

# AN INVESTIGATION OF THE ERGONOMICS OF JEANS

## KOT PANTOLONUN ERGONOMİSİNİN İNCELENMESİ

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### ABSTRACT

The aim of this study was to investigate the ergonomics of jeans. In the study, a questionnaire was prepared in order to investigate the ergonomics of jeans, and to discover what problems subjects had while using them, and using the results, to propose design changes to the ergonomics of jean patterns. The questionnaire was conducted on 1170 university students, of whom 614 were female and 556 were male, whose heights ranged from 160cm and below to 181cm and over, whose weights ranged from 50kg and below to 76kg and over, of whom 430 preferred low waist jeans, 705 chose normal waist jeans, and 35 preferred high waist jeans. In addition to collecting this data, the questionnaire focussed on four factors: “the discomforts of tightness” (Factor 1), “the discomforts of stepping up stairs” (Factor 2), “the discomforts of strain” (Factor 3), and “the discomforts of opening waist on the back” (Factor 4). In the factor analysis, the following results were observed that women, 170cm and below, 60kg and below, and the participants preferring low waist jeans experienced the discomfort of opening waist on the back (Factor 4), 66-70kg, 76kg and over experienced the discomfort of tightness (Factor 1), and the participants preferring high waist jeans experienced the discomforts of tightness (Factor 1), stepping up stairs (Factor 2), and strains (Factor 3). These results clearly showed that there exists a real problem in the waist area of most jeans. Finally, some suggestions for jean patterns have been made in order to solve the problems found and to produce jeans more ergonomically.

**Key Words:** Jeans, Ergonomics, Clothes, Clothes pattern.

### ÖZET

Bu çalışmanın amacı kot pantolonun ergonomisini incelemektir. Çalışmada kot pantolonun ergonomisini incelemek, kot pantolon kullananların karşılaştıkları problemleri belirlemek ve belirlenen problemlere göre kot pantolon kalıplarının ergonomisine yönelik tasarımlar önermek için bir anket formu hazırlanmıştır. Anket 1170 üniversite öğrencisine uygulanmıştır. Öğrencilerin 614’ü kız ve 556’sı erkek, boyları 160cm ve altı ile 181cm ve üstü arasında, kiloları 50kg ve altı ile 76kg ve üstü arasında, 430’u düşük bel, 705’i normal bel ve 35’i yüksek bel kot pantolon tercih etmişlerdir. Elde edilen verilere ilaveten anket dört faktörde toplanmıştır: “sıkıştırma rahatsızlığı” (Faktör 1), “merdivenden çıkma rahatsızlığı” (Faktör 2), “gerilme rahatsızlığı” (Faktör 3) ve “arkadan bel açılma rahatsızlığı” (Faktör 4). Faktör analizi sonuçlarında; kadınların, 170cm ve altında boya sahip olanların, 60kg ve altında kiloya sahip olanların ve düşük bel kot pantolon tercih edenlerin arkadan bel açılma rahatsızlığını (Faktör 4), 66-70kg ile 76kg ve üstü kiloya sahip olanların sıkıştırma rahatsızlığını (Faktör 1), ve yüksek bel kot pantolon tercih edenlerin sıkıştırma rahatsızlığını (Faktör 1), merdivenden çıkma rahatsızlığını (Faktör 2) ve gerilme rahatsızlığını (Faktör 3) yaşadıkları gözlenmiştir. Bu sonuçlar açıkça çoğu kot pantolonun bel kısmında gerçekten bir problem olduğunu göstermiştir. Sonuç olarak, tespit edilen problemleri çözmek ve daha ergonomik kot pantolon üretmek için kot pantolon kalıplarına yönelik bazı öneriler yapılmıştır.

**Anahtar Kelimeler:** Kot pantolon, Ergonomi, Giysi, Giysi kalıbı.

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### 1. INTRODUCTION

Nearly half of university students can be described as people who always follow fashion (1). Fashion is a temporary cyclical phenomenon adopted by consumers for a particular time and situation (2), yet it is not easy to create fashion design according to consumers’ preferences (3). Modern consumers are interested in clothing that not only looks good, but also feels good (4), since clothing offers values such as self-esteem, respectability, group-membership, status, confidence, etc (5). One item of fashion of particular interest to young consumers is jeans. Perhaps no other pieces of

clothing has caused as much status confusion and ambiguity as jeans have, since the beginning of western fashion about seven hundred years ago (6).

