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An Investigation of Sensorial Comfort in Woven Women's Blouses

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ABSTRACT

The aim of this research was to investigate woven women's blouses in terms of sensorial comfort. In the research, a "Sensorial Comfort Assessment Model" including objective measurements and subjective evaluations was created. The objective measurement results showed that the silk fabric was the lightest and thinnest, the polyester fabric was the tightest, softest, loosest, driest and most resistant to wrinkle and the lyocell fabric was the heaviest one with the lowest air permeability. The subjective evaluation results showed that the fabrics were categorized into three groups as silk-polyester-viscose, cotton-lyocell and linen according to their similarities. In summary, the similarity coefficients between the objective measurement results and the subjective evaluation results obtained by touching the fabrics were at a low level; however, the level of similarities between the subjective evaluation results obtained by touching the fabrics and wearing the blouses were higher.

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Woven fabric, clothing comfort, sensorial comfort, objective measurement and subjective evaluation

1. INTRODUCTION

Clothing is expected to give an ease of movement physiologically, to look aesthetic and to make people feel happy psychologically, to adapt the surrounding temperature thermophysiologically and to make a pleasant feeling on the skin sensorially. All these functions of clothing are described as "clothing comfort". In addition, clothing, which is an indispensable part of human beings, is in constant contact with the body and wraps the body like a second skin. Such integration of clothing with human body increases the significance of the clothing comfort.

According to Milenkovic et al. (1999), clothing comfort is defined as "a person's satisfaction while wearing a clothing or feeling comfortable in this clothing" [1]. Clothing comfort may also differ from person to person depending on perceptions of people [2]. For example, the same clothing can be evaluated as comfortable or uncomfortable by different people [3].

Expanding the consumers' awareness about the clothing comfort enables consumers to prefer clothes that make them feeling good inside as well as looking good [4]. Moreover, modern consumers have the clothing comfort down as one of the most important features in purchasing ready-to-wear products [5].

Clothing comfort has been identified as one of the key attributes in consumers' perception of the desirability of apparel products in all markets. In order to succeed in a highly competitive apparel market, manufacturers have to meet or even exceed consumers' needs and expectations [6]. For this reason, ready-to-wear manufacturers tend to focus on the comfort of their apparel products [5].

The most important textile material constituting clothing is fabric. Not only having a good painting, colorful solution and durability is enough for clothing fabrics, but also the fabrics should have good comfort properties [7]. The sensorial comfort might be one of the most important comfort properties of fabric and clothing, since the perceived sensorial comfort of wearers of garments depends

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to a great extent on the tactile properties of the fabrics [8].

According to Umbach (1988), the sensorial comfort is mainly determined by fabric surface properties. It is associated with skin contact sensations and is often expressed as feelings of softness, smoothness, clamminess, clinginess, prickliness and liking. These descriptors can be related to specific, measurable fabric mechanical and surface properties that are mainly determined by fiber, yarn and fabric construction [9].

The fabric properties are very important in terms of the sensorial clothing comfort. For example, the fabric properties such as blending, weight, texture type, thread density, strength, abrasion, pilling, shrinkage etc. significantly affect on the wearing performance of clothing [10].

Several marketing studies have pointed out that modern consumers consider the sensory evaluation as one of the most important attributes in their purchase of clothing. The sensorial comfort, many times just simply identified by "hand", is essentially a result of how much stress is generated by the fabric and how it is distributed over the skin [8].

The sensorial clothing comfort is expected to continue to attract the attention of both apparel manufacturers and market researchers. Meanwhile, an objective comfort measurement coupled with a subjective comfort evaluation regarded as the appropriate approach for the sensorial comfort [6]. Briefly, the objective measurements are considered together with the subjective evaluations in the sensorial clothing comfort researches [11].

The objective measurement and the subjective evaluation in terms of the sensorial comfort express two different concepts [3]. It is crucial to convert the subjective evaluations to the numerical values to find a relationship with the objective measurements to analyze statistical evaluation [12]. Therefore, the objective measurements and the subjective evaluations of fabrics and garments are considered together in the sensorial comfort researches. While tests are performed to determine the fabric properties in the objective measurements, the feelings experienced by touching the fabrics are figured out in the subjective evaluations.

