ÇOCUK GİYSİLERİNE KULLANILAN ASTARLIK KUMAŞLARIN PERFORMANS ÖZELLİKLERİİNİN DEĞERLENDİRİLMESİ

EVALUATING PERFORMANCE CHARACTERISTICS OF LINING FABRICS USED FOR CHILDREN DRESSES

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ABSTRACT
Clothing comfort is defined as anatomic, physical and/or mechanic and psychological harmony of man with material. Wearing does not only affect the comfort of man but also his performance and effectiveness, too. Each material forming clothing is an important factor affecting the comfort. Lining fabrics as one of the functional part of the clothing are the first surfaces contacting with the human body. Under the heavy and rapid living conditions of our century, lining fabrics become very important for the clothing with comfort and coziness are dominant over elegance and panache in textile sector. Lining fabrics exposed to friction and tension with body movement has great importance in terms of comfort. In this study the fabrics used widely for special occasions are investigated. Physical and comfort properties of lining fabrics were evaluated with various tests. In conclusion the most suitable lining fabric and its properties were determined.

Keywords: Clothing Comfort, Lining Fabric, Children’s Wear, Thermal Comfort, Physical Properties.

ÖZET

Anahtar Kelimeler: Giysi Konforu, Astarlık Kumaş, Çocuk Giysileri, Termal Konfor, Fiziksel Özellik.

1. INTRODUCTION
Wearing is inseparable part of human life. Wear undertakes a buffering task between human and the environment and plays an important role for a healthy life. Wearing in our days takes an important state for the children as well as adults. Parents desire the most beautiful and the healthiest one for their children. For this reason, it can be suggested that parents give more importance for their children rather than themselves. Desire for choosing the healthiest and harmless products of the families for their children who has more sensitive skin than the adults is extremely important. It can be stated that all these differences and quests increase the demand of parents on child products. At this point lining fabrics play important role for touching the skin on the subject of choosing wear for the children.

Comfort is related with physical properties owned by dresses or fabrics. Wearing comfort can be defined as satisfaction and feeling the balance of a person inside the dress and environmental conditions at that time with physiological, psychological and physical point of view and it
Polyamide mixture fabrics are provided and their physical properties are investigated with six different types of linings (4). Another technique applied to these fabrics. According to test results, it was observed that a progress on comfort properties of military fabric texture was observed at the end of special finish techniques applied (6). Examining the relation between subjective comfort evaluation and objective measurable evaluation, comfort properties of fabrics with different material and structures were analyzed (7). In order to analyze performance and different comfort properties of dresses made up from woven fabric for the children at elementary school age, 6 different single jersey fabrics were used and test results were compared statistically. The most suitable one was recommended (8).

Different design approaches to enhance the thermal comfort, particularly in terms of body cooling were discussed (9). It was studied to develop a method for providing thermal comfort to be determined with objective methods as easy as possible. Thermal comfort is one of the main components of comfort which is taking more importance gradually for selection of individual wearing (10).

As it is seen from the literature reviews there are numerous studies on the subject of performance properties of the material. However, it is clearly seen that lining fabrics which play an important role for the dress are not examined adequately. With this study fabric types used as lining for children dresses are determined first of all. In order to evaluate the physical and comfort properties of such fabrics, material types were designated and later some tests like texture type, denseness of yarn, fabric weight, thickness, tensile strength, air permeability, moisture permeability and tear strength were applied. According to the data acquired, lining fabrics which have the best comfort and physical properties were determined among the ones available in the market and widely used.

2. MATERIAL AND METHOD

In order to obtain the material of the study, lining fabrics used widely for children dress were determined with correspondence with companies manufacturing in this field. These fabrics were analyzed according to TS 11156 Standard for woven lining fabrics.

Furthermore, tests required for the study were performed by the instruments available in Ege University Textile and Apparel Research and Application Center.

Lining fabrics used in the study were subjected to different tests; air permeability, moisture permeability, porosity, tear strength and tensile strength besides their initial properties. Realization of tests with the number of samples, names of instruments and their standards were given below.

Fabric Construction

Texture types were determined with five test samples by a suitable magnifying glass.

Density

Density of the fabrics in waft and weft direction was determined according to TS 250 EN 1049-2: Method A on 5 test samples.

Weight per Unit Area

Square meter weights (g/m²) of the used fabrics were performed with five test samples according to TS 251 standard. They were cut with grammage stencil having an area of 100 cm² and weighed in precision balance.
Thickness

Digital Thickness Gauge Modal M034A machine is used in this analysis. Thickness test was performed according to TS 7128 EN ISO 5084 by applying 200 grams of load at 20 cm² area for 10 test samples of each sample.

