Determination of the effects of knitted fabric sewing parameters on seam damage under multiaxial loading

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ABSTRACT – REZUMAT

Determination of the effects of knitted fabric sewing parameters on seam damage under multiaxial loading

The body's movement during use exposes garments to tension and stress in different directions. To set the sewing parameters for clothing made of knitted fabrics, especially those commonly used for daily wear and sports, the damage caused by the seams to the fabric under multiaxial loading should be examined when determining sewing performance. This study examined the impact of sewing parameters on damage to knitted fabrics under multiaxial loading to identify the factors affecting sewing quality and performance. For this purpose, to perform the sewing damage tests, the single jersey, Pique, and interlock fabrics in three colours (white, red, and black) were cut into 30×30 cm-sized swatches. Samples were sewn parallel to the loop bar (lengthwise) and the fabric's loop line (widthwise) using two different stitch lengths, four needle sizes and four stitch types. A total of 576 samples were subjected to stress and strain on a seam damage testing apparatus as per DIN standard 53 882. Following the tests, the samples were examined under a microscope, and images were taken. The resulting data was analysed using the SPSS 26.0 statistical program. The Pearson Chi-squared and Fisher Exact Test were used to compare qualitative data. According to the test results determined that more significant seam damage occurred along the lengthwise samples of the fabric than the widthwise for all three fabric types. The study found that as damage increased with needle size, stitch type affected sewing damage, with the lockstitch causing minor damage, and fabric colour and stitch length had no impact on sewing damage.

Keywords: *knit fabrics, multiaxial loading seam damage, sewing parameters, textile*

Determinarea influenței parametrilor de coasere ai tricoturilor asupra deteriorării îmbinării prin coasere sub încărcare multiaxială

Articolele de îmbrăcăminte sunt expuse la tensiuni și stres în direcții diferite de mișcare a corpului în timpul utilizării. Pentru a seta parametrii de coasere pentru îmbrăcămintea realizată din tricoturi, în special cele utilizate în mod obișnuit pentru purtarea zilnică și sport, defectele cauzate de cusături sub încărcare multiaxială trebuie examinate atunci când se determină performanța de coasere. Acest studiu a examinat impactul parametrilor de coasere asupra deteriorării tricoturilor sub încărcare multiaxială, pentru a identifica factorii care afectează calitatea și performanța cusăturii. În acest scop, pentru a efectua testele de deteriorare a cusăturii, tricotul glat, tricotul Pique și tricotul interlock în trei culori (alb, roșu și negru) au fost tăiate în mostre de dimensiunea 30×30 cm. Probele au fost îmbinate prin coasere paralel cu șirurile de ochiuri (în lungime) și paralel cu rândurile de ochiuri (în lățime), folosind doi pași diferiți ai cusăturii, patru dimensiuni de finețe a acului și patru tipuri de cusături. Un total de 576 de probe au fost supuse la stres și efort pe un aparat de testare a deteriorării cusăturilor, conform standardului DIN 53 882. În urma testelor, probele au fost examinate la microscop și au fost captate imagini. Datele rezultate au fost analizate folosind programul statistic SPSS 26.0. Pentru a compara datele calitative au fost utilizate testul chi-pătrat Pearson și testul Fisher Exact. Rezultatele testelor au determinat că a avut loc o deteriorare mai semnificativă a cusăturilor mostrelor de tricot pe lungime decât pe lățime, pentru toate cele trei tipuri de tricoturi. Studiul a constatat că, pe măsură ce defectele au crescut odată cu finețea acului, tipul de cusătură a afectat deteriorarea cusăturii, cusătura cauzând defecte minore, iar culoarea tricotului și pasul cusăturii nu au avut niciun impact asupra deteriorării cusăturii.

Cuvinte-cheie*: tricoturi, deteriorări ale cusăturilor sub încărcare multiaxială, parametrii de coasere, material textil*

INTRODUCTION

As knitted fabrics fulfil consumer expectations thanks to the diversity in fabric, design, and production methods, along with the contributions of technological developments, their use is widespread in the fashion industry, from casual daily wear and activewear to stylish and classic clothing. Garments from knitted fabrics, trendy in athletic apparel and daily wear, are exposed to loads, pressure, and tension in different directions during use. Knitted clothing must incorporate features that meet the expected performance characteristics for the body's movement, the type of clothing, and the environment. Therefore, to ensure the longevity and garments composed of knitted fabrics, fabric strength and sewing performance must be considered.

