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Anthropometric Data Of Women In Kazakhstan For Corsetry Design

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Abstract:
The article deals with the anthropometric measurements of women in the Republic of Kazakhstan, in relation to the corsetry design. As the basis of the values of female measurements the sampling of 1,500 women were taken. Also, in the article the basic information describing the data of women statistical processing are described: average values, standard deviations, coefficients of asymmetry and kurtosis coefficients, coefficient of reliability of selective indicators and error (E).
Keywords: anthropometric studies, female figures, dimensional signs, corsetry design.

INTRODUCTION

New course of the economic policy of Kazakhstan till 2050 is aimed at comprehensive economic pragmatism, acceptance of any economic and administrative decisions in terms of economic viability and long-term interests and identification of new market niches (Message of the President, 2012).

First works aimed at the need to the use of anthropometric materials in determining the amount of clothing appeared in the early 30s of the 20th century.

In the early 50s anthropological theory and methods of standardization with respect to the mass production of products for personal use were developed. Professor M.V. Ignatiev found that one of the main problems in the construction of a rational dimensional typology is the choice of major dimensional traits that better predetermine all other features. Meantime, the quantitative rationality criterion of that is the degree of satisfaction. In this case, satisfaction means the relative number of people to which products fit by size, made in accordance with the standards of the proposed system. It was also proved that leading dimension traits better perform their function in case they are most related to the subordinate traits and least related to each other. On this basis, a breakdown of the garments on sizes and subsizes started to be made by the two largest (total) dimensional traits of the body, oriented in different directions (chest girth and body length – growth) (Ignatiev, 1989).

Later it became clear that two leading traits do not provide sufficient satisfaction of the population as at constant value of the chest girth there is still a great self-variability in waistline and hips girth, despite the high degree of their correlation with the chest girth. Waist and hips girth with the protruding belly reflect best the age variability of figures of the adult population, so they have also been identified as the leading features that characterize the type of fullness of adults. Therefore, in women the girth of the hips with protruding belly has been made as a third leading (corpulence) trait, and in men – waistline girth.

In 60-70ss there was an attempt to create a single dimensional typology of the population of not one, but several countries, particularly the countries of the Council for Mutual Economic Assistance (CMEA) for the first time in the history of the anthropological standardization dimension.

The result of the joint work of specialists from countries – members of CMEA was the creation of CMEA recommendations for standardization of dimensional traits of the figures of these countries' population. Developed series of government and industry standards guaranteed the proportionate clothes about 83% of male and 64% of female population, instead of 67 and 56% according to previous standards (United technique, 1989).

In the development of a uniform dimensional typology for the population of the countries – members of CMEA as typical figures were highlighted all the figures, the incidence of which is not less than 0.1%. Thus, 360 types of figures were found for the male population of all the countries – members of CMEA and 509 types – for females (United technique, 1989).

After finding the number of typical figures, for each of them anthropometric size-length standards for all subordinate features are calculated.

The previous classification of figures covers all female population of the former Soviet Union, but every 10-15 years (in some countries in 5-6 years, for example in South Korea) anthropometric standards should be updated due to the influence of acceleration, environmental changes, etc. It is known from press reports that due to the changes in the size, shape and proportions of the human body European countries – Germany, Belgium, Greece, United Kingdom, Switzerland and Spain – have performed a large-scale campaign on anthropometric survey of the population for designing clothes (Lopandina, 2010).

Providing high quality of the corsetry, renewal and expansion of their product range, improvement of public satisfaction by proportionate, comfortable, easy-to-use products with high functional and aesthetic properties is the subject of this article. To solve this problem it is necessary to create the database of the corsetry design, based on the data of anthropometric researches of Kazakh consumers figures (anthropometric characteristics, improvement of the dimensional typology, methods of designing clothes based on the most common types of figures in Kazakhstan and their individual characteristics) in order to release product demanded by the consumption market.

Method

Object of the research is anthropometric studies of the female population of the Republic of Kazakhstan, creation a new dimensional typology with age-appropriate keeping, as well as the creation of two new anthropometric measurements: HCW – height of the chest wrinkles and HPC – height of the protrusion of the chest, adapted just to the process of constructing parts of the corsetry.