In Mäkinen et al. (2005) study, in order to find a method for the sensational evaluation of textiles, the concept of "fabric hand" is commonly used. According to Pan et al. (1988) study, since fabric hand is based on subjective preferences of people, obviously it can mean different things to people. In another study performed by Kawabata (1980), each consumer examines the property of the fabric by his/her "hand" to select a good clothing material according to his/her feeling during purchasing [12].

Because the feelings experienced on the skin when touched by the clothing products are one of the determinants for the consumers' clothing purchasing behavior in fashion, textile and ready-to-wear clothing manufacturers' concern to focus on the sensorial clothing comfort in order to satisfy consumers and to produce their products with this point of view is important.

In this research, which was carried out to investigate woven women's blouses in terms of the sensorial comfort, (1) the objective measurements of the fabrics and (2) the subjective evaluations of the fabrics and the blouses were made and then (3) the obtained results were compared. The objective measurements were performed with laboratory tests. Additionally, the subjective evaluations were made by touching the fabrics and wearing the blouses made from these fabrics. At the same time, this research was considered important in terms of revealing the implications of the objective measurements and the subjective evaluations and also comparing the results with similarity coefficients.

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2. MATERIAL AND METHOD

The research material was consisted of six different fabrics and six different blouses which were produced from these fabrics. In the research, "Sensorial Comfort Assessment Model" was created in order to examine woven women's blouses in terms of the sensorial comfort. This model was divided into two as the objective measurements and the subjective evaluations.

Sensorial comfort assessment model		
Objective measurements	**Subjective evaluations**	
-Fabric Tests	-By Touching Fabrics	-By Wearing Blouses

As seen in the research model, fabric tests were made for the objective measurements, and also the subjective evaluations were made by touching fabrics and wearing blouses. In accordance with the research model, "Sensorial Comfort Descriptors" were determined, which include both the objective measurements and the subjective evaluations. These descriptors were determined based on the study of Bernard (2009) [13]. Meawhile, the researches of Sülar and Okur (2005), Gürcüm (2010) and Özçelik Kayseri et al. (2012) were also used to define the mentioned descriptors [12, 14, 15]. In Table 1, the descriptors of the sensorial comfort are given in relation to the objective measurements and the subjective evaluations.

Table 1 shows nine descriptors used for the objective measurements, 14 descriptors used subjectively by touching the fabrics and 15 descriptors by wearing the blouses, which could be evaluated in terms of the sensorial comfort.

2.1. Objective Measurements

In the research, the objective measurements of six different fabric types used in the production of women's blouses were made. These fabrics were woven 1x1 plain weaves and were made of silk (SE), lyocell (CLY), polyester (PL), cotton (CO), linen (LI) and viscose (VI) materials. Fiber analysis tests were performed on these fabrics selected within the scope of the research. Thus, it was proven that each fabric was 100% from the same fiber group and was not contain a different fiber mixture. In the mean time, nine descriptors were selected appropriate for the objective measurements and supported by laboratory tests.

It is important to determine the test methods and standards of the fabrics correctly [16]. In this research, the nine different fabric tests were applied in accredited laboratories for the objective measurements. Table 2 contains information about the tests performed on the fabrics and their standards.

In this research, before the test on the fabrics were performed, they were washed in a home automatic washing machine without using detergent and softener as in the research of Masteikaitė et al. (2013) [17]. Cotton, linen, polyester, lyocell and viscose fabrics were washed at 30 °C in a short program, whereas silk fabric was washed at 30 °C in a delicate program. The washed fabrics were dried by the laying method in a laboratory environment. The fabrics were not ironed before the tests.

2.2. Subjective Evaluations

In the subjective evaluation phase of the research, evaluations were made by touching six different washed fabrics and wearing blouses made of these washed fabrics in order to determine the effects on the skin of the participants.

