

Determination of a System of Women's Clothing Sizes in the Goransko-primorska County of the Republic of Croatia

DOI: 10.5604/12303666.1221733

University of Zagreb,
Faculty of Textile Technology
Prilaz baruna Filipovića 28a, 10 000 Zagreb, Croatia
E-mail: ksenija.dolezal@tff.hr

Abstract

The aim of this work is to improve the system of clothing sizes by the determining body measurements of adult women in the Goransko-primorska County of the Republic of Croatia. The system of clothing sizes was determined based on the results of anthropometric investigations of a specific population. Sorting data on body measurements results in their grouping in garment sizes, and based on this data, size-charts with significant differences in body shape and body proportions of a certain group of the population are created. In the system of garment sizes certain body dimensions define a garment size and create a scale determined by the standard. The standard characterizes body shape based on two dimensions of measurements, whereby the first is the basic (bust girth), and the second - a dependent variable (body height). This study was conducted on a sample of 1,104 subjects aged 20-85 years classified into seven age groups. Statistical analysis of the results, i.e. principal component analysis, was used to determine garment sizes and the presence of certain categories of them in the population measured in the Goransko-primorska County of the Republic of Croatia.

Key words: garment sizes, bust girth, body height.

Introduction

The development of human society causes changes in clothing manufacturing caused by growing demands with the aim of meeting new needs and interests of consumers. Increasing requirements, whether aesthetic or functional, introduce scientific knowledge and principles into garment manufacturing [1]. The anthropometric approach to the study of body measurements began to be implemented after gaining information about the variability of human body proportions. By means of the systematic implementation of anthropometric measurements on appropriate samples of test subjects, data of a large number of dimensions used to determine body shape are collected [1, 2]. In order to improve garment fit, it is necessary to continuously adapt each garment pattern to body build. A systematic review of garment fit includes investigating a series of elements and factors, especially those that are based on anthropometric findings. The results of anthropometric measurements of the human body performed on a representative sample are used to determine garment sizes of the population measured, and it is also possible to determine deviations, if any, from the European standards pre-

scribed (EN). The task of garment size is to cover the population with appropriate body measurements as much as possible and to enable good product launch as well as consumer satisfaction with the final product. By measuring body dimensions of a certain population it is possible to determine the presence of specific garment sizes. The regional presence of garment sizes observed for women was determined by the proportion of female test subjects equal to or greater than 1%. Namely a share less than 1% includes an extremely small number of female subjects, in whose garment sizes manufacturers show no interest. In industrial garment production an individual garment size should include a large number of the population [3 - 5].

Until recently Croatian garment manufacturers used the provisions of the former JUS standardization, renamed into the Croatian Standards, set down in the 60-ies of the last century. Since they were not completed over time, they were not fully in conformity with today's physique. In 2004 the compound technological project: Croatian Anthropometric System was initiated, within which the first anthropometric measurements of the population of the Republic of Croatia

were made. A number of body measurements were collected within this project, providing a basis for establishing a new system of garment sizes [1, 6]. The Croatian Technical Report (HRI 1148:2012 hr) under the title »Anthropometric System - Body Measurement and Size Designation of Clothes and Footwear«, which was released in February 2012, was created based on the data collected. The report was written on the basis of European standards (EN 13402: 1-3), with certain deviations characteristic to the Croatian population.

In the Croatian Technical Report the basic starting point for the size designation of clothes for women is bust girth, and a statistically significant part of adult women in the Republic of Croatia have a bust girth from 76 to 134 cm. The size range of four cm includes a bust girth from 76 to 104 cm, and in the case of six cm it ranges from 104 to 134 cm. According to this proposal of a size system 13 different bust girths for the size designation of women's clothes are foreseen. A deviation from the European standards is noticeable because they include bust girths of 140, 146 and 152 cm, but they are not significantly present in the Croatian population (*Table 1*).

Table 1. Standardized measurements of bust girths in cm.

| Bust girth | 76 | 80 | 84 | 88 | 92 | 96 | 100 | 104 | 110 | 116 | 122 | 128 | 134 |
|------------|---------|---------|---------|---------|---------|---------|----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Range | 74 - 78 | 78 - 82 | 82 - 86 | 86 - 90 | 90 - 94 | 94 - 98 | 98 - 102 | 102 - 107 | 107 - 113 | 113 - 119 | 119 - 125 | 125 - 131 | 131 - 137 |

Table 2. Stature to designate women's garment sizes in cm.

| Woman's body height with an interval of 8 cm | | | | | |
|--|-----------|-----------|-----------|-----------|-----------|
| Body height | 152 | 160 | 168 | 176 | 184 |
| Range | 148 - 156 | 156 - 164 | 164 - 172 | 172 - 180 | 180 - 188 |