Jeans are trousers made of strong cotton, especially denim fabric (7), and were originally worn by prospectors looking for gold in America a few hundred years ago. In the last 50 years, jeans have frequently been used as the street clothes of the young, gradually and steadily moving up-market and have easily become ubiquitous. They are the universally worn garment of man and boy, woman and girl (8). The use of jeans has risen

continuously despite the fluctuations in fashion and they have become the uniform of the modern individual in today’s world. In the 2000s, the prevailing fashion trend of jeans is especially low or normal waist cut. The crotch of these jeans appears to be short or normal and certain problems have been observed when wearing them, stemming from the jean patterns.

Ready-To-Wear (RTW) firms focus on meeting the consumers’ expectations (9). Additionally, well-fitting clothing can enhance the status of the wearer, which gives consumers a feeling of satisfaction (4). Several studies have indicated that consumer satisfaction is

based in part on consumer expectations prior to garment purchase and use (10). If consumers are not completely comfortable when wearing clothes, they cannot function satisfactorily (11). Hence satisfaction is important for the consumer.

Clothing, one of the basic physiological needs, provides social status as well as comfort (12). Comfort is a pleasant state of harmony between a human being and the environment (4) and ease of movement is determined by the adaptability of the clothing to the body movements (5). Jeans are also leisure wear which, owing to their comfort, are very commonly worn, particularly by millions of young people. Even though jeans are designed to enhance comfort, they can negatively affect physical activities by reducing movement. As a result of these negative effects, jeans cause discomfort and this state requires the investigation of the ergonomics of jeans.

It is likely that jeans may mechanically restrict the physical activities of the young but not affect them to make. The physical activities is required such as sitting, squatting, stepping up, bending, etc. Consequently, a study of the ergonomics of jeans may enable better evaluation of jeans and ultimately, young people may benefit through reduced impediment from their jeans in the physical activities undertaken in their daily life.

One of clothes which researchers should study in Turkey in order to improve quality is jeans, because Turkey is one of the biggest denim markets in the world. Moreover, the fact that approximately 40% of the consumers buying denim fabric products in Turkey prefer foreign brands is an important issue of interest to manufacturers (13). These trousers are preferred, especially among the young, for a number of reasons; including their comfort, durability, ease of care and their ability to be worn in all seasons. Despite these advantages, some problems still arise in the purchase and use of jeans (14). Therefore, it is important to work out the problems confronted in terms of improving the quality of the clothes. In order to improve the quality of clothes, it is required that first, customer expectations should be determined and the specific problems with the clothes should be defined. Subsequently, one of the earlier processes in improving the quality of clothes is to ergonomically prepare the patterns of clothes in a better way.

According to studies by Kurt Salmon Associates (2000), more than half of the female population in the US cannot find apparel in the marketplace to fit. In other studies, women have reported trying on as many as twenty pairs of jeans before they find a pair that fits (15,16). In another study, it was found that young women expressed the most dissatisfaction with lower body fit at the waist, hip, and thighs and were least satisfactory with the fit of pants compared to all the other apparel products (17). In addition, crotch length is perhaps the most difficult fitting problem in total enclosure suits, not only because of the differences in body lengths in the population to be accommodated, but also because the length needed by any wearer in the crotch area varies greatly with movement (18).

Most of the studies dealing with the effects of clothing on the wearer have focused on consumers' needs and expectations. In addition, relatively few studies have attempted to investigate the effects of pants on the wearer that are directly related to the ergonomics of jeans. Although such studies answer questions of garment preference and suitability, the findings of these studies are not substantial enough to redesign jean patterns. The purpose of this research is to investigate the ergonomics of jeans and propose ergonomic jean patterns that can assist pattern designers. It is also thought that the results will be of significance and beneficial to RTW firms which produce jeans enabling them to improve the quality of their products. This study had the following objectives: (a) to prepare a questionnaire to investigate the ergonomics of jeans, (b) to identify the problems stemming from current jeans patterns, and (c) to propose a redesign of jean patterns in terms of ergonomics.