The primary performance features that constitute the criteria for the sewing performance of ready-made garments are strength, flexibility, durability, and safety. Sewing performance criteria are decisive for determining seam designs and seam-processing variables before the start of production [1]. The sewing process and performance are influenced by numerous variables, including the type of sewing machine, machine settings and speed, the nature of the sewing operation, working method and ability of the garment worker, and selection of sewing parameters such as sewing thread and tension, needle size, and stitch length. Seam appearance (straightness, proper stitches) and seam tension performance (strength and flexibility) are the result of a combination of all these factors [2–5].

Sewing quality, a fundamental component of apparel production significantly affecting the overall quality of a garment, is analysed according to the functional and aesthetic performance criteria required by the garment until its final stage of use. Functional performance and seam quality (i.e., the strength and effectiveness of the seam) are evaluated based on seam strength, performance, elongation, bending, hardness, abrasion resistance, seam shear strength, shrinkage, tightness, thickness, resistance to washing and dry cleaning, and the damage sustained by the seam under various mechanical stress conditions [6–10].

During the sewing process, the fabric structure resistance and restriction to the sewing needles' entry cause sewing damage/defects.

These problems result from the fabric structure and an incorrect selection of sewing parameters such as needle type, needle size, sewing machine settings, thread, etc. [1, 11–14]. The most common types of damage caused by stitching include needle breaks, skipped stitches, seam slippage, thread breaks, seam cracking, and seam rips [11, 15].

Sewing damage, characterized by fragmented or broken fibres, filaments, or threads during the process of stitch formation on the fabric, can occur either immediately following sewing, during or after consumer use due to pressure, strain, and/or tension or as a result of washing [1].

Knitted fabrics are structurally more susceptible to damage during sewing because they contain gaps between the yarns at loop transitions and possess high elasticity [11, 16]. Therefore, stitch optimization is especially critical for knitted fabrics due to their structure and extensive usage.

The seams formed in knitted fabrics are superior at simulating garment performance, as these fabrics are more flexible and have greater exposure to tensile force. The seam strength expected from knitted fabrics may vary depending on the end use of the garment in question. For example, the seam strength of a t-shirt may be lower, while that of athletic apparel may be higher. Strong seams are a significant factor in overall garment quality. Performance, durability, usability, aesthetics, and suitability represent the most critical properties expected of a garment [2].

To increase seam strength, the type and quality of thread selected must be suitable, correct sewing techniques must be employed, and needle and machine settings should be appropriate for the density of the fabric to be sewn. In addition, attention should be paid to parameters such as optimal stitch length/density for seam quality and durability.

With an increase in stitch density, stitch strength has been observed to increase up to a certain density limit, after which mechanical damage occurs to the fabric due to the movement of the sewing needle [17, 9]. Knitted fabrics are more likely to be damaged during sewing due to the passing of loops in the fabric and their greater elasticity.

The literature on knitted fabrics is limited, and research on multiaxial loading has yet to be published. Some relevant studies have analysed the effect of fabric structures and the sewing performance properties of weft-knitted cotton garments [2]. The seam strength and breaking elongation of 100% polyester knitted fabrics have been measured along both the width and length of the fabric [18]. The sewing parameters of cotton-knitted fabrics were assessed by examining their efficiency and strength [19]. Another study investigated the effect of sewing techniques on seam strength and length using 100% polyester double-layer knitted fabrics [20]. The durability and breaking elongation values of various knitted and woven fabrics have been measured by testing their seam strength [9–15].

Several studies have explored the topic of the sewing properties and seam performance of various woven fabrics [6, 20, 21]. Research has also been conducted on how sewing parameters affect sewing quality and efficiency for different woven fabrics [22, 23]. The effects of sewing thread and stitch types on sewing strength and efficiency in woven cotton garments have also been investigated [17].

The present study examined the effects of seam parameters on seam damage incurred by knitted fabrics under multiaxial loading. Thereby determining the factors affecting seam quality and performance.

