), it is possible to get a range of products with a variety of forms and types of protective elements (Figure 5).
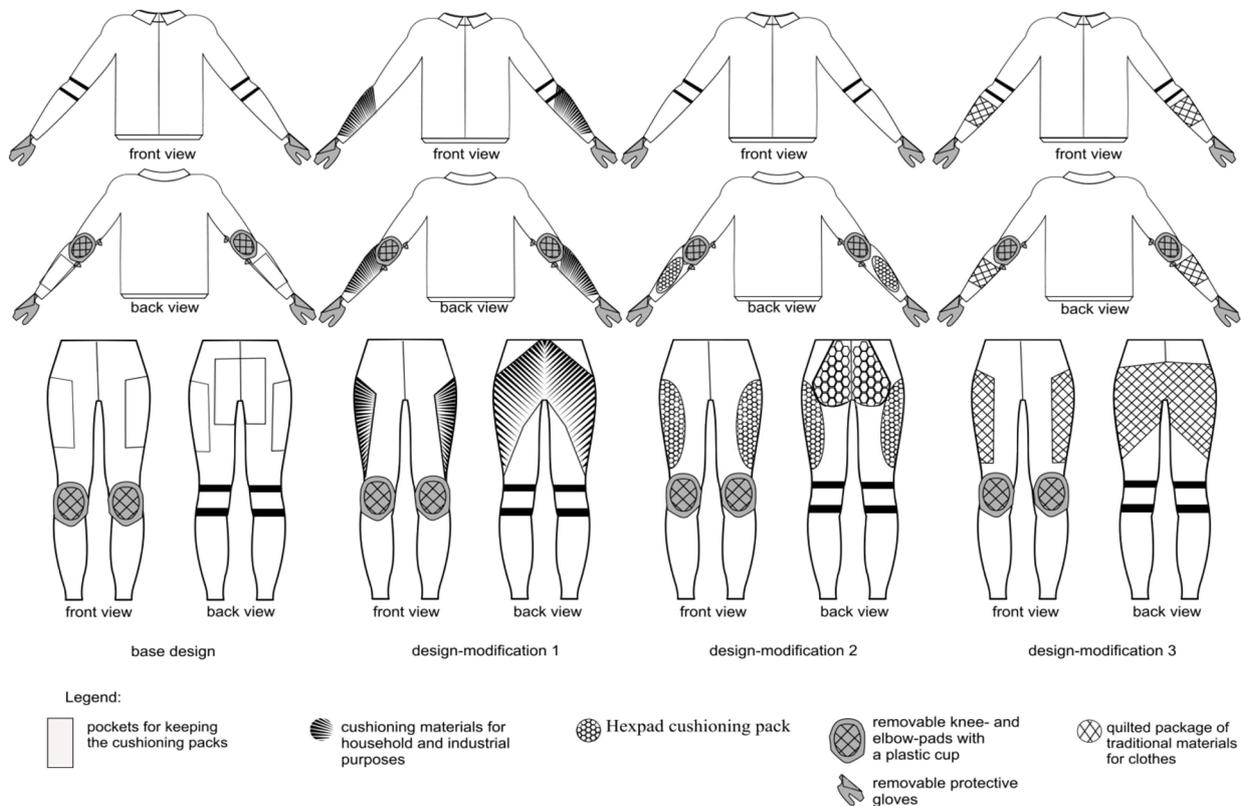

Figure 5 Sketches of the model range of children`s clothes for trainings on roller-skates with different forms and types of protective elements

The package of materials of the base design is the following: top fabric – cotton 95%, elastane 5%, surface density 220 g/m^2; pockets fabric – cotton 100%, surface density 270 g/m^2. The package of materials of the design-modification 1 is the following: top fabric – cotton 100%, surface density 165 g/m^2; protective elements consist of two layers: the protective one – of elastic expanded polyethylene with a uniform closed cell structure, density 25 kg/m^3, thickness – 10 mm, and the coating one – of cotton 30%, PE 70%, surface density 210 g/m^2. The package of materials of the design-modification 2 is the following: top fabric – cotton 100%, surface density 165 g/m^2; protective elements consist of two layers: the protective one – of Hex-Pad material and the coating one – of DuPont Coolmax material. The package of materials of the design-modification 3 is the following: top fabric – cotton 100%, surface density 165 g/m^2; protective elements consist of two layers: the protective multilayer one – of padding polyester (100% PE), surface density 150 g/m^2, and the coating one – of cotton 30%, PE 70%, surface density 210 g/m^2.

5   CONCLUSIONS

Conducted anthropometric studies allowed to identify the most frequently encountered measures of children at the age of 4 – 5 years for designing clothes for trainings on roller-skates. As a result of experimental researches the locations of protective elements on the details of children`s clothing design and its dimensional characteristics were identified. The range of children`s clothes for trainings on roller-skates, considering the received locations of the protective elements, was developed and variants of the materials packages were offered. The proposed methodology of designing the model range of multifunctional children`s clothes for trainings on roller-skates takes into accounting ergonomic requirements and can be implemented into the modern systems of automated designing of the clothes.

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