

UDC 687.1

DOI 10.47367/0021-3497_2022_3_180

**A STUDY OF ARM SHAPE
RELATED TO SLEEVE PATTERN OF CLOTHING****ИССЛЕДОВАНИЕ ФОРМЫ РУКИ,
СВЯЗАННОЙ С РУКАВОМ МОДЕЛИ ОДЕЖДЫ***BUYANDELGER DAVAADORJ**БУЯНДЭЛГЭРЮ ДАВААДОРЖ***(Industrial Technology School,
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Detecting the human sloping arm shape is a challenging task due to the clothing sleeve pattern. Sleeve is most important piece of clothing, which influence to the appearance. Good fitted sleeve depend on sloping arm shape anatomy. In the sleeve pattern to make the slope line of the forearm, most apparel engineers use the angles of Russian standard body type. But it is not giving best appearance and fit for the sleeve. Purpose of the research is to study the sloping arm shape angles of the Mongolian young male, which is used for clothing pattern. 323 healthy male were participated in this research. Three basic measurements were taken manually. To determine the main arm shape angles, photos of every person were taken from the side by digital camera (DM-Fx7). Photos were introduced by Auto Cad 07. Data of values were analyzed on the Statistica 07. Results of the study presents that Mongolian young male's arm shape is oriented upright comparing with Russian young male arm shape. Angles of Russian standard body type were more than Mongolian. It means that sleeve back sloping line will have smaller slope and could appear the wrinkles across the vertical line of the sleeve. In the next research we will study the sleeve pattern defects because of the different sloping arm shape.

Рукав – самый важный элемент одежды, который влияет на внешний вид и посадку одежды. Качество прилегания рукава к изделию достигается за счет его соответствия размеру и форме руки, пропорционального соотношения размера рукава к размеру изделия и правильной ориентации рукава. Ориентация рукава в изделии определяется положением и формой руки человека. Для проектирования рукавов одежды большинство монгольских

конструкторов одежды используют стандартные углы между плечом и предплечьем, углы, которые определяют отклонение от вертикали, проведенной от вершины оката нижнего конца переднего переката рукава для типичного телосложения русской фигуры. Но это не придает изделию лучший вид и не подходит формам руки монгольских юношей.

Целью исследования было изучение наклонных углов формы руки монгольского юноши, которая используется для конструирования одежды. В исследовании приняли участие 323 здоровых мужчин. Чтобы определить основные углы формы рук, фотографии каждого человека были сделаны сбоку цифровой камерой (DM-Fx7). С помощью фотографии мы определили углы, характерные для формы рукава, по программе Auto Cad 07. Эти значения были проанализированы с помощью программы Statistica 07. Результаты исследования показывают, что форма руки молодого монгола ориентирована вертикально по сравнению с формой руки молодого россиянина. Углы у типичного русского телосложения были больше, чем у монгола. Это означает, что наклонная линия рукава будет иметь меньший наклон и вдоль вертикальной линии рукава могут появиться складки. В следующем исследовании мы рассмотрим дефекты рукава из-за разной формы наклона плеча.

Keywords: clothing, set-in sleeve, forearm, coverage, roll.

Ключевые слова: одежда, втачной рукав, предплечье, охват, пережат.

Introduction

The arm is one of the most efficient and mobile parts of the human anatomy. It functions primarily in a forward motion but is capable of moving in every direction. In the sleeve pattern, professionals use the angles such as upper and bottom sloping angles of forearm for the Russian standard body type [1, 2]. To determine the body shape and the fit, Kohn and Ashdown first used the video-captured images [3].

Every individual has own arm shape. In the clothing pattern, they are classified as upright, perfect, forward sloping arm shape [6]. Because of the individual feature, wrinkles could appear on the surface of the sleeve, which decrease the appearance and fit [2].

To get best appearance of the sleeve, arm shape angles must be derived from the certain population anthropometry data.

Methodology

In the research, 322 healthy male subjects of age ranging from 19-25 years were participated. Their basic body measurements' values were shown in the Table 1 and were recorded manually using the measurement standard ISO 8559, DN 3137-71 [5].

Table 1

	Basic body measurements	Mean values, cm
1	Height	167.7±0.32
2	Bust circumference	89.7±0.24
3	Waist circumference	76.2±0.23
4	Upper arm circumference	20.79±1.39

The three new angles were used to determine the arm shape [3]. Terminologies of the sloping arm shape angles were shown in the Table 2

Table 2

Angles	Term	Geometric definitions	Function for the sleeve construction
α	Upper sloping angle of forearm	angle between lines of shoulder vertical and internal side of forearm	General collapse of the arm.
γ	Bottom sloping angle of forearm	angle between the lines vertical from front side of elbow and internal side of hand	Lean of the front side of sleeve bottom from the vertical line across the top point of cape.
β	Back angle of upper arm	Angle between the vertical from the back point and exterior side of upper arm	Expression of the muscle development

Every person was captured from the side way by Digital camera (DM-Fx7). Auto CAD07 was used to determine the angles. Process of the determining the angles on the Auto CAD 07 was shown in the Fig 1.

