OPEN ACCESS

International
Journal
Of Modern Engineering Research (IJMER)

Effect of Stitch Length on Different Properties of Plain Single Jersey Fabric

[1]Shilpi Akter, [2]Md. Abdullah Al Faruque, [3]Md. Mazedul Islam
[1,2]*Department of Fabric Engineering, Bangladesh University Of Textiles, Bangladesh,*
[3]*Department of Apparel Engineering, Bangladesh University Of Textiles, Bangladesh*

ABSTRACT: *The works reported in this paper present the effects of stitch length on different properties of plain single jersey fabric. Fabric properties can be changed due to use of various counts of yarn, type (ring, rotor, and compact), quality, stitch length, structural geometry, fiber composition, etc. With an increase in stitch length, the properties like Courses Per Inch (CPI), Wales Per Inch (WPI), GSM and stitch density will be decreased when the remaining other parameters are constant. Again shrinkage and spirality will be increased and bursting strength decreased with the increased stitch length. Pilling and abrasion resistance show lower grading when stitch length increases.*

Keywords: *Count, stitch length, spirality, GSM, shrinkage, single jersey.*

I. INTRODUCTION

Knitting is a process of fabric forming by the intermeshing the loops of yarn when one loop is drawn through another. Loops are formed in horizontal or vertical direction. In other words, Knitting is a conversion system in which yarns are used to form the loops and loops are intermeshed to form a fabric [1-2]. Knitted fabrics are used in manufacturing of fashion garments and even it has the potential in the formal wear segments [3]. Shrinkage is one of the most serious problems of the knitted fabrics. Specially, it is found in single jersey knitted plain fabrics. Because of different face and back side of the single jersey fabrics always tend to create curling. Thus, shrinkage is formed in single jersey mostly, where the other fabrics like double jersey are not so affected greatly as compared with it. Shrinkage creates stitching problem which resulting seam pucker. Human feels discomfort due to wear of shrink cloth [4]. Apart from this, spirality is another serious problem for single jersey knitted fabrics due to their asymmetrical loop formation [5]. Bursting strength is an important property of knitted fabrics. These fabrics have to pass many processes like dyeing and finishing. So they need enough strength to resist the force applied on it during different processing stages [6]. Fabric abrasion and pilling are also a problem for knitted fabrics. If pills are formed on the fabric surface, it looks unattractive in appearance [7, 8].

Many researches were performed to investigate the effect of different knitting parameters on the physical and mechanical properties of knitted fabrics. In this research work, effect of stitch length on different properties of plain single jersey fabrics was examined.

II. EXPERIMENTAL WORK

2.1 Materials

Throughout this study, 5 different cotton knitted samples were produced with various stitch lengths. The details of the samples were as follows, the samples were weft knitted single jersey plain fabric with 2.5mm, 2.6mm, 2.7mm, 2.8 mm and 2.9 mm stitch length. Yarn count used 30's Ne combed ring yarn. Other machine and yarn parameters were constant. Samples were knitted on a circular knitting machine, machine rpm was 30, machine gauge 24, number of feeder 66, cylinder diameter 22 inches and positive feed system.

2.2 Laboratory testing

Before testing, the samples were conditioned for 24 hours in a standard atmosphere, i.e., 20°C±2 temperature and 65%±2 Relative humidity. Five individual readings were taken and averaged for each fabric property. The samples were tested for CPI, WPI, bursting strength, shrinkage, spirality, abrasion resistance and pilling resistance.

Fabric bursting strength was tested by Bursting Strength Tester of James H.Heal, UK, and Martindale Abrasion Tester of James H.Heal, UK, was used to test the abrasion and pilling resistance. Standard Test methods of the properties used in this study were listed in table I.

Table I- Standard Test methods of the properties

Fabric properties	Standard Test Method
Bursting strength	ISO 13938-2-1999
Shrinkage percentage	D 6207-03(2015)
Spirality	ISO 16322-2 first edition
Pilling and abrasion resistance	ISO 12947-1

III. RESULTS & DISCUSSION

Different properties of plain single jersey fabrics for various stitch lengths were investigated.

3.1 Effect on CPI, WPI and stitch density

Stitch length is the major factor which affects all the parameters such as CPI, WPI and stitch density etc. For different stitch lengths and its effects on WPI, CPI and Stitch density are shown in Table II:

Table II: Effect of Stitch length on Single Jersey fabric.