Anthropometric measurements showed that a statistically significant share of the female population in Croatia has a body height from 152 to 184 cm. Standards prescribe the interval between individual statures to be 8 cm, and five different statures are determined: 152, 160, 168, 176 and 184 cm. Stature represents the interval between half of the previous to half of the next stature; accordingly, a body height from 148 to 188 cm is present. EN standards prescribe body heights from 156 to 188 cm, with the possibility of increasing the interval. According to particular groups of body heights a part of the female population in Croatia has a body height of 152 cm or 148 cm, and thus it is necessary to expand EN 13402-3 by one stature (**Table 2**) [7].

Female test subjects included in this research represent a significant share of the total number of the female population measured in the Republic of Croatia. The results allow to establish the presence of observed body dimensions in the categories prescribed in the Croatian Technical Report.

Development and role of the garment size system

In the early 19th century clothes were made by tailors according to the body measurements of an individual or client. However, the idea of making clothes that would fit a number of people with a simi-

Table 3. One of the earliest clothing size charts.

| 1 | 2 | 3 | 4 | 5 |
|-----|---------------------------------|--------------------------------|-------------------------------|----------------------------------|
| 36 | 5 | 2 | 4 | 19 |
| 36½ | 00 | 00 | 00 | 00 |
| 37 | 5 ⁵ / ₃₆ | 2 ¹ / ₁₈ | 4 ¹ / ₉ | 19 ¹⁹ / ₃₆ |
| 37½ | 00 | 00 | 00 | 00 |
| 38 | 5 ⁵ / ₁₈ | 2 ¹ / ₉ | 4 ² / ₉ | 20 ¹ / ₁₈ |
| 38½ | 00 | 00 | 00 | 00 |
| 39 | 5 ⁵ / ₁₂ | 2 ¹ / ₆ | 4 ¹ / ₃ | 20 ¹ / ₁₂ |
| 39½ | 00 | 00 | 00 | 00 |
| 40 | 5 ⁵ / ₉ | 2 ² / ₉ | 4 ⁴ / ₉ | 21 ¹ / ₉ |
| 40½ | 00 | 00 | 00 | 00 |
| 41 | 52 ⁵ / ₃₆ | 2 ⁵ / ₁₈ | 4 ⁵ / ₉ | 21 ²⁵ / ₃₆ |

lar physique developed. Knowledge of proportional principles of the human body based on the rule of the golden ratio preceded it [8, 9]. To achieve that stated above, it was necessary to make anthropometric measurements of the population and to collect the necessary data. Several tailors created their own size charts in order to achieve a better fit of a garment to the human figure. In 1897 the American Charles J. Stone published an extensive table of proportionate measurements. It is clear from his diagram of the figure and his draft »Proportions in Practice« that the measurements in the table are those of the body, but they appear to be theoretical proportions (**Table 3**) [8].

Fashion trends entirely defined the body shapes of both sexes until the mid-19th century. These differences affected the speed of development of ready-to-wear clothing and the sizing system for both genders [8]. However, the mass production of women's clothing developed in the 20-ies of the last century. Each manufacturer created his unique and sometimes arbitrary clothing size system. Such a system is often based on inaccurate data. The disadvantages of such clothing were demonstrated in an inadequate fit to the body shape, resulting in reduced interest in industry made clothing. The multitude of clothing sizes caused confusion among customers in the selection and caused additional costs due to returns of unsuitable clothing. As time went by the original standard became outdated as the body shape changed. Women increased in weight, and changes were reflected in hip girth and a bigger waist. The problem incurred could be solved by creating an actual system of clothing sizes by performing anthropometric measurements.

During 1939 and 1940 the first anthropometric measurement of the female body with the aim of determining measurements in order to create a garment size system on a sample of 15,000 American women was performed. Measurements included 59 body dimensions, and the measurement results were published in 1941 in the publication USDA Miscellaneous Publication 454 under the title »Women's Measurements for Garment

and Pattern Constructions« [9]. Since then anthropometric measurements have been performed continuously in most developed countries every 15 to 20 years.

Methodology

Subjects

This survey covers a sample of 1,104 adult women from the Goransko-primorska County of the Republic of Croatia aged 20-85 years. Depending on the age, the subjects were divided into ten-year age groups, making a total of seven groups. Within the region mentioned the sample includes 0.29% of women of the total number of the female population of the region (377,973). Within the Mountainous and Littoral Region of Croatia there are five counties; thus, the number of the population indicates the significance of the results (**Figure 1**).

