International Journal of Current Engineering and Technology
E-ISSN 2277 – 4106, P-ISSN 2347 – 5161

Available at http://inpressco.com/category/ijcet

Research Article

Visitation of Yarn Twist on Divers Properties of Cotton Knitted Single Jersey Fabric

Farial Islam Farha†* and Nasrin Akter†

†Department of Textile Engineering, Ahsanullah University of science and Technology, Dhaka-1208, Bangladesh

Accepted 18 Dec 2015, Available online 24 Dec 2015, **Vol.5, No.6 (Dec 2015)**

Abstract

A plain single jersey fabric is the most obligate weft knitted fabric in the terra of textiles. But this fabric can not be commenced with any type of yarn. Spirality is an inherent problem of single jersey fabric. Therefore to select appropriate yarn with proper Twist (Twist per inch) is a vital issue to minimize this problem to a large extent. The present study was undertaken with an aim to study the effect of varying yarn twist on Bursting strength, pilling resistance and finally Spirality of plain single jersey weft knitted fabric. Three specific count of yarn each with three different TPI was taken to knit the plain single jersey fabric. Finally Bursting strength, pilling resistance and spirality were checked for finished fabric. It was observed that with increasing twist, bursting strength and pilling resistance shows better performance while performance of spirality declines for each count of yarn.

Keywords: *Twist, Single jersey, Bursting strength, pilling resistance, spirality.*

1. Introduction

In recent years there has been a very fast growth in the knitting section of the textile industry. A demand for weft knitted garments has increased many folds over the years in the domestic and export markets. (Suh, 1967). Effect of twist variation on plain single jersey fabric has been one of the most discussed areas in textile industry as well as research fields.

Yarn properties such as count, twist and moisture conditions were found to affect the characteristics of weft knitted fabrics. The main yarn properties are yarn count and yarn twist. Both are of prime importance in the design of textile structures and, to a large extent, they govern the appearance and behavior of the various types of yarns and fabrics (J. E. Booth, 1996). The twist in the yarn effects some inherent parameters of yarn such as torsional rigidity and flexural rigidity. Yarn twist is the spiral turns given to the yarn in order to hold constituent fibres threads together (J.E. Booth, 1996). Highly twisted yarn is "Lively" and tends to twist upon it and produce "Snarls" fabrics produces from highly twisted yarns will possess a lively handle. An increase in the amount of twist produces an increase in the yarn strength, if yarn strength is increase, the fabric strength will be increased (J.E. Booth, 1996).

Yarn twist and fabric tightness are the most predominant factors contributing to spirality of cotton single jersey fabric (Tao *et al*, 1997). The amount of twist in yarn is one of the major causes for spirality in single jersey knitted fabric. Higher the twist in the yarn, higher will be the twist liveliness and this result in a higher angle of spirality in single jersey knitted fabric. When a yarn with a relatively higher twist is knitted into a loop, it tends to release its torsional strain during relaxation and thereby increases the spirality angle in the knitted fabrics (Chellamani and Vittopa, 2009).

Yarn twist has also a vital impact on pilling resistance of single jersey fabric as it defines how strongly fibres are held together in the yarn. The resistance of knitted fabrics to pilling depends on the density of fabric, i.e. when the length of knitted fabric loop decreases and the surface density increases, the resistance to pilling grows (I. Gykytė *et al*, 2002 and D. Mikučionienė, 2009). It was defined in previous works that the twist, fuzzing, quantity of fibers, cross-sectional structure of knitted fabric change resistance to pilling: when the twist of yarn is bigger, the fuzzing of fabric then decreases (N. Uçar *et al*, 2007).

Prior researchers had investigated various issues covering fields like; effects of stitch length, single yarn twist and twist ratio on the dimensional parameters like angle of spirality, GSM, shrinkage of single jersey cotton knitted fabrics (Kothari *et al*, 2011 ; Sharma *et al* 1985 ; N K Palaniswamy 2011). Another researchers showed the pilling performance and abrasion resistance of different weft knitted fabrics depending on usage of different softeners, different types of yarn etc. (Muhammet Akaydin *et al*, 2010; Gita BUSILIENĖ *et al*, 2011).