The garment industry of Kazakhstan uses new classification typology of the population of the Russian Federation as the basis for design of clothes, where the following are comprising a separate group: GOST 31400-2009 "Classification of typical figures of men extra-large sizes" (GOST 31400-2009, 2011); GOST 31397-2009 "Classification of typical figures of women extra-large sizes" (GOST 31397-2009, 2011); GOST 31398-2009 "Classification of typical figures of pregnant women" (GOST 31398-2009, 2011). In Korea the classification of typical figures is different in that the measurement clothes system is divided: for men and for young men (KS K 0050, 2004; KS K 9400, 2004); for women and for young girls (KS K 0051, 2004; KS K 9401, 2004).

But, at the present stage of corsetry designing, the competitiveness of garment in the Republic of Kazakhstan should be improved, by updating the anthropometric measurements of women, taking into account regional, ethnic and age characteristics.

Results

Actual problem is the design of garments to the figures with deviations from the conditionally typical model. As it is known that since the beginning to the middle of the 1970-es the increase in the average growth of people was observed. In the 1980-es this process ended. Now there is another trend: the majority of people is getting fat. According to anthropologists and sociologists, it is not only because of the stress and a sedentary lifestyle, but because of the innate instincts. By the end of the 20th century the number of people who have unlimited access to high-calorie food sources increased dramatically. It is predicted that by 2025, 75% of the US population will be overweight. Also a problem of aging is added: according to Dr. Charles Derass Lee of Stanford University, in the 21st century at least 20% of the population will be over 60 years old (Ovechkin, 2000).

History of improving design of garments can be divided into morphological, anthropometric and ethnic changes in population and development of clothes design under the influence of fashion (Koblyakova, et al., 1988).

The required sample size is sufficient, allowing by the characteristics of the selected units to judge the entire population characteristics and plays an extremely important role in further statistical studies. The size of the sample of the female population is defined by the population census in the Republic of Kazakhstan in 2009, the total population amounted to 16,004.8 thousand people. One of the most surprising results of the census was a sharp decline in the share of urban population from 56.3% to 54.0% and a corresponding increase in the share of rural population (Census of Kazakhstan, 2009).

After determining the percentage of the number of women in Kazakhstan to be measured, locations of anthropometric measurements were identified: Almaty, which today is a home for about 1.5 million inhabitants; Astana – 750,000 people; Taraz – 326,113 people. Shu area with a population – 94.8 ths. people is one of the largest areas of Jambyl Region. In total there are 86 cities in Kazakhstan (RK Census, 2009). In table 1 there is a list of cities in Kazakhstan, where 1,500 of women of all ages were directly measured.

Table 1 – List of cities in Kazakhstan and the number of women including age composition of the sample size

Name of the city	Age group				Number of women measured
	18-29	30-39	40-49	50 and more	
Astana	43	64	31	59	197
Almaty	297	171	70	269	775
Taraz	28	19	27	16	90
Jambyl Region	98	43	167	130	438
Total	434	297	295	474	1500

As shown in Table 1, the number of women is in accordance with the measured volume of sample. In RK similar studies have not been conducted since 1997 (Baskimbaeva, 1997).

As a result, anthropometric study of women of the Republic of Kazakhstan established: anthropometric points; dimensional signs and methods of measuring; values of measurable traits required for the corsetry design.

Standard methods of mathematical statistics were used in the study that characterize the value and variability of the trait in the sample, and therefore in the general population (Dunaevskaya, et al., 2001; Moskalenko, 2012; Nivorozhkina, et al., 1999; Ledeneva, et al, 2010). Average values of dimensional traits of women in Kazakhstan were developed, effect of age features on dimensional traits was studied.

Necessary dimensional traits for designing parts of corsetry are shown in Table 2.

Table 2 – Description of dimensional traits

Group	Name of the measurement	Method of the measurement
Girths	Chest girth first (CG1)	Measured on a person standing straight and is the maximum horizontal girth at normal breathing. Measuring belt runs along the bottom edge of the scapula behind, under the armpits and front – above the base of the milk glands
	Bust girth (for women)	Maximum horizontal girth at normal breathing. Person is standing strait, tape runs along the scapula, armpits and protruding portions of the milk glands with a medium tension(without unnatural changes of the breast shape and volume).
	Girth under breast	Horizontal girth of the body under the breast (measuring belt passes under the base of the breast).

