ENHANCING THE QUALITY OF SINGLE JERSEY KNITTED FABRIC BY PREVENTING BARRE CAUSED BY YARN PARAMETERS

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The textile industry being the backbone of Pakistan's economy needs improvement due to the introduction of various factors like increasing competition in the global market , introduction of state-of-the-art technology and high prices. The above-mentioned factors invite both our industrialists and planners to place greater emphasis on quality as well as productivity. The fabric fault 'Barre' is seriously observed in knitted fabrics particularly after dyeing and processing this fault becomes prominent in the form of different streaks in fabric. Three ring spun yarn counts samples from the same cotton i.e Ne16^{s} ,20^{s} and 30^{s} at four twist multipliers i.e3.6, 3.7, 3.8 and 3.9 were knitted into single jersey fabric. The results differed in significant and non significant with each others. The present research study is focus to analyze the effect of variation in cotton yarn characteristics (causing barre in the end product) by changing the mentioned yarn variables at ring frame.
Keywords: Knitted fabric, Barre, shade variations, mechanical variables

INTRODUCTION

In cotton textile production, one of the most common and bewildering quality control challenges is barre. Transactions for the sale of yarn among the spinners, weavers and knitters take place subject to the guarantee provided by the spinners that "Barre or Patta" will not appear in the fabric woven or knitted from the yarn. Fabric barre comprises of unwanted stripes in the woven fabrics in the direction of the weft. This fault also appears in weft knitted fabrics usually on a multi feeder machine and consists of light or dark course-wise stripes arising from differences in luster, dye-affinity, yarn spacing or loop length, yarn linear Weight or defective plating. It is obvious from the foregoing that 'Barre' is a visually conspicuous defect in woven and knitted fabrics, which appears as a result of defects in yarns and in the structure of the fabrics. Such fabrics are unsuitable for subsequent processes of dyeing, printing and finishing and, therefore, unacceptable to wet processors. The purchase of yarn by weavers and knitters subject to `patta' free guarantee provided by the spinners is therefore a logical demand. During the conversion of fibres into yarns and yarns into fabrics, action and interaction of many causes may give rise to the appearance of 'Barre'. Non-uniformity in a variety of properties exists in yarns. There may be variation in twist, bulk, strength, elongation, fineness etc. Yarn evenness deals with the variation in yarn fineness. This is the property, commonly measured as the variation in mass per unit length along the yarn. It is basic and important one, since it can influence so many other properties of the yarn and of fabric made from it. Twist has a significant influence on the colour differences of the fabric combinations.

No doubt there is material and back process concerning reasons for yarn count and other variations but the present research work was planned to investigate the effects of count and twist variation at ring frame on yarn quality to analyze its causative effect in streaks formation in knitted fabric. Anonymous (2000) described that length and length uniformity of fibre has a direct influence on yarn strength, elongation, evenness, structure and hairiness of yarn. Marmarali (2005) revealed that angle of spirality of flat knitted garments is less as compared to circular knitted garments and Anonymous (2006) stated that barre can be caused by physical, optical or dye differences in the yarns; geometric differences in the fabric structure, or by any combination of these differences.
Anonymous (2004) reported that an inconsistency that leads to barre can originate in one or more of the following categories: mixing yarns of different counts, mixing yarns from different spinning systems, mixing yarns with different blend levels, mixing yarns from different suppliers, mixing yarns with different twist level/twist direction and mixing yarns with different degrees of hairiness. Sheikh (2006) stated that during the spinning process ineffective or inadequate quality control results in the production of yarn with excessive count, twist variations and hairiness, consequently, barre appears in the fabrics woven or knitted from such yarns. Semnani *et al.* (2005) reported that the correlation between apparent quality of knitted fabrics and their yarns is very strong.

MATERIALS AND METHODS

The research work entitled "Enhacing the Quality of Single Jersey Knitted Fabric by Preventing Barre caused by Yarn Parameters" was mainly conducted at Cresent Textile mills Sargodha Road Faisalabad during the year2007. The raw cotton samples having 28.21mm span length with 49.54%, 28.40gram per tex, 4.22microgram per inch and 7.43% were the Uniformity ratio, fibre strength, fibre fineness and trash content respectively. The material was collected from the running stock of the Mills and processed through blow room, card, and draw frame and combing to roving at standard set up. Roving samples processed at ring frame for making yarn samples of the following descriptions. The main objective of the research study is to investigate the effect the different yarn counts, count deviation (i.e.) fluctuation in nominal count and twist multiplier on knitted fabric in the form of barre and other characteristics of yarn/fabric