## 2. METHOD

### 2.1. Participants

The research covered Gazi University students in Ankara. Since it was not practical on account of the time limitation and financial reasons to include all students studying at Gazi University in the study, 1170 students out of 48143 volunteered to participate in the research. This sample represented 2.4% of the total student population.

A total of 1170 students completed the questionnaire, of whom 614 were

female and 556 were male. Their heights ranged from 160cm and below to 181cm and over and their weights ranged from 50kg and below to 76kg and over. Of the participants, 430 preferred low waist jeans, 705 chosen normal waist jeans, and 35 preferred high waist jeans.

### 2.2. Questionnaire

The research began by looking back at previous studies related to the issue. The characteristics and results of the previous research were examined, some clues were gathered and some information and data which would help the methodology and the course of this study were collected. However, in spite of this extensive investigation, no acceptable questionnaire in RTW field to use in the investigation of garments ergonomically was not found. Prior to beginning the questionnaire, the jeans of the subjects were observed, their ideas about the problems they had confronted were noted, and the marketing staff of businesses selling jeans were interviewed and the types of problems they had encountered were recorded. Following this survey, some academics were asked to express their ideas about the findings, and the scale was finally created. Afterwards, a pilot study was conducted by applying this scale to 50 subjects.

The questionnaire consisted of two sections. The first section related to personal details such as gender, height, weight, and waist style, while the second section focussed on discomfort when sitting, squatting, stepping up, and bending while wearing jeans in daily life. The questions in the second section related to those physical activities. This section originally had 21 questions; however two of them were removed from the analysis because they were not defined by any factor. As a result, the second section of the questionnaire had 19 questions.

### 2.3. Data Analysis

In the research, both factor analysis and one-way ANOVA were used. Factor analysis is carried out by finding patterns among the variations in the values of several variables; a cluster of highly intercorrelated variables being a factor (19). Factor analysis has also been used to cluster variables into subgroups to reduce the data set. This approach is perhaps best suited for garment development studies (20). Additionally, one-way ANOVA is a statistical technique for testing for

**Table 1.** The One-Way Anova results between the factor values and the personal details relating to discomfort when wearing jeans (n=1170)

