Seam Characteristics of Jeans Wear

Yasser M. E. Hassan Apparel
Department Faculty of Applied Arts, Helwan University, Egypt. Work in the , Textiles and Clothing Department, Designs College, Umm Al - Qura University, Makkah, Saudi Arabia

ABSTRACT

This article reports an experimental investigation into the effect of fabric type, seam type and the type of stitch on the seam strength, seam efficiency and rating of seam pucker of jeans wear cotton: polyester blended fabrics. The rating of seam pucke was assessed subjectively. A statistical analysis using Analysis of Variance (ANOVA), to measure the significance of each factor was conducted. A quantitative relationship between these properties and the percentage of cotton in the cotton: polyester jeans wear fabrics were established. The findings of this study revealed that as the percentage of cotton fiber increases, seam strength increases. Seam efficiency is significantly affected by fabric type, seam and stitch types. It was found that the percentage of cotton fibers had the most influence on seam puckering. Increasing the percentage of cotton fiber enhanced the seam puckering significantly.

1- Introduction

The manufacture of high quality jeans wear is one of the most demanding sectors of the textile clothing industries. The task of all production stages is to coordinate a very wide variety of factors such as hard–wearing properties and comfort characteristics. Jeans wear has to protect the wearer as well as being comfortable to wearer, hard-wearing, dimensionally stable, colorfast, easy–care and fashionable appearance [(1)].

Jeans wear garments may be subjected to heavy laundering, and therefore must be constructed from durable fabrics with suitable seams and strong sewing thread [(2)]. Seam can be defined as a joint between two pieces of fabric or it is the application of a series of stitches or stitch type to one or several thickness of material [(3)]. It was assumed that ultimate seam failure results from thread rupture rather than fabric breakage or excessive opening of seams. The ratio of seam strength: fabric strength expressed as a percentage is known as the seam efficiency, and it has been found that in practice it seldom exceeds 85-90 %(2).

The deformation of fabric during its processing is one of the major problems that the manufacturing industry has been facing for many years. Seam pucker is still a primary concern in garment [4]. When sewing parameters and material properties are not chosen properly, Puckering appears along the seam line of a garment and damages its aesthetic value [5]. The shorter Oxford Dictionary defined seam pucker as "ridge, wrinkle or corrugation of the material or a number of small wrinkles running across and into one another, which appear when sewing together two pieces of fabric" [6].

For several decades, many different ways to define and control seam pucker have been introduced. Dorkin and Chamberlain [7] identifies five primary causes of puckered seams, and classified seam pucker into four groups: inherent pucker, feeding pucker, tension pucker and thread shrinkage pucker [8, 13, 14].

This study aimed at investigating some important characteristics of the jeans wear seam: namely; seam tensile strength, seam efficiency, and seam puckering. The effects of seam type, fabric types and type of stitch have been studied.

2- Experimental work

2.1- Material.

In the course of this study, four common types of fabric were used; namely: 100% cotton, 75:25, 50:50 and 70:30 cotton: polyester blended fabrics. Table (1) illustrates the specifications of al sample used in this research .

All fabric samples were woven on SULZER PROJECTILE weaving machine with 6 harness frames, and speed of 340 ppm.

The twill weave was used to weave jeans wear because its intrinsic characteristics, such as high strength, crease resistant and high stiffness [9].

Table (1) fabrics specifications.

FABRIC STRUCTURE	TWILL 1/2
Warp count	40/2
Weft y count	30/2
ends / inch	62
picks / inch	47
Weight/ square meter	320 g/m^2

2.2- Stitches and seams

Throughout this study four seam types were used, i.e., Super imposed seam (SSa-1, and SSa-2), Lapped seam (LSc-2) and Bound

seam (BSc-2). Each fabric sample was sewn using three different types of stitches, i.e., double lockstitch 301 and 304, and double chain stitch 401.

All fabric samples were sewed using 30/2 core spun yarn, which has a core of polyester fibers and a sheath of cotton fibers. Applied stitch density was 40 stitches per 10 cm using a needle of size 14.

2.3- Laboratory testing

2.3.1- seam strength

Seam tensile strength was measured using "Textile Tensile Strength, No. 6202, Asano machine MFG. CO.LTD. Osaka Japan", apparatus according to (ASTM 683-1990) .

