International Journal of Education, Learning and Development
Vol.4, No.1, pp.70--81, February 2015
Published by European Centre for Research Training and Development UK (www.eajournals.org)

FABRIC STRUCTURES OF WEFT KNITTING, AND THE EFFECT ON SOME PROPERTIES OF OUT WEAR CLOTHES FOR WOMEN

Dr. Marwa Yasien Helmy Elbyaly

Assistant professor, department of home economics, college of education, Najran University

ABSTRACT: *Knitting fabrics are characterized by several features in terms of their ability to suit shape and texture, their softness as well as high ability to withstand converting it to a large percentage of elongation before cutting. In addition, fabrics of outer clothes produced by weft knitting machines are distinguished by the provision of comfort sense and elegant appearance, which is due to knitting combinations and mechanical and physical considerations. Therefore, the present study aims to produce weft-knitting fabrics that have functional properties suitable for women outer clothes as they have higher use efficiency and clothing comfort. Samples of fabrics have been produced of raw materials like cotton, acrylic, cotton/acrylic, cotton/polyester, and acrylic/polyester. In addition to reap, single Jersey, single jersey on hold stitch, reap-stitch jacquard. The baize used by machinery was English (5). After the implementation of cloth samples, some laboratory tests were conducted on fabrics produced under research to identify their different properties and their relationship with the variables of study factors in screening and quality at the laboratories of the National Center for Research in Doqi. The standard weather was in relative humidity of 65 ± 2%, and a temperature of 20 ± 2º. Findings of testing produced fabrics revealed that samples made of acrylic/polyester with Single Jersey on hold stitch were the idealist samples whereas samples that were completely made of cotton with installation of structural Jacquard reap structure were less- ideal. In addition, samples that were completely made of cotton with a reap structure were the highest samples regarding the columns while samples completely produced of acrylic with single jersey were the lowest. Furthermore, samples made of acrylic/cotton and reap structure were in the first rank regarding moisture absorption while samples produced from acrylic / polyester and single jersey structure were the least regarding moisture absorption. Finally, samples made of acrylic / cotton and jacquard structure were the highest samples regarding the static electricity, but samples completely produced of cotton for all structures were, in general the least with regard to this kind of electricity.*

KEYWORDS: Fabric Structures, Weft Knitting, Out Wear Clothes, Clothes for Women

INTRODUCTION

The process of knitting fabrics is one of the major processes of clothing production that are highly used in various styles that cover the body such as socks, hats, gloves, underwear, sports …etc. Furthermore, knitting raw have been of the key elements that contribute to the development of clothing industry. They are so because of their properties, such as prolapse and flexibility, which is necessary to give the product the streamlined and aesthetic shape in addition to clothing explosion resistance, which resist tearing and has an ability to tolerate strain, which helps to prolong the product's consumption life, (Salman, 1999). Structural composition plays an important role, too. It represents a set of common relations between the structure of fibers and threads in the cloth, which are of high complexity, (Yousef, 2002).

ISSN 2054-6297(Print), ISSN 2054-6300(Online)

Besides, the fact that knitting fabrics can fulfill the consumer's desires regarding comfort has caused many trials to exploit the ability of mixing threads to get knitting products with higher standards such as cotton/polyester mixture that have proved their efficacy in moisture absorption which lead to more comfort. Thus, the present study aims to identify:

a) The best structural composition that achieves the characteristics of functional performance of women knitting clothing.

b) The best raw material type that provides the best characteristics of the functional performance of women's outer clothes because of the elegancy and good appearance that distinguishes the outer clothing made of knitting.

The following hypotheses were stated in order to achieve these aims.

a. There are statistically significant differences between the structural composition type and the properties of functional performance of women outer clothing made of knitting.

b. There are statistically significant differences between the type of knitting fabric and the properties of product final use performance.

Knitting machinery

There are two kinds of knitting machinery, i.e. weft knitting machines of two types circular and rectangular and wrap knitting machines. In other words, it can be said that types of machinery differ according to the type of fabrics produced by each machine. In the present study, weft rectangular knitting machine is used. This type of machinery is composed of one or two rectangular bars. One bar inclines in a (90^o) angle of the other. Needles move inside specific tracks fixed to each bar by a set of cams. Needles feeding with threads takes place by nutrition trolley on which thread feeding is installed. Single and flat fabrics are produced without edges on both sides. Generally, these machines tend to decrease and so thick threads are used to produce heavier fabrics, (Zalat, 2003).

