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Research Paper

Effect of Fabric Structure and Design on Knitted Fabric Width, Weight and its Strength

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Abstract

Knit fabric manufacturing is a challenging job in order to keep buyers' satisfaction intact with full quality line and other required comfort parameters. Knit fabric structure and design play a vital role on fabric quality level and in production criteria. Physical properties can be altered due to fabric structure and design as well as yarn diameter. Fiber composition of yarn is also a factor for particular fabric structure and design. In this study the influence of fabric structure and design was identified to get the result of any effect on fabric width, fabric thickness and fabric strength. In total twenty samples were developed in plain structure and its derivatives. In this study, the foremost goal was to observe the effect and influence of fabric structure and design on plain knitted fabric width, fabric weight and fabric strength. The highest fabric width was found in double lacoste structure and lowest fabric width was found in plain structure. Fabric structure composed with tuck stitches exhibited higher thickness of the fabric and highest fabric strength was observed in plain structure.

Keywords

Fabric thickness, GSM, Bursting strength, single lacoste, double lacoste, WPI, CPI, Stitch length

1. Introduction

Knitting is a weave process of fabric by interloping of yarns by the help of one set of yarn. Knitted fabric can be classified in two categories, weft knitted fabric and warp knitted fabric. The most popular end user products of weft knitted fabric are polo shirt, T- shirt, casual wear, sportswear and leisurewear. Warp knitted products are mainly brassieres, panties, camisoles, girdles, sleepwear, hook, eye tape, mattress stitch-in fabrics, furnishing etc. (Chen and Coiler, 1997). Knitted fabrics are light in weight and comfortable to wear. Knit fabric has some stretchable properties because of interloping. There are four basic structures involves in weft knitting, i.e., plain or single jersey, rib, interlock and purl. Plain knitted fabric is unbalanced and has different appearance on face and back side.

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Lengthwise and widthwise extensibility of plain knit fabric is moderate and high respectively. Due to unbalanced characteristics it has tendency to curl at edges (Çoban, 1999). There are some derivatives of plain structures. Among them widely used plain knitted fabric structures are plain or single jersey fabric, polo pique, single lacoste and double lacoste. For weft knitting three types of stitches are involved to knit fabric, i.e., knit stitch, tuck stitch and miss stitch (Kumar & Sampath, 2013). 'Loop' is the single unit to weave knitted fabric. Each loop in a knit fabric termed as stitch. Stitch density is used to represent the closeness of the loops. So, stitch density means the number of stitches per unit area obtained by multiplying the number of courses per inch by the number of wales per inch (Yesmin, 2014).

GSM (gram per square meter) is an important knitting parameter to meet the buyer requirement. For price negotiation it is a vital factor rather considering total weight of the fabric. Yarn count selection, machine gauge, stitch density is considered during knitting. If loop length is greater, GSM will be less and for smaller loop length GSM will be high (Fatkić, Geršak, & Ujević, 2011). Stitch length is a single length of yarn which can be expressed as, stitch length = one needle loop + two half of a sinker loop

Usually if the stitch length is larger than fabric will be more extensible and lighter but busting strength will be less (Oinuma,1990).

The researcher examined correlation between loop length, yarn count and bursting strength. Tear strength is the resistance of the fabric against force. Tear strength of the single jersey grey fabrics depends fabric GSM, CPI and WPI, yarn type, type of fabric structure (Uyanik et al., 2016). In general, for higher fabric GSM more tearing strength can be found. Greater stitch density gives more tear strength in the fabrics (Pant & Jain, 2014)

Bursting strength disclosed that the effect of knit structure is highly influential on knitted fabric. The study stated that tuck loop and miss loop decreases the bursting strength. Fabric structure with the higher thickness showed higher bursting strength (Sitotaw & Berihun, 2017). For a particular structure if tuck stitches are more compared to other structure having less tuck stitches bursting strength is changes due to frequency of different stitches (Abd El-Hady & Abd El-Baky, 2015).

2. Objectives

The aim of the study was to find out the influence of different fabric structure and design on knitted fabric width, weight and the ultimate impact on fabric strength. Plain single jersey and its derivatives were developed for this investigation.