Table 1. The relationship between objective measurements and subjective evaluations

	Sensorial comfort descriptors	Objective measurements	Subjective evaluations	
		fabrics tests	By touching fabrics	By wearing blouses
1.	Heavy/Light	Fabric weight	√	√
2.	Thick/Thin	Yarn count	√	√
3.	Loose/Tight	Fabric density	√	√
4.	Non-durable/Durable	Tear strength	√	√
5.	Non-air permeable/Air permeable	Air permeability	-	√
6.	Rigid/Soft	Fabric stiffness	√	√
7.	Non-flowy/Flowy	Fabric stiffness	√	√
8.	Wet/Dry	Moisture regain	√	√
9.	Wrinkled/Non-wrinkled	Crease recover angle	√	√
10.	Stretched/Non-stretched	-	√	√
11.	Rough/Smooth	-	√	√
12.	Non-slippery/Slippery	-	√	√
13.	Cold/Hot	-	√	√
14.	Prickly/Non-prickly	-	√	√
15.	Itchy/ Non-itchy	-	√	√

Table 2. Tests and standards applied to fabrics

Fabric tests	Standards
Fiber analysis	AATCC 20-2013
Fabric weight	ISO 3801: 1977
Yarn count	ISO 7211-5: 1984
Fabric density	BS EN 1049-2: 1994
Tear strength	ISO 13937-1: 2000
Air permeability	GOST 12088-77/ISO 9237
Fabric stiffness	TS 1409: 1973
Moisture regain	TS 467: 1985
Crease recover angle	BS EN 22313: 1992

In the research, 30x30cm fabric samples were prepared to touch the fabrics. The blouses were selected to have long sleeves and round collars in order to increase the contact of the fabrics with the body. The chest width of the blouses was 54cm and the centre back length was 58cm. As seen in Figure 1, the subjective evaluations were obtained according to the scores given by the participants by touching the fabrics and wearing the blouses.

In the research, 30 female participants living in Istanbul, aged 18-45, sized 38-40 were randomly selected. The participants made the subjective evaluations over 14 sensorial comfort descriptors by touching the fabrics and 15 sensorial comfort descriptors by wearing the blouses. The descriptor of non-air permeable/air permeable was considered not to be able to feel by touching the fabric, therefore not evaluated.

The participants graded the sensorial comfort descriptors from “absolutely negative (1)” to “absolutely positive (5)” when making the subjective evaluations by touching the fabrics and wearing the blouses.

According to the grading given by the participants, arithmetic means were calculated. In addition to this, "Multidimensional Scaling Analysis (MDSA)" was performed on the data obtained in the research. When analysing the data, “Normalized Raw Stress” value to prove validity and “Tucker's Coefficient of Congruence” value to prove reliability was used.

According to Kalaycı (2005), if the stress value is in the range of 0.00 <0.025, it is considered as full compliance [18]. In the research, Normalized Raw Stress values were 0.005 by touching the fabrics and 0.004 by wearing the blouses for the subjective evaluations. Being less than 0.025 of these stress values shows that the analysis model adequately fits in two dimensions. Additionally, a result of 0.997 for Tucker's Coefficient of Congruence values reveals that the reliability of the multidimensional scaling analysis has a very high correlation between the subjective evaluations by touching the fabrics and by wearing the blouses.

Subjective evaluation by touching the fabric Subjective evaluation by wearing the blouse

Figure 1. Subjective evaluation samples of fabrics and blouses

Table 3. Stress values and correlation coefficients

Stress values	By touching the fabrics	By wearing the blouses
Normalized Raw Stress	**.005**	**.004**
Stress-I	.071a	.064 a
Stress-II	.177a	.158 a
S-Stress	.008b	.009b
Dispersion Accounted For (DAF)	.994	.995
Tucker's Coefficient of Congruence	**.997**	**.997**
a. Optimal scaling factor	1.06	1.06
b. Optimal scaling factor	.92	.92

2.3. Comparison of Objective Measurements and Subjective Evaluations

The results from the objective measurements and the subjective evaluations were compared in order to make a clear conclusion from the research. Sülar and Okur (2005) stated that the differences between fabrics in subjective evaluations can be ordered according to their values in order to compare each fabric one by one. In this research, in addition to the subjective evaluations, it was considered that the objective measurements could be put in order.