Structural Compositions

Fabrics structural composition is a set of common relations between the structures of fabrics fibers. These relations are distinguished by complexity because of the difficulty in measuring the dimensions of these structures by means of engineering measurements, (Mohammed, 2001).

Ordinary jersey fabrics

Ordinary jersey fabrics are the simplest types of knitting fabrics structural compositions because they are easy to be produced and simple to be structured. They consist of similar stiches with one form and one face. Such stiches are made by one set of needles and some designs can be produced by controlling the needles movement via cams designed for this purpose, (Ashishtawi, 2001). In addition, single threads of a single color or multicolored threads are used to produce fabrics with different colors that appear in the form of horizontal pens. Such a structure gives a clear contrast on the face and back. It is used in the production of pullovers, sports and underwear clothes because of their rubbery, solidity, and flexibility properties in addition to the sense of comfort provided for the person by whom they are worn. (Al Jamal, 2001) mentioned a set of traits of these jersey fabrics among which are

ISSN 2054-6297(Print), ISSN 2054-6300(Online)

1. The fabrics' face differs from its back.
2. Their landscape elongation is double their portrait elongation
3. Their ability to be circumvented from the parties.
4. Their ability to unravel longitudinally in the event of a slit occurrence.
5. Their ability to be pulled from both ends.
6. Fabrics' thickness is double the thread's diameter.

Reap fabrics

Reap fabrics are of the dual fabrics on which appears the effect of reaping on the fabrics' portrait direction. They consist of a column with one stitch or more of head stiches that represent the face stiches in the jersey structure next to a column with one stich or more of head stiches that represent jersey structure back stitches according to the required order. Reap fabrics' cost is higher than the cost of jersey as they have a heavier and thicker structure. In addition, reap machines need threads that are thinner than those threads required by jersey machines, (Zalat, 2003). Yahya (2000) mentioned that reap fabrics are characterized by:

1. The similarity between their face and back.
2. They are fixed and unable to circumvent from the parties.
3. Their ability to unravel longitudinally in case of a slit occurrence.
4. Their ability to be pulled at the end of the structure only.
5. Their thickness is double the thickness of jersey fabrics produced from the same threads and specifications.
6. Their Flexibility to return after their natural width withstand, and so they are suitable for the production of collars, bracelets, and belts.
7. Their elongation in the landscape direction is double the jersey fabrics elongation while they are equal in the portrait direction elongation.

Raw materials used in the industry of knitting clothing

Cotton

Cotton is one of the best cellulosic raw materials used at all due to its numerous natural and mechanical properties. It is the most widely used raw material in spinning, weaving and knitting industry. It has the pride of place among other raw materials because of its qualities and characteristics that are unavailable in any other raw materials. Of cotton different kinds of fabrics can be produced because cotton is a cheap raw material and in the same time cotton clothes can provide their wearers with the sense of comfort, (Madhi, 2004).

ISSN 2054-6297(Print), ISSN 2054-6300(Online)

Polyester

Polyester can be prepared from chemicals mainly found in petroleum. Mutated polyester has many types. Some of these types are polyester that is mutated against balling, mutated with contraction, mutated with high susceptibility to water, or mutated for dyeing by cationic and anionic pigments. Polyester is prepared from yarn fusion in the form of continuous strings or short bristles, (Al Bili, 2006).

Acrylic

Acrylic is one derivative of petroleum compounds. Acrylic fibers are characterized by their high resistance to the effect of temperature, (Al Najaawi, 1983).

Why knitting fabrics are used in outer clothes

Al Mahdi (2006) has mentioned that knitting fabrics are distinguished by:

1. Their properties of strength such as explosion and friction resistance, elongation, resilience, pressure resistance, durability and consumption age.

1. Their air permeability, absorption susceptibility, water transport, heat insulation quality density, resistance to static electricity, which make it better for use in terms of health.

2. Ease of use properties that encourage the consumer's demand for knitting clothing like for instance for their crumbling resistance, ease of washing, dehydration and dimension stability.

