



Analysis of conformity of the sizes of the men feet of Uzbekistan to the sizes of shoe lasts

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ABSTRACT

Correspondence of the size of the foot with the dimensions of the internal shape of the shoe is one of the most important indicators of the shoe quality. It is known that the lasts dimensions in length and girth differ than the foot dimensions. The article presents the results of studies of the feet sizes of men in Uzbekistan in the amount of 994 people, which were carried out in order to determine the conformity of the size of the feet with the size of shoe lasts. Foot sizes were divided into three age groups. For each size group, the statistical parameters of size features were determined, as well as the relationship between the length of the foot and the girth. Based on the data obtained, the relationship between the average length and girth of the foot with the size of the shoe lasts of medium width for three age groups of men was determined

Keywords:

foot length, foot girth, relationship between sizes, age group, shoe last, sizing system

Introduction

Rational shoes, i.e. corresponding to the anatomical and physiological features of the foot, ensures its normal functioning, protects against deformities and diseases, prevents the development of flat feet, abrasions, calluses, etc.

Tight shoes, as well as too wide shoes, are harmful and can even be the cause of some foot diseases. Short and narrow shoes restrict movement in the joints, almost completely exclude the mobility of the fingers, lead to their curvature, ingrown nails, and also impair sweating and blood circulation. Too wide shoes lead to displacement of the foot during movement, as a result of which subluxations in the ankle joint are possible [1].

It is known that the correspondence of the dimensions of the internal dimensions of the shoe to the shape and size of the foot is one of the most important indicators of the quality of the shoe.

From a review of the literature, it is known that the size of the feet of the population, in particular, the length and fullness vary widely. With the same length, different people have a wide variation in girths in the metatarsophalangeal joint of the feet (completeness). Therefore, it is not enough to produce shoes only in different sizes (length), it is necessary to provide widths assortment as well [2,3].

However, at present, shoe enterprises are limited to the release of one single width - the average for each length. In fact, there are no

shoes of wide width, which increases the number of consumers forced to use shoes of a larger size. This can cause a violation of the state of the neuroreceptor apparatus of the foot and the development of deformity. A number of companies are engaged in the production of shoes for non-standard feet; to partially solve the problem, they produce shoes of greater completeness ("special line"). The complexity of the problem is exacerbated by the ubiquitous transition of footwear production from the metric numbering system to the Paris Point System. Information about the transfer of the size and width of shoes from one system to another is contradictory, without a scientific basis [4].

In order to choose shoes according to foot length and girth, it is necessary to correctly determine the size of the foot and the completeness of the shoe. It should be borne in mind that the size of the foot under load increases, both in length and in width [5].

The purpose of this study is the measure the feet of the male population of the Republic of Uzbekistan and determine the size of the foot according to the size of shoe lasts used in the manufacture of men's shoes.

Objects And Methods of Research

Shoe lasts for men's shoes of the DAMBOG LLC enterprise (Namangan, Uzbekistan), as well as the feet of men in the amount of 994 people, aged 18 to 62 years, were used as research objects. Men foot measurement studies were carried out in the city of Tashkent and Namangan according to the standard method

[1]. A scanner was used to obtain a plantograms of the foot [6].

During the measurements, the following foot parameters were measured: foot length (L), foot width along the outer (Wob) and inner beam (Wib), heel width (Wh), foot girth along the outer beam (Gob), foot girth along the inner beam (Gib), girth of the foot in the middle of the length of the foot (Gm.), oblique girth (Gk.). To obtain data on the size of the lasts, the length of the insole, the width of the insole, and the girth of the last were measured.

Processing of experimental data by methods of mathematical statistics was carried out using packages of applied programs for surface scanning and Microsoft Office Excel 2010.

To determine the correlation between dimensional features, a correlation-regression method was used, which makes it possible to establish such data as the presence, strength and form of relationships between the studied features, as well as to assess the significance of the results obtained. When analyzing and processing anthropometric data, the main dimensional features of the feet of various age groups of the male population were determined.

All studied men were divided into 3 age groups - 18-26 years old (507 people), 27-45 years old (274 people) and 46-62 years old (213 people). So the main dimensional signs of the foot, according to which the choice of shoes is made, is the length of the foot and the girth. Table 1 shows the main statistical parameters of these two measures of foot size for three age groups.

