

## Effect of some fabric structure factors on the functional properties of women summer boluses' fabrics

Dr. Shereen Sayed Osman

Lecture, spinning, weaving and knitted Department-Faculty of applied arts. Damietta university

[Shereen\\_osman@yahoo.com](mailto:Shereen_osman@yahoo.com)

### Summary

The research aims at studying the effect of structural factors on the fabrics' physical and mechanical properties in order to identify the most suitable properties of fabrics which suit its use as women's dressings. Four samples were produced according to the specific variables of woven fabrics' structural elements in terms of the different in the material which are cotton materials, polyester, mixing polyester, cotton by 65 % to 35 % also mixing polyester / lycra at percentage of 15 %. Secondly, the different thickness of yarns, wefts in the cm as (26 thread – 26 wefts in the cm) were used, and (26 threads – 33 wefts in the cm) were used. Thirdly, counts of warp and weft yarns as threads no. 2/50 cotton and 1/150 polyester lycra for weft were used) and (2/80 cotton and 1/40 cotton for weft) and (2/50 cotton and 1/30 cotton for weft).

Then the necessary tests were conducted to identify the effect of the samples structure applied on the properties of tensile strength, elongation, air permeability and hardness, using the Woven structure 1/1 in all Samples to fix the property while comparing the tests results to the samples under study.

After testing the physical and mechanical properties, results were statistically treated using unidirectional coefficient of variation, graphically represented by column forms and a total quality assessment method to identify the sample that gives the best level of functional performance in the samples under study. The result of study no. (1) showed the best study sample as per the results of the total quality evaluation, which showed a high impact on the mechanical and natural properties such as tensile strength and elongation in the direction of warp and abrasion resistance due to the correlation of these properties with the properties of the structural elements Variables in terms of the polyester material for the warp and weft, the use of thin threads, with the thickness of warp and weft.

**Keywords:** fabric construction-summer women fabrics- fabric physical properties- fabric mechanical properties

### Research Problem

The specifications of the fabrics of women's summer clothing still require scientific studies. Therefore, we studied the effect of the structural factors differ on the physical and mechanical properties. Through the answer to this question: Does the difference of structural factors affect its functional properties?

- The need to improve the functional characteristics of women's clothing fabrics to make them suitable for end use.

## Research Objective

1. Studying the specifications of women's summer clothing fabrics by specifying the following:

A - the best type of raw materials of produced fabrics.

B) The best structural factor that achieves the functional performance of the produced fabrics.

2. Studying the basic requirements of women's summer clothing fabrics and the possibility of improving their performance properties by studying some of the different mechanical properties on them and measuring them and then analyzing them.

## Research Hypothesis

1- The difference in structural factor of the fabrics affects the functional properties of the fabrics produced.

2- The difference in the type of material affects the functional properties of the produced fabrics.

3 - Reaching the best structural factor of the fabrics produced and its impact on the functional characteristics

## Research Methodology

The research follows the experimental analytical methodology.

## Research Limits

- The research sample consists of four samples of woven fabrics, all of them with Plain texture 1/1. The samples were produced with different specifications in the raw materials used, the density of the threads, the weft in cm and yarn count of warp and weft which will be mentioned in detail in the scientific side of the research.

- Raw materials used in cotton, polyester and lycra, at mixing percentage of 65% cotton to 35% polyester, using polyester at 93% with lycra 7%.

## Introduction

The functional characteristics of the textile products vary according to the end use of the product and the personal preference of the consumer, since clothing is one of the most important textile products. Therefore, the requirements of each type of clothing are determined according to the degree and quality of each requirement is important to establish the scientific basis for the design and implementation of textile products for garments.

As per the great importance and role played by the clothes in women's life in terms of feeling comfortable clothing and aesthetic appearance at the same time while wearing clothes so it was necessary to take care of fabrics used for women's summer clothes (blouses) and know the characteristics that make the specifications that must be characterized by.

The research study the production of this type of fabrics and study the impact of some structures difference on the functional characteristics of women's summer clothes, also the study aims at studying the basic requirements of women's clothing fabrics for summer blouses and the possibility of improving their performance properties.