3. Their good dropdown and preferred texture by most consumers.

Scientific experiments and laboratory tests

Fabrics implementation under research

Weft knitting fabrics produced from cotton, acrylic, polyester, a mixture of cotton and acrylic, a mixture of cotton and polyester, and a mixture of acrylic and polyester were used to determine the best and most suitable kind for the purpose of the present study. They were tested with regard to the used raw materials that were of three types of raw materials namely, cotton 20/1 English, acrylic 28/2 English, and polyester 150/1 denier. The study design was 100% Cotton, 100% Acrylic, A mixture (100% cotton &100%/ acrylic, A mixture (100% cotton & 100%/polyester), and A mixture (100% acrylic &100%/polyester). The structural compositions that were used were Single jersey; single jersey, reap, and jacquard stich reap. Rectangular weft knitting machine and English baize were also used in the present study. (Ashishtawi, 2001).

Produced fabrics by the study

Twenty samples by the weft knitting machine were produced. Table (1) illustrates the specifications of these produced fabrics with different structural compositions and English baize machine, (Ashishtawi, 2001).

ISSN 2054-6297(Print), ISSN 2054-6300(Online)

Table 1. Specifications of knitting fabrics produced with different structural compositions and machine baize English

Structural composition	Raw material
100% Cotton Mixture (cotton/acrylic) Mixture (cotton/polyester) 100% Acrylic Mixture (acrylic/polyester)	Single Jersey
100% Cotton Mixture (cotton/acrylic) Mixture (cotton/polyester) 100% Acrylic Mixture (acrylic/polyester)	Single Jersey/ on hold stitch
100% Cotton Mixture (cotton/acrylic) Mixture (cotton/polyester) 100% Acrylic Mixture (acrylic/polyester)	Reap
100% Cotton Mixture (cotton/acrylic) Mixture (cotton/polyester) 100% Acrylic Mixture (acrylic/polyester)	Reap/Jacquard stitch

Laboratory tests conducted on the produced by the study

Some laboratory tests were conducted on the produced fabrics being studied to determine their various properties. Besides, the relationship of these properties with study variables namely, raw material type and structural compositions was also studied. Tests were conducted in the Testing and Quality laboratories of the National Institute for Research in Dokki in the standard weather. The relative humidity was 65 ± 2%, and the temperature was 20 ± 2^{o} with stay away at least one millimeter from the width. Conducted tests included testing the weight of one square meter of fabrics (g/m^2) that was conducted in accordance with the standard specifications, A.S.T.M, Standard, D, 1971, 64-1970. In addition to testing fabrics permeability to air: (cm 3 / cm 2 / s), regarding to the standard specifications, A.S.T.M. Standard, D, 737 – 96. The percentage of fabrics moisture absorption was also tested by reference to the Egyptian specification number 1518 in 1985. The fabrics explosion resistance, static electricity, dimension stability in the direction of rows and columns were also examined regarding the Egyptian Standard Specification Number 242 in 2001, the standard specification, ASTM D4238-9, ASTM D4238-90, the standard specification, ASTM D6207 ASTM D6207 – 03, and the standard specification, ASTM D6207 ASTM D6207 – 03.

ISSN 2054-6297(Print), ISSN 2054-6300(Online)

FINDINGS

Factorial analysis statistical program in addition to T. test were used to identify the effect of the present study variables like fabrics' type and structural composition on the natural and mechanical properties of the fabrics. Table (2) shows the test results. of the natural and mechanical fabrics properties produced under research.

Table 2. The effect of fabrics' type and structural composition on the natural and mechanical properties of produced fabrics

Structural composition	Raw material	Air permeability ($cm^3/cm^2/s$)	Dimensions stability (rows) (%)	Dimensions stability (columns) (%)	Static electricity (kilo volt)	Explosion resistance (kg/cm^2	Humidity absorption (%)	Weight of square miter (g/m^2)
Single Jersey	100% Cotton	44.50549	1.534091	1.195219	10	68	42.55319	62.60504
Single Jersey on hold stitch		52.1978	3	2.124646	80	29.6	48.93617	62.08333
Reap		27.47253	3.824363	1.159196	40	100	85.10638	37.43719
Jacquard reap		35.15484	1.208054	0.849858	20	100	89.3617	40.87791
Single Jersey	Cotton/acrylic	38.46154	4.285714	2.248876	20	38.4	42.55319	73.21867
Single Jersey on hold stitch		56.86813	11.25	2.542373	20	25.6	48.93617	72.86064
Reap		14.56044	34.61538	10.71429	20	100	100	37.96178
Jacquard reap		46.7033	17.19745	7.653061	4	100	100	36.8356
Single Jersey	Cotton/Polyester	43.55312	13.77551	4.249292	8	54.8	42.55319	62.47379
Single Jersey on hold stitch		79.94505	69.23077	1.415094	11.42857	37.2	46.80851	58.89328
Reap		31.31868	3.624161	1.415094	13.33333	100	89.3617	40.43419
Jacquard reap		39.56044	100	38.46154	10	100	87.23404	48.69281
Single Jersey	100% Acrylic	28.2967	4.029851	5,474453	80	41.2	48.93617	69.46387
Single Jersey on hold stitch		56.86813	69.23077	5.474453	10	41.6	48.93617	63.9485
Reap		17.30769	100	100	4	100	87.23404	46.20515
Jacquard reap		34.06593	9.818182	19.23077	10	100	85.10638	50.85324
Single Jersey	Acrylic/polyester	57.41758	69.23077	100	16	42	42.55319	100
Single Jersey on hold stitch		100	5.732484	100	40	100	44.68085	94.60317
Reap		31.04396	34.61538	7.653061	8	100	85.10638	53.59712
Jacquard reap		35.71429	2.456779	37.5	8	100	86.70213	47/30159