Table 1. Statistical parameters of dimensional signs of the foot of men of three age groups

Name of indicator	18-26			27-45			46-62		
	L	Wob	Gob	L	Wob	Gob	L	Wob	Gob
	1	2	3	4	5	6	7	8	9
Maximum	296	120	274	302	120,2	280	297	120,1	340
Minimum	235	80,5	220	235	84	220	237	82,2	220
Average value	266,8	95,3	245,7	264,6	96,9	246,6	262,8	97,7	248,3
Sample standard deviation	11,935	6,1	10,5	12,4	7,1	12,6	10,7	8,1	13,8
Mean error	0,528	0,274	0,465	0,749	0,427	0,760	0,731	0,556	0,944
The coefficient of variation	0,044	0,064	0,042	0,046	0,072	0,051	0,040	0,083	0,055

It is known that the length of the foot can be the same, but the other sizes may differ from each other. In addition, there may be a certain correlation between different dimensional features [6, 7]. Since the studied anthropometric data were divided into three

age groups, correlations were determined for the length and girth of the foot for three age groups (Fig. 1-3) and correlations for the length and width of the foot along the outer beam for three age groups (Fig. 4-6).

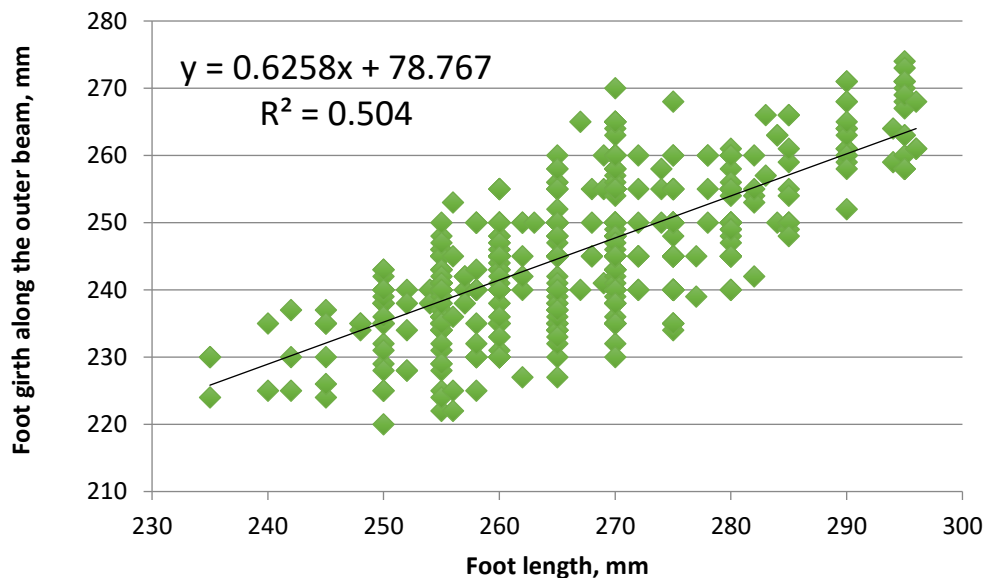


Fig. 1. Dependence between the length and girth of the foot (men 18-26 years old)

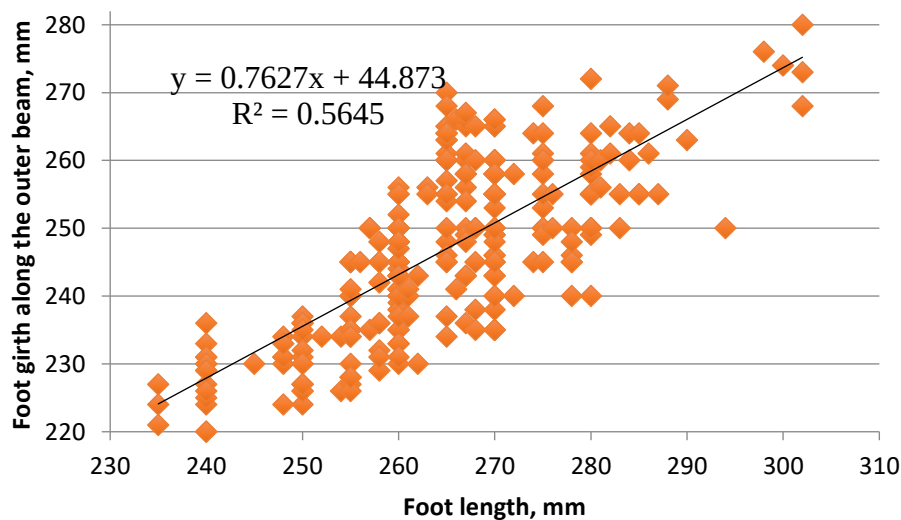


Fig. 2. Dependence between the length and girth of the foot (men 27-45 years old)