Methods

The measurements required for this study were accomplished within the scope of the compound technological project »Croatian Anthropometric System« (STIRP HAS), in which the standard method applied in similar projects in Europe and the world was used. The measurement procedure was performed using a one arm anthropometer and measuring tape as part of the anthropometric instruments in conformity with the standards ISO 3635, ISO 8559 and EN 13402. Measurements were accomplished on persons in an upright posture, after which measurement values were entered into prepared charts [10 - 14]. Two body dimensions (body height and bust girth) were measured on a sample of female test subjects (**Figure 2**) [15, 16].

Bust girth is a body dimension measured across the bust prominence. The measurement is accomplished using a measuring tape. Due to its elasticity it is the best choice in measuring girth. Human body height is the distance from the bottom of the feet to the top of the head in a human body, standing erect. Its value is determined using a one-arm anthropometer [10, 17, 18]

In the article body measurements are used that were obtained in the project of the Croatian anthropometric system through conventional anthropometric methods. Conventional anthropometric measurements were carried out because the measurement is covered by a large number

of women over a large geographic area in a short period of time. The measurements were carried out by field surveyors, while several people were measured at the same time. New scanning technology, such as a 3D body scanner, could not be used because they were field measurements, where people were measured at the same time in several different places.

Statistics

The study of the complex system of body measurements of a particular sample of women of the Mountainous and Littoral region of Croatia was performed by means of descriptive statistics, which involves estimating the parameters of the central tendency (mean and median) and dispersion (standard deviation, coefficient of variation, confidence interval 95%, and range of a data set). The distribution of body measurements included in this research was verified with appropriate graphical representations.

The methods mentioned used for describing belong to the group of univariate methods of data analysis, by which body measurements are analysed one by one, or at most in pairs. Body measurements, however, constitute a unique and interconnected system for describing the structure (morphology) of the body so that univariate methods generated are more or less dependent on partial relationships. The principal component method in this study helps to verify the garment sizing system based on the categorisation of bust girth and body height. The analysis results are listed in tables and are presented in graphs, and statistical conclusions were made with a permissible error of $\alpha = 0.05$. Software packages Statistica and SPSS and technical literature were used for describing and data processing [19 - 21].

Results and discussion

Descriptive statistical methods were applied to assess the parameters of the central tendency and the dispersion of body height and bust girth. Appraisals of the basic parameters are listed in **Table 4**, and a comparison of the distribution of body heights by age group of the sample and the total population of Croatian women is graphically shown in **Figure 3** [22].

It is evident from **Table 4** that the body height of the subjects is consistently reduced with age, which on average



Figure 1. Map of the Republic of Croatia.

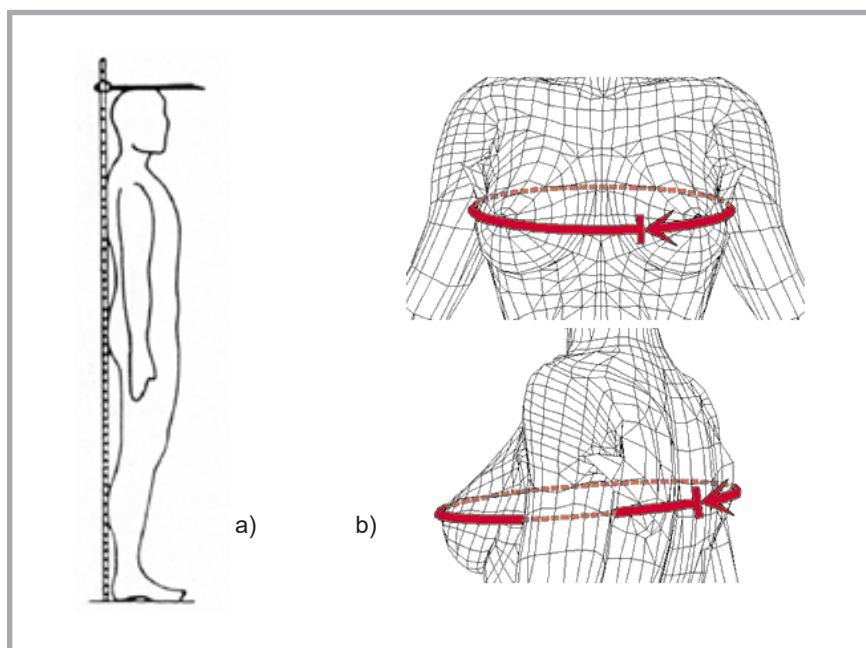


Figure 2. Main body measurements: a) body height and b) bust girth [15, 16].

amounts to 10 cm from the youngest to the oldest group. Starting with the first age group, the values of body height are reduced by 3.5 cm slowly to the 50 - 59 year old group, where a greater decline in the value to the 70 - 79 year old group starts, on average by six cm. In the last

age group the reduction in body height continues with far less intensity [22].