### **The different properties of fabrics to suit their use as clothes:**

1. Performance properties that affect the fabrics' consumptive period and identify the woven ability to endure are affected by factors such as tensile strength, elongation, abrasion resistance.
2. Properties of achieving thermal comfort are affected by factors such as the amount of insulation, fabrics thermal properties, air permeability, water absorption.
3. There are several properties that affect the aesthetic appearance of clothing fabrics including Drapability, Pilling resistance, Thickness, Color and Texture.
4. Properties of easy fabrics care are affected by the rate of fabrics soiling as well as its ability to frequent washing and ironing. (Amira Ahmed Farghali Abdel Hakim, 2015)

Clothing comfort includes three separate elements: thermal comfort, one of the important goals of wearing clothes is to keep the body temperature stable. The clothing should attain three simultaneous functions: sun protection, sweat absorption from the skin surface and the speed dry of clothes sweat (Shaimaa Ismail Mohammed Amer, 2017)

As per the great importance and role played by the clothes in women's life in terms of feeling comfortable clothing and aesthetic appearance at the same time while wearing clothes so it was necessary to take care of fabrics used for women's clothes and know the characteristics that make the specifications that must be characterized by.

The most suitable fabrics used in women's clothes, which must be accompanied by physical, chemical and mechanical processes occur during the structure of clothing fabrics and this occurs in the surrounding climatic conditions, which leads to the formation of several properties employed to meet the functional and aesthetic requirements of the fabric product.

Functional and aesthetic characteristics of women's fabrics can be classified according to the behavior of the fabric product towards the variables that it deals with in the real environment for **its final use into:**

- Positive Properties including Air permeability, Water absorption, Tensile strength, Abrasion resistance, Thickness, Color fixing, Pilling resistance, Elongation, Drapability, Wrinkle resistance and Touch.
- Negative properties including Stiffness, Shrink, increasing the weight and thickness and static charges.

### **Effect of the structure factors on some of the functional and aesthetic requirements of women fabrics:**

1. Air permeability
2. Tensile strength
3. Elongation
4. Weight
5. Thickness
6. Abrasive

### **Practical experiments**

Research samples were produced using different specifications according to the specific variables of woven fabrics' structural elements using cotton materials, polyester, polyester lycra, as well as the different thickness of yarns, wefts and counts of warp and weft yarns in order to conduct the necessary tests to identify the effect of the samples structure applied on

the properties of tensile strength, elongation, air permeability and hardness, using the Woven structure 1/1 in all Samples in order to fix the Fabric structure property while comparing the tests results to the samples under study.

Table (1) shows the samples' executive specifications

Physical and mechanical properties tests

### **Laboratory tests were carried out according to the following standard specifications:**

1. Tensile Strength and Elongation
2. Air Permeability
3. Fabric Stiffness
4. Thickness, Thickness was measured as per standard specifications ASTM D 1777-96
5. wet & dry crocking
6. Fabric pilling

### **Results and Discussions:**

The following is a review of the structure effect on the tensile strength of the samples in the direction of warp and weft as shown in Figure 1:

- Sample 1 attained the highest tensile strength in the direction of warp by 612 N. This can be attributed to the effect of the material used type as the polyester fiber was used for both the warp and weft yarns, whereas the polyester fibers are characterized by strength and durability, accordingly this is reflected in the samples' tensile strength. As weaven density is one of the most important factors affecting the strength of the fabrics, increasing the warp yarns density for sample 1 increases tensile strength.
- Sample 3 recorded the lowest value of tensile strength in the warp direction by 318 N and it can be assumed that it contains 100% cotton raw material in its composition for warp and weft yarns, whereas cotton is considered medium-duty as well as the lowest samples in the warp density.
- Sample 4 recorded the highest value of the tensile strength in the weft direction. It can be assumed to the effect of using a higher yarns density than all the samples in the weft direction, in addition to its affect by the high of the polyester material which leads to the increase in sample's tensile strength in this direction.
- while noting that sample 3 was less in the tensile strength in the weft direction because of the use of less weft yarns in all samples' density, with the use of cotton raw material, which reflected in the lower tensile strength of the thread, accordingly the sample's tensile strength in the weft direction.
- The tensile strength in the warp direction increases than in the weft direction of all the samples and may be due to the yarns density in the warp direction is higher than the weft direction of all samples, regardless of the sample raw material composition.