*Corresponding author: **Farial Islam Farha**

This exixtent study focuses on the relation of different TPI (twist per inch) of a particular count yarn with the bursting strength, angle of spirality and pilling resistance of 100% cotton plain single jersey fabric.

2. Material and Methods

2.1 Materials

2.1.1 Fabric

100% cotton plain single jersey fabric (scoured, bleached and dyed) made from three different count yarn with three different amount of twist for each count was used for this experiment. TPI for each sample was measured by Heals quadrant twist tester. The specifications of the fabric are given below.

Table 1: Fabric specifications

Fabric Type	Composition	Specimen no.	Yarn count	TPI
Plain Single jersey fabric	100% cotton	1	20's	19.29
		2		20.82
		3		21.43
		1	26's	19.16
		2		20.02
		3		20.65
		1	30's	21.84
		2		22.46
		3		22.69

2.2 Machines

The same parameters and machine was used for knitting 20's, 26's & 30's yarn using negative feed device. Parameters of the knitting machine were as follows:

Table 2: Machine specifications

Name of machine	Single cylinder Hosiery (Socks) knitting machine
Brand name	Jiunn long (Taiwan)
Diameter of machine	4"
Number of feeder	1
Number of needle	132T
Machine gauge	11G

2.3 Methods

2.3.1 Dyeing

Dyeing process of the samples was carried out in Ahiba IR dyeing machine with the following recipe.

Table 3: Recipe of combined scouring and bleaching

Wetting Agent	1.0 g/l
Detergent	2.0 g/l
Peroxide Stabilizer	1.0 g/l
Caustic Soda 36° Be	4.0 g/l
H2O2 (35%)	4.0 g/l
Temperature	95°C
Time	60 min
PH	11.5
M:L	1:10

Table 4: Recipe of Dyeing.

Wetting Agent	1.0 g/l
Sequestering Agent	1.0 g/l
Antifoaming agent	1.0 g/l
Dyes	2%
Glauber salt	45 g/l
Na2CO3	0.1 g/l
Temperature	60 °C
Time	60 min
PH	10.5
M:L	1:10

2.3.2 Finishing

The finishing process designated drying and stentering on MATHIS sample machine. Then all the finished samples were tested.

2.3.3 Bursting strength measurement

Bursting strength of the samples were measured by MESDAN Bursting strength Tester within pressure range of 0-20 kg/cm2 according to test method ISO 13938-1:1999. Five data for each specimen was taken to find out the average bursting strength.

2.3.4 Pilling resistance measurement

Pilling resistance of each sample was measured by SDL International Martindale M235 according to test method ASTM D4970. The size of specimen was 140 mm diameter of 4 pcs and 90 mm diameter of 4 pcs.

2.3.5 Spirality measurement

Spirality of each samples was measured very cautiously according to the CTI test method.

3. Results and Discussions

3.1 Bursting strength

Fig-1(a), 1(b) and 1(c) represent the effect of TPI on the bursting strength of plain single jersey fabric produced from 20's, 26's and 30's yarn count respectively. The results indicated increase of bursting strength for every sample with the increase of twist per inch and loss of strength value with the increase of yarn count. Because finer yarn have small cross-sectional area than coarser yarn and less pressure of fibres from outer surface to inner shell.