According to data of the Croatian Technical Report and the averages of body heights determined by age group of the entire female population of the Republic

Table 4. Basic parameters of the distribution of women's body heights of the Mountainous and Littoral Region of Croatia by age group. *a* number of cases, *b* arithmetic mean, *c* standard deviation, *d* coefficient of variation, *e* confidence interval 95%.

| Range | Age | N ^a | \bar{x} ^b | s ^c | CV ^d , % | 95% CI ^e | | Range | |
|---------------------------|--------------|----------------|------------------------|----------------|---------------------|---------------------|----------------|--------------|--------------|
| | | | | | | h ₁ | h ₂ | min. | max. |
| Goransko-primorska county | 20 - 29 | 236 | 165.3 | 6.6 | 4.0 | 164.4 | 166.1 | 145.7 | 182.0 |
| | 30 - 39 | 171 | 164.9 | 6.4 | 3.9 | 163.9 | 165.8 | 147.0 | 187.0 |
| | 40 - 49 | 179 | 163.5 | 6.3 | 3.9 | 162.6 | 164.5 | 151.5 | 184.0 |
| | 50 - 59 | 157 | 162.8 | 6.7 | 4.1 | 161.7 | 163.8 | 146.5 | 182.0 |
| | 60 - 69 | 125 | 159.7 | 6.2 | 3.9 | 158.6 | 160.8 | 147.5 | 182.0 |
| | 70 - 79 | 133 | 157.0 | 6.7 | 4.3 | 155.9 | 158.2 | 135.0 | 176.0 |
| | 80 - 85 | 103 | 156.5 | 6.7 | 4.3 | 155.2 | 157.8 | 139.0 | 177.0 |
| | Total | 1104 | 162.1 | 7.3 | 4.5 | 161.7 | 162.6 | 135.0 | 187.0 |

Table 5. Basic parameters of the distribution of the body height of women of the Republic of Croatia. *a* number of cases, *b* arithmetic mean, *c* standard deviation, *d* coefficient of variation, *e* confidence interval 95%.

| Range | Age | N ^a | \bar{x} ^b | s ^c | CV ^d , % |
|---------------------|--------------|----------------|------------------------|----------------|---------------------|
| Republic of Croatia | 20 - 29 | 1105 | 166.7 | 6.5 | 3.9 |
| | 30 - 39 | 734 | 165.6 | 6.4 | 3.9 |
| | 40 - 49 | 782 | 164.2 | 6.2 | 3.8 |
| | 50 - 59 | 620 | 162.8 | 6.3 | 3.9 |
| | 60 - 69 | 530 | 160.7 | 6.2 | 3.9 |
| | 70 - 79 | 571 | 158.2 | 6.9 | 4.3 |
| | 80 - 85 | 505 | 157.5 | 7.0 | 4.5 |
| | Total | 4847 | 162.1 | 6.5 | 4.0 |

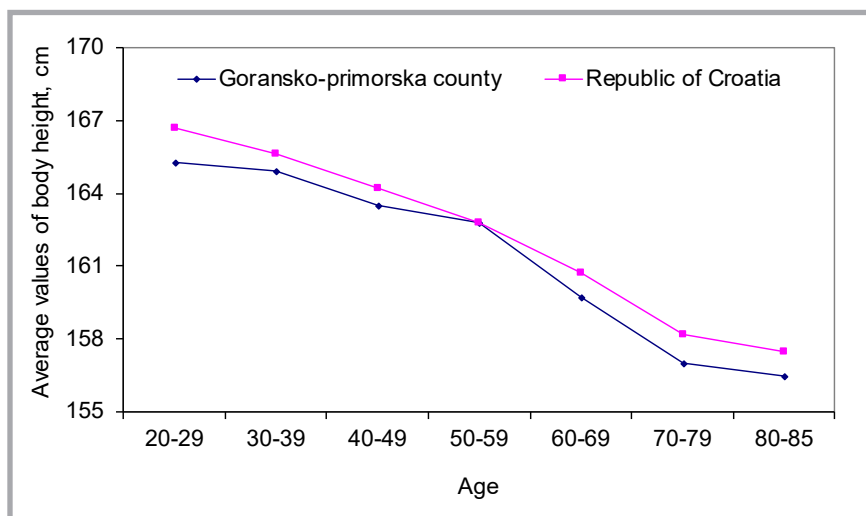


Figure 3. Comparison of the average body height of women by age group in the Goransko-primorska county and the total sample of the Republic of Croatia.