ISSN 2054-6297(Print), ISSN 2054-6300(Online)

Figure (1) clarifies these results

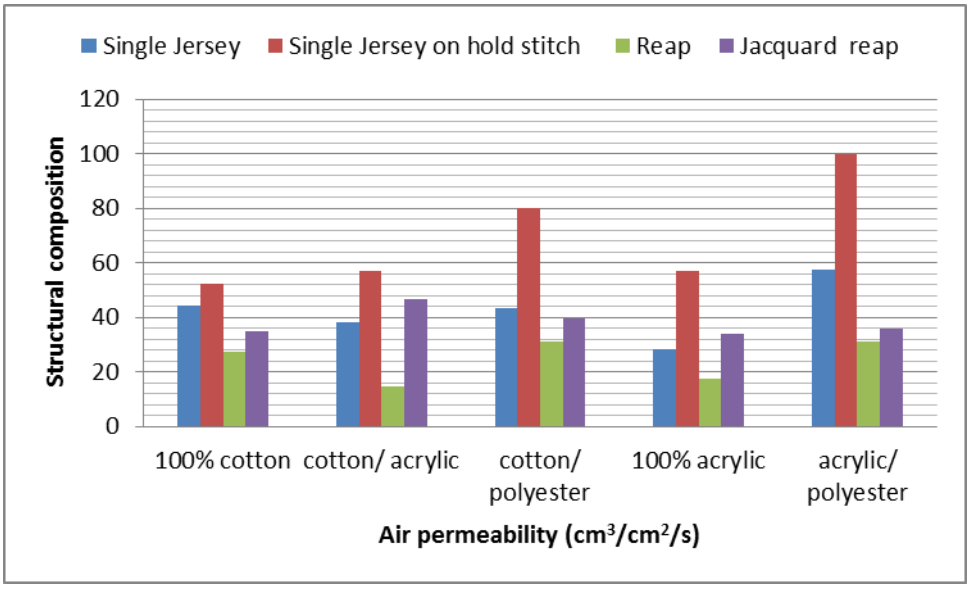


Figure 1: The impact of structural composition and raw material types on produced fabrics' air permeability properties.

As shown in figure (1), air permeability of the produced samples of single jersey structural composition (on hold stitch) and completely acrylic thread raw material was the highest. While samples of reap structural composition and cotton thread raw material had the least air permeability.

Figure (2) illustrates the impact of structural composition and raw material types on the property of dimensions stability of the produced fabrics in the direction of rows.