MATERIALS AND METHODS

Material

The fabric properties of the 100% cotton knitted fabrics (single jersey, Pique, and interlock; all obtained from the firm of Ares Örme, Turkey) analysed in the study are presented in table 1. Before starting the sewing process, all fabric samples were stored at standard room temperature (20±2°C) and relative humidity (65±4%) for 24 hours.

Since the fabrics being tested possessed different structural characteristics (e.g., loop properties, thickness, weight), sewing threads and needle sizes were selected by the fabric structures. The machine needles used in the study were obtained from Groz-Beckert, while the sewing threads were procured from Coats. JUKI brand machines were used for all stitch types on all fabric samples. The stitches tested included a 301 lockstitch, 401 chainstitch, 504 three-thread overlock, and 514 four-thread overlock. Characteristics of the needles used are shown in table 2, sewing thread properties are listed in table 3, and information on the sewing machines is given in table 4.

Table 1

KNIT FABRIC CHARACTERISTICS						
Knit face structure	**Colour**	**Fiber content**	**Knit density**		**Weight (g/m^2)**	**Yarn count (Ne)**
			Wales (no./cm)	**Courses (rows/cm)**		
Single jersey	White	100% Cotton	15	20	150	30/1
	Red	100% Cotton	15	21	150	30/1
	Black	100% Cotton	15	20	150	30/1
Pique	White	100% Cotton	12	18	200	30/1
	Red	100% Cotton	11	18	200	30/1
	Black	100% Cotton	12	18	200	30/1
Interlock	White	100% Cotton	14	16	250	30/1
	Red	100% Cotton	14	16	250	30/1
	Black	100% Cotton	14	16	250	30/1

Table 2

MACHINE NEEDLE CHARACTERISTICS	
Groz-Beckert machine needle properties	
Size	**Point type**
Nm 60	FFG/SES
Nm 65	FFG/SES
Nm 70	FFG/SES
Nm 75	FFG/SES
Nm 80	FFG/SES
Nm 90	FFG/SES

Table 3

SEWING THREAD CHARACTERISTICS				
Coats sewing thread properties				
Number	**Tex**	**Length**	**Average strength (cN)**	**% Stretch min – max**
150	24	5,000 m	980	17 – 22
120	21	5,000 m	1,190	17 – 22

Table 4

MACHINE TYPE AND CHARACTERISTICS		
Brand	**Machine type**	**Revolutions (RPM)**
JUKI	Lockstitch	1000 – 4500
JUKI	3-4 Thread Overlock	2860 – 3450
JUKI	Chainstitch	2860 – 3450

Method

Sample preparation

To perform the sewing damage tests, the single jersey, Pique, and interlock fabrics were cut into 30×30 cm-sized swatches. Two groups of samples were prepared to determine seam damage lengthwise and widthwise for each fabric. The first group samples were sewn parallel to the loop bar for each stitch type to examine lengthwise damage. The second group of samples was sewn parallel to the loop line for each stitch type. In the continuation of the study, sample groups were expressed as lengthwise and widthwise in damage evaluations. Information about the samples is given in table 5.

Sewability tests were conducted based on the DIN 53 882 standard. Testing of textiles; determination of the sewing behaviour of knitted fabrics [24]. After straight test seams were sewn, the fabric swatches, while being held between two clamps, were subjected to a 200 N load as well as 30 cross movements to simulate garment wear and tear (figure 1). Following this testing process, the fabric seams were inspected for sewing damage.

The microscope used was a Leica MZ7.5 Stereo Zoom Microscope 6.3× – 50×, as depicted in figure 2. Images of seam damage were obtained at 1.0 magnification.