Table 6. Basic parameters of the distribution of bust girth (in cm) of women of the Mountainous and Littoral region by age group. *a* number of cases, *b* arithmetic mean, *c* standard deviation, *d* coefficient of variation, *e* confidence interval 95%.

| Range | Age | N ^a | \bar{x} ^b | s ^c | CV ^d , % | 95% CI ^e | | Range | |
|---------------------------|--------------|----------------|------------------------|----------------|---------------------|---------------------|----------------|-------------|--------------|
| | | | | | | h ₁ | h ₂ | min. | max. |
| Goransko-primorska county | 20-29 | 236 | 91.8 | 7.4 | 8.1 | 90.8 | 92.7 | 80.0 | 127.0 |
| | 30-39 | 171 | 95.9 | 9.6 | 10.0 | 94.5 | 97.3 | 75.0 | 126.5 |
| | 40-49 | 179 | 100.0 | 10.1 | 10.1 | 98.5 | 101.5 | 78.0 | 132.0 |
| | 50-59 | 157 | 105.9 | 11.5 | 10.9 | 104.1 | 107.7 | 73.0 | 134.0 |
| | 60-69 | 125 | 107.5 | 10.0 | 9.3 | 105.7 | 109.3 | 80.0 | 130.0 |
| | 70-79 | 133 | 108.5 | 10.4 | 9.6 | 106.7 | 110.3 | 79.0 | 131.0 |
| | 80-85 | 103 | 104.5 | 11.9 | 11.4 | 102.2 | 106.8 | 68.0 | 132.0 |
| | Total | 1104 | 100.7 | 11.7 | 11.6 | 100.0 | 101.4 | 68.0 | 134.0 |

of Croatia (**Table 4**) compared to the sample observed, it is possible to determine deviations in the values of the body dimension observed (**Figure 3**).

In the graphical representation, deviations in the values of body height in all age groups can be observed, except in 50 - 59 year old age group.

Furthermore appraisals of basic parameters of bust girth are listed in **Table 5**, and a comparison of the distribution of their values by age group of the sample and the total population of Croatian women is graphically shown in **Figure 4**.

Table 6 shows that the bust girth of female test subjects constantly increased with age, on average 13 cm from the youngest to the oldest group [22].

Starting with the first age group, average values of bust girth linearly increase by 14 cm to the 50 - 59 year old age group. After that a further increase with less intensity in the average value to age group 70 - 79 amounts to 2.5 cm. In the last age group average values of bust girth begin to decrease, and the reduction in comparison to the previous group amounts to 4 cm.

According to data of the Croatian Technical Report and averages of bust girths determined by age group of the entire female population of the Republic of Croatia (**Table 7**) compared to the sample observed, it is possible to determine deviations in the values of the body dimension observed (**Figure 4**).

In the graphical representation, deviations in the values of bust girth in all age groups can be observed. The greatest deviations were recorded for the 70 - 79 year old age group, while these values nearly overlap in the last group.

Based on the results shown, when observing both bodily dimensions in particular and by establishing their deviations from the national average, the possibility of influencing the improvement of garment fit opens up. Since the point is the industrial production of clothes, garment sizes should be attached to the sample observed [16, 22, 23].

Therefore in the course of further study the appearance of women's clothing sizes within the given region of Croatia was determined. The garment size system

is the result of grouping body measurements of the population observed, whose values are displayed in tables with clearly noticeable differences in body shape and body proportions. Clothing sizes of the population of the Republic of Croatia measured were determined by regulations of the European standards, with deviations specific to each population (Croatian Technical Report). The regional presence was observed for the garment sizes of the female population of the Republic of Croatia determined; their total occurrence in the population measured is also shown. Although the population measured covers a greater range of clothing sizes, only those that cover the presence of women equal to or greater than 1% will be used (Table 8).

As it is evident from the table, out of 52 clothing sizes, a share greater than 1% of subjects covers 27 of them, which altogether comprises 87.6% of the population of women of the region mentioned. The most common sizes, with a share greater than 4%, cover 534 female subjects of the region mentioned. The greatest number of clothing sizes with a share greater than 1% is present in the bust girth range from 86 cm to 119 cm, with height categories from 148 cm to 172 cm. The most present clothing size includes 73 female subjects or 6.8%, and is determined by bust girth ranging from 86 cm to 90 cm and body height ranging from 156 cm to 164 cm (Figure 5) [22, 24].