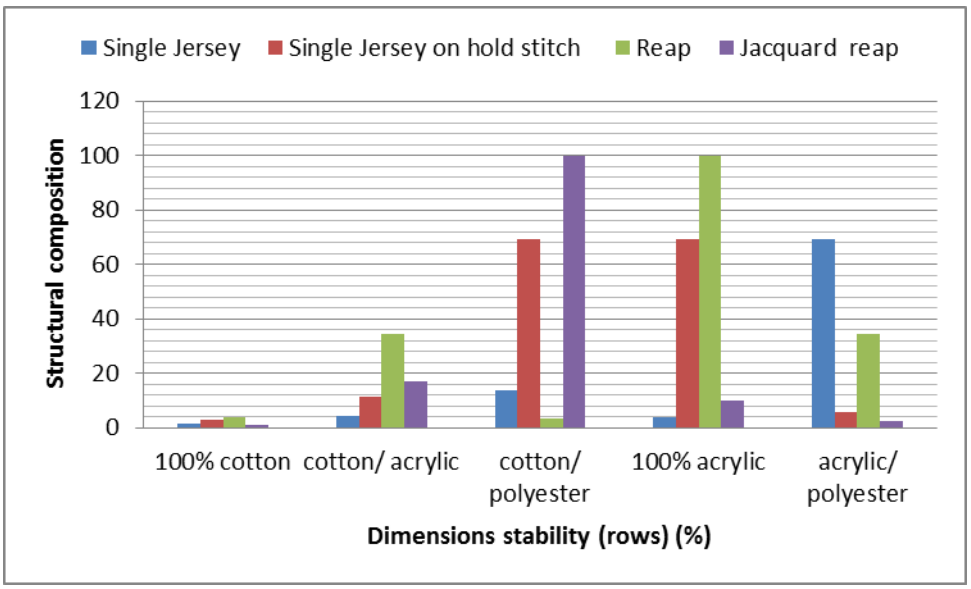


Figure 2: The impact of structural composition and raw material types on the property of dimensions stability of the produced fabrics in the direction of rows

ISSN 2054-6297(Print), ISSN 2054-6300(Online)

As appears in figure (2) produced samples of Jacquard reap structural composition and completely cotton thread elongation was the highest. Elongation of produced samples of single jersey structural composition and acrylic/polyester had the least elongation

Figure (3) clarifies the impact of structural composition and raw material types on the property of dimensions stability of the produced fabrics in the direction of columns.

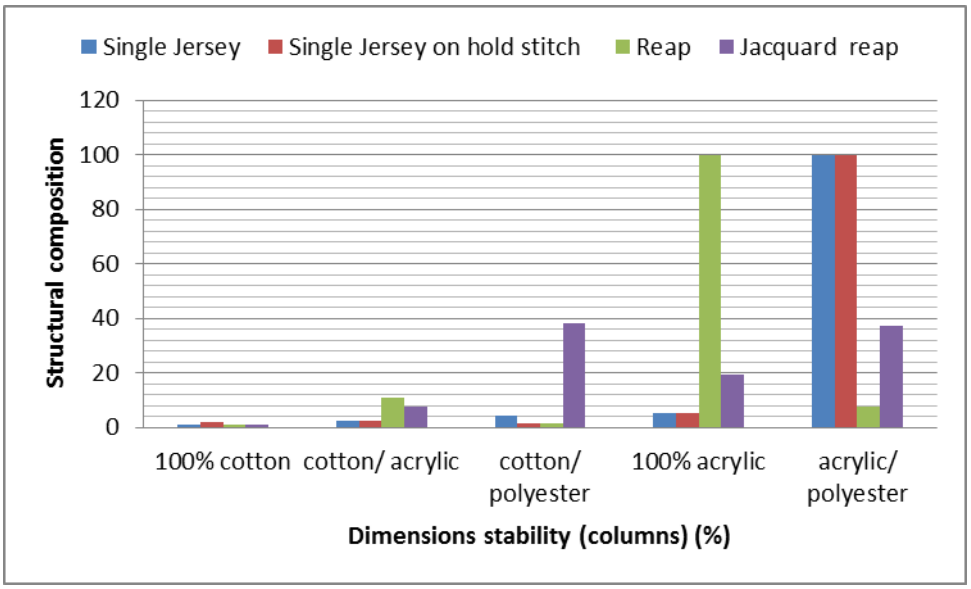
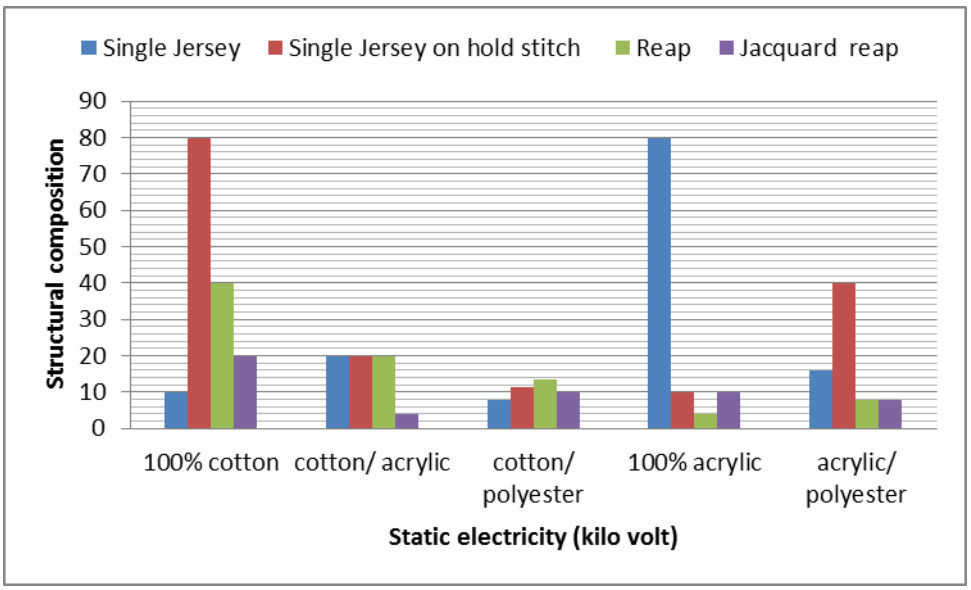