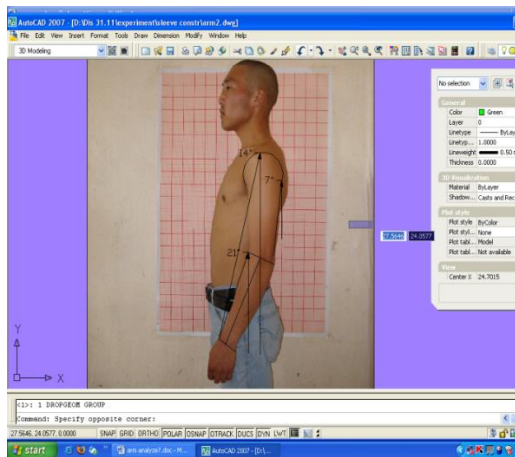


Fig. 1

Results

Data analyzing was made by Statistica 07. Descriptive statistics of the arm shape angles was shown in the Table 3 [7].

Table 3

	Descriptive statistics	α	γ	β
1	Mean	9.34	14.57	7.01
2	Standard Error	0.15	0.20	0.25
3	Median	9	15	8
4	Mode	9	16	0
5	Standard Deviation	2.65	3.58	4.45
6	Sample Variance	7.00	12.81	19.85
7	Kurtosis	-0.48	-0.53	-0.60
8	Skewness	0.04	-0.06	-0.1
9	Range	11	15	17
10	Minimum	4	7	0
11	Maximum	15	22	17
12	Sum	2833	4503	2189
13	Count	303	309	312
14	Largest(1)	15	22	17
15	Smallest(1)	4	7	0
16	Confidence Level(95.0%)	0.29	0.40	0.49

Histograms were created and shown in the Figure.2.

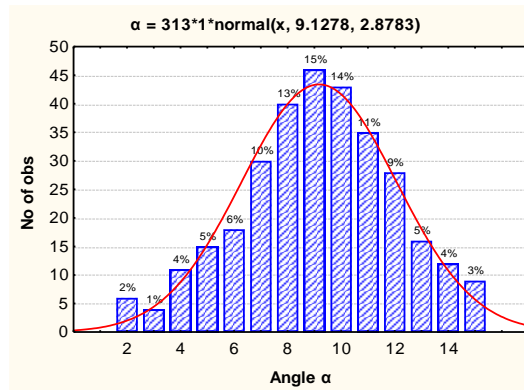


Fig. 2

The Shapiro-Wilk W Test, Kolmogorov-Smirnov test, Lillifors Test method was used in testing for normality and shown in Table 4.

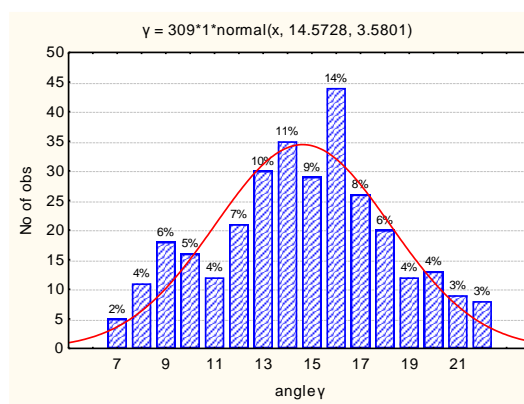


Fig. 3

Table 4

Tests	α	γ	β
Shapiro-Wilk test SW-W	0.9811 p=0.0004	0.9795 p=0.0002	0.9424 p=0.0000
Kolmogorov-Smirnov test	D= 0.0861 p<0.05	D= 0.0821 p<0.05	D= 0.1314 p<0.01
Lillifors Test Distribution	p<0.0099 Normal	p<0.0099 Normal	p<0.0099 Normal

The correlation analysis was examined for each pair of angles variables.

Table 5

Parameters	Sloping arm shape angles		
	α	β	γ
R square	0.9795	0.9357	0.9694
Correlation and P	0.9897 P=00000	9673 P=00000	9846 P=00000
Correlation	(α, γ)	(α, β)	(γ, β)