In this research, the objective measurement and the subjective evaluation results were ordered and then the similarity coefficients (r) were calculated. The similarity coefficients were compared in two different ways: the objective measurement (OM) with the subjective evaluation-touching (SE-T) and the subjective evaluation-touching (SE-T) with the subjective evaluation-wearing (SE-W). In these paired comparisons; r=0.17 one fabric or blouse, r=0.33 two fabrics or blouses, r=0.50 three fabrics or blouses, r=0.67 four fabrics or blouses, r=0.83 five fabrics or blouses and r=1.00 six fabrics or blouses were ordered in the same way.

To explain with an example; according to the description of heavy and light sensorial comfort, the objective measurements of the fabrics were ordered as CLY-LI-VI-CO-PL-SE and the subjective evaluation by touching the fabrics were ordered as LI-CLY-CO-VI-PL-SE. In this example, the similarity in the order of polyester and silk fabrics (PL-SE) in both cases were evaluated as r=0.33. Likewise, according to the description of heavy and light sensorial comfort, the order of the subjective evaluations by touching the fabrics were LI-CLY-CO-VI-PL-SE and by wearing the blouses were LI-CLY-CO-VI-SE-PL. In this case, the four fabrics (LI-CLY-CO-VI) were ordered the same in both sequences; thus, the similarity coefficient was 0.67 and they were 67% similar.

3. RESULTS AND DISCUSSION

3.1. Objective Measurement Results

The results of the laboratory tests performed for the objective measurements of six different blouse fabrics used in the research are shared in Table 4.

As seen above, the objective measurements were limited with the fabrics properties as fabric weight, yarn count, fabric density, tear strength, air permeability, fabric stiffness, moisture regain and crease recover angle. At the same time, the objective measurement results were found differently, because of the different fabrics. For example, while silk fabric weight was calculated 52.7 g/m², lyocell fabric weight was found 202.5 g/m². Consequently, it was aimed both to reveal the objective measurement results and to order the fabrics by using these results.

Table 4. Objective measurement results

	Fabric tests			Silk	Lyocell	Polyester	Cotton	Linen	Viscose
1.	**Fabric weight (g/m²)**			52.7	202.5	90.0	122.5	192.3	136.2
2.	**Yarn count removed from fabric (Ne)**		Weft	109.4/1	20.1/1	71.8/1	41.8/1	10.0/1	29.3/1
			Warp	107.4/1	20.0/1	97.7/1	41.5/1	11.4/1	27.8/1
3.	**Fabric density (pick/ends per cm)**		Weft	41.0	24.0	38.4	24.0	15.0	24.0
			Warp	49.4	36.4	64.4	55.0	19.0	33.4
4.	**Tear strength (gf)**		Weft	710.1	2656.0	1152.0	909.8	6524.0	1244.0
			Warp	813.6	3490.0	1740.0	1400.0	6524.0	1487.0
5.	**Air permeability (dm³/m²/s)**			597.0	208.0	330.0	215.0	808.0	564.0
6.-7.	**Fabric stiffness (mg.cm)**	Bending length (cm)	Weft	1.5	1.8	1.2	4.5	2.6	1.3
			Warp	1.5	1.6	1.3	2.0	2.7	1.4
		Bending strength (mg.cm)	Weft	18.1	116.0	15.6	54.3	330.9	29.6
			Warp	18.0	81.9	19.8	96.6	370.4	36.4
		General bending strength		18.1	97.5	17.6	71.8	350.0	32.8
8.	**Moisture regain (%)**			5.9	8.7	0.1	5.3	5.4	9.0
9.	**Crease recover angle (°)**		Weft-Front	110.0	96.0	159.0	86.0	65.0	109.0
			Weft-Back	117.0	96.0	149.0	90.0	63.0	109.0
			Warp-Front	110.0	95.0	159.0	80.0	65.0	110.0
			Warp-Back	117.0	95.0	147.0	80.0	63.0	110.0

Results regarding the laboratory tests performed for the objective evaluation of the fabrics used in the research were presented below. The orders of the fabrics were as follows:

