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EFFECT OF CHANGE IN YARN COUNT & CYLINDER STITCH LENGTH ON WAFFLE KNIT FABRIC GSM

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ABSTRACT

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Knitwear industry keeps great contribution in the Bangladesh socio-economic development. The sector is producing top quality knit garments for global fast fashion brands. But most of the goods produce by this single jersey derivatives fabric such a plain, single lacoste, double lacoste, polo pique etc. Now a day's development of various rib derivatives such as waffle fabric creates a new era for knit fabric manufacturing. The present study attempts to disclose the effect of yarn count and stitch length on waffle fabric Arial density. Three different yarn counts i.e. 26/1Ne, 30/1 Ne and 40/1 Ne used for producing miss waffle knit fabric. The waffle samples produced with fixed dial Stitch length i.e. 1.95 mm and various cylinder stitch length (for 26/1 Ne waffle fabric) i.e. 3.90 mm. 3.95 mm, 4.00 mm and (for 30/1 Ne waffle fabric) cylinder stitch length were 3.80 mm, 3.85 mm, 4.00 mm, and finally (for 40/1 Ne waffle fabric) cylinder stitch length were 3.65 mm, 3.70 mm, 3.75 mm. All waffle samples tested separately for GSM. Then effects of yarn count and stitch length on waffle knit fabric GSM is observed.

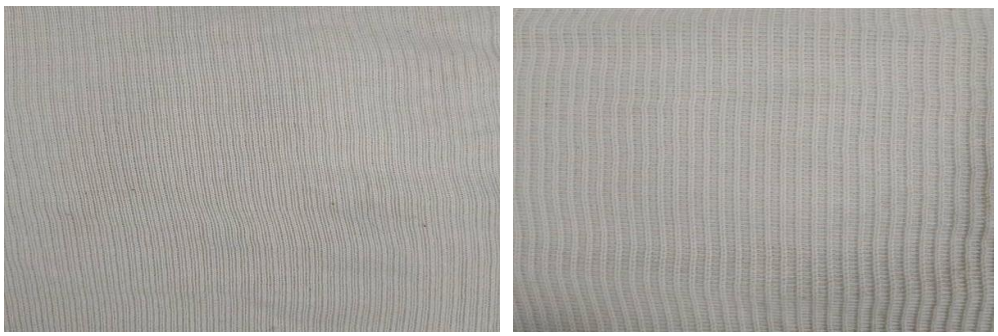
***Key words**: waffle knit, yarn count, stitch length, gsm*

INTRODUCTION

There are two major varieties of knitting: weft knitting and warp knitting (Knitting Basics, 2004). Four primary structures – plain, rib, interlock and purl-are the base structures from which all weft knitted fabrics and garments are derived (Spencer 2001). In recent years, development of various fabrics has grown rapidly. Waffle structure is one of them. Waffle fabric, or sometimes honeycomb fabric, is usually made of cotton or microfiber. This type of fabric design can be produced both knitting and weaving process.

Waffle knit fabric can be used for as decorative dress purpose, sweater, heavy jersey, muffler, insulating fabric, blankets, absorbent fabric , dishtowels, Sports jersey, basket covers and lamp shades with versatile cotton utility fabric. Waffles knit fabrics are made wide range of weights or GSM (gram per square meter). The waffle knit also allows air to flow through the fabric so that it dries quickly. Waffle fabric is used for cleaning surfaces in industry. Waffle Knits not only share a similar appearance to the tasty morning treat, but they are also just as delightful.

Waffle Knit can be various excellent arrays. These waffle knit fabrics resemble waffles with its protruding square knitted pattern. Waffles knit fabrics are made from pure high quality cotton materials which make it soft and very smooth. These waffle knit fabrics are ideal for creating clothing pieces, furniture, handicrafts and many other items. Basically Waffle knit is a derivative of basic rib knitted structure, so in waffle knit it characteristics mostly like double jersey knit fabric. This is a balanced knit fabric. As its balanced fabric it has no curling tendency. In waffle knitting there are commonly found tuck waffle and miss waffle structure. Our research investigation was carried out by producing miss waffle fabric. Present application should form the basis of further extension of the analysis to include the various double-knitted constructions. The knitted fabrics, in general, are more stretchable than the woven fabrics. Though waffle is a double jersey rib derivatives but its shows different appearance both technical face and back. In the technical face it appearance of the technical face of plain fabric but on the other side it appearance like honeycomb.