Following variables were checked on ring spinning frame

Yarn Count (C)	Count Deviation (D)	Twist Multiplier (T)
C1 = $16^{,S}$	D1 = -1.0	T1 = 3.6
C2 = $20^{,S}$	D2 = -0.5	T2 = 3.7
C3 = 30^{S}	D3 = +0.5	T3 = 3.8
	D4 = +1.0	T4 = 3.9

The yarn samples of 16^s, 20^s and 30^s were spun from cotton samples. Under the influence of above mentioned variables and cone samples were prepared Terrot brand knitting machine of 24 inch gauge with 25 feeders, 24 inch cylinder diameter and dial height 4 inch was engaged for the preparation of single jersey knitted fabric samples. The knitted fabric samples were placed on flat surface for 24 hours at 65+/-2%relative humidity and 27+/- 2% temperatures for conditioning purpose .Then the following characteristics of fabrics were tested. **Fabric Weight.** It is the weight of one square meter fabric in gram. The weight of the fabric should not very from the specified weight by more then+-5%according to the standard given by ASTM Committee (1997). **Spirality.** It is the deviation of courses and wales line angle from 90.More angle deviation more will be the spirality. Spirality was measured when fabric is in tubular form according to ASTM Committee (1997a). **Fabric Barre.** The flat table examinations and light source observation method was used to analyze fabric barre as recommended by Bailey (2002). **Statistical Analysis.** Three factor factorial tests were applied and were crossed and forty eight combinations/samples were prepared with five replications, then they were randomized according to factorial arrangement in CRD. The data thus obtained analyzed as suggested by Faqir (2004) using M-stat microcomputer statistical program as devised by Fareed (1992).

RESULTS AND DISCUSSION

Fabric Weight

The analysis of variance and comparison of individual treatment means for fabric weight is given in table 1 and 1(a) respectively. The results show that the yarn count (C) and twist multiplier (T) has highly significant effect while count deviation (D) and all possible interactions C×T, C×D, T×D and C×T ×D have non-significant effect on the fabric Weight of single jersey knitted fabric.

Duncan's Multiple Range tests for mean values of fabric Weight for different values of yarn count (C) as given in Table 1(a) ranked as 215.07, 177.47 and 130.57 gram per square meter for C1, C2 and C3 respectively. These values differ significantly from each other. The results are in accordance with the research work of Jamal (1998) who expressed that weight of the knitted fabric depends upon the count and stitch length, with increase in stitch length the fabric weight decreased. Similarly, Gill (2000) concluded that stitch weight increased slightly for finer counts, while the fabric Weight decreased. The mean values of fabric weight at different twist multiplier (T) indicate significant effect and ranked as 169.85, 172.92, 175.77 and

Table 1. Analysis of variance for Fabric Weight (GSM)

S.O.V.	Df	S.S.	M.S	F. Value	Prob.
C	2	172057.922	86028.961	9319.8944	0.0000**
T	3	1631.420	543.807	58.9130	0.0000**
D	3	14.660	4.887	0.5294	N.S
C×T	6	72.460	12.077	1.3083	0.2609 NS
C×D	6	41.080	6.847	0.7417	N.S
T×D	9	7.370	0.819	0.0887	N.S
C×T×D	18	15.700	0.872	0.0945	N.S
Error	96	886.145	9.231		
Total	143	174726.757			

** = Highly Significant N.S = Non-significant

178.94 gram per square meter for T1, T2, T3 and T4 respectively. The results show that with the increase in twist factor, fabric weight of knitted fabric increased. In this trend previously Sharma *et al.* (1987) mentioned that stitch Weight increases with twist. It means fabric contraction takes place and ultimately the fabric weight increased.

Table 1(a). Comparison of individual treatment means for fabric weight (GSM)

Yarn Count (C)	Count Deviation (D)	Twist Multiplier (T)
C1 = 215.07 a	D1=174.70	T1 = 169.85 d
C2 = 177.47 b	D2=174.64	T2 = 172.92 c
C3 = 130.57 c	D3=173.92	T3 = 175.77 b
	D4=174.22	T4 = 178.94 a

Mean values of fabric weight at different count deviations (D) show the non-significant effect and ranked as 174.70, 174.64, 173.92 and 174.22 gram per square meter for D1, D2, D3 and D4 respectively. Previously Corbman (1983) mentioned that the plain knit produce a relatively light weight fabric compared with the thicker fabric produced by other stitches. Moreover, Brackenbury (1992) stated that weight of fabric is determined by two factors, loop size and yarn size and the weight of fabric increased with decreased loop size. Similarly Anonymous (2004) reported that an inconsistency that leads to barre can originate in one or more of the following categories: mixing yarns of different counts, mixing yarns from different spinning systems, mixing yarns with different blend levels, mixing yarns from different suppliers, mixing yarns with different twist level/twist direction and mixing yarns with different degrees of hairiness and that leads to faults of knitting i.e. fabric weight.