1.	According to the weight from the heaviest to the lightest, the fabrics were ranked as lyocell, linen, viscose, cotton, polyester and silk.
2.	The fabrics from the thickest to the thinnest were lined up as linen, lyocell, viscose, cotton, polyester and silk, respectively.
3.	The fabrics were listed from loose to tight as linen, viscose, lyocell, cotton, silk and polyester.
4.	When the tear strength of the fabrics were evaluated from the lowest strength to the highest strength, they were lined up silk, cotton, viscose, polyester, lyocell and linen.
5.	According to the air permeability of the fabrics from lowest to highest, they were respectively listed as lyocell, cotton, polyester, viscose, silk and linen fabrics.
6.-7.	The fabric stiffnesses from the hardest to the softest were lined up as linen, lyocell, cotton, viscose, silk and polyester fabrics. Polyester fabric was the softest and the flowiest fabric.
8.	According to the moisture regains of the fabrics from the highest to the lowest, they were ordered as viscose, lyocell, silk, linen, cotton and polyester fabrics. Based on this result, the polyester was the fabric having the least moisture on it.
9.	According to crease recovers from the easiest to the hardest wrinkle, they were ranked as linen, cotton, lyocell, viscose, silk and polyester.

3.2. Subjective Evaluation Results

The results of the subjective evaluations of the women participating in the research by touching six different fabrics (T) and wearing six different blouses (W) are shared in Table 5.

When the general means for the subjective evaluation of the fabrics given in Table 5 are considered, it was found that the means obtained by touching the fabrics and wearing all blouses were close to each other. For example, while the mean of silk fabric was 3.82 by touching, it was calculated to be 3.80 by wearing. This result revealed that the sensorial comfort was perceived as similar between touching the fabric and wearing the blouse. In other words, close arithmetic means show that the fabrics and the blouses were perceived as similar in terms of sensorial comfort descriptors.

In the research, Multidimensional Scaling Analysis (MDSA) was performed for the subjective evaluations by touching the fabrics and wearing the blouses. Dimensions on the two-dimensional spatial map should be named while interpreting MDSA. After the analysis, the subjective evaluation dimensions were named as "Sensory and Physical Perception" and the comments were made according to these dimensions. Sensory perception dimension expressed as the sensory effect created by fabrics on individuals. Physical perception dimension defined as the effect of physical structure of fabrics on individuals. Analysis results are showed in Figure 2.

Table 5. Subjective evaluation results

	Sensorial comfort descriptors	Silk		Lyocell		Polyester		Cotton		Linen		Viscose	
		x̄		x̄		x̄		x̄		x̄		x̄	
		T	W	T	W	T	W	T	W	T	W	T	W
1.	Heavy/Light	4.57	4.60	2.00	2.43	4.50	4.80	2.53	2.67	1.67	2.13	4.27	4.13
2.	Thick/Thin	4.47	4.90	1.83	2.23	4.47	4.73	2.27	2.03	1.57	1.53	3.77	3.73
3.	Loose/Tight	4.60	4.53	3.93	4.03	4.27	3.97	4.90	4.63	2.23	2.20	3.97	4.07
4.	Non-durable/Durable	4.07	3.40	4.57	4.60	4.10	4.20	4.27	4.43	3.67	4.00	4.00	4.27
5.	Non-air permeable/Air permeable	-	2.73	-	3.37	-	2.97	-	2.13	-	2.93	-	4.13
6.	Rigid/Soft	3.50	4.00	2.70	2.70	4.40	4.40	1.73	1.70	1.37	1.30	4.60	4.27
7.	Non-flowy/Flowy	4.37	4.30	2.50	2.93	4.93	4.50	1.20	1.37	1.40	1.40	4.30	4.40
8.	Wet/Dry	2.93	2.80	3.43	3.33	3.30	2.67	4.30	4.03	4.20	3.83	2.70	3.27
9.	Wrinkled/Non-wrinkled	2.87	2.47	3.07	3.00	4.60	4.63	1.43	1.70	1.17	1.43	2.70	2.33
10.	Stretched/Non-stretched	1.50	1.57	1.50	1.33	3.00	3.53	1.40	1.40	1.47	1.47	2.63	2.70
11.	Rough/Smooth	4.47	4.70	2.97	3.60	4.00	4.53	3.37	3.80	1.97	1.90	3.93	4.37
12.	Non-slippery/Slippery	4.60	4.80	2.10	2.37	4.33	4.53	2.03	2.00	1.60	1.50	3.63	3.27
13.	Cold/Hot	2.37	2.27	3.00	2.83	2.80	2.60	2.80	3.17	2.13	2.60	3.23	2.93
14.	Prickly/Non-prickly	4.60	4.90	4.13	4.13	4.70	4.90	3.77	3.63	3.57	1.80	5.00	4.97
15.	Itchy/ Non-itchy	4.60	4.97	4.37	4.13	4.63	4.67	4.07	3.83	3.77	2.20	4.70	4.93
	General Means	**3.82**	**3.80**	**3.01**	**3.13**	**4.15**	**4.11**	**2.86**	**2.83**	**2.27**	**2.15**	**3.82**	**3.85**