Figure 3: The impact of structural composition and raw material types on the property of dimensions stability of the produced fabrics in the direction of columns

As illustrated by Figure (3) the contraction level of the produced samples of reap jacquard structural composition and completely cotton thread was the highest. On the opposite, the contraction level of samples produced of reap jacquard structural composition and acrylic/polyester thread was the least.

Figure (4) reveals the impact of structural composition and raw material types on the property of produced fabrics static electricity.



ISSN 2054-6297(Print), ISSN 2054-6300(Online)

Figure 4: The impact of structural composition and raw material types on the property of produced fabrics static electricity

Figure (4) illustrates reveals that static electricity level of produced samples of reap jacquard structural composition, cotton/acrylic thread, reap structural composition and acrylic thread raw material was the highest. Whereas, samples of single jersey (on hold stitch) and completely cotton raw material had the lowest level of static electricity.

Figure (5) presents the impact of structural composition and raw material types on the property of fabrics explosion resistance.

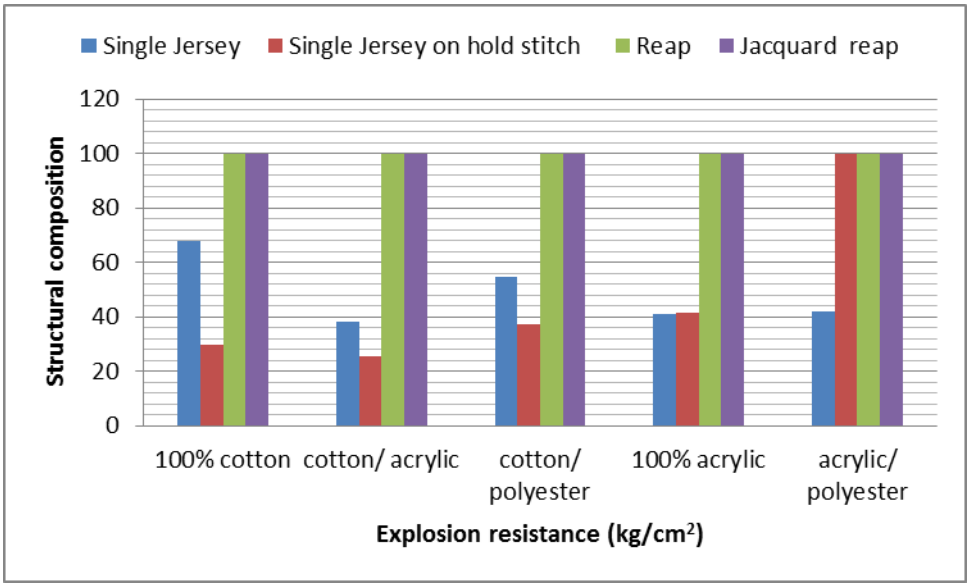


Figure 5: The impact of structural composition and raw material types on the property of fabrics explosion resistance

Figure (5) reveals that the explosion resistance level of produced samples of reap and reap jacquard structural compositions was the highest. On the other part, samples of single jersey (on hold stitch) and cotton/acrylic raw material had the lowest ability to resist explosion.

Figure (6) shows the impact of structural composition and raw material types on the property of fabrics humidity absorption.