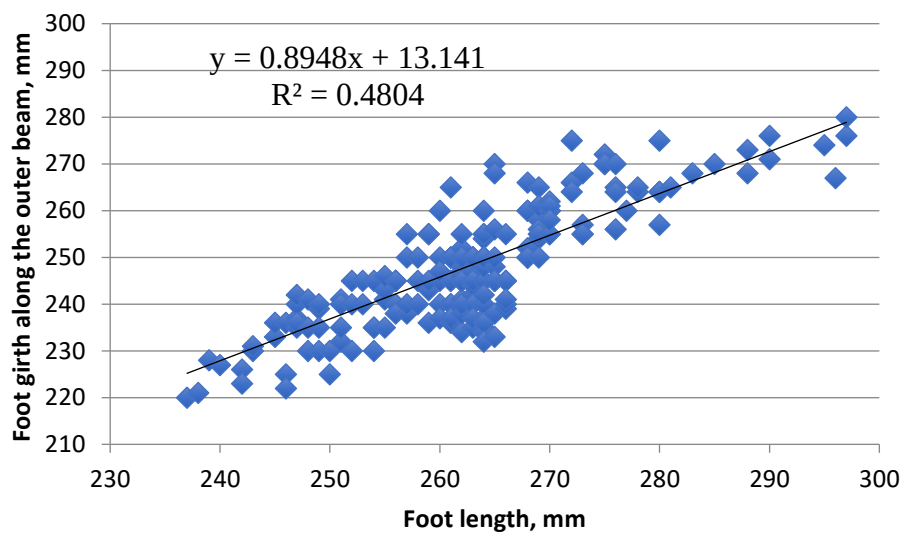


Fig. 3. Dependence between the length and girth of the foot (men 46-62 years old).

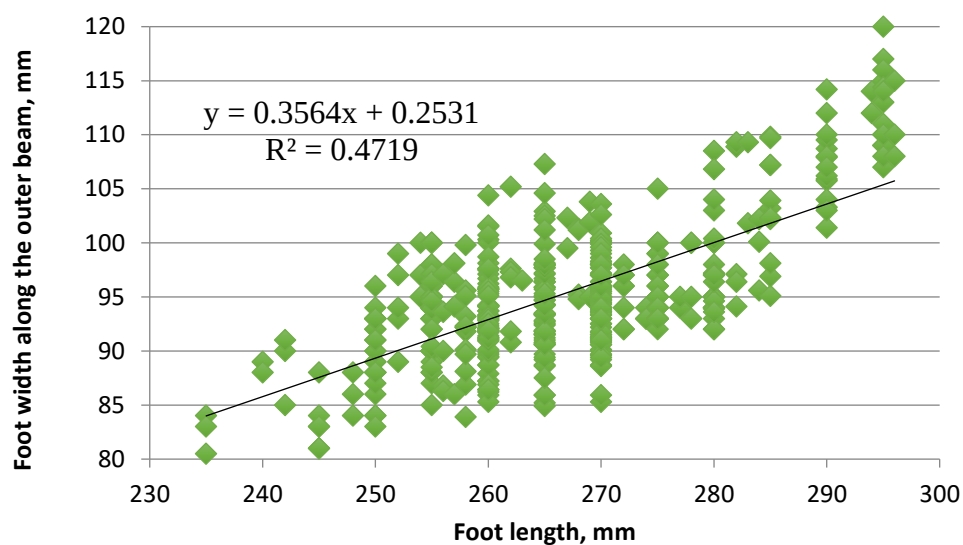


Fig. 4. Dependence between the length and width of the foot (men 18-26 years old).

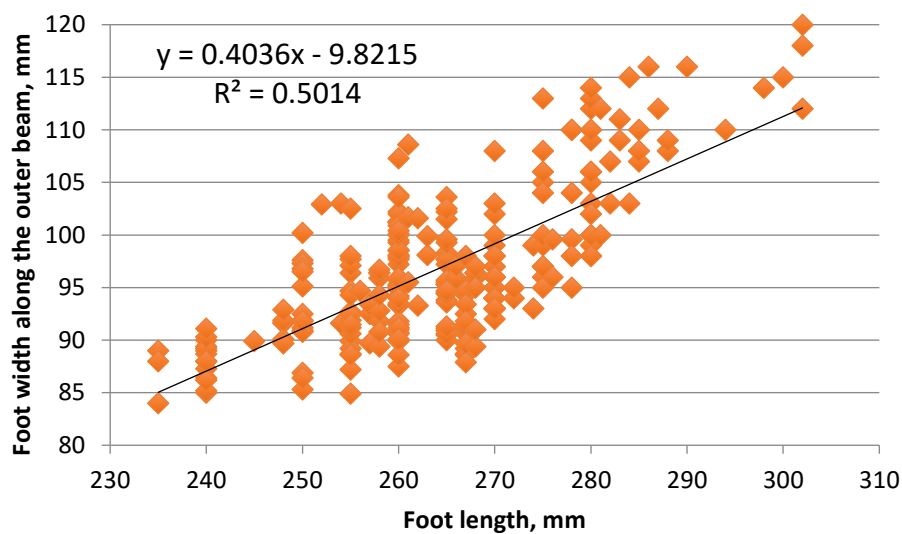


Fig. 4. Dependence between the length and width of the foot (men 27-45 years old).