Fabric Spirality

The analysis of variance and comparison of individual treatment means for fabric spirality is presented in table 2 and 2(a) respectively. The results show that the yarn count (C), twist multiplier (T) and interaction C×T has highly significant effect while count deviation (D) and other possible interactions C×D, T×D and C×T ×D have non-significant effect on the fabric spirality of single jersey knitted fabric.

The mean values of fabric spirality for different values of yarn count given in table 2(a) ranked as 8.80, 10.94 and 14.29 for C1, C2 and C3 respectively. These values differ significantly from each other. The results are at par with the research of Anonymous (2000) described that length and length uniformity has a direct influence on yarn strength, elongation, evenness, hand, structure and hairiness as well as on yarn twist performance. While Marmarali (2005) revealed that angle of spirality of flat knitted garments is less as compared to circular knitted garments and Anonymous (2006) stated that barre can be caused by physical, optical or dye differences in the yarns; geometric differences in the fabric structure, or by any combination of these differences.

Mean values of fabric spirality at different twist multiplier (T) show significant effect and ranked as 7.44, 9.60, 12.35 and 15.97 for T1, T2, T3 and T4 respectively. The results show that with the increase in twist factor, fabric spirality of knitted fabric increased. In this trend, previously Black (1975) mentioned that at higher twist multiplier, the spirality of ring spun yarn is increased and Sharma *et al.* (1985) narrated that the angle of the lines with the vertical is increased with the twist factor. Similarly Araujo and Smith (1989) stated that the angle of spirality increases with the twist multiplier and they further stated that the angle of spirality decrease as follows: Friction spinning > Ring spinning > Rotor spinning > Air jet spinning. The mean values of fabric spirality at different count deviations (D) show the non-significant effect and ranked as 11.25, 11.24, 11.35 and 11.52 for D1, D2, D3 and D4 respectively. Moreover, Nawaz *et al.* (2000) concluded that the spirality increased by stitch length

Table 2. Analysis of variance for fabric spirality

SOV	Df	S.S.	M.S.	F. Value	Prob.
C	2	735.755	367.878	485.8084	0.0000**
T	3	1463.209	487.736	644.0899	0.0000**
D	3	1.905	0.635	0.8383	N.S
C×T	6	58.042	9.674	12.7747	0.0000
C×D	6	1.051	0.175	0.2312	N.S
T×D	9	0.211	0.023	0.0309	N.S
C×T×D	18	0.218	0.012	0.0160	N.S
Error	96	72.696	0.757		
Total	143	2333.086			

** = Highly Significant N.S = Non-significant and take down tension and angle of spirality may be reduced by using combed yarn, however the tension of yarn and machine speed have no effect on spirality.

Table 2(a). Comparison of individual treatment means for fabric spirality

Yarn Count (C)	Count Deviation (D)	Twist Multiplier (T)
C1 = 8.80 c	D1 = 11.25	T1 = 7.44 d
C2 = 10.94 b	D2 = 11.24	T2 = 9.60 c
C3 = 14.29 a	D3 = 11.35	T3 = 12.35 b
	D4 = 11.52	T4 = 15.97 a

Any two mean values not sharing a letter in common differ significantly at 0.05 level of probability

Fabric Barre

Effect of Yarn Count

The fabric analysis in the case of fabric made from different yarn counts (16^s, 20^s and 30^s) show that yarn counts do not create the fabric barre, however if there is a mixing of yarn of different counts then knitted fabric may produce fabric barre or streaks. The results are correlated with the findings of Anonymous (2004) reported that an inconsistency that leads to barre can originate in one or more of the following categories mixing yarns of different counts, mixing yarns from different spinning systems, mixing yarns with different blend levels, mixing yarns from different suppliers, mixing yarns with different twist level/twist direction and mixing yarns with different degrees of hairiness and Sheikh (2006) stated that during the spinning process ineffective or inadequate quality control results in the production of yarn with excessive count, twist variations and hairiness, consequently, 'Barre' appears in the fabrics woven or knitted from such yarns while Semnani *et al.* (2005) reported that the correlation between apparent quality of knitted fabrics and their yarns is very strong.