(A) (B)

Fig. 1. (A) Technical face and (B) Technical back side of Waffle knit fabric

Knit fabrics provide comfortable wear to almost any style of garment (Iyer 1995). Fabric GSM means the weight of fabric in grams in per square meter area. Sometimes also termed as Arial density. The dimensional stability of knit fabrics is an important area of the knitting industry. Stitch length, yarn count, structure of fabric

influence the dimensional stability of fabric (Spencer 2001). In case of knitted fabric specification GSM, stitch length and yarn count is mainly considered.

Fabric weight may be expressed either as the weight per piece, per running meter, or per unit surface area. Weight per square meter: quotient of the weight and length of a single layer of fabric (Hans-Karl 2001). This paper attempts to investigate the effect of stitch length and different yarn count on waffle knitted fabric's gsm.

MATERIALS AND METHODS

Raw material and equipment's used

For this work, we produced miss waffle knitted fabric sample using three different yarn count i.e. 26/1 Ne, 30/1 Ne, 40/1 Ne, and each sample consist three different cylinder stitch length but dial stitch was fixed. Cylinder stitch length changed by varying variable dia for quality (VDQ) pulley. Total nine (9) samples were produced. These fabric samples are presented in Table 1 and machine specification presented on Table 2.

Table 1. Waffle sample produce using three different yarn counts (Fixed cylinder stitch length)

Waffle Sample No	Yarn Count	(Fixed Dial Stitch Length + Cylinder Stitch Length) mm
1	26/1 Ne (Group A)	1.95 + 3.90
2		1.95 + 3.95
3		1.95 + 4.00
4	30/1 Ne (Group B)	1.95 + 3.80
5		1.95 + 3.85
6		1.95 + 4.00
7	40/1 Ne (Group C)	1.95 + 3.65
8		1.95 + 3.70
9		1.95 + 3.75

Table 2. Knitting machine specification

Machine Name	Machine Description
Double Jersey Circular Knitting Machine	Machine Brand- Unitex Machine origin- Singapore Machine Feeder- 78 Machine Dia- 32 Inch. Machine Gauge- G 18 ,Machine RPM- 10
Fabric GSM cutter	Brand Name- Schroder Model Number- GSM100 Cutter origin- Germany Cutting area- 100 cm^2 of fabric sample
Digital weight balance	Brand Name- Schroder Place of Origin- Germany Model Number- GSM-200 Max. Capacity- 200g x 0.01g, 20,000g/ m^2 x 1 g/m^2 Platform size- Diameter 100 mm

Determination of fabric GSM by GSM cutter

Principle

The mass per unit area is determined by exposing a fabric sample to the standard atmosphere for testing textile until it has reached equilibrium with that atmosphere. Specimens of known dimensions are than taken and weighed and the mass per unit area of the sample calculated.

Test Method

B.S. 1051, 1981 and ISO 139, 1973.

Test samples

Test samples should be sufficiently large to enable 5 specimens of 100 cm^2 to be taken, spaced to give a good representation of the sample, avoiding selvedges and/or center creases.

Test procedure

Samples are conditioned for 24 hours in a standard atmosphere of 27±2^{0}C and 65±2% RH. The method for measuring GSM was simply following the steps. Firstly, to take the conditioned fabric for test on the GSM cutter pad so that no crease or crinkle is formed. Secondly, to cut the fabric with GSM cutter (cut area was 100 square cm). Thirdly, to take the weight of the fabric by an electric balance. Fourthly, multiply the weight of the cut sample by 100. The result is the GSM of the fabric.

