Faculty of Engineering

Department of Textile Engineering

Project on

Analysis Technical Relationship within count, Stitch length and Grey GSM of (1×1) Rib fabric and (1×1) Interlock Fabric

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Advance in Fabric Manufacturing Technology

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Declaration

We here by assure that, Atiqullah Mahmod Atiq, Md. Fiaz Ullah and Mariam Rahman have done this project under the supervisor of Asit Ghosh, Assistant Professor, Department of Textile Engineering, Daffodil International University. We also ensure that, this project report is an original work and no part of this report has been copied from elsewhere.

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Special thanks to Textile engineers of Industries Niagara textile Ltd and Pakiza Knit composite Ltd from whom we collect information and sample.

We also like to confess our deep credit to all teachers and person and especially our "Fabric Manufacturing Technology" department for this support which was very grateful for us.

At least, we also agree that we are liable for the shortages, lacking and mistakes which doubtlessly accept.

Abstract

In this project mainly focus on the Rib and Interlock fabric. We notice some interesting relationship each other facts like yarn count, stitch length and grey GSM of knit fabric mainly (1×1) Rib and (1×1) interlock fabric. If yarn count, Stitch length increase then grey GSM decrease. Now a days, maximum knit factories they face some common problem to select correct knit fabric. In the way our project mainly basis on grey knit fabric where yarn count respectively 24 Ne,28 Ne ,30 Ne for (1×1) Rib and 30Ne, 34Ne,40 Ne for (1×1) Interlock fabric. We were trying to relation of the knit fabric practically and theoretically implementation from our factories with our best. This report set up as our result and research is also acceptable.

Keywords:

Count, Stitch length, GSM, Rib fabric, Interlock fabric.

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CHAPTER 1

Introduction

1.1 Introduction

Any kind of fabric produced by following some common equation like fabrics, yarn, thickness, thickness of yarn which are responsible for quality of fabrics. In our country we are working on basically 2-types of fabrics woven and knit fabric. But in this project we working on knit fabric. We are trying to find out relation among count, S/L and grey GSM. We also trying to find out problems between grey knit fabrics to finished knit fabric.

Now a day, popularity of knit fabric increasing day by day. Many buyers are now interested to export knit cloth from our country because knit cloth suitable for any season and it is also fashionable.

Our main concentration of this project to focus better idea about technical relationship among count, Grey GSM, stitch length.

1.2 Objective of the study:

1. To know about rib and interlock fabric structure.
2. Difference between of these fabric
3. To deeply knowledge about rib and interlock fabric.
4. To find out relation among GSM, Count and stitch length.
5. To know about stitch length calculation.

CHAPTER 2

LITERATURE REVIEW

2.1.1 Knitting:

Knitting is the process by which yarn may be turn into cloth by inter looping and can be done using machine or hand.

Knitting can be classified 2 type such as

1. Circular knitting

2. Flat knitting

There are two main structure of knitting process such as

1. Warp knitting and

2. Weft knitting.

2.1.2 Warp knitting:

Warp knitted structure, the work is continued by length wise, through the intermeshing of loops in the direction of wale. Each loop in the horizontal direction made from different thread in warp knitted structure. The advantage of this fabric structure that it is not easily unroll and it has less elasticity properties from weft knitting.

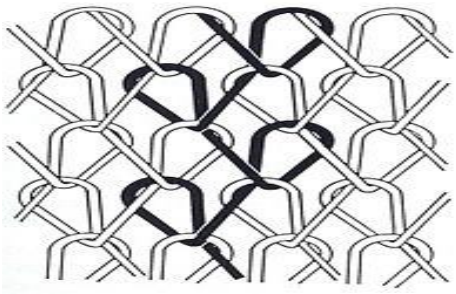

Fig-1: Warp knitted structure

2.1.3 Weft Knitting:

Weft knitting is the procedure which is one set on yarn using. Weft knitted fabric structure thread runs in horizontal direction and loop produced by one thread. It has highly elastic and highly drape properties structure. It has suitable for under and outer garments and it can be both flat and tube form.

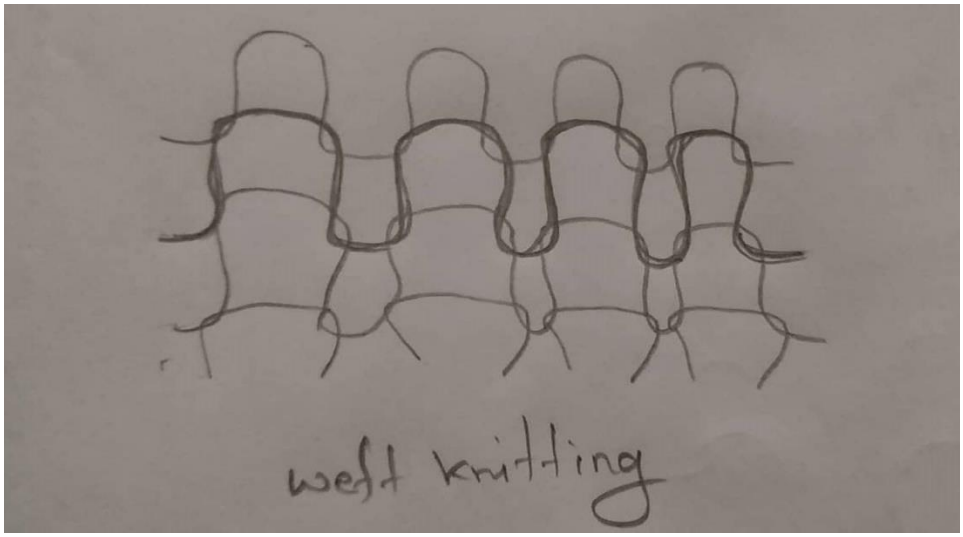

Fig -2: weft Knitting

Weft knitted fabric can be divided into two classes such as-

1. Single jersey or plain jersey fabric.

2. Double jersey

Most popular single jersey fabric name is given below:

- 100% Single jersey
- Single Lacoste
- Double Lacoste

- Double fabric pique
- Terry
- Single pique
- Fleece fabric

Double jersey fabric can be classified into two classes:

- Rib fabric
- Interlock fabric

2.2. Terminology and Definition:

2.2.1. Course and wales

Knit fabric are made by two ways. These are called course and wales. Course is produced by horizontal yarn. Wales is produced by vertical yarn.