Effect of Twist Multiplier

The results obtained in case of different twist multipliers show that if T.M. is higher from a certain limit, the fabric barre are visually shown in the knitted fabric samples. The results are correlated with the findings of Hergeth *et al.* (2003) stated that the incidence and causes of barre are extensively discussed and can include yarns incorrectly creeled, mixed yarn counts or deniers, mixed types of yarn, yarns of differing twists, etc, and yarns supplied from different manufacturers and inadvertently mixed. Similarly, Kumar (2003) stated that major causes of fabric barre are fibre micronaire variation, fibre colour variation, yarn linear Weight variation, yarn twist variation, yarn hairiness variation and knitting tension variation.

Effect of Count Deviation

The fabric analyses show that in the case of yarn count deviation, fabric barre are produced if there is an excessive yarn count fluctuation. Those yarns which fluctuate ±1 from nominal value of the yarn count, cause the fabric barre or streaks in knitted fabric. The results are correlated with the findings of Bailey (2002) concluded that faulty management in the spinning plant can result in the following yarn related causes of barré: yarn count variations, yarn twist variation, wrong yarn – size, color, blend level and twist direction. In this concern Pratt (2004) reported that the work of the American Association of Textile Chemists and Colorists (AATCC) Committee on barre assessment outlined and the four-part word/number system proposed for adoption as a standard is described. The system consists of (1) a rating of barre intensity on a 5 to 1 scale (no barre to worst case); (2) a description of the barre pattern as 'simple', 'complex' or 'banded'; (3) an estimation of the percentage of yarns within each pattern repeat that are involved in the barre pattern; and (4) a description of the yarns that contrast with the normal population such as 'light', 'bulky'.

LITERATURE CITED

Anonymous. 2000. Fibre length, achievements and new challenges. The ICAC Recorder 18(2): 3-8.

Anonymous. 2004. Fiber management research report using HVI data to contol barré 6399 Weston Parkway, Cary. North Carolina. 27513.

Anonymous. 2006. Indentifying and solving problem caused by barre. Cotton Grower Magazine. http://www.cottoninc.com/cottongrowerarticles/barre

Araujo, M.D. and G.W. Smith. 1989. Spirality of knitted fabric. Text. Res. Inst. 79(3):480-488.

ASTM Committee. 1997. Standard method of test for fabric Weight of the Knitted fabrics. ASTM Designation D-1905. Amer. Soc. for Testing and Materials, Philadelphia, USA.

ASTMa Committee. 1997. Standard method of test for spirality of the knitted fabrics. ASTM Designation D-3882. Amer. Soc. for Testing and Materials, Philadelphia, USA.

Bailey, D.L. 2002. Barre: Methods to prevent barré in knitted fabric Presented at 15th EFS Conference, June 10-12, Memphis, TN. USA.: 1-17.

Black, D.H. 1975. Knitting with cotton and cotton blend open yarn spun yarns. Text. Res. J. 45(1): 48-53.

Brackenbury, T. 1992. Knitting clothing technology. Blackwell Scientific Publications, London. 160-161.