RESULTS AND DISCUSSION

Sample Group A: Determination of waffle fabric gsm, produced by 26 /1 Ne count yarn (Sample no 1,2,3)

Table 3. Determination of waffle fabric gsm for 26/1 Ne sample no 1 (Cylinder Stitch length 3.90 mm)

Sample No	Yarn Count	(Fixed Dial Stitch Length+ Cylinder Stitch Length) mm	GSM	AVG. GSM	Standard Deviation	CV%
1	26/1 Ne	1.95 + 3.90	218	216	1.581139	0.732009
			217			
			216			
			215			
			214			

Table 4. Determination of waffle fabric gsm for 26/1Ne, sample no 2 (Cylinder Stitch length 3.95 mm)

Sample No	Yarn Count	(Fixed Dial Stitch Length+ Cylinder Stitch Length) mm	GSM	AVG. GSM	Standard Deviation	CV%
2	26/1 Ne	1.95 + 3.95	217	215	1.581139	0.735413
			216			
			215			
			214			
			213			

Table 5. Determination of waffle fabric gsm for 26/1Ne, sample no 3 (Cylinder Stitch length 4.00 mm)

Sample No	Yarn Count	(Fixed Dial Stitch Length+ Cylinder Stitch Length) mm	GSM	AVG. GSM	Standard Deviation	CV%
3	26/1 Ne	1.95 + 4.00	216	214	1.581139	0.73885
			215			
			214			
			213			
			212			

Sample Group B: Determination of waffle fabric gsm, produced by 26 /1 Ne count yarn (Sample no 4,5,6)

Table 6. Determination of waffle fabric gsm for 30/1 Ne, sample no 4 (Cylinder Stitch length 3.80 mm)

Sample No	Yarn Count	(Fixed Dial Stitch Length+ Cylinder Stitch Length) mm	GSM	AVG. GSM	Standard Deviation	CV%
4	30/1 Ne	1.95 + 3.80	199	197	1.581139	0.802609
			198			
			197			
			196			
			195			

Table 7. Determination of waffle fabric gsm for 30/1 Ne, sample no 5 (Cylinder Stitch length 3.85 mm)

Sample No	Yarn Count	(Fixed Dial Stitch Length+ Cylinder Stitch Length) mm	GSM	AVG. GSM	Standard Deviation	CV%
5	30/1 Ne	1.95 + 3.85	197	195	1.581139	0.81084
			196			
			195			
			194			
			193			

Table 8. Determination of waffle fabric gsm for 30/1 Ne, sample no 6 (Cylinder Stitch length 4.00 mm)

Sample No	Yarn Count	(Fixed Dial Stitch Length+ Cylinder Stitch Length) mm	GSM	AVG. GSM	Standard Deviation	CV%
6	30/1 Ne	1.95 + 4.00	192	190	1.581139	0.832178
			191			
			190			
			189			
			188			

Sample Group C: Determination of waffle fabric gsm, produced by 40/1 Ne count yarn (Sample no 7, 8, 9)

Table 9. Determination of waffle fabric gsm for 40/1 Ne, sample no 7 (Cylinder Stitch length 3.65 mm)

Sample No	Yarn Count	(Fixed Dial Stitch Length+ Cylinder Stitch Length) mm	GSM	AVG. GSM	Standard Deviation	CV%
7	40/1 Ne	1.95 + 3.65	148	146	1.581139	1.082972
			147			
			146			
			145			
			144			

Table 10. Determination of waffle fabric gsm for 40/1 Ne, sample no 8 (Cylinder Stitch length 3.70 mm)

Sample No	Yarn Count	(Fixed Dial Stitch Length+ Cylinder Stitch Length) mm	GSM	AVG. GSM	Standard Deviation	CV%
8	40/1 Ne	1.95 + 3.70	146	144	1.581139	1.098013
			145			
			144			
			143			
			142			

Table 11. Determination of waffle fabric gsm for 40/1 Ne, sample no 9 (Cylinder Stitch length 3.75 mm)

Sample No	Yarn Count	(Fixed Dial Stitch Length+ Cylinder Stitch Length) mm	GSM	AVG. GSM	Standard Deviation	CV%
9	40/1 Ne	1.95 + 3.75	144	142	1.581139	1.113478
			143			
			142			
			141			
			140			