ISSN 2054-6297(Print), ISSN 2054-6300(Online)

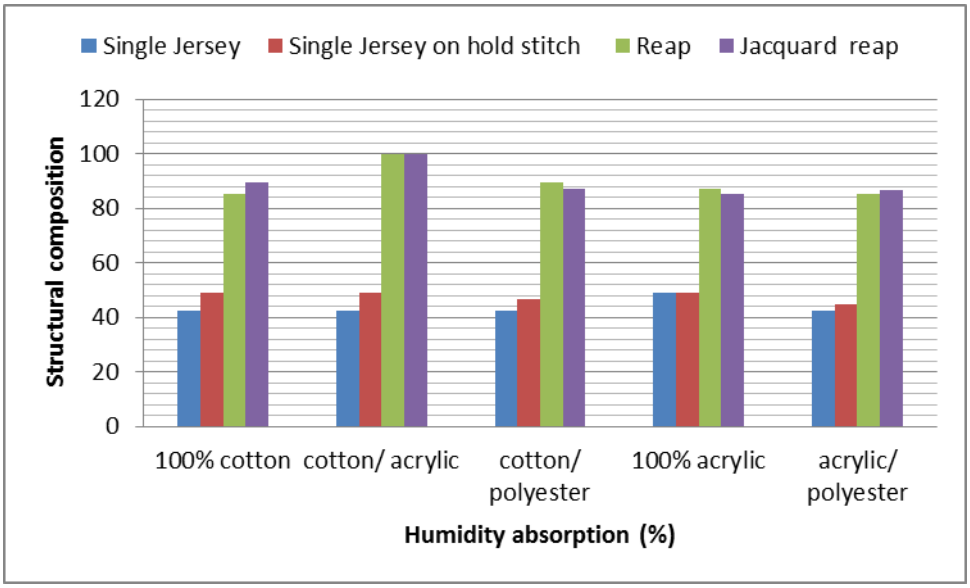


Figure 6: The impact of structural composition and raw material types on the property of fabrics humidity absorption

Figure 6 proves that humidity absorption ability of samples produced of jacquard reap structural compositions and cotton/ acrylic thread raw material, in addition to reap structural composition and cotton/acrylic thread raw material was the highest. In contrast, samples produced of single jersey of all raw materials except those produced of completely acrylic had the least ability of humidity absorption.

Figure (7) illustrates the impact of structural composition and raw material types on the property of fabrics humidity absorption.

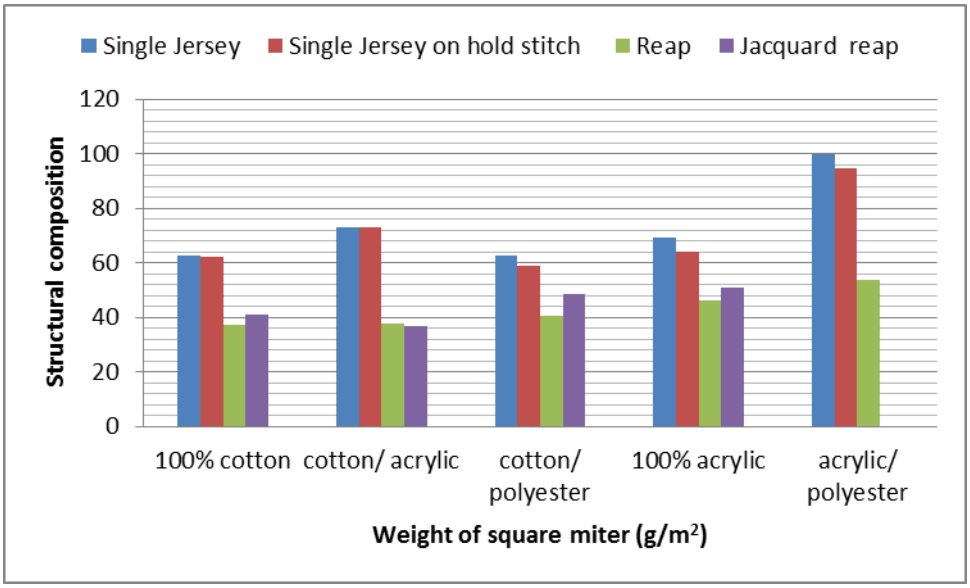


Figure 7: The impact of structural composition and raw material types on the property of fabrics humidity absorption

ISSN 2054-6297(Print), ISSN 2054-6300(Online)

Figure (7) proves that samples produced of reap structural composition and completely cotton raw material had the highest weight. In contrast, samples of single jersey structural composition and acrylic thread raw material had the least weight.