	Factors	Categories	f	% Mean SD		F value	Significance level	Meaningful difference	
Gender	Factor 1	1)Female	614	52,48	21,98	7,37	0,38	p=0,538	-
		2)Male	556	47,52	22,25	7,90			
	Factor 2	1)Female	614	52,48	10,46	4,33	0,39	p=0,534	-
		2)Male	556	47,52	10,30	4,81			
Factor 3	1)Female	614	52,48	6,39	2,92	1,49	p=0,222	-	
	2)Male	556	47,52	6,60	3,00				
Factor 4	1)Female	614	52,48	10,55	2,88	298,53	p=0,000	(1-2)	
	2)Male	556	47,52	7,45	3,25				
Height	Factor 1	1)160cm and below	207	17,69	21,98	7,24	0,26	p=0,935	-
		2)161-165cm	230	19,66	22,18	7,39			
		3)166-170cm	240	20,51	22,21	7,10			
		4)171-175cm	168	14,36	22,15	8,24			
		5)176-180cm	189	16,15	21,67	8,14			
		6)181cm and over	136	11,62	22,59	8,05			
	Factor 2	1)160cm and below	207	17,69	10,33	3,99	1,12	p=0,347	-
		2)161-165cm	230	19,66	10,70	4,63			
		3)166-170cm	240	20,51	10,54	4,75			
		4)171-175cm	168	14,36	10,19	4,62			
		5)176-180cm	189	16,15	9,79	4,29			
		6)181cm and over	136	11,62	10,70	5,15			
	Factor 3	1)160cm and below	207	17,69	6,36	2,78	0,43	p=0,826	-
		2)161-165cm	230	19,66	6,47	2,89			
		3)166-170cm	240	20,51	6,66	3,00			
		4)171-175cm	168	14,36	6,57	3,14			
		5)176-180cm	189	16,15	6,31	2,98			
		6)181cm and over	136	11,62	6,56	2,99			
	Factor 4	1)160cm and below	207	17,69	9,96	2,75	29,10	p=0,000	(1-4)(1-5)(1-6) (2-4)(2-5)(2-6) (3-4)(3-5)(3-6)
		2)161-165cm	230	19,66	10,45	3,00			
		3)166-170cm	240	20,51	9,66	3,46			
		4)171-175cm	168	14,36	8,24	3,53			
		5)176-180cm	189	16,15	7,44	3,44			
		6)181cm and over	136	11,62	7,75	3,25			
Weight	Factor 1	1)50kg and below	182	15,55	20,36	6,97	2,88	p=0,009	(1-5)(1-7)
		2)51-55kg	200	17,09	21,80	7,13			
		3)56-60kg	208	17,78	22,38	7,50			
		4)61-65kg	182	15,55	22,07	7,56			
		5)66-70kg	147	12,56	23,24	7,93			
		6)71-75kg	118	10,09	22,07	8,61			
		7)76kg and over	133	11,38	23,38	7,88			
	Factor 2	1)50kg and below	182	15,55	9,87	3,82	0,84	p=0,536	-
		2)51-55kg	200	17,09	10,54	4,24			
		3)56-60kg	208	17,78	10,57	4,79			
		4)61-65kg	182	15,55	10,47	4,38			
		5)66-70kg	147	12,56	10,81	4,92			
		6)71-75kg	118	10,09	10,00	5,12			
		7)76kg and over	133	11,38	10,30	4,90			
	Factor 3	1)50kg and below	182	15,55	5,87	2,68	1,92	p=0,074	-
		2)51-55kg	200	17,09	6,58	2,95			
		3)56-60kg	208	17,78	6,40	2,91			
		4)61-65kg	182	15,55	6,57	2,94			
		5)66-70kg	147	12,56	6,83	3,10			
		6)71-75kg	118	10,09	6,69	3,29			
		7)76kg and over	133	11,38	6,65	2,89			
	Factor 4	1)50kg and below	182	15,55	9,93	2,95	16,33	p=0,000	(1-4)(1-5)(1-6)(1-7) (2-4)(2-5)(2-6)(2-7) (3-4)(3-5)(3-6)(3-7)
		2)51-55kg	200	17,09	10,30	2,85			
		3)56-60kg	208	17,78	9,80	3,56			
4)61-65kg		182	15,55	8,20	3,59				
5)66-70kg		147	12,56	8,15	3,45				
6)71-75kg		118	10,09	8,16	3,69				
7)76kg and over		133	11,38	7,96	3,12				
Waist Style	Factor 1	1)Low waist	430	36,75	20,70	7,34	20,40	p=0,000	(1-2)(1-3)(2-3)
		2)Normal waist	705	60,26	22,68	7,50			
		3)High waist	35	2,99	28,00	9,34			
	Factor 2	1)Low waist	430	36,75	10,00	4,25	17,80	p=0,000	(1-3)(2-3)
		2)Normal waist	705	60,26	10,40	4,57			
		3)High waist	35	2,99	14,71	5,76			
	Factor 3	1)Low waist	430	36,75	6,05	2,86	14,73	p=0,000	(1-2)(1-3)(2-3)
		2)Normal waist	705	60,26	6,65	2,96			
		3)High waist	35	2,99	8,57	2,82			
	Factor 4	1)Low waist	430	36,75	10,36	3,04	53,16	p=0,000	(1-2)
		2)Normal waist	705	60,26	8,28	3,41			
		3)High waist	35	2,99	9,29	3,68			

differences in the means of several groups (21) and based on a comparison of two sources of variance in the sample groups: between-and within-group variance (22).

Data were obtained from 1170 university students who were asked to indicate how they feel when wearing jeans in the described manner on a five-point Likert-type scale ranging from “never” to “always”. Afterwards, SPSS (Statistical Package for the Social Sciences) programme was used to encode these degrees as never=1, rarely=2, occasionally=3, often=4, and always=5.