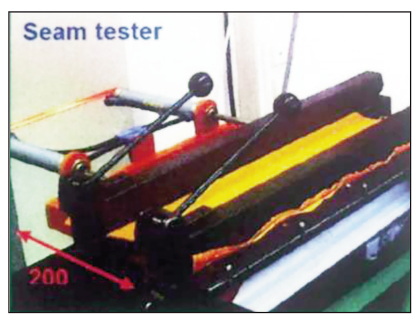

Fig. 1. Seam damage test apparatus

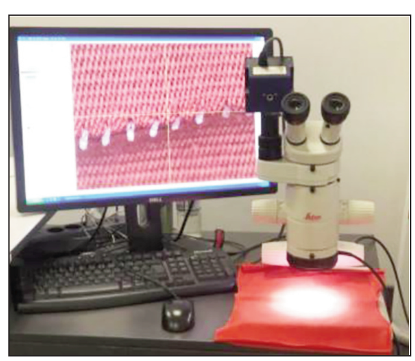

Fig. 2. Leica MZ7.5 Stereo Zoom Microscope

Table 5

STITCHING PARAMETERS FOR FABRIC SAMPLES							
Fabric type	**Colour**	**Width-wise samples (pcs.)***	**Length-wise samples (pcs.)****	**Needle sizes**	**Thread number**	**Stitch classes**	**Stitch length (per cm)**
Single Jersey	White	32	32	60-65-70-75	150	301-401-504-514	3–5
	Red	32	32	60-65-70-75	150	301-401-504-514	3–5
	Black	32	32	60-65-70-75	150	301-401-504-514	3–5
	Total	192 pieces					
Pique	White	32	32	65-70-75-80	120	301-401-504-514	3–5
	Red	32	32	65-70-75-80	120	301-401-504-514	3–5
	Black	32	32	65-70-75-80	120	301-401-504-514	3–5
	Total	192 pieces					
Interlock	White	32	32	70-75-80-90	120	301-401-504-514	3–5
	Red	32	32	70-75-80-90	120	301-401-504-514	3–5
	Black	32	32	70-75-80-90	120	301-401-504-514	3–5
	Total	192 pieces					
Grand Total		576 pieces					

Note: * Width-wise samples pcs.: Number of samples sewn into parallel to loop line; ** Length-wise samples pcs.: Number of samples sewn into parallel to loop bar.

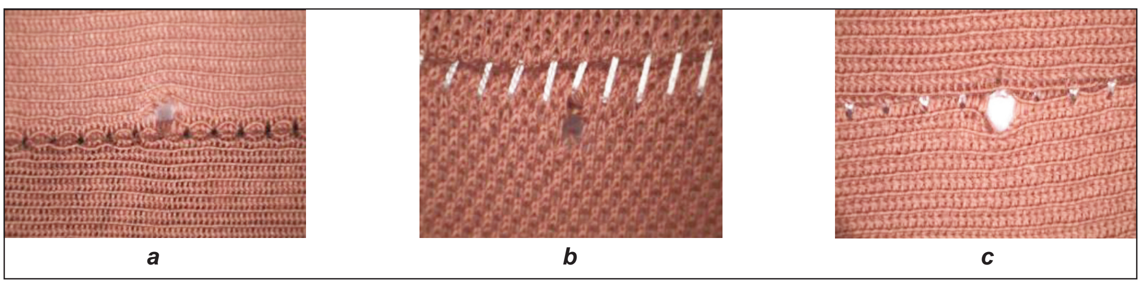

Fig. 3. Single jersey, Pique, and interlock fabric test swatches showing damage from the seam tester: *a* – Single Jersey; *b* – Pique; *c* – Interlock

FINDINGS

Statistical Evaluation of the Data The SPSS 26.0 statistical package program was used to analyse the findings obtained in the study. Descriptive characteristics of the fabric samples in the study were examined. Afterwards, the Pearson Chi-Square and Fisher Exact tests were employed to compare the qualitative data. The results were evaluated at 95% and 99% confidence intervals, with corresponding significance levels of $p<0.05$ and $p<0.01$, respectively.

The sewing damage incurred along the widthwise and lengthwise samples of the fabrics is examined in table 6 and figure 4. More damage in lengthwise samples than in widthwise samples was observed for all three fabric types. Since these knitted fabrics possess more significant stretch along the length, the damage was more visible there than along the width. To produce a quality garment, stitching and sewing parameters must be selected correctly [2–14].

The seam damage seen along the widthwise and lengthwise samples of single jersey fabric is shown in table 7 and figures 5 and 6. There was a relationship between seam damage (both widthwise and lengthwise) and needle size and stitch type ($p<0.01$ for all). Upon closer examination of the effect of needle size, damage was found to be high in samples produced using Nm 75 needles but low in those sewn with Nm 60 needles. While there were high rates of damage associated with 4-thread and 3-thread overlock and chainstitching, no specific damage was detected with lockstitching.