Porosity

The total porosity of the fabric has three components; intrafiber porosity, intrayarn porosity and interyarn porosity. Some structural parameters like yarn structure and knitting type have effects on porosity features (18). According to the equation given below, \( \rho_a \ (g/cm^3) \) and \( \rho_b \ (g/cm^3) \) represent the fabric and fibre density respectively (19).

\[
\varepsilon = 1 - \frac{\rho_a}{\rho_b}
\]

Tear Strength

Tear strength of fabrics was performed on 5 test samples according to TS EN ISO 13937-1 standard on Jeames Heal trademark Model Elmatear instrument by ballistic pendulum method.

Moisture Transmission

Moisture transmission properties of the fabrics were measured with 5 test samples by MMT (Moisture Management Tester) instrument. Properties measured with MMT test instrument can be listed as wetting time, absorption rate, maximum wetting diameter and spreading speed.

Tensile Strength

Tensile strength tests of fabrics were performed with 5 test samples according to TS EN ISO 13934-1: band method by Zwick Z010 trademark Universal tensile test instrument; distance between jaws are 200 mm, velocity is 100 mm/min.

Air Permeability

Measurements of air permeability of clothes were performed by Fx 3300 Air Permeability Instrument. According to TS 391 EN ISO 9237 for Air permeability test; for 10 test samples of each sample, 100 Pascal pressure difference at 20 cm² area were applied.
This instrument provides objective measurement of moisture transmission of fabric. The fabric is kept at horizontal position by top and low sensors under a certain pressure. A computer dynamically records resistance change between each pair of metal rings standing next to top and low sensors. During the period of 20 seconds of pumping, test solution of 0.15 grams is given to top surface of the fabric that is transmitted in three directions within a test period of 120 seconds. Liquid spreads from the point given from the top of the fabric surface to bottom, and from the bottom of the fabric to the sides and finally evaporates. Moisture management tester can be seen as follows (20).

![Figure 6. SDL Atlas - Moisture Management Tester](image)

**Thermal Properties**

Thermal properties of the fabrics was measured using ALAMBETA device. Various thermal comfort parameters of samples placed between the measurement plate can be measured in a short period. The temperature of the lower and upper plate are different. While top plate temperature is 33°C, the bottom plate is 23°C.

![Figure 7. ALAMBETA](image)

Some parameters such as thermal absorbency, thermal conductivity, thermal resistance are measured with the help of the device (21).

3. **FINDINGS**

Initial properties of lining fabrics with different structures selected for tests were determined according to TS 11156 Standard. These fabrics and their properties were presented in Table 1.

Results of tests on the samples were given in the figures shown below.

**Tear Strength**

According to tear strength test results given in Figure 8, tear strength of the fabric was increased with the increased polyester content of the fabric. For 100% cotton fabrics tear strength was increased in direct proportion with density.

![Figure 8. Test results measured by tear strength](image)

**Tensile Strength**

According to tensile strength test results given in Figure 9, a direct proportion was observed between tensile strength of fabric and polyester content of the fabric. For 100% cotton fabrics tensile strength was increased in direct proportion with denseness.

![Figure 9. Test results measured by tensile strength](image)

**Table 1. Structural characteristics of lining fabrics used in testing**

<table>
<thead>
<tr>
<th>Fabric Number</th>
<th>Material Composition (%)</th>
<th>Fabric Construction</th>
<th>Warp yarn per cm (ends/cm)</th>
<th>Weft yarn per cm (picks/cm)</th>
<th>Weight per unit area (g/m²)</th>
<th>Porosity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cotton 100%</td>
<td>1/1 Plain</td>
<td>21.7</td>
<td>18.2</td>
<td>57</td>
<td>80%</td>
</tr>
<tr>
<td>2</td>
<td>Cotton 100%</td>
<td>1/1 Plain</td>
<td>37.3</td>
<td>20.3</td>
<td>72</td>
<td>72%</td>
</tr>
<tr>
<td>3</td>
<td>Cotton 70 % Polyester 30%</td>
<td>1/1 Plain</td>
<td>42.4</td>
<td>30.8</td>
<td>106</td>
<td>71%</td>
</tr>
<tr>
<td>4</td>
<td>Polyester 100%</td>
<td>1/1 Plain</td>
<td>26.2</td>
<td>25.3</td>
<td>59</td>
<td>46%</td>
</tr>
</tbody>
</table>
Air Permeability

Results of air permeability tests applied to fabrics were given in Figure 10. It was observed that when the polyester content of fabric was increased, air permeability was decreased. For 100% cotton fabrics it was observed a decrease in air permeability depending on the increase of denseness.

Moisture Transmission

As shown in Figure 11, the highest moisture transmission was owned by fabric 1, open textured cotton fabric. The second one was fabric 2, cotton fabric followed by fabric 3 and fabric 4 respectively. Here it was seen that there were differences in moisture transmission depending on cotton amount and fabric volume.

Correlation analysis has been performed to evaluate the relationship between air permeability and moisture transmission test results by using SPSS 18.0 given in Table 2. Correlation coefficient is calculated as 0.996. According to the results this relationship is statistically significant (p<0.05) and there is a strong relationship between these two parameters.