A four-factor solution was yielded by this study, which accounted for 64.62% of the variance. The four factors are shown below;

- Factor 1, explaining 17.30 of the variance (Cronbach’s Alpha=0.66), included six items relating to “*the discomforts of tightness*”,
- Factor 2 accounted for 17.15% of the variance (Cronbach’s Alpha=0.76) and consisted of five items relating to “*the discomforts of stepping up stairs*”,
- Factor 3, explaining 16.88% of the variance (Cronbach’s Alpha=0.68), included five items relating to “*the discomforts of strain*”,
- Factor 4 accounted for 13.29% of the variance (Cronbach’s Alpha=0.83) and consisted of three items relating to “*the discomforts of opening waist on the back*”. These results suggest that the data were adequate and appropriate for factor analysis.

In data analysis, data frequency and their percentage for the personal details and the factor analysis for the discomfort during wearing period, the jeans were carried out. Also, the results of the one-way ANOVA were added. In the one-way ANOVA, with regard to the means of the data, their standard deviations, F values, significance levels, Scheffe test results and the meaningful differences were stated and statistical consequences were obtained.

### 3. RESULTS

In the chart below, the relationship between the factor values and the personal details -gender, height, weight, and waist style- are presented (Table 1).

The one-way ANOVA results between the factor values and the personal details in Table 1 are presented below;

- It can be seen that in jeans, women are more likely to have the discomfort in which their waist is opened on the back than are men (Factor 4).
- It was found that the participants with a height of 170cm and below have the discomfort of opening waist on the back more than those with a height of 171cm and over (Factor 4).
- It was found that the participants in the weight ranges 66-70kg and 76kg and over have the discomfort of tightness more than those who are 50kg and below (Factor 1). In addition to this, it was discovered that the participants with a weight of 60kg and below experienced the discomfort in which their waist is opened on the back more in comparison with those with 61kg and over do (Factor 4).
- It was found that the participants preferring high waist jeans experience the discomforts of tightness (Factor 1), stepping up stairs (Factor 2), and strains (Factor 3) more than those preferring low waist and normal waist jeans. However, it can be seen that the participants preferring low waist jeans have discomfort of opening waist on the back (Factor 4) more frequently than those preferring normal waist jeans.

Taking the results of this study into account, the following suggestions have been made:

- 1- Because jeans for both genders are made out of the same patterns, women experience discomfort in which their waist is opened on the back. In order to avoid this discomfort, it is necessary that jeans patterns should be prepared by taking the anatomy of both genders into consideration. Furthermore, the body sizes of young people should be measured and a standard size chart ought to be generated so as to define the anatomy of both genders.
- 2- The crotch on the back of the jean pattern needs to be heightened (Figure 1). In the process of heightening, the new waist line should be marked by joining the back and the front jeans patterns from the side seam. The process of heightening the back crotch has been presented in figure 1.

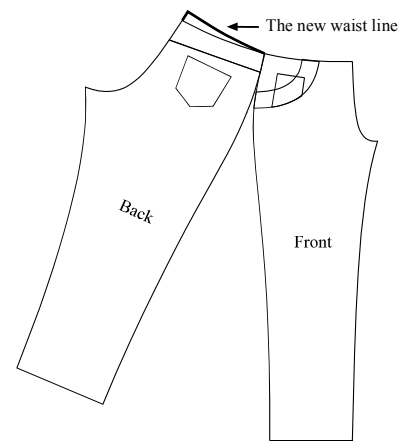


Figure 1. The process of heightening the back crotch

- 3- The waist line must be checked by joining the back and the front patterns from the side seams together as a whole (Figure 2). If the waist line needs to be corrected, a new waist line must be drawn as follows.

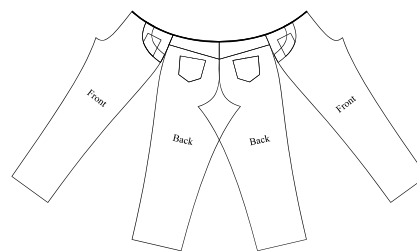


Figure 2. The process of checking the waist line for the back and front jeans patterns

- 4- The belt patterns for the jeans should be made in accordance with waist forms, through joining the back and the front jean patterns together. As a result, the belt is tight enough around the waist due to the fact that the back is not opened downwards during physical activity.