Stitch Length, l(mm)	WPI	CPI	Stitch Density, S(Loops/inch^2)
2.5	36	52	1872
2.6	36	49	1764
2.7	35	48	1680
2.8	35	46	1610
2.9	34	44	1496

From table II, it is clear that CPI & WPI change with the change of stitch length. For single jersey fabric, CPI and WPI decrease with the increase of stitch length.

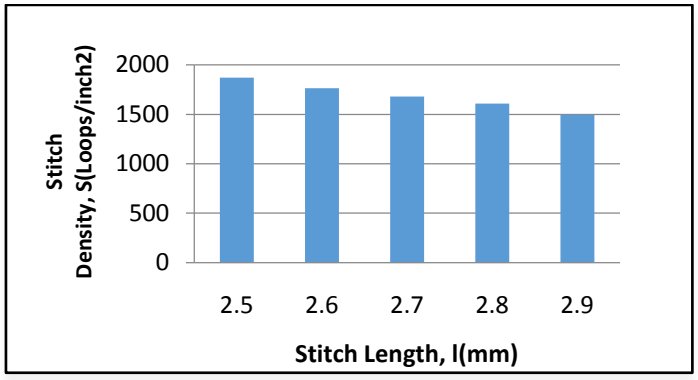

Figure 1: Variation of stitch length on stitch density

From figure 1, as stitch length increases there should be less loops per square inch, hence stitch density will decrease. The figure also shows that with the increase of stitch length, stitch density decreases.

3.2 Effect of stitch length on GSM

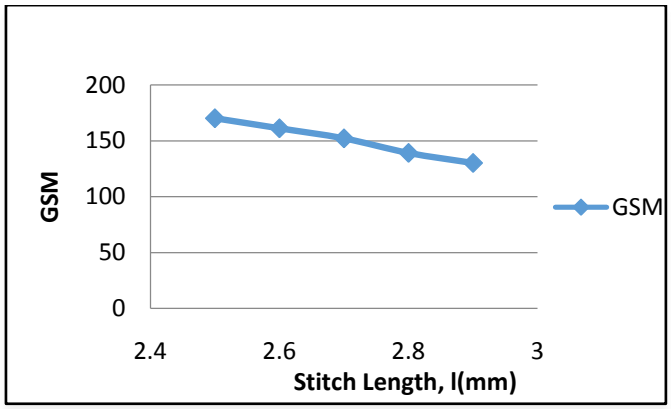

Figure 2: Variation of stitch length on GSM

It is found that with the increase of stitch length there must be more open space in the fabric hence areal density will decrease. The figure 2 shows that with the increase of stitch length GSM of the fabric decreases.

3.3 Effect of stitch length on fabric shrinkage

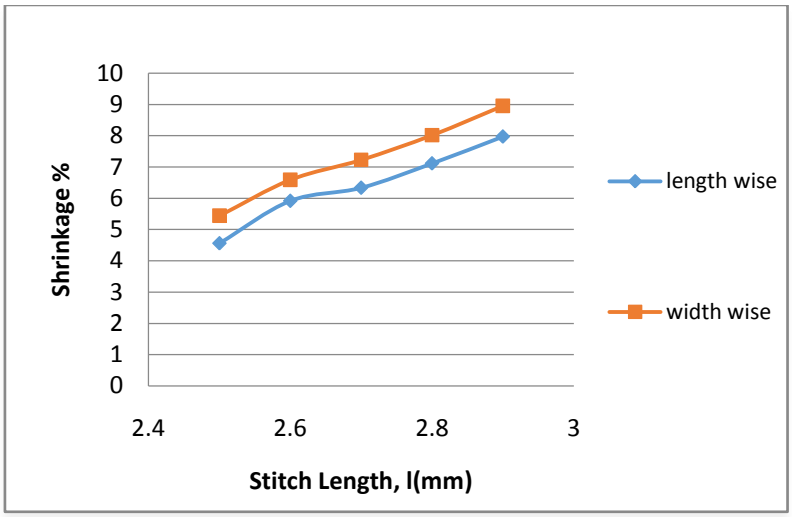

Figure 3: Variation of stitch length on shrinkage

With the increase of stitch length widthwise shrinkage changes randomly as shown in figure 3. Single jersey fabrics are constructed with only knit loops and it has high elasticity in width, results change the dimension of the fabrics after washing. Shrinkage of the single jersey fabric increases with the increases of stitch length and maximum shrinkage was found for a 2.9 mm stitch length. Lengthwise shrinkage is also changed for the increase of stitch length. It is observed that when stitch length is increased, lengthwise shrinkage is also increased. Maximum shrinkage was found for a 2.9 mm stitch length.