Wales line are fixed by m/c gauge and coarse lines can be changed by adjusting in the m/c, It is called Texture.

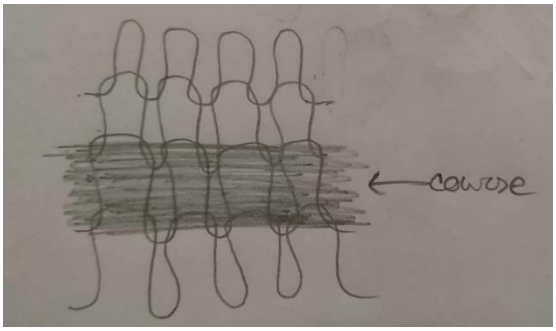

Fig-3: Course

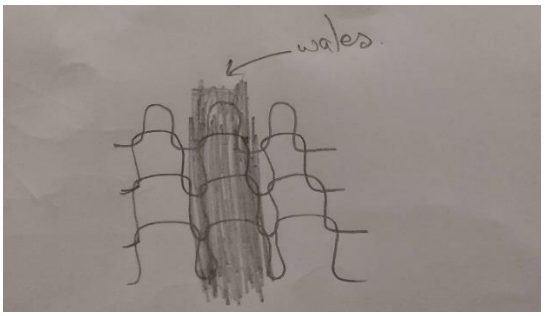

Fig-4: Wales

2.2.2 Course per inch

Course per inch denoted by placing an inch glass (counting glass) on the fabric and counting the number of courses are contained within the area. These values may be varied if the fabric is distorted.

2.2.3 Wales per inch

It is denoted by placing an inch glass (counting glass) on the fabric and counting the number of wales which are contained within the area. These values may be varied if the fabric is distorted.

2.2.4 Needle gauge

Needle gauge is measured by the number of needle contained in per one inch of the needle bed in knitting m/c.

Needle gauge can be help measured the total number of needle.

$$\text{Number of needle} = \pi \times \text{m/c diameter} \times \text{m/c gauge}$$

2.2.5 Machine gauge

M/C gauge can be measured by the number of needle in a unit length of the needle bed. Needle bed may flat or circular and circular double knitting m/c it used for cylinder as well as dia. M/C gauge is denoted by ‘’E’’. The formula is given below:

$$\text{M/C gauge} = \text{No of needle / inch}$$

2.3 Discussion of knitting Machine:

2.3.1 Circular Knitting machine:

Circular knitting machine is the machine which produce knit fabric. Circular knitting machines are widely used for knitted fabric manufacturers to meet needs of apparel and textile industry. Now a days, knit fabric is the most popular fabric for man wear because of its good appearance, comfortable and easy to maintain. Circular knitting machine only produced knit fabric that's why this machine is also popular. Circular knitting machine produced single jersey, Double jersey, Rib and Interlock, Polo Pique, Lacoste, Fleece and terry fabric etc. In this machine has yarn creel and yarns are come from yarn cone by pipe and these yarns are feed into feeder. Cam and needles are arranged as per as design buyer requirement.

There are various classes of circular knitting machine used in the textile industry.

- Single jersey circular knitting machine.

- Double jersey –
    1. Rib machine
    2. Interlock machine.

- Flat Bed knitting Machine.

2.3.2 Single jersey circular knitting machine:

Fig-5: Single jersey circular knitting m/c.

2.3.3 Double jersey circular knitting machine (Rib):

Fig-6: Double jersey circular knitting m/c (Rib)

2.3.4 Double jersey circular knitting machine (Interlock):

Fig-7: Double jersey circular knitting m/c (Interlock)

2.3.5 Various Parts name and their function knitting machine:

Tabel-1: Various parts name and their function knitting m/c.

Sl. No	Name of parts	Function
1	Creel	Creel is used to store the yarn package and ready to feed in the machine.
2	VDQ Pulley	To control the GSM and stitch length. When pulley moves toward the positive direction then GSM is decrease and in the reverse direction GSM will decrease.
3	Pulley Belt	It is use to maintain the rotation of the Manager positive feed.
4	Brush	Brush is used to clean the pulley belt.
5	Tension Disk	Tension disk confront the tension of the supply yarn.
6	Inlet and outlet stop motion	To stop the machine instantly when a yarn is break.
7	Yarn guide	Yarn guide help the yarn to feed in the feeder.
8	MPF wheel	To controls the rotation of the MPF wheel
9	MPF	To give positive feed to the machine
10	Feeder ring	Feeder ring is a ring, where all feeders are set together.
11	Feeder	It is help yarn to feed in to the machine.
12	Needle	To help the yarn to create a loop.

13	Needle track	Where all needle is placed together in a decent design.
14	Sinker	To hold the loop and help to create new loop.
15	Sinker ring	It is a ring where all sinker are please together.
16	Cam box	Cam box is used to where the cam are set horizontally.
17	Cam	To convert the rotary machine into a suitable reciprocating action for the needle and others elements.
18	Lycra stop motion	To stop the machine when the lycra is break.
19	Cylinder	To place the needle in right position.
20	Indicator light	This device is used to identify the feeder or wheel place where yarn break
21	Screen	It is a digital screen .which show the all machine information and we can give command to the machine.
22	Automatic oiler	It give the machine oil all the time properly and automatically.
23	Inverter	Inverter is used to control the speed of the machine.
24	Blower fan	Blower fan using for reduce dust and fiber from cylinder and feeder wheel.
25	Power switch	Power switch give the power to the machine.
26	On/off Switch	To help the m/c to start and stop.