Effect of yarn count and stitch length on waffle (GSM)

Table 12. Comparison of change in cylinder stitch length on waffle fabric produced by 26/1 Ne yarn (Group A)

Fabric Type	Sample No	Yarn Count	(Fixed Dial Stitch Length + Cylinder Stitch Length) mm	AVG. GSM
Waffle Knit	1	26/1 Ne	1.95 + 3.90	216
	2	26/1 Ne	1.95 + 3.95	215
	3	26/1 Ne	1.95 + 4.00	214

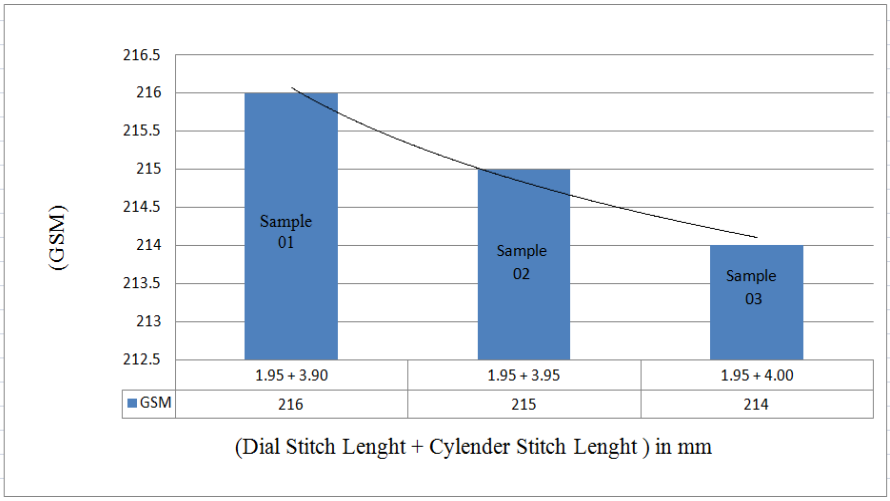


Fig. 2. Comparison between change in cylinder stitch length on waffle fabric GSM (26/1 Ne yarn)

Observation –A: From table 3, 4 and 5 here three waffle sample produced by same 26/1 Ne yarn count. There dial stitch length fixed i.e. 1.95 mm and used three different cylinder stitch length i.e. 3.90 mm, 3.95 mm and 4.00 mm. All the samples GSM put into table 12 and it shows that change in cylinder stitch length directly effects on waffle fabric gsm i.e. increasing cylinder stitch length deceasing gsm and vice versa.

Table 13. Comparison of change in cylinder stitch length on waffle fabric produced by 30/1 Ne yarn (Group B)

Fabric Type	**Sample No**	**Yarn Count**	**(Fixed Dial Stitch Length + Cylinder Stitch Length) mm**	**AVG. GSM**
Waffle Knit	4	30/1 Ne	1.95 + 3.80	197
	5	30/1 Ne	1.95 + 3.85	195
	6	30/1 Ne	1.95 + 4.00	190