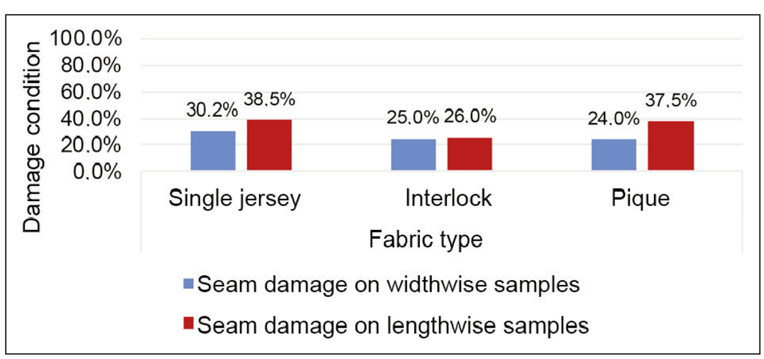

Fig. 4. Seam damage lengthwise and widthwise for each fabric

Table 6

SEAM DAMAGE ON LENGTHWISE AND WIDTHWISE SAMPLES							
Fabric		Indicator	Seam damage on widthwise samples		Total	Chi-squared	*p*
			Absent	Present			
Fabric type	Single Jersey	F	67	29	96	1.108[a]	0.575
		%	69.80%	30.20%	100.00%		
	Interlock	F	72	24	96		
		%	75.00%	25.00%	100.00%		
	Pique	F	73	23	96		
		%	76.00%	24.00%	100.00%		
Fabric		**Indicator**	**Seam damage on lengthwise samples**		**Total**	**Chi-squared**	***p***
			Absent	**Present**			
Fabric type	Single Jersey	F	59	37	96	4.114[a]	0.128
		%	61.50%	38.50%	100.00%		
	Interlock	F	71	25	96		
		%	74.00%	26.00%	100.00%		
	Pique	F	60	36	96		
		%	62.50%	37.50%	100.00%		

Note: [a] Pearson Chi-squared Test.

Table 7

SEAM DAMAGE ON LENGTHWISE AND WIDTHWISE SAMPLES IN SINGLE JERSEY FABRIC							
Single jersey		Seam damage on widthwise samples			Total	Chi-squared	*p*
		Indicator	Absent	Present			
Needle size	Nm 60	F	23	1	24	23.167[b]	0.000**
		%	95.80%	4.20%	100.00%		
	Nm 65	F	18	6	24		
		%	75.00%	25.00%	100.00%		
	Nm 70	F	18	6	24		
		%	75.00%	25.00%	100.00%		
	Nm 75	F	8	16	24		
		%	33.30%	66.70%	100.00%		
Stitch type	3-Thread Overlock	F	14	10	24	17.656[b]	0.000**
		%	58.30%	41.70%	100.00%		
	4-Thread Overlock	F	15	9	24		
		%	62.50%	37.50%	100.00%		
	Lockstitch	F	24	0	24		
		%	100.00%	0.00%	100.00%		
	Chainstitch	F	14	10	24		
		%	58.30%	41.70%	100.00%		
Single jersey		**Seam damage on lengthwise samples**			**Total**	**Chi-squared**	***p***
		Indicator	**Absent**	**Present**			
Needle size	Nm 60	F	23	1	24	27.718[b]	0.000*
		%	95.80%	4.20%	100.00%		
	Nm 65	F	14	10	24		
		%	58.30%	41.70%	100.00%		
	Nm 70	F	16	8	24		
		%	66.70%	33.30%	100.00%		
	Nm 75	F	6	18	24		
		%	25.00%	75.00%	100.00%		
Stitch type	3-Thread Overlock	F	9	15	24	31.846[b]	0.000*
		%	37.50%	62.50%	100.00%		
	4-Thread Overlock	F	9	15	24		
		%	37.50%	62.50%	100.00%		
	Lockstitch	F	24	0	24		
		%	100.00%	0.00%	100.00%		
	Chainstitch	F	17	7	24		
		%	70.80%	29.20%	100.00%		

Note: ** $p<0.01$; * $p<0.05$; [a] Pearson Chi-squared Test; [b] Fisher Exact Test.