27	Manual driver	It is use to driver the machine manually.
28	Machine motherboard	All the electronic parts are placed hear.
29	Take up roller	Take up roller is used to take up the fabric from the knitting machine.

CHAPTER 3

MATERIALS AND METHOD

3.1 Materials:

100% cotton yarn where was used for manufacturing (1×1) Rib fabric and (1×1) Interlock fabric. This fabric received from Niagara Textile Ltd. Here Rib fabric count was 24Ne, 28Ne,30Ne and interlock fabric count was 30Ne,34Ne,40Ne.

3.2 Name of yarn source:

1. Amber Super yarn Ltd,

2. Multazim Spinning Mills Ltd,

3. Karotoatoa Spinning Mills Ltd.

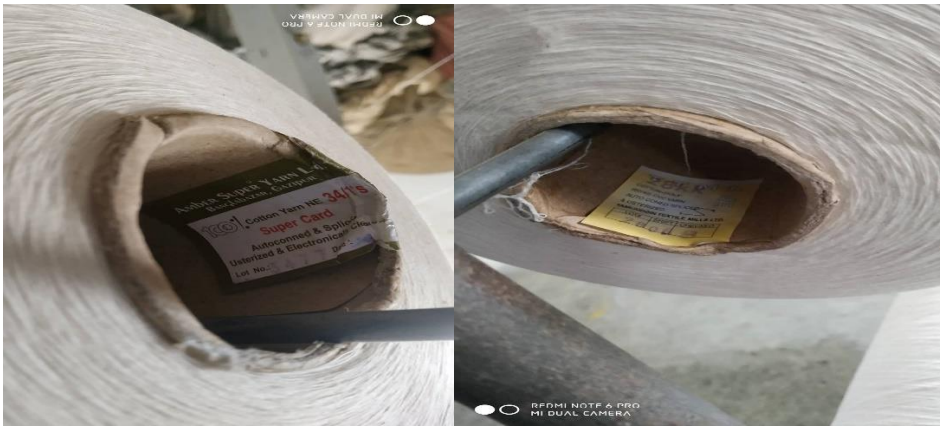

Fig-8: Various type of yarn package.

3.3 Instruments:

1. Scale,

2. GSM Cutter,

3. Electric balance.

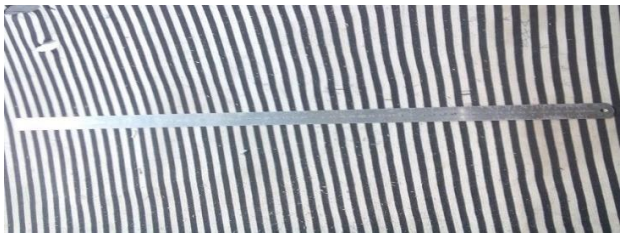

Fig-9: Scale

Fig-10: GSM cutter

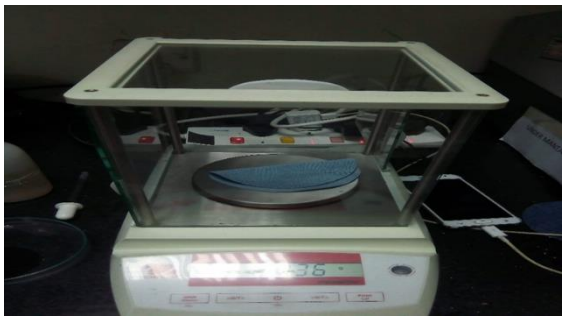

Fig-11: Electric Balance

3.4 Method:

First, we collected some of different experiment data from Niagara Textile Ltd and Pakiza knit composite Ltd and then we were study this data those data which relation in our project. The Working Process flow chart is given below:

Firstly, we follow received work order

↓

Secondly assure yarn registration rule to diameter and fabric

↓

Thirdly machine set up follow

↓

Fourthly, following machine started and set quality standard

↓

Stitch length observe

↓

Production running for 5 kg

↓

Check the quality

↓

Then passing the quality main production running

↓

Roll unload for production

↓

Before delivery collected for desire sample

↓

Then check the collected data with empirical data

↓

Check the stitch length and the GSM following fabric

↓

Lastly analysis the data relation within count, stitch length and GSM

CHAPTER 4

EXPERIMENTAL WORK

4.1 Rib Fabric:

Rib fabric is one kind of fabric which the face and back loop are same foam, vertical rows of stitch inter looping possibly on the face and back side of the fabric.

Characteristics:

- The appearance same on both sides, like face of plain.
- Unroving only from end knitted last.
- Fabrics edge no tendency to curl.
- Thickness of fabric is approximately twice than single jersey
- Fabrics are two series of knit loops are arranged into parallel in a course.

4.2 various types of rib structure:

- (1×1) Rib
- (1×1) HF Lycra Rib
- (2×1) Rib
- (2×1) HF Lycra Rib
- (2×2) Rib

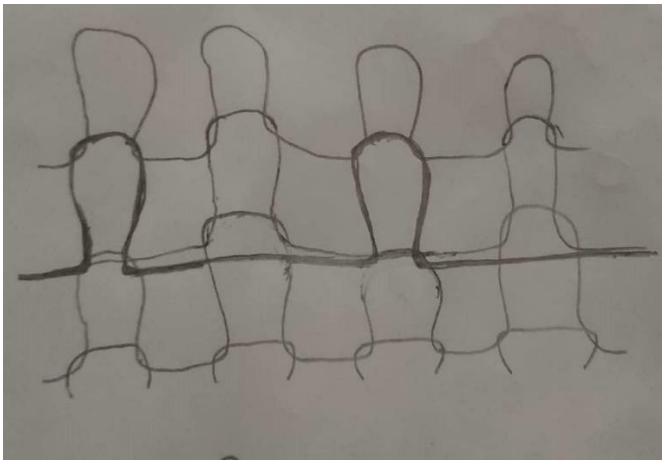

Fig-12: Rib Knitted Structure

4.3 Rib machine Specification:

Brand Name: Pailung

Origin: Taiwan

Model No: TL-12A/C

Machine diameter: 34

Machine gauge: 18

No of Feeder: 60

Needle: 1896

4.4 Interlock Fabric:

Loops are locked for each side and fabrics are produced closely interlocking stitches allowing it two stitch.