Conclusion

Average values determined for the main body measurements of female test subjects of the Goransko-primorska county indicate changes caused by aging. The results confirm the reduction in body height by extending the human lifespan. The average value, if all age groups observed are included, amounts to 10 cm. However, this reduction does not occur with the same intensity from the first to the last group, which is confirmed by a significant decline in the value for the 50 - 59 year old age group, while for the 80 - 85 year old age group the decline slows down considerably. The reduction in body height by expanding the human lifespan is a natural process caused by changes in the human skeleton during aging, and the results obtained confirm the real value of these changes on the sample tested.

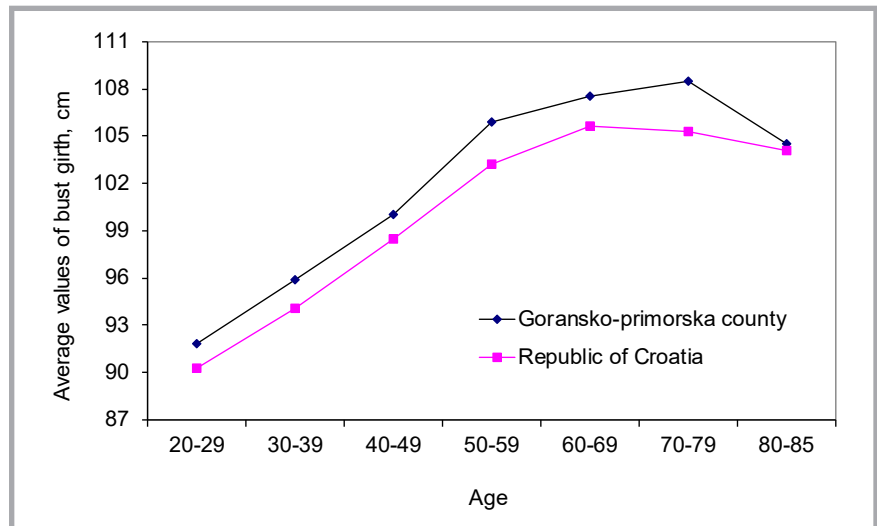


Figure 4. Comparison of the average bust girth of women by age group in the Goransko-primorska county and the total sample of the Republic of Croatia.

Table 7. Basic parameters of the distribution of bust girth of women of the Republic of Croatia. ^a number of cases, ^b arithmetic mean, ^c standard deviation, ^d coefficient of variation, ^e confidence interval 95%.

| Range | Age | N ^a | \bar{x} ^b | s ^c | CV ^d , % |
|---------------------|--------------|----------------|------------------------|----------------|---------------------|
| Republic of Croatia | 20 - 29 | 1105 | 90.3 | 8.5 | 8.0 |
| | 30 - 39 | 734 | 94.1 | 10.4 | 9.1 |
| | 40 - 49 | 782 | 98.5 | 9.7 | 9.9 |
| | 50 - 59 | 620 | 103.2 | 10.3 | 10.0 |
| | 60 - 69 | 530 | 105.6 | 10.6 | 10.0 |
| | 70 - 79 | 571 | 105.3 | 10.5 | 10.0 |
| | 80 - 85 | 505 | 104.1 | 11.5 | 10.8 |
| | Total | | 4847 | 100.2 | 10.3 |

Table 8. Frequency of women's garment sizes in the region Goransko - primorska county (N = 1104). ^a lower limit of the group < x ≤ upper limit of the group.

| Bust girth | | Body height | | | | |
|----------------------|---|-------------|-----------|-----------|-----------|-----------|
| | | 148 - 156 | 156 - 164 | 164 - 172 | 172 - 180 | 180 - 188 |
| 78 - 82 ^a | n | 4 | 9 | 6 | 2 | |
| | % | 0.4 | 0.8 | 0.6 | 0.2 | |
| 82 - 86 | n | 9 | 26 | 28 | 4 | 2 |
| | % | 0.8 | 2.4 | 2.6 | 0.4 | 0.2 |
| 86 - 90 | n | 19 | 73 | 49 | 10 | |
| | % | 1.8 | 6.8 | 4.6 | 0.9 | |
| 90 - 94 | n | 21 | 44 | 39 | 10 | 1 |
| | % | 2.0 | 4.1 | 3.7 | 0.9 | 0.1 |
| 94 - 98 | n | 19 | 51 | 43 | 16 | 4 |
| | % | 1.8 | 4.8 | 4.0 | 1.5 | 0.4 |
| 98 - 102 | n | 17 | 58 | 45 | 10 | 4 |
| | % | 1.6 | 5.4 | 4.2 | 0.9 | 0.4 |
| 102 - 107 | n | 27 | 66 | 43 | 5 | 1 |
| | % | 2.5 | 6.2 | 4.0 | 0.5 | 0.1 |
| 107 - 113 | n | 30 | 62 | 38 | 8 | 2 |
| | % | 2.8 | 5.8 | 3.6 | 0.7 | 0.2 |
| 113 - 119 | n | 26 | 32 | 14 | 4 | 2 |
| | % | 2.4 | 3.0 | 1.3 | 0.4 | 0.2 |
| 119 - 125 | n | 12 | 32 | 9 | 2 | |
| | % | 1.1 | 3.0 | 0.8 | 0.2 | |
| 125 - 131 | n | 7 | 12 | 6 | | |
| | % | 0.7 | 1.1 | 0.6 | | |
| 131 - 137 | n | | 4 | | 1 | |
| | % | | 0.4 | | 0.1 | |