### **Results of Air Permeability Test**

Structural effect on samples' air permeability from Fig. 3 shows that sample 3 has the highest air permeability value of 493.5 L / M<sup>2</sup> / S and may be because it is the lower density samples for warp and weft threading, while the lowest air permeability which is 161.75 L / M<sup>2</sup> / S recorded for sample 1. In spite of the accuracy of the yarns used, it is higher than all the

samples in the density of the warp and weft yarns, whereas the air permeability increases by increasing the size and number of spaces formed by the fabric, which is largely controlled by the coefficient of coverage value for the woven, the air permeability rate decreases by increasing the coefficient of coverage value of warp, weft or one of them.

### **Results of Fabrics Thickness Test**

One of the main structure factors of the fabrics, which determines the fabrics' thickness, yarns count in warp and weft direction, the raw material type and the woven structure. The following is a review of the cloth thickness test results on the samples carried out.

The structure effect on fabrics thickness is revealed through samples carried out of Figure 4, whereas Figure 3 shows the highest value of fabrics thickness by 0.24 mm while the result of sample 1 is 0.17. The reason for this is that the yarns used in the warp and weft direction of sample 3 are thicker than sample 1, Because there is a direct relationship between the diameter of the used weft thread and the thickness of the woven samples.

### **Results of Fabrics Weight Test**

The structure effect on fabrics weight per square meter is revealed through samples carried out of Figure 5, where sample 3 was the highest in weight while the result of sample 4 is the least, this is because the yarns used in warp and weft direction of sample 3 is thicker than sample 1, Because there is a direct relationship between the diameter of the used weft thread and the weight of the square meter, along with the of thickness and hardness properties.

### **Results of Hardness Test**

The effect of variables structure of the samples on hardness property is shown, as sample 3 attained the highest degree of hardness. This is likely to be due to the use of sample structure includes higher thickness yarns than the other samples in warp and weft directions, besides it is the highest value of thickness and weight. While the lowest degree of hardness was recorded in sample 1, more precise yarns were used in warp and weft directions, besides it is the lowest value of thickness and weight, whereas the fabrics hardness is affected by thickness and weight.

### **Results of Fabric pilling Test**

The effect of variables structure of the samples on Fabric pilling is shown, as sample 2 attained the highest degree of Fabric pilling. This is likely to be due to the use of sample structure includes lower thickness yarns in warp and weft, besides containing lycra with weft yarns which reduce the appearance of lint on the sample's surface.

While the less Fabric pilling was recorded in sample 3, where thicker yarns were used than other samples in warp and weft directions, besides, it is less density for yarns in warp and weft directions, consisting of the cotton material known to have great potential to form lint especially strung yarns of medium to short staple.

### **Results of Total Quality Assessment of Research Samples**

Table () shows the comparison between the research samples to reach the best sample of the research. This is done by calculating the percentage of quality of the samples' properties then representing them in the radar forms 6-7,8,9 for each sample as each side of the figure represents the percentage of the tested properties as following:

## Summary of the Results

- From the statistical analysis of the samples under study, we conclude the following:

1. The first sample attained the highest quality area, which means that it is characterized by the best structure that gives the highest quality of functional and aesthetic performance.
2. The sample was characterized thanks to its structure with a high degree of mechanical and natural properties such as tensile strength and elongation in wrap direction. This is due to the bonding of these properties by using the polyester material for wrap and weft as well as thick yarns count.
3. Installation of sample 1 from polyester for wrap and weft, using thin yarns, with yarns densities that allow for air permeable spaces to allow air permeability in the case of non-sweat absorbent fibers.
4. It is also characterized by Fabric pilling, resistance of high dry and wet friction, which gives this sample a distinct aesthetic performance rather than other samples.
5. Statistical analysis showed a weak relation between the samples' structure factors difference and the resistance to dry and wet friction.

Sample No. 3 was the lowest in the quality area, which means that it is the weakest in the mechanical and natural properties, resulting in a weak assessment of the functional and aesthetic properties.

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