Characteristics:

- The foam of the both side of fabric are same
- Wales line are opposite to each other, loops are locked together
- Fabric edge no tendency to curl
- Fabric elongation of the lengthwise and widthwise are same as single jersey.
- Thickness of fabric is approximately twice than single jersey.

4.5 Various types of Interlock Structure:

- Interlock (1×1)
- Lycra interlock (1×1)

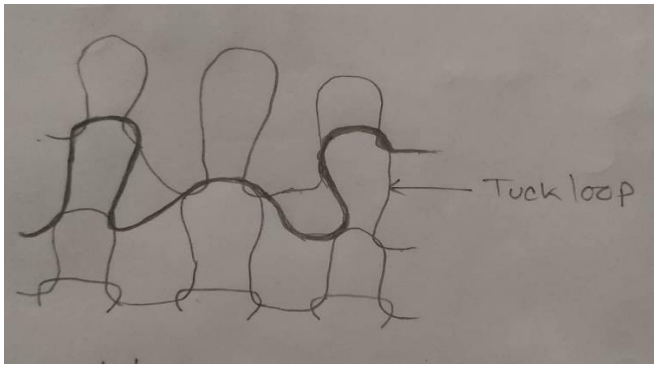

Fig-13: Interlock Knitted Structure

4.6 Interlock Machine Specification:

Brand Name: Pailung

Origin: Taiwan

Model No: TL-KD3B/CE

Machine diameter: 34

Machine gauge: 24

No of Feeder: 90

Needle: 2256

4.7 Stitch Length:

Stitch length means loop length and it show the length of complete knitted loop of yarn. Stitch length can influence the fabric dimension and fabric weight. Stitch length represented by mm.

4.8 Fabric GSM:

GSM is very important factor for a Textile engineer for understanding and production of a fabric. GSM means Gram per Square meter. It is denoted by the weight of fabric in gram per one square meter. By this specification compare the fabrics in unit area which is heavier and which is lighter. For measuring GSM, at first fabric sample is cut by GSM cutter and then cut sample weight is taken by electric balance. When we found the weight in gram per one square meter fabric and GSM of the fabric by the GSM cutter is gained by the multiplying the sample weight with 100.

4.9 Count:

Count is a numerical expression that is defined the fineness or coarseness of yarn. Count measured by the weight per unit length or length per unit weight.

Count can be classified into two types such as

- Direct count
- Indirect count

Direct count:

The direct count of yarn can be indicated by when the length unit is fixed but the weight is variable. When the count is higher than the yarn is coarser.

The following formula is used to calculate yarn count:

$$\text{Count} = (W \times l) \div (w \times L)$$

Thus,

W = Weight of sample

L = Length of sample

w = The unit wt. in system

l= The unit wt. in system

System	Unit Mass	Unit Length	Uses
Denier	Gram	9000m	Polyester
Pounds/Spindle	Pounds	144400 Yds	Jute
Woollen	Grain	20 Yds	Wool

Table-2: Direct count system

Indirect count:

The indirect count can be indicated by when the weight unit is fixed but length unit is variable. When the count is higher than the yarn is finer.

The following formula is used to calculate yarn count:

$$\text{Count} = (w \times L) \div (W \times l)$$

Thus,

W= Weight of sample

L= The length of sample

w =The unit wt. in system

l = The unit length in system

System	Unit mass	Unit length	Uses
English(Ne)	840 yds	1lbs	Cotton yarn
Metric(Nm)	1 km	1 kg	Cotton yarn
Worsted (Ws)	560 yds	1lb	Worsted yarn
Woolen(Nw)	256 yds	1 lb	Woolen yarn

Table-3: Indirect count system

4.10 Empirical data of (1×1) Rib fabrics:

No of observation	Count	Stitch length (mm)	Grey GSM (gm/m2)
01	24	2.60	240-250
		2.70	230-240
		2.80	220-230
02	28	2.60	195-205
		2.70	185-195
		2.80	175-185
03	30	2.60	170-180
		2.70	160-170
		2.80	150-160

Tabel-4: Empirical data of (1×1) Rib fabrics

4.11 Empirical data of (1×1) Interlock fabrics:

Observation number	Count	Stitch length(mm)	Grey GSM(gm/m2)
01	30	1.5	225-235
		1.52	215-225
		1.57	205-215
02	34	1.5	195-205
		1.52	185-195
		1.57	175-185
03	40	1.5	170-180
		1.52	160-170
		1.57	150-160

Tabel-5: Empirical data of (1×1) Interlock fabrics

CHAPTER 5
RESULT AND CALCULATION

Result and Discussion:

This experiment we collected three sample with three types of different count, three type of different stitch length and Grey GSM for (1×1) Rib fabric and (1×1) Interlock fabric.

5.1. Experiment calculation for Grey GSM Measurement:

Firstly, we collected Rib and Interlock fabric sample. Then we cut the collected Rib and Interlock fabric sample by using GSM cutter and after then weighted from the electric balance. Lastly the measuring weight multiple with 100/m2.

For 24 Ne (1x1) Rib fabric from electric balance then we weight get 2.44 gm grey fabric.

So, Grey GSM = 2.44 gm×100/m2

=244 gm/m2

Like that, 28 Ne and 30 Ne for Rib fabric, 1.85gm and 1.55 gm grey fabric weight found 185 and 155.