In brief, it can said that statistical analysis has proved that samples produced of single jersey structural composition (on hold stitch) and acrylic/polyester raw material have yielded better results regarding all natural and mechanical properties that were measured. In the opposite, results of samples produced of reap Jacquard structural composition and cotton/acrylic raw material showed the least results regarding all tested properties. These results corroborates the effect of structural composition and thread raw material from which fabrics samples were produced depending on the properties of knitting fabrics functionality used in women outer clothing.

When produced fabrics were put in order regarding their varied performance properties, it was found that single jersey on hold stitch made of a mixture of acrylic and polyester were the most appropriate. Table (3) illustrates the results of other produced samples.

Table 3. The order of produced samples in accordance to their quality and machine gig (5)

Structural composition	Thread raw material	Ideal space
Single jersey on hold stitch	Mixture (acrylic/polyester)	12745
Single jersey	Mixture (acrylic/polyester)	12082
Reap	100% acrylic	9907
Reap Jacquard stitch	Mixture (cotton/polyester)	7353
Reap	100% cotton	7326
Single jersey on hold stitch	100% acrylic	7119
Reap	Mixture (acrylic/polyester)	6942
Single jersey on hold stich	100% cotton	6849
Reap	Mixture (cotton/acrylic)	6794
Single jersey on hold stitch	Acrylic	6622
Reap Jacquard stitch	Mixture (acrylic/polyester)	6590
Reap	Mixture (cotton/polyester)	6422
Reap Jacquard stich	100% acrylic	5921
Single jersey on hold stitch	Mixture (cotton/acrylic)	5747
Single jersey	Mixture (cotton/polyester)	5665
Single jersey	100% cotton	5569
Single jersey	Mixture (cotton/acrylic)	5443
Reap Jacquard stitch	100% cotton	4992
Reap Jacquard stitch	Mixture (cotton/acrylic)	4764

Table (3) indicates that fabrics produced from the structural composition of single jersey on hold stitches and a raw material of a mixture of acrylic and polyester is the best with regard to the varied performance properties with an ideal space that equals 12745. While fabrics produced from the structural composition of reap Jacquard stitch and a thread raw material of a mixture of cotton and acrylic is the fabrics that has the least performance properties with an ideal space that equals 4764.

ISSN 2054-6297(Print), ISSN 2054-6300(Online)

ACKNOWLEDGMENT

The research is funded by the Deanship of Scientific Research at Najran University and holds the agreement number NU/SHED/14/088. The researcher is greatly indebted to the deanship of scientific research at Najran University for funding this study and the provision of any required help.

REFERENCE

Al Bili, M. Y. H. (2006), The Effect of the Difference in some Structural Compositions of Fabrics on pilling Property of Mixed Cotton Fabrics, (MA. Thesis), University of Kafr El-Sheikh.

Al Jamal, F. A. (2001). Studying the Factors Affecting the properties of compression and durability of socks Fabrics with Weft Knitting Machinery, (MA. Thesis), Helwan University, Egypt.

Al Mahdi, A. A. (2006). A Study for Evaluating some of Knitting Fabrics for the Sake of Improving the Quality of Egyptian Product, (MA. Thesis), Mansoura University.

Al Najaawi, A. F. (1983). Technology of Industrial Fibers and their Mixture, Alexandria, Knowledge Establishment.

Ashishtawi, A, M. (2001). The Effect of some Structural Compositions on The functional and Aesthetic Properties of School Child Clothes, (MA. Thesis), Minufia University, Egypt.

Madhi. N. I. (2004). The Effect of Softening Factors, Enzymes and Care on the Functionality of Cotton Weft Knitting Fabrics and their Use in Readymade Clothes Industry, (Ph.D. thesis), Minufia University, Egypt.

Mohammed, M. A. (2001). A Proposed Program to Use some Structural Compositions to Produce Knitting Fabrics, (Ph.D. dissertation), Minufia University, Egypt.

Salman, S. (1999). The effect of weft knitting gig machine on the properties of fabrics explosion resistance, dropdown and knitting withstand power, *journal of home economics, 9 (2/3)*.

Yahya, M. A. (2000). Obstacles of Running Knitting Fabrics at Factories of Readymade Clothes, (MA. Thesis), Minufia University, Egypt.

Yousef, M. A. (2002). *The Relationship between Natural and Static Properties of Weft Knitting Fabrics and their Quality*, (unpublished MA. Thesis), College of Applied Arts, Helawan University.

Zalat, A. S. (2003). Knitting and Crochet, Mansoura, Dar Al Islam House for printing and publication.

ISSN 2054-6297(Print), ISSN 2054-6300(Online)