	Waist girth	Girth of natural waistline between the ilium and the lower ribs. When measuring, a person breathes normally, stands upright with a relaxed belly, measuring belt is not tightened.
	Hips girth	Horizontal girth measured at the most protruding portions of the buttocks.
Length	Height	Vertical distance from the top of the head to the soles of the feet. When measuring a person stands straight, without shoes, feet together.
Heights	Height of the chest wrinkles (HCW)	Vertical distance from the natural waistline to the basis of the milk glands.
	Height of the protrusion of the chest (HPC)	Vertical distance from the base of the breast to the protruding points of the breast
Width	Distance between the breast point (center of the breast)	The measurement is made horizontally between the exposed breast points.
Depth	Waist depth 1 (Wd_1)	Measured horizontally the distance from the vertical plane, tangent to the scapula points to the line applied horizontally to the longitudinal back muscles at the level of waist line.

The introduction of new two dimensional signs: height of the chest wrinkle (HCW) and height of the protrusion of the chest (HPC) is the basis for making an improved method of corsetry design.

Necessary for the corsetry design average anthropometric measurements of dimensional traits of 1,500 women of Kazakhstan are presented in Table 3.

Table 3 – Data of average arithmetic values of anthropometric measurements of women in Kazakhstan

Measurement	Mean	Min	Max	S.D.	m(x)
Chest girth first (CG1)	92.6	76.5	115.5	8.2	0.44
Breast girth	96.5	80.7	118.8	8.6	0.46
Girth under breast	82.7	65.2	113.5	10.92	0.59
Waist girth	103.8	87.5	131.9	9.97	0.51
Hips girth	19.9	16.5	25.0	1.7	0.08
Height	164.1	154.87	177.2	5.15	0.27
Height of the chest wrinkle	7.27	3.57	11.5	1.56	0.08
Height of the protrusion of the chest	6.6	4.2	11.5	1.32	0.08
Center of the breast	4.0	1.4	8.8	1.42	0.06
Waist depth 1	11.3	8.1	16.0	1.65	0.08

Data and evaluation of average arithmetic values (Mean), the average standard deviation (S.D.), skewness (Y1), kurtosis (Y2), the reliability of selective indicators (m(x)) and error (E) for groups of the female population of the Republic of Kazakhstan with age-appropriate.

Table 4 – Statistical analysis of female population in Republic Kazakhstan (18-29 years old)

Measurement	Mean	min	max	S.D.	m(x)	Y_1	Y_2	E, %
Chest girth first (CG1)	85.6	74.0	109.4	7.0	0.40	1.09	1.3	0.0021
Breast girth	89.4	78.0	113.4	7.0	0.40	0.2	0.7	0.0006
Girth under breast	72.9	60.0	98.8	7.5	0.43	1.3	1.7	0.0026
Waist girth	72.3	60.0	105.0	9.3	0.54	1.3	1.7	0.0025
Hips girth	97.7	86.0	123.0	7.5	0.33	1.3	1.5	0.0024
Height	167.0	157.5	180.4	5.2	0.30	0.5	0.1	0.0008
Height of the chest wrinkle	12.3	9.0	17.3	1.85	0.1	0.12	0.57	0.0005
Height of the protrusion of the chest	6.6	4.2	11.5	1.32	0.08	0.18	0.199	0.0003
Center of the breast	18.0	14.5	23.4	1.6	0.09	0.5	0.2	0.0004
Waist depth 1	4.4	2.0	9.5	1.35	0.08	0.71	2.61	0.0023

Table 5 – Statistical analysis of female population in Republic Kazakhstan (30-39 years old)

Measurement	Mean	min	max	S.D.	m(x)	Y_1	Y_2	E %
Chest girth first (CG1)	91.7	75.0	114.4	8.2	0.47	0.3	0.3	0.0005
Breast girth	95.7	80.0	118.4	9.2	0.53	0.5	0.6	0.0009
Girth under breast	80.9	65.5	100.4	9.6	0.55	0.3	0.9	0.0009
Waist girth	81.4	65.5	114.4	11.8	0.68	1.0	0.1	0.0009
Hips girth	102.7	86.8	130.0	10.4	0.60	0.8	0.1	0.0010
Height	165.5	156.0	177.4	5.1	0.29	0.4	0.4	0.0003
Height of the chest wrinkle	11.2	8.3	15.8	1.62	0.09	0.56	0.185	0.0008
Height of the protrusion of the chest	7.0	4.0	11.0	1.79	0.10	0.079	0.614	0.0004
Center of the breast	19.6	16.0	24.4	1.7	0.09	0.2	0.4	0.0004
Waist depth 1	4.09	1.4	9.0	1.47	0.08	0.84	0.47	0.0013