For 30 Ne (1x1) Interlock fabric from electric balance then we weight get 2.30 gm grey fabric.

So, Grey GSM = 2.30 gm×100/m2

=230 gm/m2

Like that, 34 Ne and 40 Ne for Interlock fabric, 1.95gm and 1.60 gram grey fabric weight found 195 and 160.

5.2. Analytical calculation for stitch length measurement:

Firstly, we took rib and interlock fabric sample. Then marked by a pen 50 wales for (1×1) Rib fabric and (1×1) Interlock fabric sample and opened the one course and measured the stitch length in cm scale and divided those data by 10 mm. Finally, we measured stitch length in mm.

For (1×1) rib fabric, we measured 50 wales length in same course 26 cm.

So, Stitch length = 26/10 mm

= 2.6 mm.

Like that, 50 wales length 27 cm and 28 cm then we found stitch length 2.7mm and 2.8 mm.

For (1×1) interlock fabric, we measured 50 wales length in same course 15 cm.

So, Stitch length =15/10 mm

=1.5mm

Like that, 50 wales length 15.2 cm and 15.7 cm then found stitch length 1.52 mm and 1.57 mm.

5.3. Analysis of (1×1) Rib fabric:

Count (Ne)	Stitch length (mm)	Grey GSM (gm/m2)
24	2.60	244
28	2.70	185
30	2.80	155

Table-6: Count, Stitch Length and Grey GSM of (1×1) Rib fabric.

This analysis for Rib fabric, show in relation count, stitch length and grey GSM.Table-6 show that here rib fabric respectively 24 Ne, 28Ne and 30Ne are selected, then stitch length are selected 2.60 mm ,2.70 mm and 2.80 mm.

5.4. Relation between Grey GSM and Count of (1×1) Rib fabric:

Grey GSM	Count
244	24
185	28
155	30

Tabel-7:Relation between Grey GSM and Count of (1×1) Rib fabric.

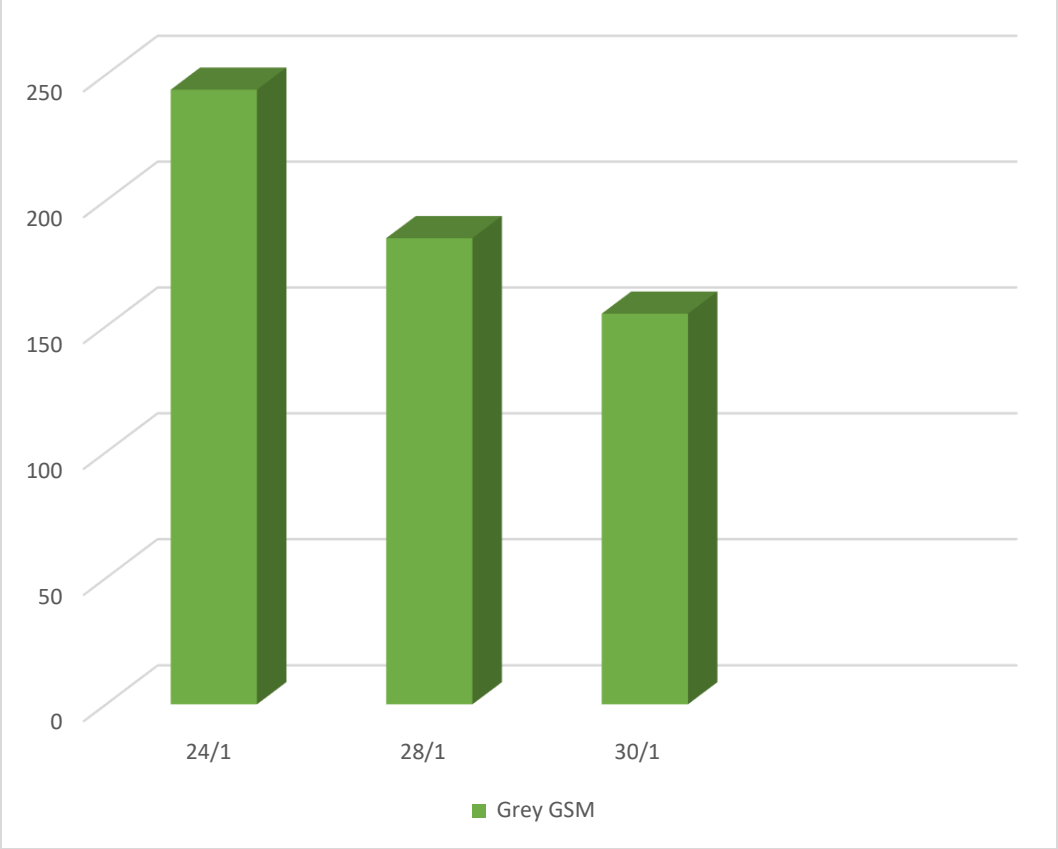

Fig-14: Relation between Grey GSM and Count of (1×1) Rib fabric.

Table-7 and figure-14 shows that here the grey GSM are inversely proportional to the count and that means when the count increase then the grey GSM will be decrease.

5.5. Relation between Grey GSM and stitch length of (1×1) Rib fabric:

Grey GSM	Stitch length
244	2.60
185	2.70
155	2.80

Tabel-8: Relation between Grey GSM and Stitch length of (1×1) Rib fabric.