2.3.2-Rating of seam pucker

A test procedure for a subjective assessment of the seam pucker has been proposed by the American Association of Textile Chemists and Colorists (AATCC, test methods 8813-1992) [10]. The evaluation of seam pucker is done by three observers; each one compares three specimens at a time with photographs. Each seam is marked as equivalent in appearance to one photographic standard, where 5 indicate the best, non-puckered, seam, and 1 is the worst. Average values are then calculated from the nine determinations [11].

A statistical procedure was used to evaluate the significance of each factor at 0.01 statistical probability, using analysis of variance (ANOVA) method [12].

3- Results and discussion

All the above factors were compared by calculating regression lines for all seam types. The dependent variable in each equation represents the property which was measured and the independent one is the percentage of cotton fibers in the blended fabrics. The coefficient of determination value (R^2) for each regression line was also assessed.

3.1- seam strength

The effects of cotton percentage on the seam strength of cotton: polyester blended fabrics at different stitch types were depicted in

figure (2-4). It was observed that in general, as the cotton percentage increased the seam strength of the blended fabrics reacts in the same manner .The pronounced effect of the cotton percentage observed for seam types LSC-2 of stitch type 301 and 304, whereas the most significant influence was shown in the seam of type BSC-2 which was sewn using stitch type 401. The significant effect of cotton percentage ratio on the seam strength can be attributed to the increase of friction coefficient between blended fabrics and the stitch yarn with the increase in the cotton in the blend.

The regression equations which correlate the seam strength to the cotton percentage for stitch type 301 were:

$y_1 = -0.0026x^2 + 0.382x - 2.785$

$y_2 = -0.0049x^2 + 0.792x - 11.747$

$y_3 = -0.0072x^2 + 1.212x - 6.720$

$y_4 = -0.0067x^2 + 1.031x + 18.049$

In these equations, y_1, y_2 , y_3 and y_4 represent the strength of seam types SSa-1, SSa-2, LSC-2, and BSC-2 , while x, represents cotton percentage. The estimated R^2 values of these equations were 0.88, 0.95, 0.96 and 1 respectively, which means that these regression lines fit the data very well.

The statistical analysis proved that the seam type has the most significant impact on the seam strength. It is shown from figures (2-4) that the seam type BSC-2 revealed the highest seam strength with the stitch type 301 and 304, whereas with the stitch type 401 seam of type LSC-2 illustrated the highest seam strength.

The following relations represent the regression relationships between the seam strength of seam types SSa-1, SSa-2, LSC-2, and BSC-2 and the cotton percentage in the cotton: polyester blended fabrics which sewn using stitch type 304.

$y_1 = -0.014x^2 + 2.2318x - 47.741$

$y_2 = -0.0094x^2 + 1.577x - 23.883$

$y_3 = -0.0234x^2 + 3.819x - 75.740$

$y_4 = -0.0211x^2 + 3.047x - 30.296$

The determination coefficients of these equations were 1, 1, 0.98, and 0.92 respectively, confirming that they fit data very well.

It was observed that the type of the stitch has a pronounced effect on the seam strength regardless the percentage of cotton in the blend. The stitch of type 304 gave the highest seam strength followed by stitch type 401 and 301 respectively. The average value of the seam strength

of the stitch types were 45, 42, and 28 kg for stitches 304, 401 and 301 respectively.

For the stitch type 401, the statistical analysis showed that the regression relationships between the seam strength and the cotton percentage for seam types SSa-1, SSa-2, LSC-2, and BSC-2 are as follows:

$$y_1 = -0.0063x^2 + 1.0776x - 12.014$$
$$y_2 = -0.0078x^2 + 1.2526x - 19.534$$
$$y_3 = -0.0202x^2 + 3.2828x - 52.436$$
$$y_4 = -0.0149x^2 + 2.5815x - 30.207$$

The coefficient of determination was found to have 0.98, 1, 0.98, and 0.96 for the seams of type SSa-1, SSa-2, LSC-2, and BSC-2 respectively.

3.2- seam efficiency

The statistical analysis demonstrated that the seam efficiency has been affected significantly by cotton percentage, seam and stitch types. It was found that seam type has the most significant influence on the seam efficiency followed by cotton percentage and stitch type. Figures (5-7) illustrate the relationship between cotton percentage and seam efficiency at different seam types for stitches of type 301, 304, and 401 respectively.