Table 6 – Statistical analysis of female population in Republic Kazakhstan (40-49 years old)

Measurement	Mean	min	max	S.D.	m(x)	Y_1	Y_2	E %
Chest girth first (CG1)	96.2	77.0	118.7	8.8	0.51	0.3	0.1	0.0003
Breast girth	100.2	82.0	121.4	9.1	0.52	0.1	0.5	0.0005
Girth under breast	83.9	67.0	108.5	9.3	0.54	0.1	0.5	0.0004
Waist girth	86.4	66.0	115.4	10.7	0.62	0.4	0.03	0.0005
Hips girth	106.6	88.0	135.4	10.7	0.62	0.3	0,6	0.0006
Height	162.4	154.0	176.0	5.1	0.29	0.6	0.09	0.0008
Height of the chest wrinkle	10.9	8.0	15.5	1.49	0.08	0.33	0.143	0.0005
Height of the protrusion of the chest	7.7	4.0	11.8	1.53	0.09	0.045	0.194	0.0001
Center of the breast	20.8	17.5	25.8	1.7	0.09	0.5	0.3	0.0007
Waist depth 1	4.0	1.4	8.5	1.64	0.09	0.8	0.12	0.0010

Table 7 – Statistical analysis of female population in Republic Kazakhstan (50 and over)

Measurement	Mean	min	max	S.D.	m(x)	Y_1	Y_2	E %
Chest girth first (CG1)	96.9	80.0	119.4	8.8	0.4	0.3	0.4	0.0006
Breast girth	100.9	83.0	122.2	9.1	0.41	0.2	0.4	0.0005
Girth under breast	87.7	72.0	109.4	7.8	0.35	0.1	0.4	0.0002
Waist girth	90.8	69.5	119.4	11.9	0.54	0.2	0.3	0.0005
Hips girth	108.5	89.5	139.4	11,3	0.51	0.6	0.1	0.0008
Height	159.6	144.0	173.0	5.8	0.26	0.09	0.05	0.0001
Height of the chest wrinkle	10.8	7.3	15.5	1.66	0.07	0.2	0.318	0.00005
Height of the protrusion of the chest	7.8	4.0	12.8	1.6	0.07	0.446	0.51	0.0008
Center of the breast	21.3	18.0	26.5	1.8	0.08	0.5	0.09	0.0006
Waist depth 1	3.7	1.0	8.5	1.25	0.005	0.69	1.37	0.0016

The results of the statistical analysis show that all anthropometric measurements are different. With the ageing, the following dimension traits increase: girths – chest, waist, hips (figure 1); width – the center of the chest (Figure 2); waist depth 1 (Figure 3). Simultaneously the growth of 18-29 reduces to 167.0 cm; 30-39 – 165.5 cm; 40-49 – 162.4 cm; 50 years and more – 159.6 cm. Generally growth reduction is depending on the age factor and reduces from 1.5 cm. to 3.1 cm. Age dynamics of dimensional traits HPC and HCW are shown on Figure 1.

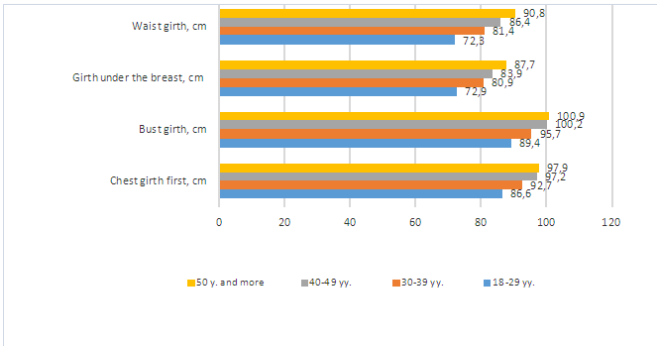

Figure 1 – Age dynamics of dimension signs of Chest girth, first, Bust girth, Girth under the breast, Waist and Hips girth.

Shown in Figure 1, the dynamics of height of the chest fold decrease and height of the protrusion of the chest increases, due to the fact that the decrease in height (Height, height of the chest fold), and breast augmentation (height of the protrusion of the chest) depends on the age factor.