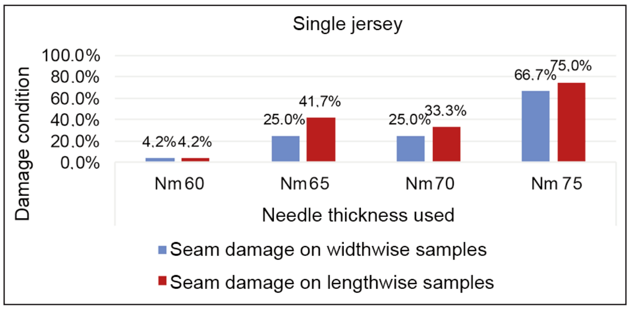

Fig. 5. Comparison of seam damage lengthwise and widthwise in single jersey concerning needle size

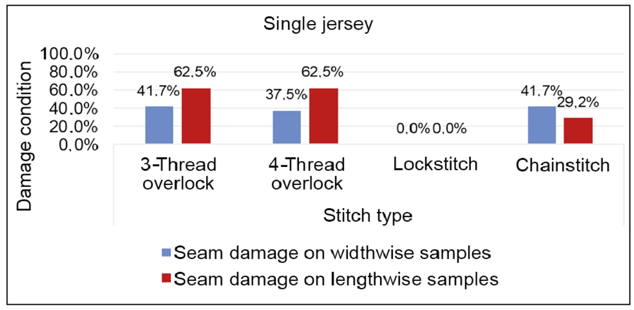

Fig. 6. Comparison of seam damage lengthwise and widthwise in single jersey concerning stitch type

No statistically significant relationship was observed between the sewing damage (both widthwise and lengthwise) and fabric colour or stitch length (p>0.05 for all).

Seam damage along the widthwise and lengthwise samples of the Pique fabric is presented in table 8. and figures 7 and 8. No statistically significant relationships were observed between damage along the widthwise samples, fabric colour, needle size, or stitch length (p>0.05 for all).

Regarding seam damage along the lengthwise samples of the fabric, a statistically significant relationship was detected between seam damage along the lengthwise and needle size (p<0.01). In particular, a

Table 8

SEAM DAMAGE ON LENGTHWISE AND WIDTHWISE SAMPLES IN PIQUE FABRIC

Pique		Seam damage on widthwise samples			Total	Chi-squared	*p*
		Indicator	Absent	Present			
Needle size	Nm 65	F	22	2	24	6.223[b]	0.091
		%	91.70%	8.30%	100.00%		
	Nm 70	F	19	5	24		
		%	79.20%	20.80%	100.00%		
	Nm 75	F	17	7	24		
		%	70.80%	29.20%	100.00%		
	Nm 80	F	15	9	24		
		%	62.50%	37.50%	100.00%		
Stitch type	3-Thread Overlock	F	14	10	24	17.656[b]	0.000**
		%	58.30%	41.70%	100.00%		
	4-Thread Overlock	F	15	9	24		
		%	62.50%	37.50%	100.00%		
	Lockstitch	F	24	0	24		
		%	100.00%	0.00%	100.00%		
	Chainstitch	F	14	10	24		
		%	58.30%	41.70%	100.00%		
Pique		Seam damage on lengthwise samples			Total	Chi-squared	*p*
		Indicator	Absent	Present			
Needle size	Nm 65	F	20	4	24	29.730[b]	0.000**
		%	83.30%	16.70%	100.00%		
	Nm 70	F	22	2	24		
		%	91.70%	8.30%	100.00%		
	Nm 75	F	12	12	24		
		%	50.00%	50.00%	100.00%		
	Nm 80	F	6	18	24		
		%	25.00%	75.00%	100.00%		
Stitch type	3-Thread Overlock	F	14	10	24	18.339[b]	0.000**
		%	58.30%	41.70%	100.00%		
	4-Thread Overlock	F	11	13	24		
		%	45.80%	54.20%	100.00%		
	Lockstitch	F	23	1	24		
		%	95.80%	4.20%	100.00%		
	Chainstitch	F	12	12	24		
		%	50.00%	50.00%	100.00%		

Note: ***p*<0.01; **p*<0.05; [a] Pearson Chi-squared Test; [b] Fisher Exact Test.