Fig. 1. Graphical representation of individual treatment means for fabric weight

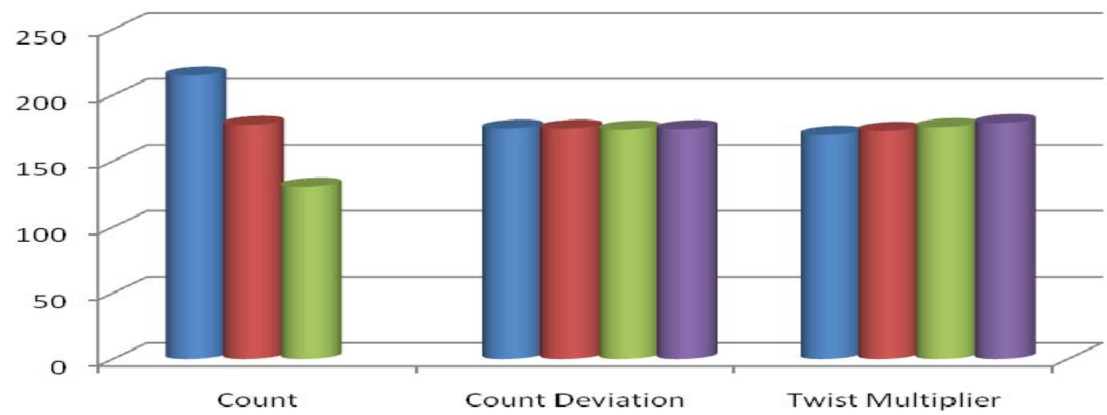
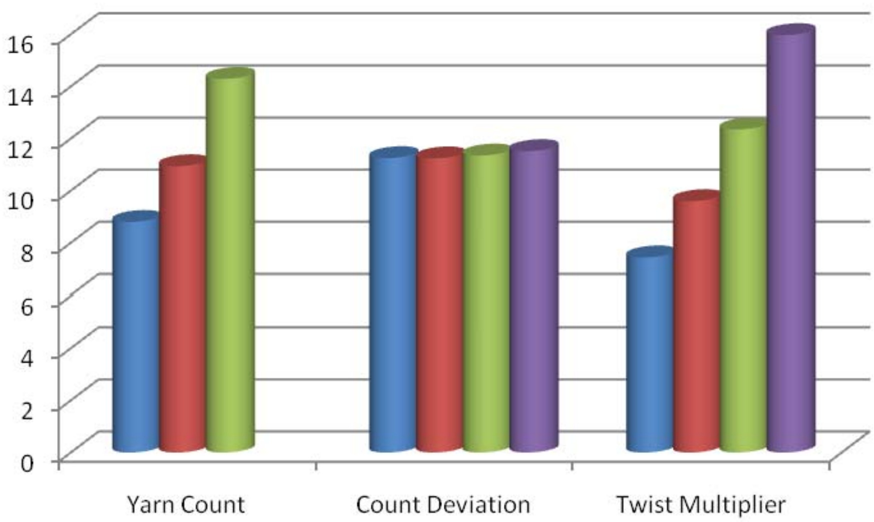


Fig. 2 Graphical representation of individual treatment means for fabric spirality



Corbman, B.P. and M.D. Potter. 1983. Textiles, Fibre to Fabrics. McGraw Hill Book Co., Singapore. 104-123.

Faqir, M. 2004. Statistical methods and data analysis. Kitab Markaz, Bhawana Bazar, Faisalabad, Pakistan. 315-316.

Freed, R.D. 1992. M-Stat Microcomputer statistical program. Michigan State University of Agriculture, Norway. 324 B. Agriculture Hall, East Lausing, Michigan Lausing, USA.

Gill, U.D. 2000. Influence of yarn count and some knitting variables upon the quality of double knit fabrics. M.Sc. Thesis, Deptt. of Fib. Tech., Univ. of Agri., Faisalabad.

Hergeth, H.H., G.W. Smith, F. da-Silva and M.A.A. Marin. 2003. Influences of selected circular knitted fabric and machinery variables on dyed and finished knitted fabrics. Melliand International. 9(2): 26-27.

Jamal, A. 1998. Effect of some knitting variables on shrinkage of single jersey cotton fabric. M.Sc. Thesis, Deptt. of Fib. Tech., Univ. of Agri., Faisalabad.

Kumar, V. 2003. Fabric Barre. http://www.geocities.com/vijaykummar777/barriness.htm

Marmarali, A. 2005. Spirality of knitted fabrics. www.geocities.com/textile51/01.doc

Nawaz, S.M., B. Shahbaz and M.T. Sarwar. 2000. Influence of knitting variables upon spirality of single jersey fabric. Pak. Text. J. 49(1): 48-50.

Pratt, H.T. 2004. A descriptive terminology for barre. http://www.scopus.com/a descriptive terminology for barre.html

Semnani, D., M. Latifi, M.A. Tehran, B. Pourdeyhimi and A.A. Merati. 2005. Effect of yarn appearance on apparent quality of weft knitted fabric. J. Tex. Inst. 96 (5): 295-301.

Sharma, I.C., S. Gosh and N.K. Gupta. 1985. Dimensional and physical characteristics of single jersey fabrics. Text. Res. J. 55(3): 149-152.

Sharma, I.C., N.K. Gupta, B.R. Agarwal and N.R. Patnaik. 1987. Effect of twist factor and stitch length of open-end spun cotton yarn on properties of rib knitted fabric. Text. Res . J. 57(2): 73-81.

Sheikh, H.R. 2006. Prevent fabric 'Barre' to produce good quality finished product. http://www.webtex.com.br/arquivosPDF/prevent_barres.pdf.