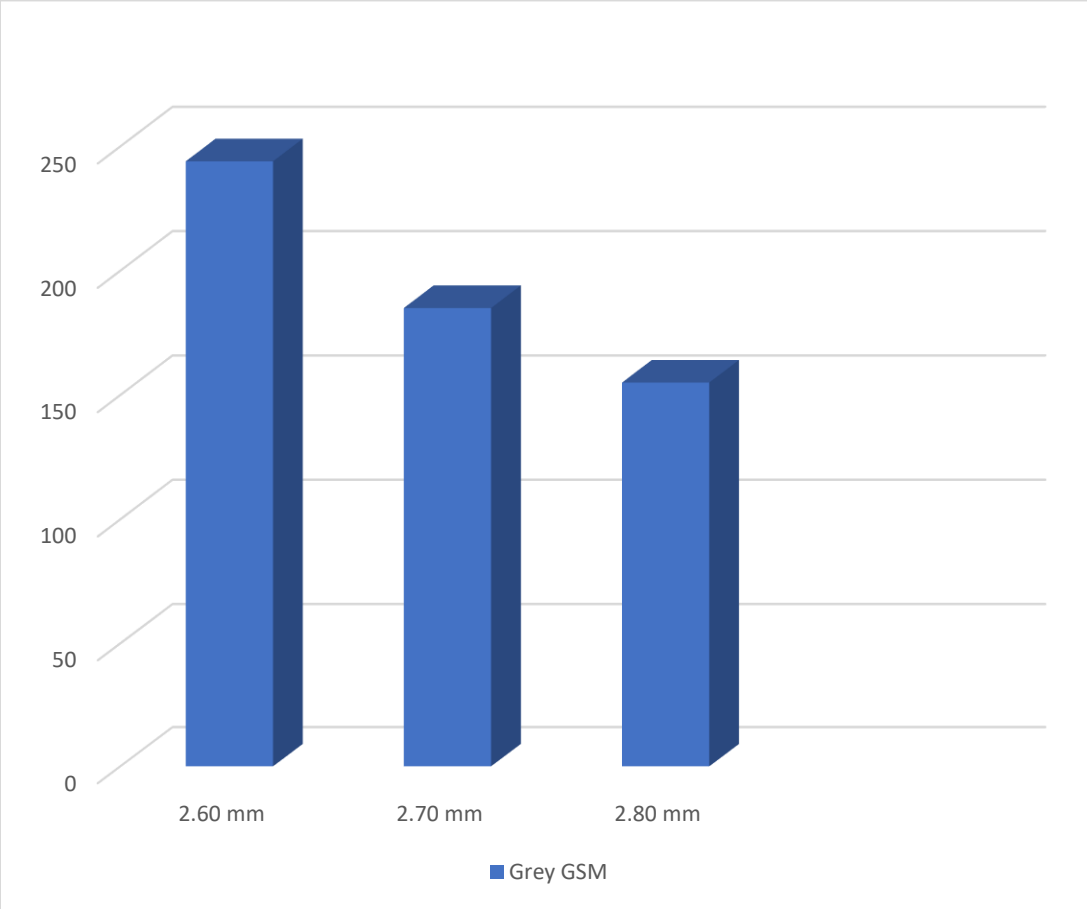

Fig-15: Relation between Grey GSM and stitch length of (1×1) Rib fabric.

Table-8 and figure-15 show that here the grey GSM is inversely proportional to the stitch length same as count and that means when the stitch length increase then the grey GSM will be decrease.

5.6. Relation among Grey GSM, Count and Stitch length of (1×1) Rib fabric:

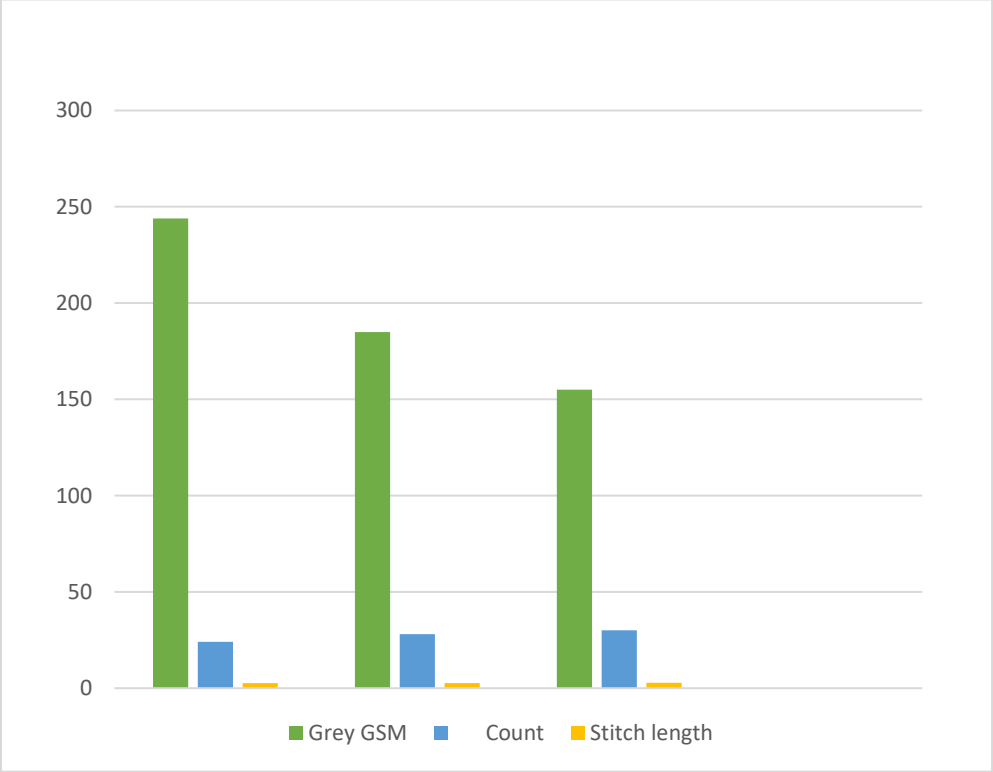

Fig-16: Relation among Grey GSM, Count and Stitch length of (1×1) Rib fabric.

Figure 16 show that the relation among grey GSM are inversely proportional to the count and stitch length. That means if stitch length and count are increase then grey GSM will be decrease.