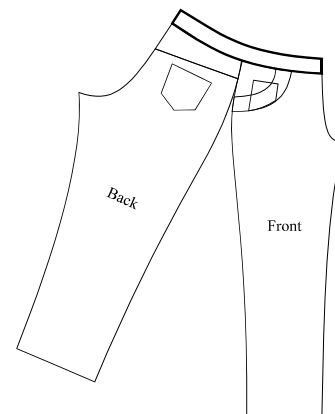


Figure 3. The belt pattern for the waist form

5- The waist must be checked by sewing a prototype jean from denim fabric, and corrected. In figure 4, both the incorrect and correct waist lines have been presented.

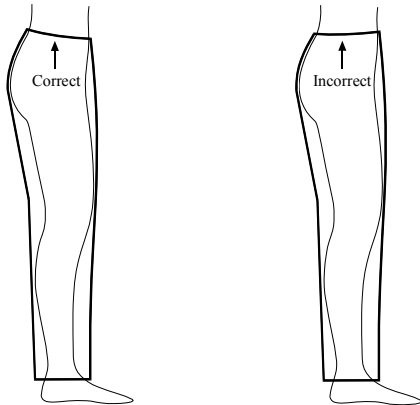


Figure 4. Correct and incorrect waist lines

#### 4. DISCUSSION

The objective of this study was to investigate the ergonomics of jeans based on a representative sample of young people using RTW jeans and with a wide range of body shapes. Current jeans patterns may lead to the back being opened when a person leans forward. As many surveys have shown, there are still both demands and complaints in the current sizing system; in particular, it is difficult to find suitable pants because of the fixed ratio between hip, thigh and waist sizes (23). Moreover, the generation of individually fit basic garment patterns is one of the most important steps in the garment-manufacturing process (24), since apparel pattern making creates a set of pattern pieces of fabric which are sewn into the desired garment (25). Therefore, using the right sizes and preparing the patterns properly would overcome the problems experienced in fitting garments to the body.

The problem arising from the results of the survey, the waist being seen in the back when wearing jeans, is a fit problem. Poor fit leads to pressure against the skin, restricting body motion (26). In addition to this, one of the problems of garment fitting is improper apparel sizing (27). Besides, most of sizing systems developed in the USA, Austria, England, Germany, Hungary, Japan and South Korea examined classified women's figures in order to give consumers an acceptable fit (28). Understanding the fit preferences of female consumers could help apparel companies to produce and meet

demands for comfortable and well fitting clothes for female (29).

Anthropometric surveys are one of the most feasible solutions to develop the relationship between pattern sizes and body dimensions (30) and the process of developing pattern size charts involves taking anthropometric body measurements (31). By using three-dimensional (3D) human body data measured by 3D scanning technology, it is possible to make personalized dummies for use in fitted pattern making (23). Body scanning technology is less expensive, faster, and incomparably more detailed than traditional anthropometry; it has already been used for 3D anthropometric surveys. In addition, apparel scholars are challenged to explore the possible applications of scanning technology to develop new sizing systems, pattern-drafting methods, grading systems, 3D draping, virtual clothing interaction, etc (32). Therefore, in order to achieve a better fit of jeans to the body, it would be better to have three dimensional body measurements and conduct anthropometric studies accordingly.

Dissatisfaction with the fit of RTW has been one of the most common problems expressed by older women (33). Older women who had a petite stature expressed the greatest overall dissatisfaction with the fit of trouser length, leg fullness, and crotch length in RTW trousers (34). Also, it was demonstrated that low levels of satisfaction were more closely associated with apparel fitting the lower body compared to other apparel categories (33). In this research, it was found that young people experienced the fact that their jeans' waist opened on the back. Consequently, the results show that consumer satisfaction is low.

In a study by Rosenblad-Wallin, 1985, user-oriented product development is initiated from a user problem and then an accurate problem analysis is carried out to find the problem and to identify the users concerns. Consequently, it is to satisfy the user interest (5). Additionally, developing a model for protective clothing effects on performance requires a multidisciplinary perspective, incorporating the fields of textile and clothing science, ergonomics, work physiology, industrial engineering, and statistics. The understanding gained from these efforts should ultimately facilitate the development of more comfortable and less impeding garments (20). Because of these,

jeans' patterns should be redesigned in order to give improved comfort and ease of movement. The result would be jeans that better satisfied ease of movement.