From figures (5-7) and from the statistical analysis it is shown that seam efficiency is swiftly increase wit the increase in the cotton percentage in cotton: polyester blended fabrics. As the cotton percentage increased from 30% to 100% the seam efficiency has been increased with 14%, 23% and 14% for stitch types 301, 304, and 401 respectively. The regression relationships between cotton percentage and seam efficiency of jeans wear blended fabrics for stitch type 301 at different seam types are as follows:

$$y_1 = -0.0014x^2 + 0.243x - 3.080$$
$$y_2 = -0.0023x^2 + 0.450x - 7.874$$
$$y_3 = -0.0033x^2 + 0.724x - 7.920$$
$$y_4 = -0.0035x^2 + 0.737x + 30.207$$

According to the regression analysis the coefficient of the determination value is 0.99, 0.99, 0.96, 0.97 respectively assuring that these equations fit the data very well.

It is also shown that from figures (5-7) the seam of type BSC-2 has the highest seam efficiency for the stitches of type 301 and 304,

whereas for the stitch of type 401 the seam of type LSC-2 demonstrated the highest seam efficiency.

The following equations represent the regression relationships between seam efficiency and cotton percentage for the seam types SSa-1, SSa-2, LSC-2 and BSC-2 using stitch type 304.

$$y_1 = -0.0094x^2 + 1.577x - 23.883$$
$$y_2 = -0.014x^2 + 2.232x - 47.741$$
$$y_3 = -0.0211x^2 + 3.047x - 30.296$$
$$y_4 = -0.0211x^2 + 3.819x - 75.740$$

The R^2 values for these regression lines are 1, 1, 0.92 and 0.98 which confirms that these lines represent the data significantly.

The statistical analysis also revealed that the highest seam efficiency was associated with stitch type 304 followed by 401 and 301 respectively. The average value of seam efficiency was 17%, 45% and 27% for stitches 301,304 and 401 respectively. The regression relationships which correlate the seam efficiency of jeans wear cotton: polyester fabrics to the cotton percentage for stitch type 401 are as follows.

$$y_1 = -0.0037x^2 + 0.702x - 12.471$$
$$y_2 = -0.0028x^2 + 0.612x - 8.936$$
$$y_3 = -0.0095x^2 + 1.821x - 32.887$$
$$y_4 = -0.0064x^2 + 1.446x - 21.660$$

3.3- Rating of seam pucker

IN this study seam puckering is evaluated subjectively. The statistical analysis proved that the rating of seam pucker is significantly influenced by cotton percentage.

Figures (8-10) demonstrate the effect of cotton percentage on the rating of seam pucker of jeans wear cotton: polyester fabrics at different seam types using stitches 301, 304 and 401 respectively. From these figures it is shown that as the cotton percentage increased the rating of seam pucker increased. This means that seam puckering is significantly enhanced with the increase in the percentage ratio of cotton fiber in the blend.

The statistical analysis also revealed that the stitch type has insignificant effect on the rating of seam pucker. For all types of stitches the seam of type LSC-2 demonstrated less pucker than the other stitches. The average value of seam pucker rating for stitch types 301, 304, and 401 were 4.18, 4.13 and 4.28 which means that it has no influence on the rating of the seam pucker.

4- Conclusions

The findings of this study can be sum up as follows:

- Jeans wear must be made of durable fabrics with suitable seams and strong sewing threads.
- The twill weave is the most suitable construction to make jeans wear.
- Seam strength of jeans wear cotton: polyester fabrics is significantly affected by cotton percentage in the blend, seam and stitch type.
- Seam strength has been increased with the increase in the cotton percentage in the jeans wear cotton: polyester fabrics. seam type BSC-2 gave the highest seam strength with the stitch type 301 and 304, whereas with the stitch type 401 seam of type LSC-2 showed the highest seam strength.
- Seam type was found to have the most significant impact on the seam efficiency followed by cotton percentage and stitch type.
- Rating of the seam pucker was assessed subjectively. It was found that seam and stitch types have no significant influence on the rating of the seam pucker.

Figure (2): Effect of cotton percentage on seam strength of jeans wear at different seam types using stitch type 301.