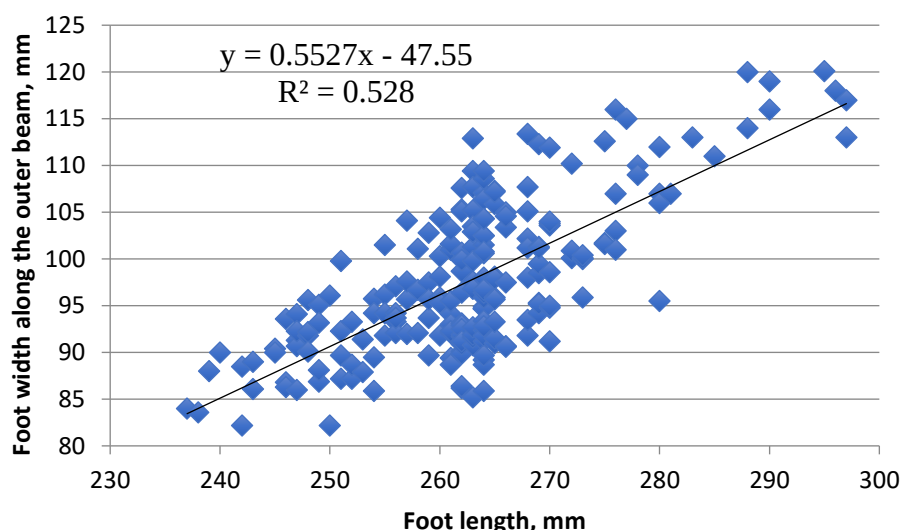


Fig. 4. Dependence between the length and width of the foot (men 46-62 years old).

The study of the size of shoe lasts was carried out using measuring tools, a ruler and a measuring tape. At “DOMBOG” Ltd., shoes are made on shoe lasts with an interval of 6.67 mm between sizes, i.e. the difference in the length of the footprint of adjacent shoe sizes produced by the enterprise is 6.67 mm. Such a system for designating shoe sizes is called the Paris Point system [9].

Results And Discussion

As a result of rheographic studies described in [10], the permissible limits for reducing the girth of the foot in bundles (squeezing the foot) as a percentage were established. This compression of the feet of men is 3.20-3.43%. Based on these data, approximate ratios of the average length and girth of the foot with the size of the shoe of medium fullness for three age groups of men were determined (table 2).

Table 2. Correspondence of the average length and girth of the foot with the size of the last of medium fullness for three age groups of men

Age group	Average foot length (mm)	Average foot girth (mm)	Last size in metric system	Shoe size in Paris Point system	Last girth in section 0.72/0.68
1 группа (18-26 лет)	266,8	245,7	270	42	238
2 группа (27-45 лет)	264,6	246,6	265	42	239
3 группа (46-62 лет)	262,8	248,3	265	41	240

As a result of the research, a database (DB) of anthropometric studies of the feet of men was created, which allows the selection of lasts both for the manufacture of shoes with the transition from the metric system of measurement to the Paris Point system, with the determination of size and completeness, and the standard sample for solving the

problem of forming a complete assortment footwear according to the age category. Certain statistical parameters of the midfoot made it possible to give recommendations for the parameters of shoe lasts for three age categories of men.

Due to the difficulty in determining the size of shoes in the Paris Point system when ordering,

a "Table of correspondence with the length and girth of the foot of metric and bar-mass sizes of lasts (shoes) in accordance with the length of the foot" has been developed, which is currently used at DOMBOG LLC

Conclusions

- Anthropometric studies of the feet of men aged 18 to 62 years were carried out, which made it possible to create a bank of anthropometric data and, based on the selected middle foot, to design a standard last for men's closed shoes;
- determined the approximate ratio of the average length and girth of the foot with the size of the last of medium width for three age groups of men.
- the results obtained in the course of the work allow, according to the anthropometric data of the foot of a certain region and age group, to design a rational last for men's shoes;
- an analysis of the ratios of the shape and dimensions of the foot and last was carried out, which makes it possible to substantiate the transition from the parameters of the foot to the corresponding parameters of the last using refined data on the characteristics of the cross-vertical sections of the last.

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