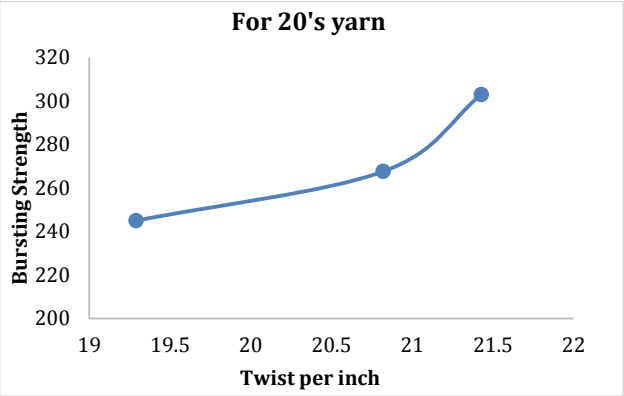

Fig. 1 (a)

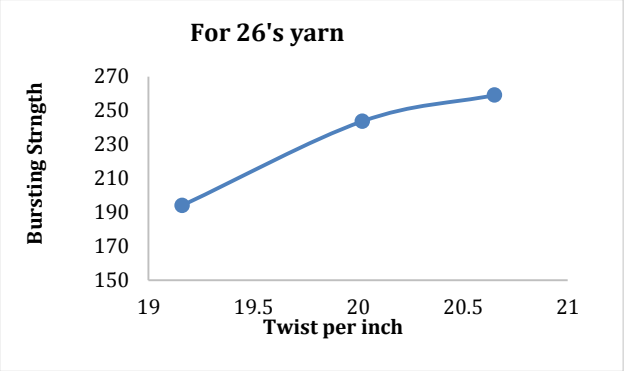

Fig. 1 (b)

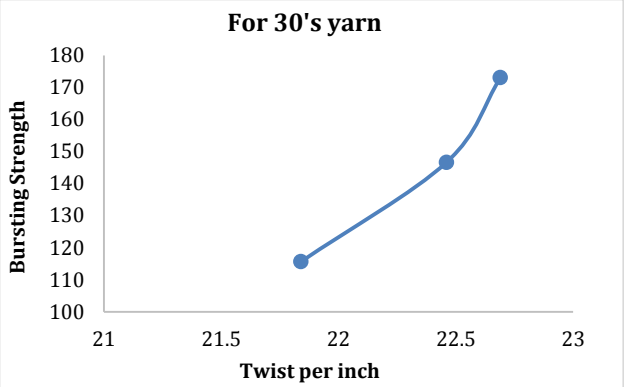

Fig.1 (c)

Fig.1 Effect of yarn twist on Bursting Strength

3.2 Pilling Resistance

Fig- 2(a), 2(b) and 2(c) represent the influence of twist per inch on the pilling resistance of plain single jersey fabric produced from 20's, 26's and 30's yarn count respectively. The results shown better pilling performance for higher twist per inch in case of all count of yarn due to more cohesion force of fibres. With the increase of TPI the binding of fibres by yarn becomes stronger which causes lower tendency of pulling out of short fibres during pilling.

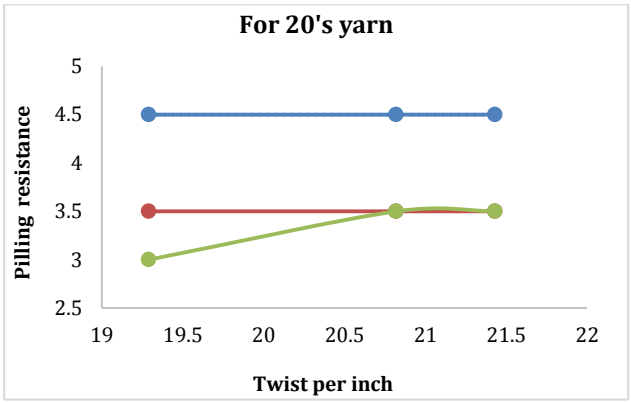

Fig. 2 (a)