3. Methodology

3.1. Raw Material and Machine Preparation

The research study was conducted at Kamal Knitex Ltd., Narayanganj during the period of November, 2018 to May, 2019. In this study 100% cotton yarn were taken in different yarn count and was knitted on 24 gauge knitting machine at different machine diameter. Plain knit fabric structure and its derivatives (plain, polo pique, single lacoste and double lacoste) were produced for this investigation. In total 20 samples were prepared for investigation. Yarn count was 28/1 Ne. Circular weft knitting machine named Pailung, macine diameter 30 inch with machine gauge 24 was selected to produce the fabric.

3.2. Methods

For each and every structure 5 replications were produced to observe their changes in fabric weight, fabric width and bursting strength in terms of different fabric structure and design. All fabrics were produces under standard atmospheric conditions. Plain fabric structure was produced with 2.65 mm stitch length in selected five knitting machines. Polo Pique fabric structure was developed with 2.75 mm stitch length at selected five weft knitting machines.

Table-1: Fabric width, fabric weight and bursting strength for plain structure

Machine No.	Stitch Length mm	Fabric Width (open), inches	Fabric GSM	Bursting Strength, Kpa
54	2.65	62	127	612
61	2.65	61	126	617
78	2.65	62.80	127	611
79	2.65	61.30	131	612
92	2.65	63	129	610

Table-2: Fabric width, fabric weight and bursting strength for Polo Pique structure

Machine No.	Stitch Length, mm	Fabric Width (open), inches	Fabric GSM	Bursting Strength, Kpa
54	2.75	85	145	480
61	2.75	85.32	142	482
78	2.75	86.50	141	484
79	2.75	85.78	144	485
92	2.75	87	141	483

Table-3: Fabric width, fabric weight and bursting strength for Double Lacoste structure

Machine No.	Stitch Length, mm	Fabric Width (open), inches	Fabric GSM	Bursting Strength, Kpa
54	2.65	87	152	527
61	2.65	87.30	149	532
78	2.65	86.42	150	530
79	2.65	86.50	148	529
92	2.65	87.25	151	526

Table-4: Fabric width, fabric weight and bursting strength for Single Lacoste structure

Machine No.	Stitch Length, mm	Fabric Width (open), inches	Fabric GSM	Bursting Strength, Kpa
54	2.75	78	136	527
61	2.75	79	134	525
78	2.75	78.7	136	523
79	2.75	78.20	135	522
92	2.75	79	137	526

4. Findings and Discussion

Effect of plain knit structure with stitch length 2.65 mm on fabric width, fabric weight and fabric strength were carefully investigated.

Figure-1 showed that, the mean value of fabric width was 62 inches for plain structure and 86 inches, 78.58 inches and 87 inches for Polo Pique, Single Lacoste and for Double Lacoste Structure respectively.