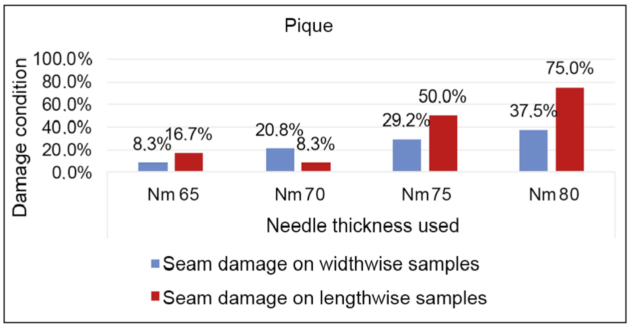

Fig. 7. Comparison of seam damage lengthwise and widthwise in pique concerning needle size

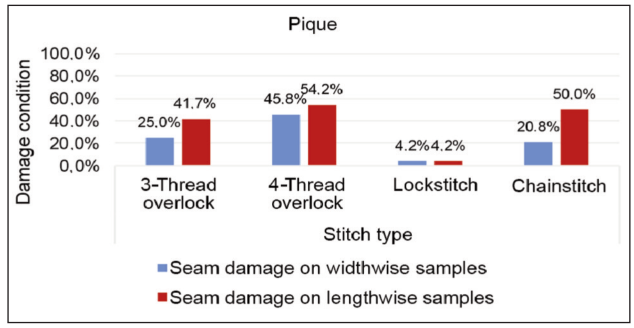

Fig. 8. Comparison of seam damage lengthwise and widthwise in pique concerning stitch type

high degree of damage was detected in the samples sewn using Nm 80 and Nm 75 needles. In contrast, examining samples produced with Nm 65 and Nm 70 needles exhibited low levels of damage.
There was a statistically significant correlation between seam damage widthwise-lengthwise samples and the type of stitching used ($p<0.01$). While noticeable damage occurred in the samples sewn using 4-thread and 3-thread overlock and chainstitching, with lockstitching, damage rates were low.
The seam damage observed in the interlock fabric samples is shown in table 9 and figures 9 and 10.

Table 9

SEAM DAMAGE ON LENGTHWISE AND WIDTHWISE SAMPLES IN PIQUE FABRIC							
Interlock		**Seam damage on widthwise samples**			**Total**	**Chi-squared**	***p***
		Indicator	**Absent**	**Present**			
Needle size	Nm 70	F	24	0	24	94.593 [b]	0.000**
		%	100.00%	0.00%	100.00%		
	Nm 75	F	24	0	24		
		%	100.00%	0.00%	100.00%		
	Nm 80	F	24	0	24		
		%	%	0.00%	100.00%		
	Nm 90	F	0	24	24		
		%	0.00%	100.00%	100.00%		
Stitch type	3-Thread Overlock	F	18	6	24	0.113[b]	1.000
		%	75.00%	25.00%	100.00%		
	4-Thread Overlock	F	18	6	24		
		%	75.00%	25.00%	100.00%		
	Lockstitch	F	18	6	24		
		%	75.00%	25.00%	100.00%		
	Chainstitch	F	18	6	24		
		%	75.00%	25.00%	100.00%		
Interlock		**Seam damage on lengthwise samples**			**Total**	**Chi-squared**	***p***
		Indicator	**Absent**	**Present**			
Needle size	Nm 70	F	24	0	24	90.272[b]	0.000**
		%	100.00%	0.00%	100.00%		
	Nm 75	F	24	0	24		
		%	100.00%	0.00%	100.00%		
	Nm 80	F	23	1	24		
		%	95.80%	4.20%	100.00%		
	Nm 90	F	0	24	24		
		%	0.00%	100.00%	100.00%		
Stitch type	3-Thread Overlock	F	18	6	24	0.259[b]	1.000
		%	75.00%	25.00%	100.00%		
	4-Thread Overlock	F	17	7	24		
		%	70.80%	29.20%	100.00%		
	Lockstitch	F	18	6	24		
		%	75.00%	25.00%	100.00%		
	Chainstitch	F	18	6	24		
		%	75.00%	25.00%	100.00%		

Note: ** $p<0.01$; * $p<0.05$; [a] Pearson Chi-squared Test; [b] Fisher Exact Test.