5.7. Analysis of (1×1) Interlock fabric:

Count (Ne)	Stitch length (mm)	Grey GSM (gm/m2)
30	1.5	230
34	1.52	195
40	1.57	160

Table-9: Count, stitch length and Grey GSM of (1×1) Interlock fabric.

This analysis for interlock fabric, show the relation count, stitch length and grey GSM. Table-9 show that here interlock fabric respectively 30Ne, 34Ne, and 40Ne are selected, then stitch length selected 1.5mm, 1.52mm and 1.57mm.

5.8. Relation between Grey GSM and Count of (1×1) Interlock fabric:

Grey GSM	Count
230	30
195	34
160	40

Table-10: Relation between Grey GSM and count of (1×1) Interlock fabric

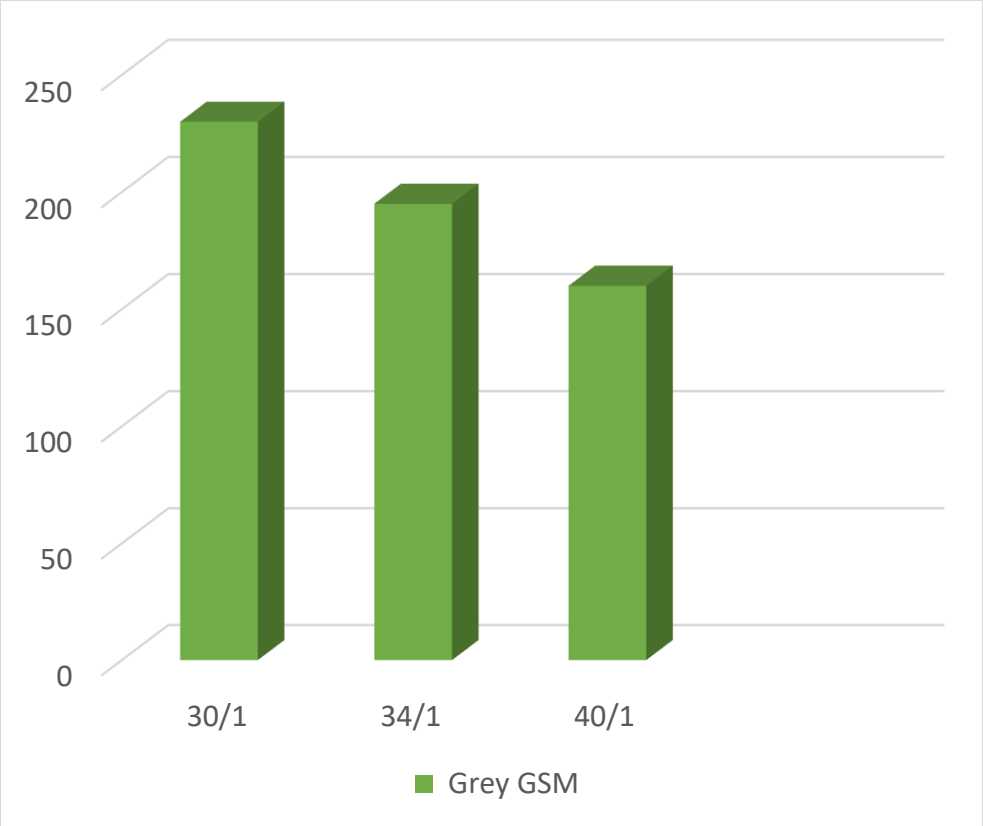

Fig -17: Relation between count and Grey GSM of (1×1) interlock fabric.

Table-10 and figure 17 show that the grey GSM is inversely proportional to the count. That means if the stitch length increase then the grey GSM will be decrease and like as Rib fabric but different quality of parameter.

5.9 Relation between Grey GSM and stitch length of (1×1) Interlock fabric:

Grey GSM	Stitch length
230	1.5
195	1.52
160	1.57

Table-11: Relation between Grey GSM and Stitch length of (1×1) Interlock fabric.

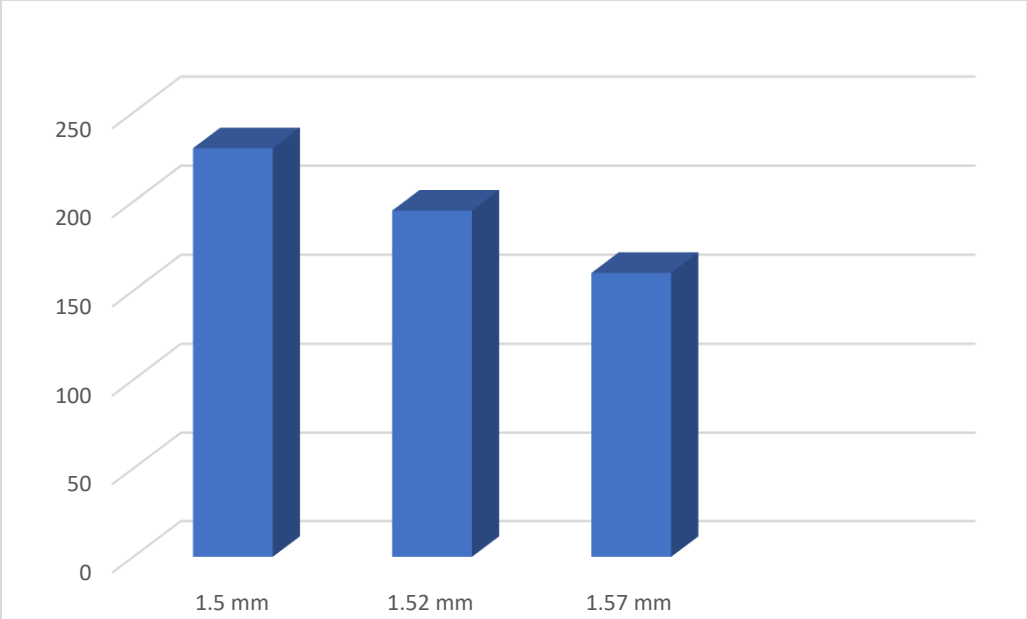

Figure-18: Relation between Grey GSM and Stitch length of (1×1) Interlock fabric

Table-11 and figure-18 show that here the grey GSM is inversely proportional to the stitch length same as count and that means if the stitch length increase then the grey GSM will be decrease like as rib fabric but parameter will be different.