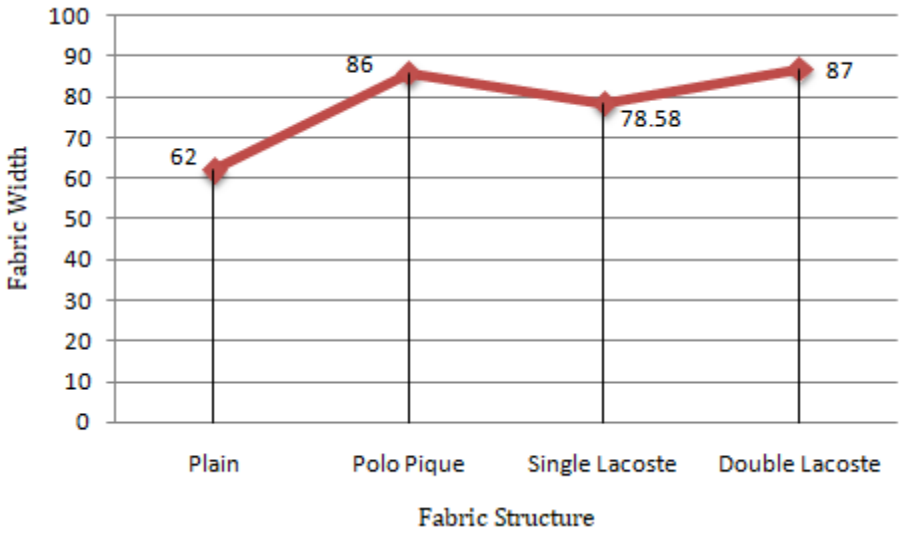

Figure-1: Behavior of fabric width in different fabric structure

Figure-2 stated that, the mean value of fabric weight was 128 gram per square meter for plain structure and 142.6, 135.6 and 150 for Polo Pique, Single Lacoste and for Double Lacoste structure respectively.

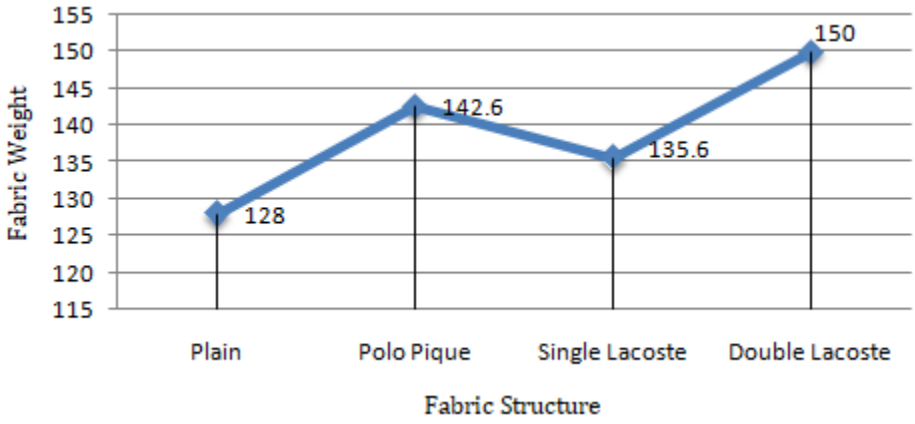

Figure-2: Behavior of fabric weight in different fabric structure

Figure-3 showed that the mean value of bursting strength was 612 Kpa for plain structure and 483 Kpa, 524 Kpa and 528 Kpa for Polo Pique, Single Lacoste and for Double Lacoste structure respectively.

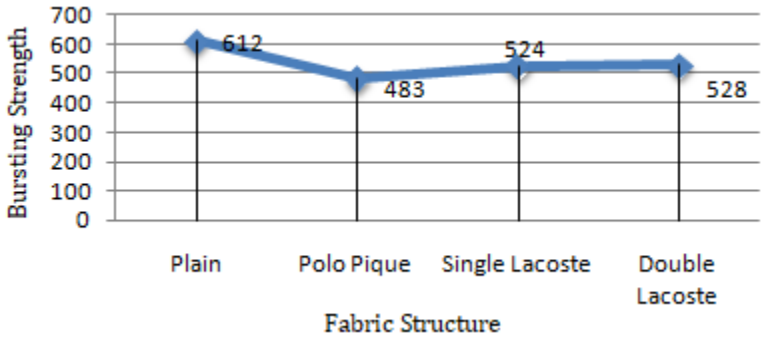

Figure-3: Behavior of fabric bursting strength in different fabric structure

Figure-4 describes that for different fabric structure has different behavior on fabric width, fabric weight and bursting strength.

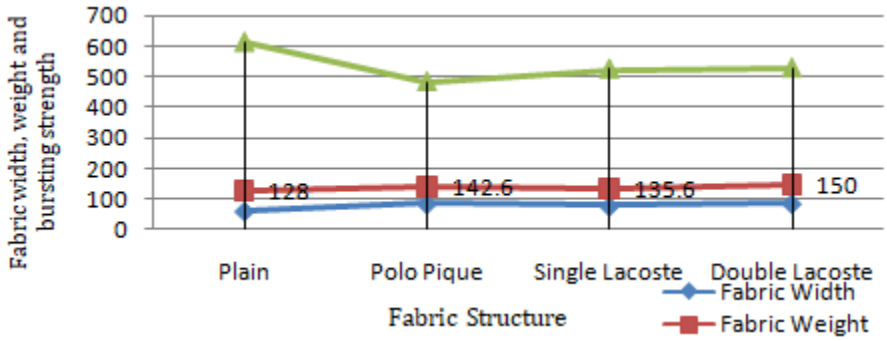

Figure-4: Behavior of fabric bursting strength, fabric weight and fabric width in different fabric structure