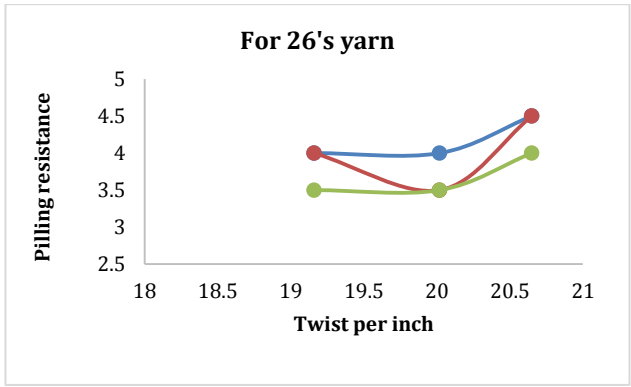

Fig. 2 (b)

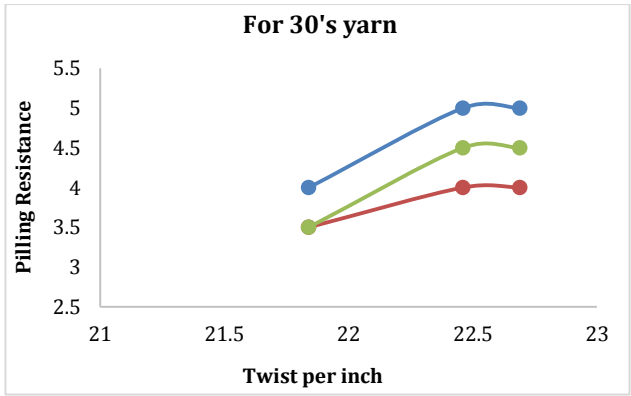

Fig. 2 (c)

Fig.2 Effect of Twist per inch on pilling performance

3.3 Spirality

Fig-3 (a), 3(b) and 3(c) represent the increased amount of spirality with the increase of twist per inch in every case. It happened because yarn having more twist per inch possess more tendency of being untwist after loop formation. Due to this tendency twist liveliness also increased which finally lead to more spirality.

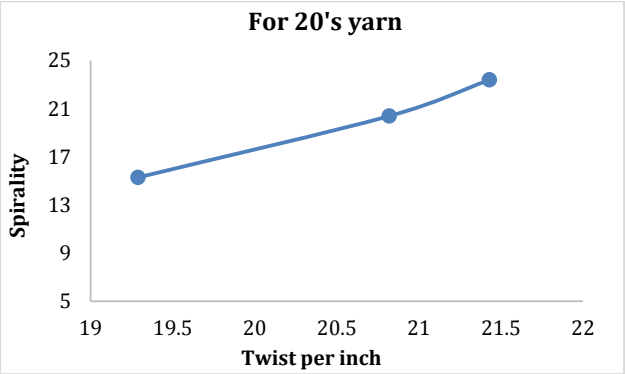

Fig. 3 (a)

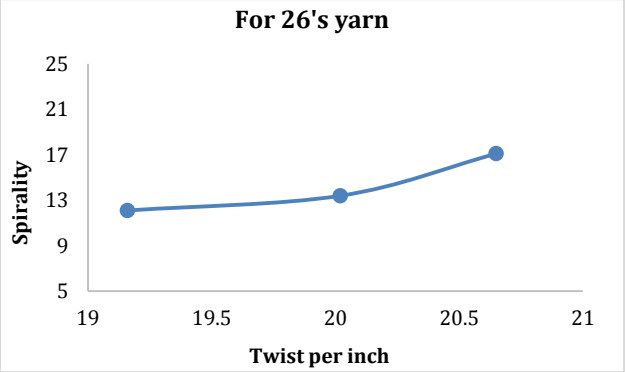

Fig. 3 (b)