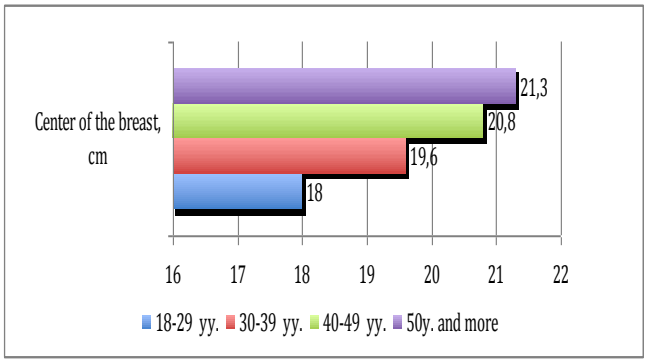

Figure 2 – Age dynamics. Center of the breast

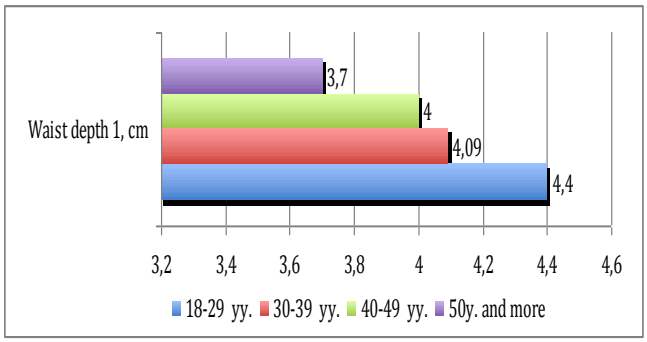

Figure 3 – Age dynamics of waist depth 1

Simultaneously it reduces the growth of 18-29 – 167.0 cm; 30-39 – 165.5 cm; 40-49 – 162.4 cm; 50 and over – 159.6 cm (Figure 4).

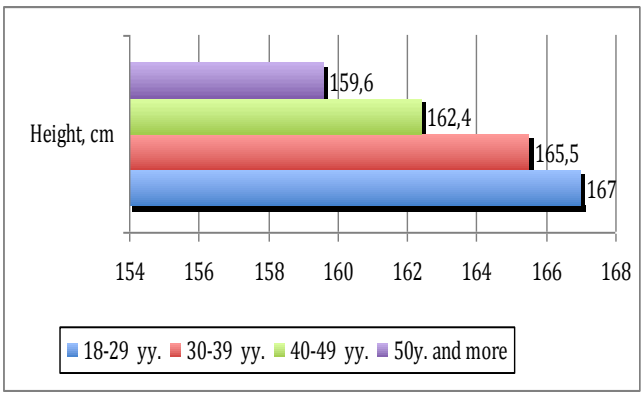

Figure 4 – Age dynamics of body length (height)

Overall reduction in growth, depending on the age factor, is in the aisles of from 1.5 cm to 3.1 cm.
Age dynamics of dimension traits heights – HCW and HPC are presented on Figure 5.

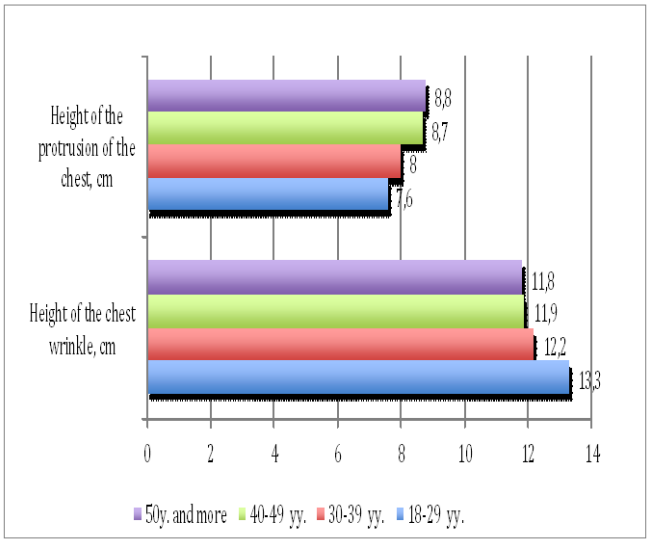

Figure 5 – Age dynamics of dimension traits of HCW and HPC

Represented in Figure 5, the dynamics of height of the chest wrinkle decrease and height of the protrusion of the chest increases, due to the fact that the decrease in height (Height, Height of the chest wrinkle), and breast augmentation (height of the protrusion of the chest) depends on the age factor.