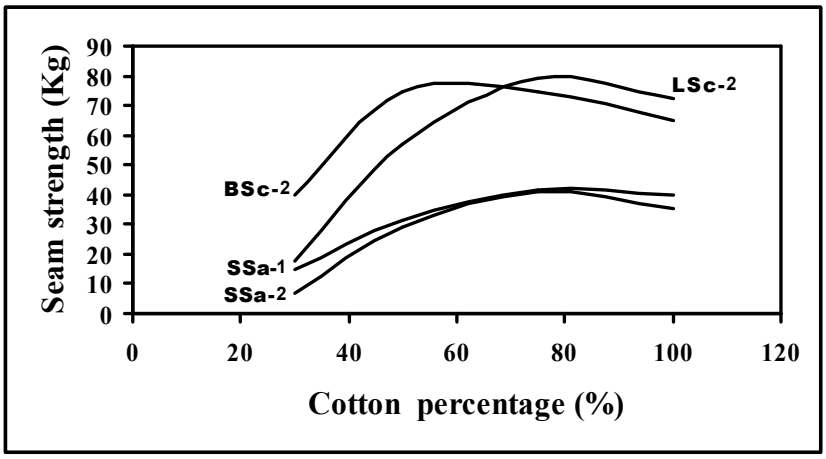

Figure (3): Effect of cotton percentage on seam strength of jeans wear at different seam types using stitch type 304.

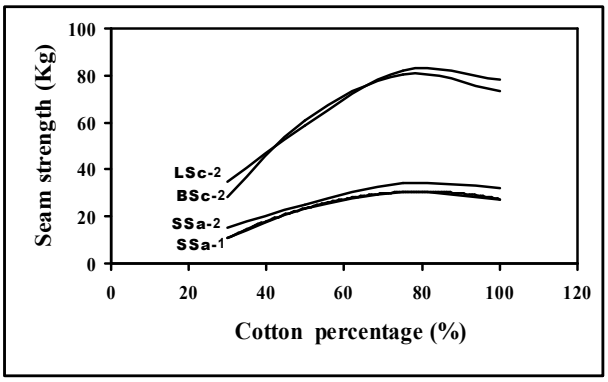

Figure (4): Effect of cotton percentage on seam strength of jeans wear at different seam types using stitch type 401.

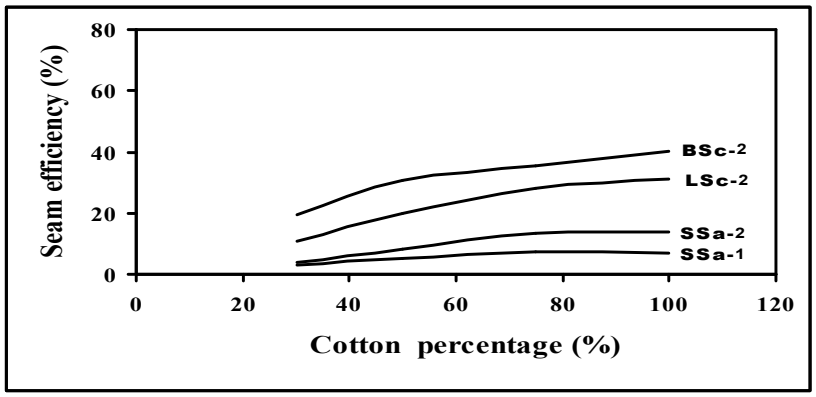

Figure (5): Effect of cotton percentage on seam efficiency of jeans wear at different seam types using stitch type 301.

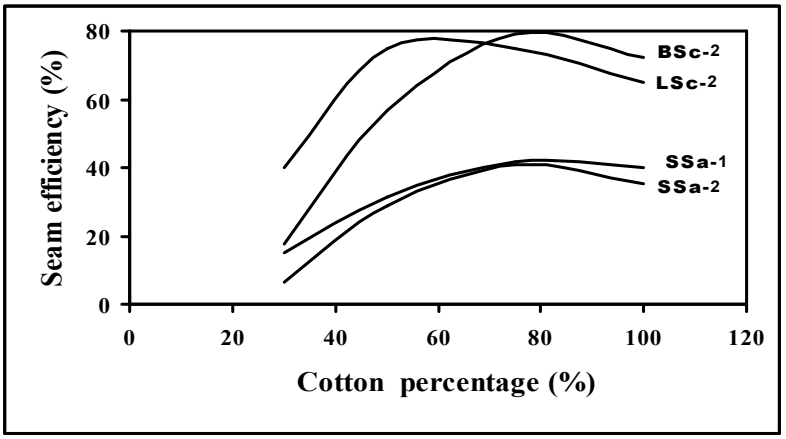

Figure (6): Effect of cotton percentage on seam efficiency of jeans wear at different seam types using stitch type 304.