The average values of bust girth according to the research results rise with expanding of the human lifespan. This increase is evident in all age groups except the last one, the oldest group, and the intensity of the increase decreases with an increasing in the age of female test subjects.

Therefore the results above allow a detailed insight into the changes in body dimensions, and within this research they form a basis for determining garment sizes. According to the system obtained, 52 garment sizes were attained, out of which 27 of them were separated (covering more than 1% of test subjects) for industrial garment manufacture, or 87.6% of the total sample. The remaining 12.4% of the subjects were covered with 25 clothing sizes, which are not industrially manufactured because they refer to a very small number of people.

Problems related to manufacturing and launching clothing confirm the importance of such research, and they emerge due to large variations in the body dimensions of the inhabitants of an area. If clothing size systems of a country are established, whether at a local, national or international level, valuable insights used by industry and consumers are gained.

References

- Ujević D, Nikolić G, Doležal K, Brlobašić Šajatović B, Szivovicza L, Hrženjak R, Hrastinski M and Lazibat T. *Anthropometric studies and Croatian anthropometric system*. In: Theoretical aspects and application of Croatian anthropometric system (CAS) Ed. D. Ujević, University of Zagreb, Faculty of Textile Technology, Croatia 2009, pp. 138-148.
- Ulijaszek S J and Mascie-Taylor C G N. *Anthropometry: the Individual and the Population*, Cambridge University Press, Cambridge, 1994, ISBN 9780521019972
- Ujević D and Hrastinski M. *Prilog podlozi za nove hrvatske norme za veličinu odjeće i obuće te njihova označavanja*. In: Hrvatski antropometrijski sustav – Podloga za nove hrvatske norme za veličinu odjeće i obuće. Ed. D. Ujević, Tekstilno-tehnološki fakultet, Sveučilište u Zagrebu, 2006, p. 407-439.
- Szivovicza L, Ujević D, Hrastinski M and Mujkić A. *Statistical data analysis and short description of the results of or the anthropometric measurement of the compound technological project Croatian anthropometric system*. In: Theoretical aspects and application of Croatian anthropometric system (CAS) Ed. D. Ujević, University of Zagreb, Faculty