Discussion

The main task of designing clothes is to develop drawings for individual or typical figure. Each design methodology includes information about the figure of a person or a finished product, methods of processing, received data in technical calculations and formulas using which the dimensions of structural segments and nodes of clothing details are made, as well as methods of garments geometric construction and design. When designing physical characteristics, tailoring and processing methods are taken into account which eventually forms a final system of internal information for every method (Koblyakova, 1988).

Existing design methods in terms of accuracy and validity of the results can be divided into approximate and engineering. The accuracy of them cannot be higher than the accuracy of the original measurements. Therefore, the more information about person's figure is available, the better is basic and fashion design of garments. Approximate methods of construction are dress form, calculated graphical and geometric methods. Triangulation techniques, cutting-plane, structural bands and belts and geodesic lines are engineering methods of clothing design (Koblyakova, 1988).

Designing of garments should be based on the results of regular (every 15 or 30 years) anthropometric study of the population, on a mathematical model, which is able to adequately display the surface of human body on textile plane.

Since 1972, in Kazakhstan cut system *has become* widespread, described in the book by Line Jaque **Cut technique** (*it`s better to used bold without quotation marks*). The book summarizes the experience of French designers and engineers in women's lightweight clothes and linen design. Basic patterns of this system allow to obtain the silhouette of the late 40s – early 50s very accurately, and technical modeling techniques are applicable to the basic patterns of other systems (Jaque, 1991).

Since 2001, in Russia and then in Kazakhstan cut system "*Muller and son*" has been intensively promoted. We investigated the possibility of practical application of this technique for custom tailoring, and it turned out that this system is based on anthropological characteristics of the population of Central Europe (Muller, 2006). If belt products as per Muller can be put on the typical figure, so basic patterns of shoulder products cannot be used for figures of Kazakhstan's population. And at the same time, the basic shoulder patterns of Muller garments, in principle, can be adapted to modern conditions.

Now designers are making basic and model drawings using construction method SMDC (Single method of designing clothes CMEA, 1989) and CETSL (Central Experimental technical sewing laboratory). This laboratory was under the Ministry of Consumer Services, and has been developing materials for enterprises engaged in custom tailoring (Sakulin, et al., 1998). To construct the basic patterns on SMDC a large number of measurements are required. When measuring, errors are inevitable: the more measurements, the greater the error in making product drawing.

Techniques and methods for the construction of corsetry are very different in light industry, in particular, they were developed by Akilova Z.T. (Akilova, 1979), Shpachkova A.V., Chizhova N.V., Andreeva E.G. (Shpachkova, et al., 2010), Muller and son "cut technique" (Muller, 2006). Shortcomings and problems of these design techniques are the use of a large number of dimensional traits: Akilova Z.T. – 18; Shpachkova A.V., Chizhova N.V., Andreeva E.G. – 19; in the M. Muller and son – 15. Some of them are directly measured, and some are found with the help of formulas.

Analysis of the techniques of corsetry design provided that corset details, derived from the basic design of adjacent silhouette shoulder parts due to the use of the dimensional trait "Chest girth third" do not provide a tight fit in the upper bearing part of a corset, which is one of the critical requirements for the quality of fitting this type of product. Therefore, summarizing the experience of the application of the best systems of cut, new corsetry construction was developed and recommended (Baskimbaeva, et al., 2014). The method is based on the following principle: a set of necessary anthropometric measurements of women in Kazakhstan, taking into account age-related changes and achievement a tight fit in the upper bearing surface of corsetry, which are surface above the base of the breast while reducing the complexity of the design process that will ensure high quality fitting.

Conclusion

Making female anthropometry database in the Republic of Kazakhstan allows to provide specifications of manufactured garments with global level of quality.

Statistical methods, worked-out mean values of dimensional traits of 1,500 women in Kazakhstan used in the study, investigated the effect of age-related features on dimensional traits.

Anthropometric data is recommended for the corsetry design providing calculation and construction of horizontal and vertical lines, calculation and construction of breast and waist darts, which differs from the studied methods of design. So it is suggested to use the dimensional trait BG_1 and recommended fewer dimensional traits and eliminated redundant design of neck, shoulders and armholes lines, that are not an upper support portions, eliminated fitting through the use of corsetry adapted to new measurable traits (HCW – height of the chest wrinkle and HPC – height of the protrusion of the chest).

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