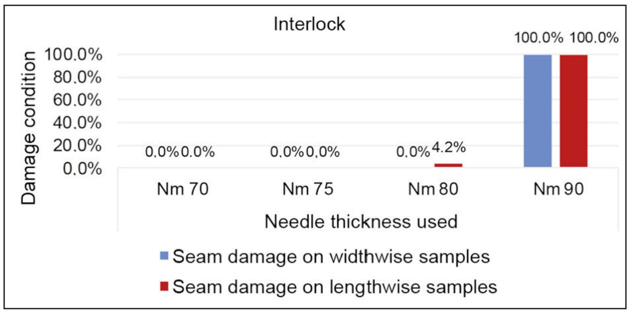

Fig. 9. Comparison of seam damage lengthwise and widthwise in interlock concerning needle size

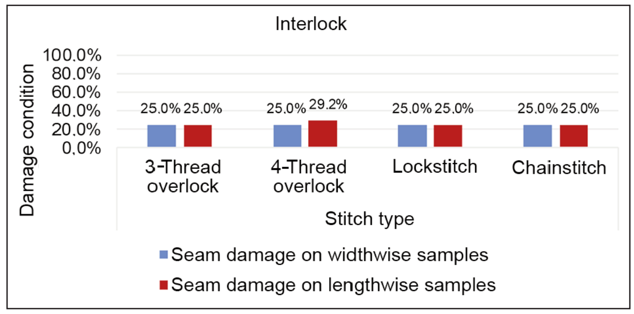

Fig. 10. Comparison of seam damage lengthwise and widthwise in interlock concerning stitch type

There were statistically significant differences between seam damage along the widthwise and lengthwise fabric samples and needle size ($p<0.01$ for all). A closer examination of the role of needle size revealed high damage in samples produced with Nm 90 needles. In contrast, no damage was detected in samples created using other needle sizes.

No statistically significant relationship was observed between widthwise and lengthwise damage and fabric colour, stitch length, or stitch type ($p>0.05$ for all).

CONCLUSION

This research examined the effects of stitch parameters on stitch damage of knitted fabrics under multi-axial loading, and the factors affecting stitch quality and performance were determined. The tests performed on knitted fabrics sewn in the loop bar direction and loop line determined that the damage was more in the lengthwise direction than in the widthwise direction.

To determine the effects of needle size and stitch type on seam damage, tests were performed on a single jersey, Pique, and interlock knitted fabrics in white, red, and black (all colours for each fabric type were produced in the same weights). According to our results, needle size affected seam damage on knitted fabrics, with the latter increasing with larger needle sizes. This finding highlights the importance of selecting needle size based on fabric thickness. Needle sizes in the range of Nm60-Nm65-Nm70 for single jersey, Nm65-Nm70 for Pique, and Nm70-Nm75-Nm80 for interlock were determined to be optimal for minimizing seam damage. The stitch types tested included lockstitching, chainstitching, and 3-thread and 4-thread overlock. The test results revealed that more damage was detected in samples of all three fabric types produced using both 3-thread and 4-thread overlock and chainstitching than the lockstitched samples.

The appearance and performance of seams depend on the sewing and stitch type, stitch density, sewing machine settings, and quality of sewing thread [2].

The importance of material and stitch type has emerged to ensure the stitch quality on knitted fabrics before production, to increase the quality of the product and to avoid any problems in consumer use.

The selection of supplies and stitch types most suitable for the product, fabric, and design features should be prioritized. The overall performance of the garment substantially depends on the quality of the sewing [8].

The sewability of knitted fabrics is a comprehensive and challenging field. The selection of appropriate supplies, yarn, fabric type, sewing thread, and machine parameters is critical for the production of high-quality garments with minimal defects [11]. Therefore, to evaluate the necessary improvements regarding machine design, fabric parameters, and sewing thread, it is necessary to examine the parameters associated with and affecting fibre, yarn, fabric structure, thread, and sewing machine.

Although relevant studies are to be found in the literature, especially concerning woven fabrics, in the garment industry, testing devices used for seam strength and sewability are common, mainly for woven fabrics. However, because of knitted fabrics' flexible structure and superior sewing simulation, sewing damage tests are rarely performed in the apparel sector.

The findings obtained in this study, explicitly conducted on knitted fabrics, will constitute a meaningful contribution to the literature and a valuable reference for manufacturers in material selection for optimal sewing quality.

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