According to the results in Table 3, Fabric 2 has the highest thermal conductivity value. Although fabric 1 and fabric 2 has the same material composition, fabric 2 has better conductivity since it is thinner. Thermal absorbency values show an increasing trend from fabric 1 to 4. Considering the results of thermal resistance, fabric 2 has the highest resistance value depending on the fabric material, thickness and density.

4. CONCLUSION

Since there is less fat layer is present in the skin structure of children than adults, protective layer is not fully developed against external factors. For this reason some fabrics may cause undesirable effects on the skin of children. In order to minimize this problem, families specially prefer dresses from cotton raw materials. Skin is an organ providing heat control covering a large area of the body. Therefore products with high absorbance must be preferred for the children having sensitive skin. However in some special days, athletes with cotton are not preferred since their appearance is not good. They are not preferred also because using them in special days of hot seasons creates generally a sense of excess and increases sweat. In this case it is necessary that dresses should create air conditioner for the skin.

Table 2. Correlation analysis of air permeability and moisture transmission

<table>
<thead>
<tr>
<th>Correlations</th>
<th>Air permeability</th>
<th>Moisture transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td>1</td>
<td>0.996</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>0.004</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 3. Test results measured by ALAMBETA Tester

<table>
<thead>
<tr>
<th>Fabric Number</th>
<th>Material Composition (%)</th>
<th>Conductivity (W/mK)</th>
<th>Thickness (mm)</th>
<th>Absorption (Ws½/m²K)</th>
<th>Resistance (m²K/W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cotton 100%</td>
<td>0.038</td>
<td>0.19</td>
<td>135</td>
<td>0.0063</td>
</tr>
<tr>
<td>2</td>
<td>Cotton 100%</td>
<td>0.044</td>
<td>0.17</td>
<td>140</td>
<td>0.0073</td>
</tr>
<tr>
<td>3</td>
<td>Cotton 70% Polyester 30%</td>
<td>0.042</td>
<td>0.25</td>
<td>147</td>
<td>0.0060</td>
</tr>
<tr>
<td>4</td>
<td>Polyester 100%</td>
<td>0.036</td>
<td>0.08</td>
<td>169</td>
<td>0.0038</td>
</tr>
</tbody>
</table>
Night dresses produced for girls generally put on directly over the skin. For these dresses generally synthetic and satin weave structure are preferred as the main fabric. Visual richness, brighter appearance in comparison with natural material, obtaining vivid color with painting process and capability to make various ornaments of such fabrics provide their selectivity. In fact some of them were made with materials used in wedding dresses. There is absolutely lining process during production stage of these dresses. The most important material providing comfort is lining since it is in contact with skin directly. The highly used linings used in production of children dresses were considered and evaluated in respect of comfort and physical properties. The children's dresses for special occasions are not used for a long time. However, most children are very energetic inherently. Therefore, the materials used in the children's dresses are required to be strength.

Tear and tensile strength tests showed similar results. It was observed that fabric 4 as the most resistant one since it contained synthetic raw material. Fabric 3 is a mixture of cotton and PES and had nearly the same resistance but it should be preferred since it contained cotton rather than fabric 4. Dresses put on special days have not been used for a long time since their name implies. For this reason resistance properties of such lining fabrics of such dresses can be ignored.

Children show less patience than adults against some discomforts. For this reason they should feel comfortable in clothes. Regarding air and moisture transmission of the fabrics, Number 1 fabric has the best properties since it is sparsely textured cotton fabric. Number 2 fabric is better than fabrics 3 and 4 with respect to comfort. High air and moisture permeability of fabric 1 and 2 provides them to be preferred as such dresses to be used for warmer climates. Thus, vapor when body temperature rises will be absorbed by the fabric and this makes children dryness feel. It was observed that as the synthetic fiber amount increases, performance properties showed differences. Tear and tensile strength has increased and air permeability and moisture transmission has decreased depending upon the increase of synthetic content of the fabric.

If it is necessary to make a preference among four fabrics, the most comfortable ones were 1 and 2. However since resistance values of fabric 1 are very low and its texture is sparse and ready-made dress manufacturing has difficulties in production, it is not much preferred for children night dress wearing. However it can be suggested that fabric 2 has advantages of cotton, becoming thin and light, also convenient to serial production; thus it is the most favorable fabric to be used as lining fabric in terms of comfort.

However, Fabric 3 has to be chosen especially if there is a better expectation from the product in terms of strength. Fabric 3 has natural and synthetic mixed structure and it reflects the best features of both raw materials. It is a common fact that parents generally change their children's evening dress with a comfortable one after a couple of hours. For the special days convenience of parents essentially depends on convenience of children. Wearing the clothes during the night depends on the comfort of it. Therefore, using natural raw materials and performance properties of lining take an important role.

REFERENCES