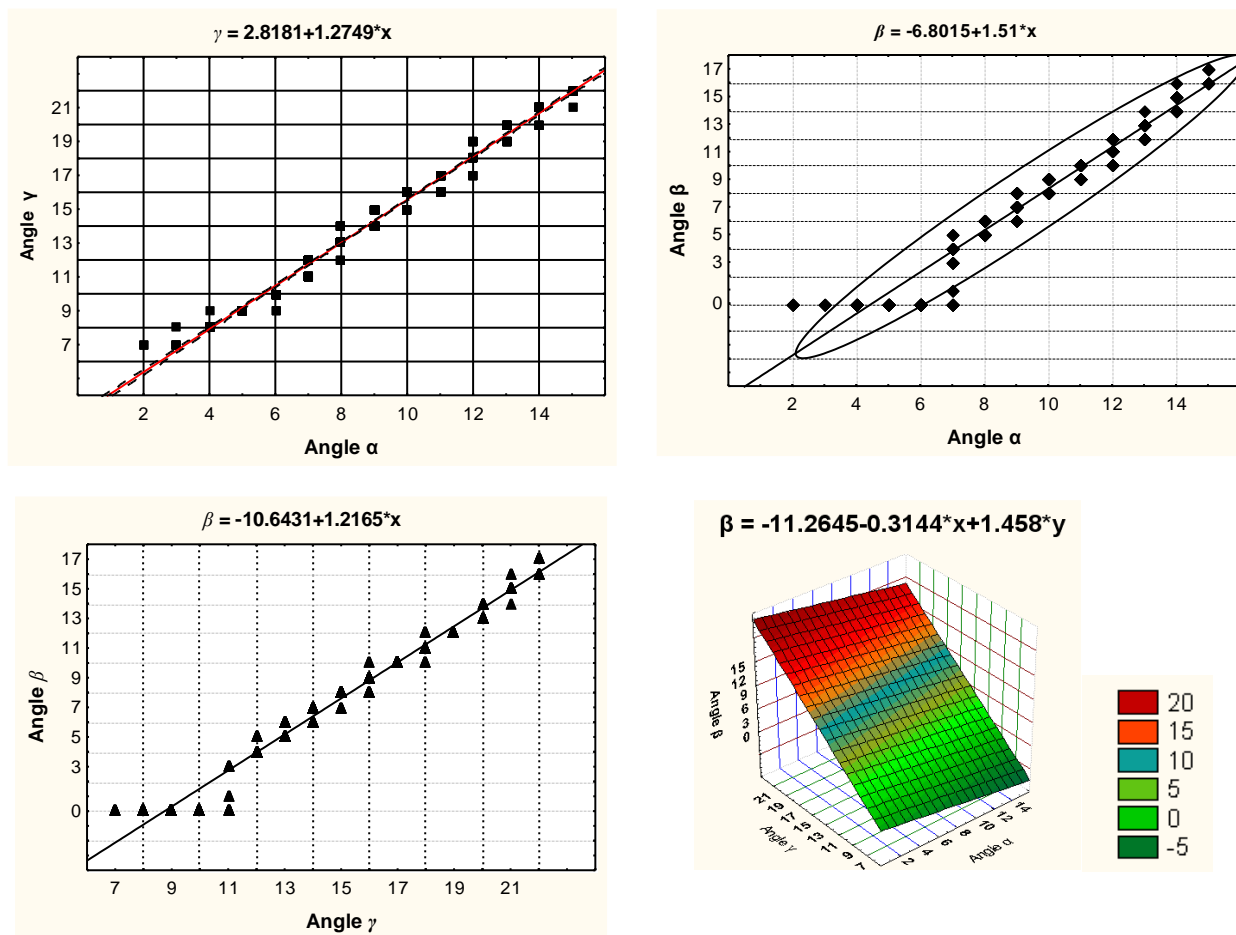


Fig. 4

The surface plot were created by angles, which characterized sloping shape of the arm in the sleeve construction. The specified surface were fitted the values of the variable represented by the z-axis and is shaded in colors corresponding to the z-axis values. Scatter plots were shown in Fig 4.

Mean values of the angles was compared with sloping arm angles of the Russian young men offered by Chenquian. Kuzmichev [4]. It is shown in the Table 6

Table 6

Symbols	Sloping arm angle's values		
	Russian standard body type [1]	Russian young male [4]	Mongolian young male
α	13.0.....14.0	11....13	6.7.....12.0
γ	11.0.....12.0	13-17	11.0.....19.1
β	Not considered	5...7	2.611.5

For Mongolian young males, standard deviation of the angles were larger than Russian.

In general, Mongolian young men's arm shape referred to forward sloping arm shape compare with Russian. Sloping angles of Russian standard body type were more than Mongolian young men.

CONCLUSIONS

For the research, 322 healthy male were invited. Body basic measurements were taking manually. To study the arm shape angles for sleeve construction, males' photos from side were captured by Digital camera. Angles were determined by the Auto Cad 07 in the photo. *Statistica-07* was used to analyze the data of angles. By the result, classification of the sloping arm shape of young men was offered and shown in the table 7.

From the descriptive analyze, all angles had negative kurtosis, which indicates a relatively flat distribution compare with standard distribution. Skewness characterized the degree of asymmetry of a distribution around its

mean. The standard deviations of the angles were big.

Table 7

Angles	Forward	Perfect	Upright
α	12 more	6.7.....12.0	7.0 rather large
γ	20.1 more	11.0.....19.1	10.0 rather large
β	12.5 more	11.5.....2.6	3.6 rather large

Compared results with the Russian young male, upper sloping angles were smaller, lower sloping angles were bigger. It means that shape arm of Mongolian young male belonged to the forward sloping arm shape. Also upper sloping angles of Mongolian young males were smaller; bottom angles were bigger than standard body angles. From the results we could predict that Mongolian young male's arm shape has different from the Russian young male and Russian Standard body type. We need to make

sure that the sloping arm shape angles were counted for the sleeve construction.

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Поступила 10.03.22.