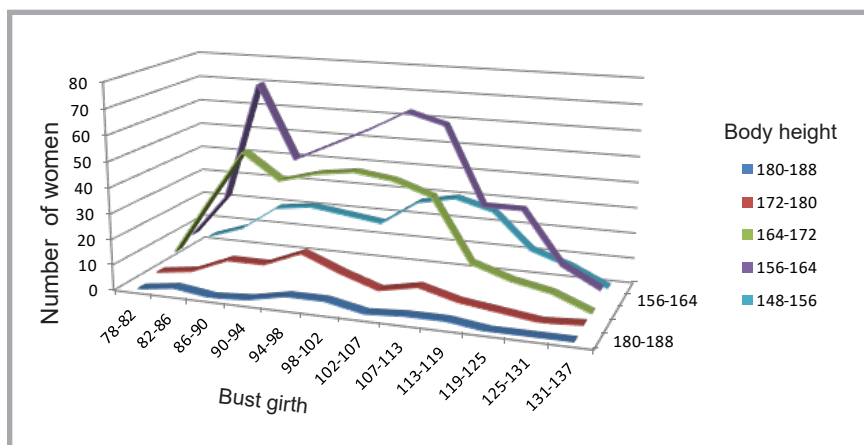


Figure 5. Presence of clothing sizes in the population measured

- of Textile Technology, Croatia 2009, pp. 227-276.
- Rudan P, Smolej Narančić N. and Szivovicza L. *Antropologija i mogućnost primjene u praksi*. In: *Zbornik izlaganja, Hrvatski antropometrijski sustav – Put u Europu*, Tekstilno-tehnološki fakultet Sveučilišta u Zagrebu, Zagreb, 2004., ISBN 953-7105-06-7.
- Lazibat T. *Općenito o normama i normizaciji*. In: Hrvatski antropometrijski sustav – Podloga za nove hrvatske norme za veličinu odjeće i obuće. Ed. D. Ujević, Tekstilno-tehnološki fakultet, Sveučilište u Zagrebu, 2006, p. 183-197.
- Antropometrijski sustav – *Mjerenje tijela i označavanje veličina odjeće i obuće*, Hrvatski tehnički izvještaj, HRI 1148:2012 hr. (Croatian Standards Institute, 2012, ICS: 01.040.61:61.020).
- Ashdown SP. *Sizing in Clothing: Developing Effective Sizing Systems for Ready-to-Wear Clothing*, Woodhead Publishing in Association With The Textile Institute, Cambridge, 2007.
- Standardization of Women's Clothing, <http://museum.nist.gov/exhibits/apparel/index.htm>, (Accessed on 23. March 2013).
- Ujević D. *Antropometrijski instrumenti i njihova primjena*. In: Hrvatski antropometrijski sustav – Podloga za nove hrvatske norme za veličinu odjeće i obuće. Ed. D. Ujević, Tekstilno-tehnološki fakultet, Sveučilište u Zagrebu 2006, p. 211-223.
- Ujević D, Rogale D, Hrastinski M, Dragčević Z, Lazibat T, Brlobašić Šajatović B, Hrženjak R, Doležal K, Drenovac M, Karabegović I, Mimica Ž, Smolej Narančić N and Szivovicza L. *Hrvatski antropometrijski sustav: priručnik*, Faculty of Textile Technology, University of Zagreb, Zagreb, 2006.
- HRN ISO 3635:2012 – *Označavanje veličine odjeće – Definicije i postupak mjerenja tijela (ISO 3635:1981)*.
- HRN ISO 8559:2012 – *Oblikovanje odjevnih predmeta i antropometrijska istraživanja – Tjelesne mjere (ISO 8559:1989)*.
- HRN EN 13402 (1.-3. dio) 2008, *Označavanje veličina odjeće – 1. dio: Nazivi, definicije i postupak mjerenja tijela (ISO 3635:1981, MOD; EN 13402-1:2001), 2. dio: Primarne i sekundarne dimenzije (EN 13402-2:2002), 3. dio: Mjere i intervali (EN 13402-3:2004)*.
- Ujević D, Hrastinski M, Dragčević Z and Szivovicza L. *Eksperimentalno utvrđivanje tjelesnih mjera u okviru STIRP-a HAS*. In: Hrvatski antropometrijski sustav – Podloga za nove hrvatske norme za veličinu odjeće i obuće. Ed. D. Ujević, Tekstilno-tehnološki fakultet, Sveučilište u Zagrebu 2006, p. 280-303.
- Schritt-für-Schritt-Anleitung: richtig maßnehmen, http://www.burdastyle.de/aktuelles/news/massschnitt-schritt-fuer-schritt-anleitung-richtig-massnehmen_aid_3292.html. (Accessed 20. March 2013).
- Chih-Hung H, Hai-Fen L and Mao-Jiun W. Developing Female Size Charts for Facilitating Garment Production by using Data mining, *Journal of the Chinese Institute of Industrial Engineers* 2007; 24 (3): 245-251.
- Chun-Yoon Jongsuk, and Jasper C. R.: *Garment-sizing Systems: An International Comparison*, *International Journal of Clothing Science and Technology*, 1993; 5 (5): 28-37.
- StatSoft, Inc. (2010). *Statistica (data analysis software system)*, version 9.1., URL: <http://www.statsoft.com>. (Accessed 05.November 2011).
- Pallant J. *SPSS: priručnik za preživljavanje, Potpuni vodič kroz analizu podataka pomoću SPSS-a*, Mikro knjiga, Beograd, 2011.
- Horvat J. *Statistika pomoću SPSS/PC+*. J. J. Strossmayer University Osijek, Faculty of Economics in Osijek, 1995.
- Doležal K. *Investigation of the influence of regional characteristics of the physical dimensions garment construction and fit*. PhD Thesis, University of Zagreb, Zagreb, 2012.
- Ujević D, Hrastinski M, Brlobašić Šajatović B, Doležal K, Hrženjak R, Drenovac M, Petrak S, Mujkić A and Szivovicza L. *Anthropometry of human body*. In: Theoretical aspects and application of Croatian anthropometric system (CAS) Ed. D. Ujević, University of Zagreb, Faculty of Textile Technology, Croatia 2009, pp.73-80.
- Ujević D, Nikolić G, Doležal K and Szivovicza L. *New Anthropometric Instruments*. *Collegium Antropologicum*, 2007; 31, 4: 1031-1038.

Received 18.11.2015 Reviewed 24.02.2016