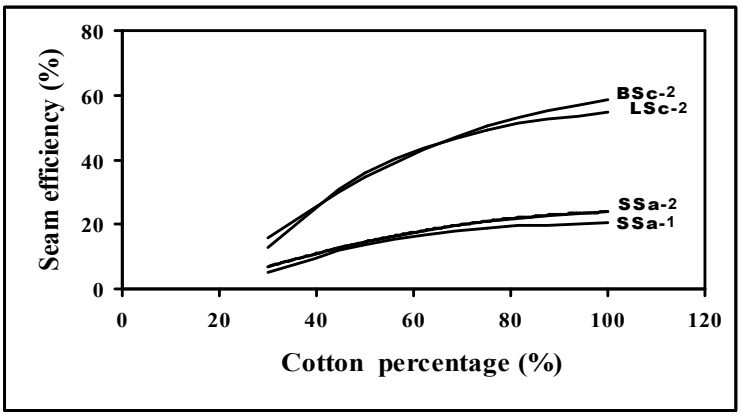

Figure (7): Effect of cotton percentage on seam efficiency of jeans wear at different seam types using stitch type 401.

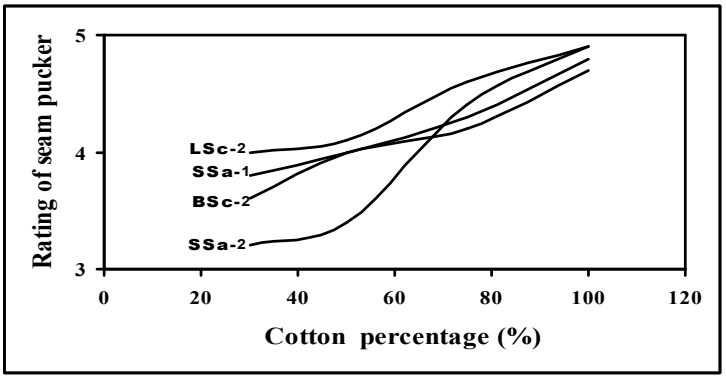

Figure (8): Effect of cotton percentage on seam rating pucker of jeans wear at different seam types using stitch type 301.

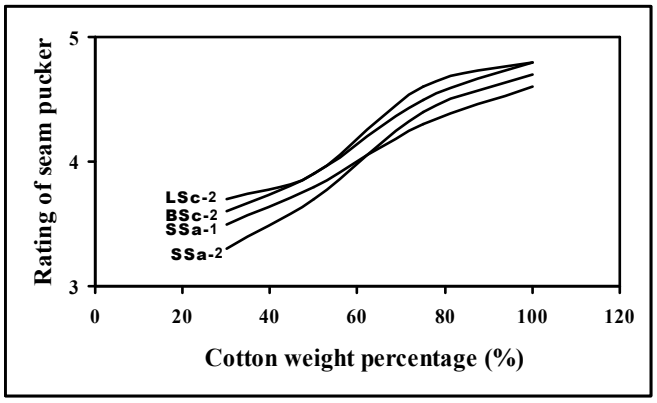

Figure (9): Effect of cotton percentage on seam rating
Pucker of jeans wear at different seam types using stitch type 304.

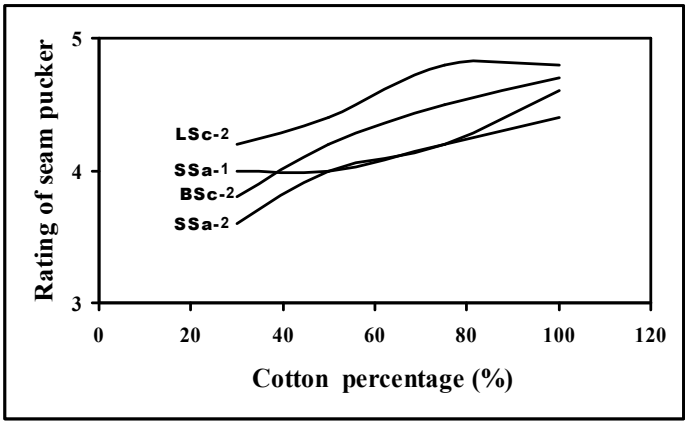

Figure (10): Effect of cotton percentage on seam rating pucker of jeans wear at different seam types using stitch type 401.

References

1- Jurg Rupp and Andrea Bohringer " Jeans wear: Interaction between the individual stagers of production" ITB, International Textile Bulletin, 5/93.