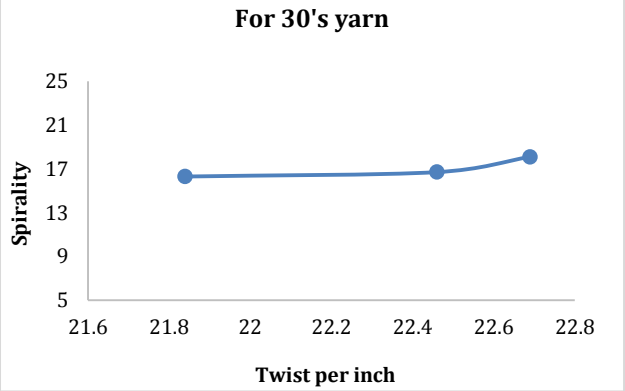

Fig. 3(c)

Fig.3 Effect of Twist per inch on spirality of plain single jersey fabric

Conclusion

Bursting strength, pilling performance and spirality are few important features of plain single jersey fabric. In this study, an attempt was taken to show the effect of twist variation of 20's, 26's and 30's yarn on above mentioned properties of cotton single jersey fabric. These properties are also affected by machine gauge, stitch length, relaxation state etc. Hence all other parameters except yarn twist were kept constant. In all samples an increase in fabric strength, pilling resistance and spirality was observed with the increase in twist per inch of yarn. This trend was visible in 20's, 26's and 30's yarn samples but the intensity of change varied from count to count. This research work can be extended in future by studying the effect with other yarn properties in same as well as other fabric structures (e.g. rib, interlock etc.).

References

J. E. Booth, (1996), Principles of Textile Testing, *CBS Publishers and Distributors*, pp. 209-235.

I. Gykytė, E. Strazdienė, R. Titas, V. Urbelis, (2002), Pilling of Knitted Materials, *Materials Science (Medžiagotyra)*, Vol.8, no. 3, pp. 316 – 319.

D. Mikučionienė, (2009), The Influence of Structure Parameters of Weft Knitted Fabrics on Propensity to Pilling. *Materials Science (Medžiagotyra),* Vol.15, no. 4, pp. 335 – 338.

N. Uçar, S. Ertuğrul, (2007), Prediction of Fuzz Fibers on Fabric by Using Neural Network and Regression Analysis, *Fibres & Textiles in Eastern Europe,* Vol.2, no. (61), pp. 58 – 61.

G. Busilienė, K. Lekeckas, V. URBELIS, (2011), Pilling Resistance of Knitted Fabrics, *Materials Science (Medžiagotyra),*Vol.17, no. 3,pp. 297-301.

M. Akaydin, Y. Can, (2010), Pilling Performance and Abrasion Characteristics of Selected Basic Weft Knitted Fabrics, *Fibres & Textiles in Eastern Europe*, Vol. 18, No. 2, pp. 51-54.

M. W. Suh, (1967), A study of the shrinkage of plain knitted cotton fabric based on the structural changes of the loop geometry due to yarn swelling and deswelling, *Textile Research Journal*, Vol. 37, no. 5, pp. 417-431.

N. K. Palaniswamy, A. P. Mohamed, (2005), Effect of single yarn twist, ply-to- singles twist ratio and tightness factor on spirality of single jersey cotton knitted fabrics, *Indian Journal of Fibre and Textile research*, Vol. 30, pp. 258-262.

J. Tao, R. C. Dhingra, C. K. Chan, M.S. Abbas, (1997), Effects of Yarn and Fabric Construction on Spirality of Cotton Single Jersey Fabrics, *Textile Research Journal,* Vol. 67, no. 1, pp. 57-68.

K. P. Chellamani, M. K. Vittopa, (2009), Fibre-yarn relationships in short staple ring spinning system, *Textile Magazine*, Vol. 50, no. 7, pp. 12.

V. K Kothari, G. Singh, K. Roy, and R. Varshney, (2011), Spirality of cotton plain knitted fabrics with respect to variation in yarn and machine parameters. *Indian Journal of Fibre and Textile Research*, Vol. *36, no.*3, pp. 227.

I. C. Sharma, S. Gosh and N.K. Gupta. (1985), Dimensional and physical characteristics of single jersey fabrics, *Textile Research Journal*, Vol. 55, no. 3, pp. 149-152.