From the above figure 3, it reveals that the lengthwise shrinkage is less than widthwise for single jersey fabric and both lengthwise and widthwise shrinkage is increased due to the increase of stitch length.

3.4 Effect of stitch length on spirality

Spirality is the distortion of the place of loops where they formed. The higher the loop length, the higher the distortion of the place of loops. From the figure 4, it is established that with the increase of stitch length spirality of single jersey fabric increases. As the increase of stitch length decreases the stitch density or decrease the number of loops per unit area of the fabrics, results in instability of the fabrics. After that, if any force applied on less density fabric, it is distorted easily. Spirality is minimum for the stitch length 2.5 mm and maximum for the 2.9 mm.

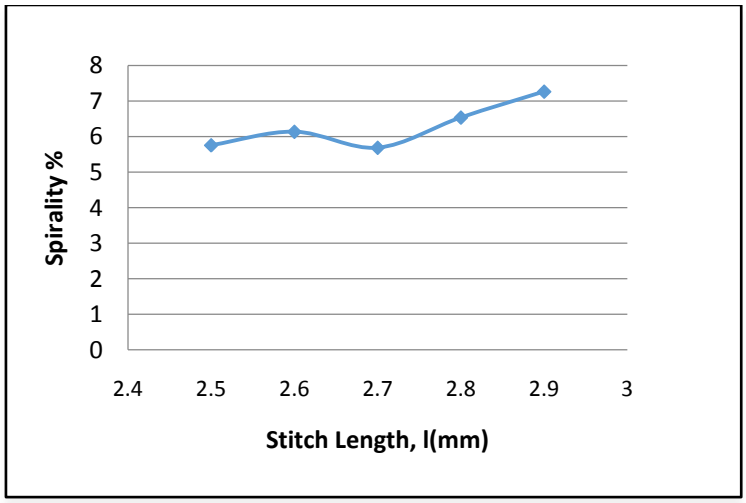

Figure 4: Variation of stitch length on spirality

3.5 Effect of stitch length on bursting strength

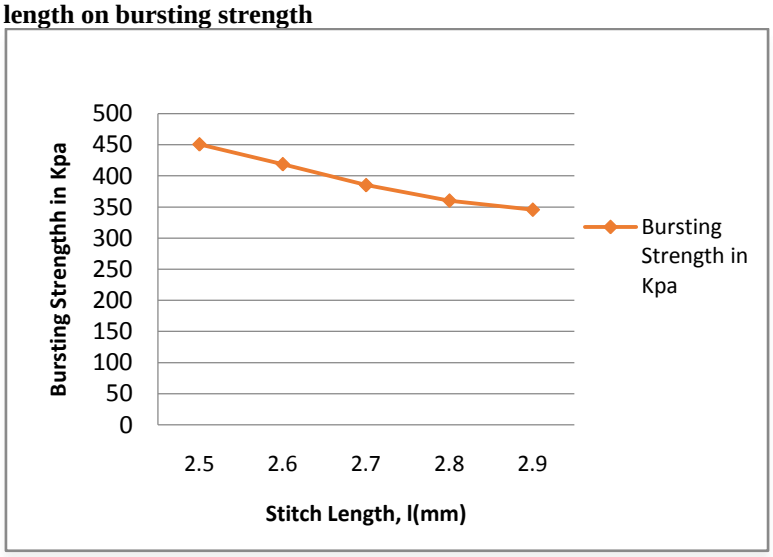

Figure 5: Variation of stitch length on bursting strength

From the above figure 5, we can observe that if the stitch length increases bursting strength is decreased. This is due to when stitch length is less; number of loops per unit area is more. Therefore, the resistance towards the force is more in case of less stitch length of fabric. It reveals that there is a correlation between bursting strength and stitch length and stitch length greatly control the bursting strength of knitted fabrics. Bursting strength of single jersey fabric decreases with the increase of stitch length and higher strength is found in the lower stitch length. Maximum bursting strength is 450.6 KPa for stitch length 2.5 mm.