5.10 Relation among Grey GSM, Count and Stitch length of (1×1) Interlock fabric:

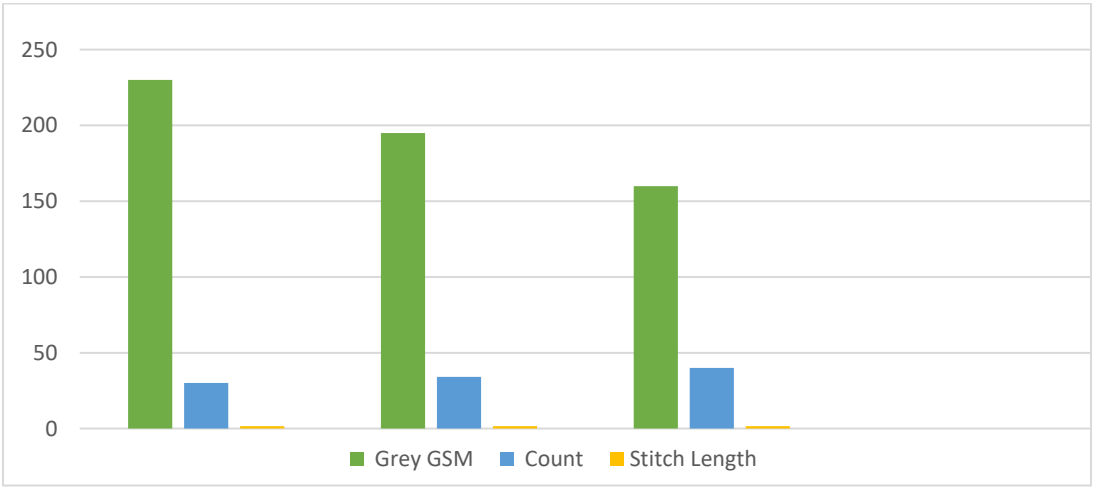

Fig-19: Relation among Grey GSM, count and Stitch Length (1×1) interlock fabric.

Figure-19, show that the relation among grey GSM are inversely proportional to the count and stitch length. That means when stitch length and count are increase then grey GSM will be decrease like as rib fabric but parameter will be different.

5.11. Compare between empirical and experimental data of (1×1) Rib fabric:

Observation number	Count	Stitch length	Experiment Grey GSM	Empirical Grey GSM(gm/m2)
01	24	2.60	244	240-250
02	28	2.70	185	185-195
03	30	2.80	155	150-160

Table-12: Compare between empirical and experimental data of (1×1) Rib fabric.

When we finding the table-12, we can see that when the count 24 Ne and the stitch length 2.60 mm then our experimental grey GSM is 244 where the industry experienced grey GSM range is 240 to 250. Same as when the count 28 Ne, 30 Ne and the stitch length 2.70 mm, 2.80 mm then our experimental grey GSM individually 185 and 155.where the industry experienced grey GSM range 185 to 195, 150 to 160 and that means for (1×1) Rib fabric, this experiment is accurate.

5.12. Compare between empirical and experimental data of (1×1) Interlock fabric:

Observation number	Count	Stitch length	Experimental Grey GSM	Empirical Grey GSM (gm/m2)
01	30	1.5	230	225-235
02	34	1.52	195	185-195
03	40	1.57	160	150-160

Table-13: Compare between empirical and experimental data of (1×1) Interlock fabric.

When we finding the table-13, we can see that when the count 30Ne and the stitch length 1.5mm then our experimental grey GSM is 230. Where the industry experienced grey GSM range is 225

to 235. Same as when the count 34Ne, 40Ne and the stitch length 1.52mm, 1,57mm then our experimental grey GSM individually 195 and 150.where the industry experience grey GSM range 185 to 195, 150 to 160 and that means for (1×1) interlock fabric, this experiment is accurate.

We can say that for both (1×1) Rib fabric and (1×1) interlock fabric from table 7, table 9 and table 8 and table 10, if the count is increased then the grey GSM will be decreased where the stitch length is fixed.

$$\text{Grey GSM } \alpha \text{ } 1/\text{Count} \ldots\ldots\ldots\ldots\ldots\ldots 1$$

It was investigated that when stitch length increased then grey GSM would be decreased.

$$\text{Grey GSM } \alpha \text{ } 1/\text{ Stitch length} \ldots\ldots\ldots\ldots\ldots 2$$

From above 1 and 2equation, we get equation 3. Now it has been defiantly say that when stitch length and count increased then the grey GSM would be decrease and that means,

$$\text{Grey GSM } \alpha \text{ } 1/ (\text{Count} \times \text{Stitch length}) \ldots\ldots\ldots\ldots\ldots 3$$

CHAPTER 6

CONCLUSION

Conclusion

Mainly the project work is prepared for Rib fabric and Interlock fabric different quality parameter like as count, stitch length and grey GSM. Yarn count and stitch length is very important parameter of weft fabric produced. This project focused only (1×1) Rib fabric and (1×1) interlock fabric from this thesis finding a better idea about selection of count, stitch length and grey GSM. Which is very essential characteristics for rib and interlock fabric in the industries. From before the experimental data it has been show that, if the count increased, then the stitch length increased but the grey GSM will be decreases. From the analysis, it also gives an idea about grey stage of knit fabric that would be better performance for the proper selection of count, stitch length and grey GSM.

CHAPTER 7

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