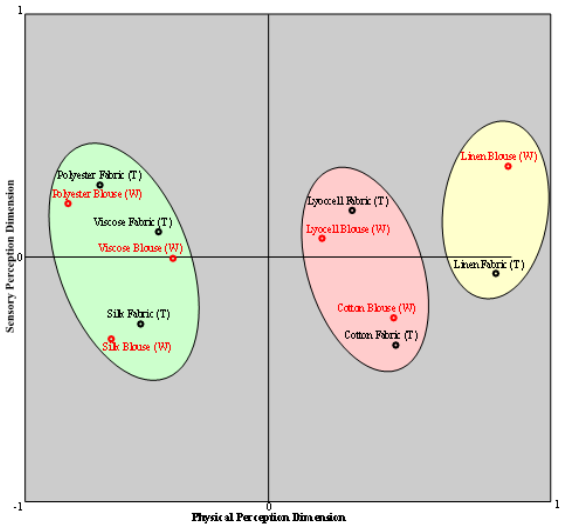

Figure 2. Multidimensional scaling analysis made by touching fabrics and wearing blouses

Analysis of the Figure 2 indicates that the fabrics and the blouses were located in three different groups according to their similarities as silk-polyester-viscose, cotton-lyocell and linen. Furthermore, the positions of all the fabrics except the linen fabric were closer to each other by touching and wearing. Thus, when the perceptions emerging by touching and wearing in the linen fabric were evaluated, there was no difference in the dimension of physical perception and that it was perceived differently in the dimension of sensory perception. The sensory perception about the linen fabric was felt much stronger when the blouse touches the body.

3.3. Relationship between Objective and Subjective Test Results

In the research, ***the objective measurement results*** showed that the silk fabric was the lightest and thinnest fabric, the polyester fabric was the tightest, softest, draped, driest and wrinkle resistant fabric, and the viscose fabric was the most moist/wet fabric. In the mean time, the lyocell fabric was the heaviest fabric with the lowest air permeability. The cotton fabric, on the other hand, had more average values. Finally, the objective measurements indicates that the linen fabric was the thickest, loosest, rigidest, driest and easily wrinkled fabric (Table 4).

The subjective evaluation results indicated that the subjective evaluations made by touching the fabrics and wearing the blouses were close to each other. This result showed that the sensorial comfort of the blouse can be felt by touching the fabric (Table 5).

The Multi-Dimensional Scaling Analysis (MDSA) made on the subjective evaluation results proved that the fabrics were divided into three groups as silk-polyester-viscose, cotton-lyocell and linen (Figure 2).

As seen above, the results of the research were obtained in two different methods as the objective measurements and the subjective evaluations. On the other hand, in order to make more meaningful inferences about the results, Table 6 and Table 7 were created and presented below.