2- Richard Chmielowiec "Seam strength factors" Textile Asia, March 1999.

3- Harold Carr and Barabara Latharn "The technology of clothing manufacture" Blackwell Scientific Publication, Second Edition, 2004.

4- Hebeler, H., and Kolb, H., " The measurement of fabric wrinkling " Textile Research Journal, 650-653, Sep 2009.

5- Brain, D. H., " Prediction of strengths of lockstitch seams in woven fabrics" Journal of the Textile Institute, PP. 493-505, 2008.

6- The shorter oxford dictionary, 1967, Oxford express, third edition, pp. 1614.

7- Dorkin, C. M. C., and Chamberlain, N. H., Seam Pucker – its Causes and prevention, Col. Inst. Tech. Rep. 10 (1998).

8- Chang Kyu and Tae Jin., Objective of Seam Pucker Artificial Intelligence, Textile Research Journal, 69(10), 1999.

9- Isabel, B., "Textile fabrics and their selection" Prentice hall, New York, English edition, 1986.

10-AATCC Tentative Test method 88B-1964T; USA Standard L14.172-2004.

11-The evaluation of seam –puckering, Journal of the Textile Institute, 20001, 62, PP. 176.

12-Yehia E. El Mogahzy " Applied statistics and quality control for engineers and manufacturers" Quality ech, AL, U.S.A, 2002.

13-Guillotin, M., Puckering of Seams, Tech. Hab. 279, 71, 1979.

14-J&P Coats Ltd., Seam Pucker, CMT Clo. Mach. Times 5, 2004.

خواص حياكات ملابس الجنز

أ.د. ياسر محمد عيد حسن

استاذ بقسم الملابس الجاهزة – كلية الفنون التطبيقية – جامعة حلوان

يجب أن تتميز ملابس الجنز بالمتانة العالية وذلك من خلال تصنعها من أقمشة عالية المتانة كذلك يجب استخدام أسلوب الحياكة المناسب لها وذلك للوصول إلى أعلى كفاءة في طرق وأساليب الحياكة من حيث المتانة والمظهرية. وتعتبر الأقمشة المبردية المصنوعة من القطن / بوليستر هي أكثر الأقمشة ملائمة لصناعة ملابس الجنز.

و يهدف هذا البحث إلى الوصول إلى أفضل أنواع الغرز وأساليب الحياكات التي تلائم ملابس الجنز وبناء على ما سبق تم دراسة المتغيرات الآتية.

- **نسبة الخلط : قطن** ١٠٠%: **قطن** ٧٥%: بوليستر ٢٥%، قطن٣٠%: بوليستر ٧٠%
- **نوع الغرزة:** غرزة الحياكة العادية المغلقة رقم (٣٠١)، غرزة الحياكة العادية الزجزاج رقم (٣٠٤)، غرزة السلسلة المزدوجة الخيوط رقم (٤٠١)
- **أنواع الحياكة** : الحياكات المتراكبة (الجينز) SSa-2–الحياكات البسيطة (الفرنسية)– SSa-1 الحياكات البسيطة (العادية) LSc-2 – الحياكات الرابطة (الكمر) –BSc

<u>وبإجراء الاختبارات الطبيعية والميكانيكية والإحصاء التطبيقي تم الوصول إلى النتائج الآتية:</u>

وجد أن لنسبة الخلط تأثير معنوي على قوة شد وكفاءة الحياكات لملابس الجنز المصنوعة من القطن/بوليستر حيث تزداد كفاءة وقوة شد الحياكة لملابس الجنز بزيادة نسبة القطن في الأقمشة المنتجة. كذلك وجد أن لنوع الحياكات تأثير معنوي على قوة شدو كفاءة الحياكة حيث أعطت الحياكات الرابطة (الكمر) BSc- 2 أفضل نتائج مع الغرزة الحياكة العادية المستقيمة رقم (٣٠١) ، غرزة الحياكة العادية المتعرجة رقم (٣٠٤) بينما كانت أفضل نتائج الحياكات البسيطة (العادية) LSc-2 مع الغرزة غرزة السلسلة المزدوجة الخيوط رقم (٤٠١) .

كذلك وجد أن لنسبة الخلط تأثير معنوي على تجعد الحياكات بينما نوع الغرزة ونوع الحياكات ليس لها تأثير معنوي على تجعد الحياكات.