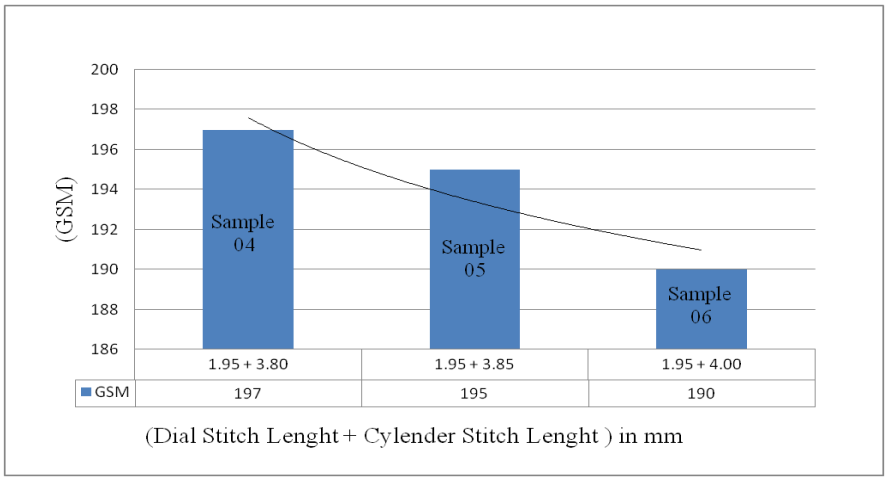


Fig. 3. Comparison between change in cylinder stitch length on waffle fabric GSM (30/1 Ne yarn)

Observation –B: From table 6, 7 and 8 here three waffle sample produced by same 30/1 Ne yarn count. There dial stitch length fixed i.e. 1.95 mm and used three different cylinder stitch length i.e. 3.80 mm, 3.85 mm and 4.00 mm. All the samples GSM put into table 13 and it shows that change in cylinder stitch length directly effects on waffle fabric gsm i.e. increasing cylinder stitch length deceasing gsm and vice versa.

Table 14. Comparison of change in cylinder stitch length on waffle fabric produced by 40/1 Ne yarn (Group C)

Fabric Type	**Sample No**	**Yarn Count**	**(Fixed Dial Stitch Length + Cylinder Stitch Length) mm**	**AVG. GSM**
Waffle Knit	7	40/1 Ne	1.95 + 3.65	146
	8	40/1 Ne	1.95 + 3.70	144
	9	40/1 Ne	1.95 + 3.75	142

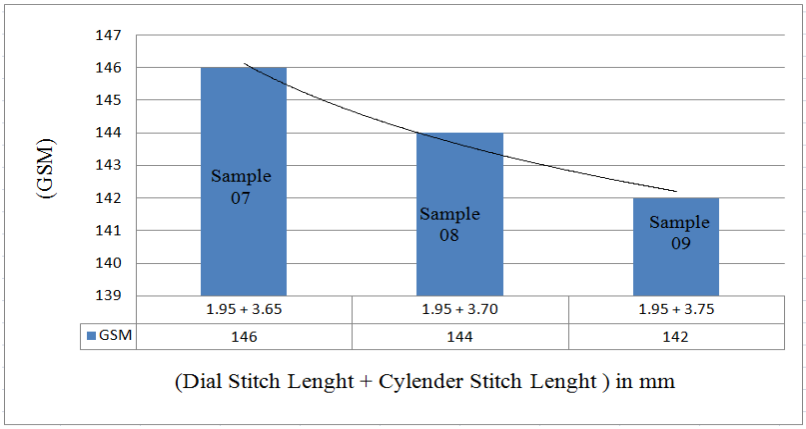


Fig. 4. Comparison between change in cylinder stitch length on waffle fabric GSM (40/1 Ne yarn)

Observation –C: From table 9, 10 and 11 here three waffle sample produced by same 40/1 Ne yarn count. There dial stitch length fixed i.e. 1.95 mm and used three different cylinder stitch length i.e. 3.80 mm, 3.85 mm and 4.00 mm. All the samples GSM put into table 14 and it shows that change in cylinder stitch length directly effects on waffle fabric gsm i.e. increasing cylinder stitch length deceasing gsm and vice versa.

Observation –D: From table 12, 13 and 14 here three waffle sample produced by three deferent yarn count 26/1 Ne , 30/1 Ne and 40/1 Ne and it clearly conclude that increasing the indirect yarn count liable for decreasing gsm and vice versa.

CONCLUSION

As GSM is an important parameter for producing all the knitted fabric. But GSM is a risky variable for producing both single jersey and double jersey derivatives. Waffle knit is a rib derivative. In the observation A, B and C it clearly shows that there is directly relation between change in cylinder stitch length and waffle fabric gsm. From table 12, 13 and 14 gives a clear statement that increasing in cylinder stitch length is responsible for decreasing the gsm. On the other hand decreasing in cylinder stitch length is responsible for the increasing gsm. The same trends are got from comparison of different type yarn count used for waffle fabric.

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