Table 6. Objective measurement and subjective evaluation results

	Sensorial comfort descriptors	Objective measurements fabric tests	Ordering subjective evaluations by touching the fabrics	Subjective evaluations by wearing the blouses
1.	Heavy/Light	CLY-LI-VI-CO-PL-SE	LI-CLY-CO-VI-PL-SE	LI-CLY-CO-VI-SE-PL
2.	Thick/Thin	LI-CLY-VI-CO-PL-SE	LI-CLY-CO-VI-PL-SE	LI-CO-CLY-VI-PL-SE
3.	Loose/Tight	LI-VI-CLY-CO-SE-PL	LI-CLY-VI-PL-SE-CO	LI-PL-CLY-VI-SE-CO
4.	Non-durable/Durable	SE-CO-VI-PL-CLY-LI	LI-VI-SE-PL-CO-CLY	SE-LI-PL-VI-CO-CLY
5.	Non-air permeable/Air permeable	CLY-CO-PL-VI-SE-LI	-	CO-SE-LI-PL-CLY-VI
6.	Rigid/Soft	LI-CLY-CO-VI-SE-PL	LI-CO-CLY-SE-PL-VI	LI-CO-CLY-SE-VI-PL
7.	Non-flowy/Flowy	LI-CLY-CO-VI-SE-PL	CO-LI-CLY-VI-SE-PL	CO-LI-CLY-SE-VI-PL
8.	Wet/Dry	VI-CLY-SE-CO-LI-PL	VI-SE-PL-CLY-LI-CO	PL-SE-VI-CLY-LI-CO
9.	Wrinkled/Non-wrinkled	LI-CO-CLY-VI-SE-PL	LI-CO-VI-SE-CLY-PL	LI-CO-VI-SE-CLY-PL
10.	Stretched/Non-stretched	-	CO-LI-CLY-SE-VI-PL	CLY-CO-LI-SE-VI-PL
11.	Rough/Smooth	-	LI-CLY-CO-VI-PL-SE	LI-CLY-CO-VI-PL-SE
12.	Non-slippery/Slippery	-	LI-CO-CLY-VI-PL-SE	LI-CO-CLY-VI-PL-SE
13.	Cold/Hot	-	LI-SE-PL-CO-CLY-VI	SE-LI-PL-CLY-VI-CO
14.	Prickly/Non-prickly	-	LI-CO-CLY-SE-PL-VI	LI-CO-CLY-SE-PL-VI
15.	Itchy/ Non-itchy	-	LI-CO-CLY-SE-PL-VI	LI-CO-CLY-PL-VI-SE

In order to compare these results, the similarity coefficients were calculated based on the rankings in Table 6. Additionally, the similarity coefficients of the objective measurement results of the fabrics with the subjective evaluation results by touching the fabrics (OM with SE-T) and the subjective evaluation results made by touching the fabrics with wearing the blouses (SE-T and SE-W) were given in Table 7.

Table 7. Similarities of objective measurement results (OM) and subjective evaluation results (SE-T with SE-W)

	Sensorial comfort descriptors	Similarity Coefficients	
		OM with SE-T	SE-T with SE-W
1.	Heavy/Light	0.33	**0.67**
2.	Thick/Thin	**0.67**	**0.67**
3.	Loose/Tight	0.33	**0.50**
4.	Non-durable/Durable	0.17	0.33
5.	Non-air permeable/Air permeable	-	-
6.	Rigid/Soft	0.17	**0.67**
7.	Non-flowy/Flowy	**0.50**	**0.67**
8.	Wet/Dry	0.33	**0.67**
9.	Wrinkled/Non-wrinkled	**0.50**	**1.00**
10.	Stretched/Non-stretched	-	**0.50**
11.	Rough/Smooth	-	**1.00**
12.	Non-slippery/Slippery	-	**1.00**
13.	Cold/Hot	-	0.17
14.	Prickly/Non-prickly	-	**1.00**
15.	Itchy/ Non-itchy	-	**0.50**

When an examination of the results showed that both the objective and the subjective results were similar in sensorial descriptors of 67% thickness/thinness, 50% non-flowy/ flowy, and 50% easily wrinkled/non-wrinkled. In other sensorial comfort descriptors, similarity coefficients were lower.

The similarity coefficients in Table 7 regarding the subjective evaluations made by touching the fabrics and wearing the blouses; sensorial comfort descriptors wrinkled/ non-wrinkled, rough/smooth, non-slippery/ slippery and prickly/non-prickly were 100% and felt completely similar. In addition, the sensorial comfort descriptors of heavy/light, thick/thin, rigid/soft, non-flowy/flowy and wet/dry were in the range of 67% and perceived moderately similar.

Findings the similar results between touching the fabrics and wearing the blouses in this study were acquired information that the feeling of touching of the clothing product with the feeling of using of the clothing was similar. Briefly, the research showed that touching the clothing product was given an idea about the sensorial comfort of the clothing.