In this work, it has been found that fabric width increases with the increase of stitch length. The effect of fabric structure on fabric width was clearly noticed that highest fabric width was found in Double Lacoste structure on the other hand at same yarn count and stitch length single jersey got lower fabric width. As a consequence, fabric thickness was found greater with tuck stitches and for this reason it was heavier in weight per unit area than the fabric structure only involves with knit stitches. Highest bursting strength was observed in plain structure and lowest was found in Polo Pique structure. Presence of higher tuck stitches lead to decrease the bursting strength as because fabrics with tuck stitches are more porous in nature.

5. Conclusion

This research was conducted to study the effects of fabric structure and design on knitted fabric width, fabric weight and bursting strength. It can be concluded that fabric weight and fabric strength of all structures increases with the decreasing of stitch length. Fabric width was greater on Double Lacoste structure and lower on plain structure. Tuck stitches play a key role in the matter of bursting strength and fabric thickness. The result of the project work can be used for professional purposes. It was found that bursting strength of different knitted fabrics was dependent upon different factors. In this study we can recognized that fabric strength of knitted

fabrics is dependent on fabric structures, fiber types and blends as well as yarns. The empirical study examined twenty knitted fabrics for their fabric strength, weight and fabric width. ASTM D-6797 2015 standard was used to measure both attributes using INSTRON 5544 machine. The current study reaffirmed the relationship between structural and performance attributes in terms of comfortability.

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References

Abd El-Hady, R. A. M. & Abd El-Baky, R. A. A. (2015). The influence of pile weft knitted structures on the functional properties of winter outerwear fabrics. *J American Sci*, *11*: 101-108.

Chen, Y. & Coiler, B. J. (1997). Characterizing ofFabric End use by Fabric Physical Properties. *Textile Research Journal*, *11*(67): 247- 252.

Çoban, S., (1999), "GenelTekstilTerbiyesiveBitimİşlemleri, İzmir", EgeÜniversitesiYayınları, pp: 248-265.

Fatkić, E., Geršak, J. & Ujević, D. (2011). Influence of knitting parameters on the mechanical properties of plain jersey weft knitted fabrics. *FIBRES & TEXTILES in Eastern Europe*, *19*(5): 87-91.

Kumar, V. & Sampath, V. R. (2013). Investigation on the Physical and Dimensional Properties of Single Jersey Fabrics made from Cotton Sheath–Elastomeric Core Spun. *FIBRES & TEXTILES in Eastern Europe*; Vol: *21*, No. 3(99): 73-75.

Oinuma, R. (1990). Effect of stitch length on some properties of cotton 1×1 rib knitted fabrics. *Journal of the Textile Machinery Society of Japan*, *36*(3): 91-95.

Pant, S. & Jain, R. (2014) Comfort and mechanical properties of cotton and cotton blended knitted khadi fabrics. *Stud Home Com Sci*, *8*(2 & 3): 69-74.

Sitotaw, D. B. (2017). An Investigation on the Dependency of Bursting Strength of Knitted Fabrics on Knit Structures, Industrial Engineering and management, *6*(3), DOI: 10.4172/2169-0316.1000221

Uyanik, S., Degirmenci, Z., Topalbekiroglu, M. & Geyik, F. (2016). Examining the relation between the number and location of tuck stitches and bursting strength in circular knitted fabrics. *Fibres and Textiles in Eastern Europe*, 24.

Yesmin, S. (2014). Effect of stitch length and fabric constructions on dimensional and mechanical properties of knitted fabrics. *World Applied Sciences Journal*, *32*: 1991-1995.