According to another study, the variation in crotch depth was not included in the analysis of Petrova and Ashdown's study even though it is important for body shape definition of the lower torso; it was controlled for this variation by adjusting the pant vertically (32). In another study, the crotch appeared to be too short, as the suit was tight over the buttocks, especially when bending. This was observed with subjects of all sizes (18). The results of this survey indicate that there is essentially a problem stemming from crotch.

#### 5. CONCLUSION

Ergonomic clothes are important in providing greater comfort during physical activities. This research was undertaken in order to investigate the ergonomics of jeans by analysing the relationship between jeans, their wearers, and their activities in daily life. The results of this research are as follows:

- Participants, approximately 52% of whom were female, 48% of whom were male; nearly 40% of whom were between 161 and 170cm in height; approximately 35% of whom were between 51 and 60kg in weight; and almost 60% of whom preferred normal waist jeans and 37% of whom preferred low waist jeans.
- Women experienced discomfort in which their waist was opened at the back (Factor 4) more than men. However, no meaningful correlation was observed between the discomforts of tightness (Factor 1), stepping up stairs (Factor 2), strain (Factor 3), and gender.
- Participants with a height of 170cm and below reported discomfort of opening waist at the back more than those 171cm and over (Factor 4). However, no meaningful correlations were found between the other factors and height.
- Participants with a weight of 60kg and below experienced discomfort of opening waist at the back more than those 61kg and over (Factor 4) and, in addition, those in the 66-70kg, and 76kg and over weight ranges experienced the discomfort of tightness more than those 50kg and below (Factor 1). No meaningful

correlation was observed between the discomforts of stepping up stairs (Factor 2), strain (Factor 3), and weight.

- Participants who preferred high waist jeans reported the discomforts of tightness (Factor 1), stepping up stairs (Factor 2), and strains (Factor 3) more than those who preferred low waist and normal waist jeans. In addition, participants who preferred low waist jeans experienced the

discomfort of opening waist on the back (Factor 4) more frequently than those who preferred normal waist jeans. To sum up, the results, overall, have revealed that the participants experienced the discomfort in which their jeans waist opened on the back.

The purpose of this study was to determine the discomfort problems in regard to ergonomics and to create clothing pattern designs having optimal fitting. People wearing jeans would not

probably not experience discomfort if the jeans' patterns were redesigned as suggested by this research.

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*Bu araştırma, Bilim Kurulumuz tarafından incelendikten sonra, oylama ile saptanan iki hakemin görüşüne sunulmuştur. Her iki hakem yaptıkları incelemeler sonucunda araştırmanın bilimselliği ve sunumu olarak "Hakem Onaylı Araştırma" vasfıyla yayımlanabileceğine karar vermişlerdir.*

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## **KUMAŞ ÜRETİMİNDE YENİLİKLER**

Türkiye'de dev adımlarla ilerleyen tekstil firmaları üzerine sigara kokusu sinmeyen, yürüdükçe etrafa parfüm kokulu saçan elbiseler üretmeye başladı.

Katmadeğeri yüksek olan bu ürünlerle ilgili Türk tekstil sektörü de birbirinden farklı özelliklerde ürünler geliştiriyor. Bu akıllı ürünler arasında sigara kokusu tutmayan ve yürüdükçe parfüm kokusu yayan takım elbiselerden, klima görevi gören ürünlere, anti bakteriyel, selülit önleyici ve nem dengeleyici kadın çoraplarından, yaz aylarında kullanıma uygun hafif deri giysilere kadar pek çok ürün hayatımıza girmeye hazırlanıyor.

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Akıllı tekstil ürünlerinde son yenilik ise klima görevi gören kumaşlar. Bu konudaki araştırmalar meyvesini vermek üzere. Yakında hava şartlarına bakılmadan sokakta istediğiniz kıyafetle dolaşma imkanı sağlayan kumaşlardan elbiseler de üretilecek.

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