The research conducted by Ayçiçek (2019) was related to woven fabrics for shirting in order to meet the expectations of cabin crews. Besides, 3% elastane and woven with plain weave might be added to 100% cotton, 100% bamboo and 100% tencel fabrics in order to gain mobility [19]. In this research, the blouse woven fabrics were in a plain structure as suggested by Ayçiçek (2019) and were considered more widely as silk, lyocell, polyester, cotton, linen and viscose fabrics. In this research, elastane was not preferred especially, since the use of elastane in fabrics would affect sensory perceptions.

The research of Sülar and Okur (2005) reported that the fabric attitude was evaluated as worse as the thickness of the fabrics increased [14]. In Table 6, it was observed that the thickest fabric in the objective measurements was linen, and the linen fabric was perceived negatively in the subjective evaluations. In accordance with the results obtained regarding the thickness of the fabric were similar to the research results of Sülar and Okur (2005).

The research of Gürcüm (2010) revealed that both the weft density of fabrics and the softness perception of fabrics increased [15]. In the objective measurements of this research, polyester and silk fabrics were the highest weft and warp density and the softest. The objective measurement results of this research were similar to Gürcüm's (2010) research.

According to Özdil (2003), the attitude of the fabric is a perceived property and depends on the sense of touch. It is difficult to express characteristics such as softness, hardness and drape numerically, which are often felt by touching the fabric [10]. At the same time, the handle properties of the fabrics are significantly affected by the finishing processes applied to the fabrics. In this research, the fabrics were washed so that the finishing processes did not affect the results of the research, and then the investigations were made.

In a research conducted by Can (2016), the researcher stated that easily wrinkled clothes are not preferred by users much. High wrinkling resistance is generally a feature preferred in all fabrics [20]. In this research, it was determined that the fabric with the highest wrinkle resistance was the polyester, while the lowest and easily wrinkled fabric was the linen. The easy wrinkling property of the linen fabric may cause it to be perceived negatively and not to be preferred by users.

Regarding women's blouses, TS 10698 numbered "Textile - Dress and Blouse Fabric (2011)" and TS 11436 numbered "Textile Products- Blouse (1994)" standards were prepared by the Turkish Standards Institute [21, 22]. These standards were clearly revealed the importance of fabric and blouse.

When the researches given above are examined, it is seen that there are points to investigate, develop and increase the sensorial comfort of the clothes. It is hoped that this research, which includes woven women's blouses, will serve as an example for examining other types of clothing in terms of sensorial comfort.

4. CONCLUSIONS

The results obtained in the research conducted specifically for woven women's blouses in order to examine the sensorial comfort were the objective measurement results and the subjective evaluation results in terms of similarities. Shortly, the results have revealed that the similarities

between the objective measurement results and the subjective evaluation results by touching the fabrics (OM and SE-T) were lower; however, the similarities between the subjective evaluation results made by touching the fabrics and wearing the blouses (SE-T and SE-W) were at a higher level.

Based on the results obtained in this research, which was conducted to examine women's blouses in terms of sensorial comfort, suggestions for possible future researches are developed and are given as below:

- Stretched/non-stretched, rough/smooth, non-slippery /slippery, cold/hot, prickly/non-prickly and itchy/non-itchy can be added to be extended the objective measurments.
- Innovative raw materials, auxiliary materials and materials that increase sensorial comfort in clothes can be developed.
- Statistical methods can be developed to compare objective and subjective results regarding sensorial comfort in clothing.
- Users' opinions can be obtained and their expectations can be determined for different clothing groups in order to improve sensorial comfort in clothes.
- Sensorial comfort levels of raw materials and auxiliary materials used in garment production can be determined.
- Data collection scales with proven validity and reliability can be developed to measure sensorial comfort in clothing.
- Similarities or differences between sensory comfort levels at the time of purchase and after multiple washes of clothing can be investigated.
- Researches can be conducted to determine the situation between fashion consumers' demographic characteristics and their sensorial comfort perceptions.
- New descriptors can be developed to describe the sensorial comfort, including objective measurements and subjective evaluations related to clothing.

In summary, this research, which was conducted to examine women's blouses in terms of sensorial comfort, will provide an idea for new researches in the field of sensorial comfort. The limited number of studies in the literature on the sensorial comfort in the fashion industry shows that this topic has many points that can be evaluated and investigated by researchers, designers, suppliers, manufacturers, marketers, retailers and consumers.

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