3.6 Effect of stitch length on abrasion resistance

Abrasion resistance is plotted in figure 6 and it was measured by the weight loss percentage. The abrasive wear of a fabric depends on the construction of the yarn and the structure of the fabric. It is found that, single jersey fabric showed higher abrasion loss% due to its soft nature on the surface with the increase of stitch length.

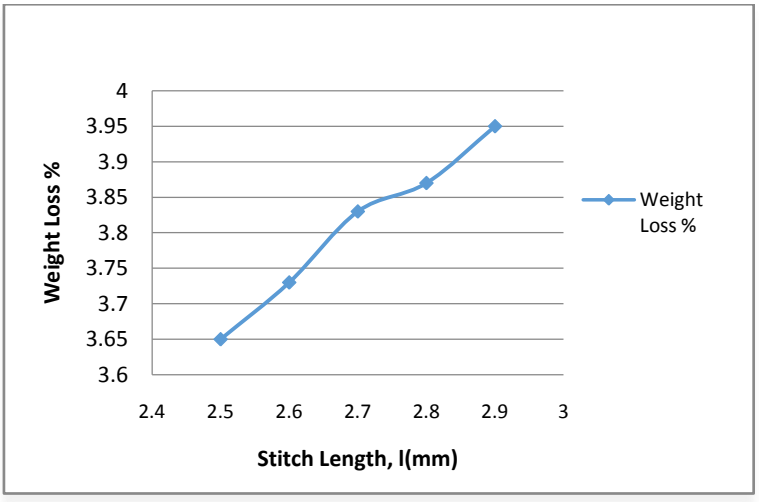

Figure 6: Variation of stitch length on Abrasion resistance

3.7 Effect of stitch length on pilling resistance

Pill formation is a great difficulty for cotton knitted fabrics. From the table III, it is seen that, as the stitch length increased, the pilling grade values decreased from higher to lower grade. Moreover, the increased stitch length reduced the resistance to pilling. For lower stitch length 2.5 mm, pilling resistance is better and it is gradually decreased due to increase of stitch length.

Table III : Effect of stitch length on Pilling resistance

Stitch Length in mm	Pilling resistance (Rating)
2.5	3
2.6	3
2.7	3
2.8	2
2.9	2

IV. CONCLUSION

In this research work, the effects of stitch length on plain single jersey fabrics were investigated. Among the various properties, CPI, WPI, Stitch density, GSM, shrinkage, spirality, bursting strength, abrasion and pilling resistance were examined. Five different stitch lengths were used to produce the plain single jersey fabric for this experiment. The yarn count and other machine parameters were constant. A significant change was observed for the various stitch lengths. CPI, WPI, stitch density and GSM decrease with the increase of stitch length. Spirality and shrinkage increase but bursting strength decreases with the increase of stitch length. Abrasion and pilling resistance illustrate lower grade with the increase of stitch length.

REFERENCES

[1]. David J.Spencer - Knitting Technology (3rd edition) Chapter – 22, Page – 274 – 284.
[2]. Manonmani G & Vigeswaran Cheetier - Stability of compact yarn for manufacturing of Eco- Friendly processed weft knitted fabrics, JTATM, 6(3) ppl-18 (2010).
[3]. Elias Khalil , Md. Solaiman – Effect of stitch length on physical & mechanical properties of
[4]. Single jersey cotton knitted fabric, IJSR, Vol-3, Issue -9, ISSN:2319-7064, (2014).
[5]. Vishal Desale, P.P.Raichurkar, Akhilesh Shukla & Ramkesh Yadav.; "A Study on Spirality of Single Jersey Knitted Fabric", Textile journal, 4(11): 1371-1379, 2008.
[6]. Tao, J., Dhingra, R., C., Chan, C., K., Abbas, M.,S.; "Effects of yarn and Fabric construction on spiralitv of Cotton Single Jersey Fabrics", Textile Research Journal, 67, 57-68. 1997.
[7]. Kavusturan, Y., 2002. The Effects of Some Kint Structurans on the Fabric Properties in Acrylic Weft Knitted Outerwear Fabrics. Teksti Maraton, pp: 40-46.
[8]. Rangulam, R.B., J. Amirbayat and I. Port, 1993. The Objective Assessment of Fabric Pilling Part 1 : Methodology. Journal of Textile Institute. 84: 221-226.
[9]. Ukponmwan, J.O, A. Mukhopadhyay and K.N. Chatterjee, 1998. Pilling. Textile Progress, 28(3): 1-57.