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Effect of Structural Design on the physical properties of Eri union fabrics

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Abstract: *For the purpose of the study eri yarn was used as warp and red eri, cotton, polyester, acrylic and rayon yarns were used as weft direction to prepare woven fabric. Total ten samples were woven on the fly shuttle handloom. Among these woven samples five was plain eri union fabric without jacquard attachment and five samples was patterned eri union fabric with jacquard and other attachment including jacquard accessories. The constructed eri union fabric were evaluated with test methods for certain physical properties viz- elongation ,fabric abrasion resistance , fabric pilling, fabric stiffness, and fabric tearing. Findings revealed that patterned eri union fabrics exhibited better performance as plain eri union fabric and highly suitable for fashionista.*

Key Words: *Union fabric, eri , red eri, cotton, polyester, acrylic, jacquard, plain, patterned etc.*

1. INTRODUCTION:

Textile demand varies from year to year with the changing fashion; the consumer's preference influences the demand for different types of fibers and fabrics. The increase in the world demand for textile is expected to continued not only due to increase in the world population but also due to the standard of living. Therefore, the focus of fibre-fabric research has shifted to towards the exploration of new textiles and their combinations with the previous ones. Textiles have been an integral part of mankind since the ancient times and the art of all ages have depicted this in various mediums. Art is a man made expression of something beautiful, but beauty seems to be different for different people. In today's world, fashion changes every second and it is important to have innovative ideas especially in textile designing (Kaur *et al*., 2014). Indians are world famous for their magnificent workmanship and produced the most beautiful hand spun and hand woven textiles, yet preserved and exhibited in many of the known Indian as well as western museums. India had a long tradition of excellence in making high quality handloom products with extraordinary skills and craftsmanship. Assam, one of the states of North Eastern region of India also enjoys a place of pride in the whole country for its artistic hand woven products. Handloom weaving is recognised as a prestigious cottage industry and play a vital role in the economic and cultural life of the people of Assam. Silk textiles produced in the family loom with beautiful eye catching designs are prestigious and proud possessions for every Assamese lady. Textile production at household level is typically a feminine activity except in Sualkuchi where men are also engaged in weaving. Handloom weaving as a folk art forms an integral part of the life

Handloom forms a precious part of generational legacy and exemplifies the richness, which has been kept alive by skilled weavers engaged in the age old tradition of weaving (Boruah, 2014). Handloom textiles are unique and differ from monotony of mill-made textile in texture and design (Chetia, 1992). The weavers with their skillful blending of myths, faiths, symbols and imagery provide their fabric an appealing dynamism. Their strength lies in innovative designs, which cannot be replicated by the power looms. Handloom is the culture heritage of our country and hence it is imperative to protect and promote the textile sector and weaving product. The beautiful handloom products of Assam as a whole with distinctive characteristics produced by indigenous weavers in different ethnic groups have contributed immensely to the textile tradition and its rich heritage. A union fabric is a textile fabric, which is woven from different yarns in warp and weft. In this type of fabrics the properties of two different yarns are combined together to get a new fabric having the properties of both the yarns. Union fabric enables the weavers to combine two different sets of yarns so that good qualities are emphasized and poor qualities are minimized, thereby having the fabrics with better functional properties. Union fabrics, if woven with eri in one direction and cotton, polyester, rayon and acrylic in the other direction using structured design will create a variegated effect and the resultant fabrics are expected to have better functional properties. If Eri is woven as a union fabric with other yarns, we can expect an attractive fabric with improved functional properties. In this type of fabrics the properties of two different yarns are combined together to get a new fabric having the properties of both the yarns. The eri union fabric obtained will offer flexibility in choosing varities of eri fabric which would be cost effect yet attractive.(Konwar and Kaur, 2015) Gupta *et al*. (2005) mention that the woven jacquard structured fabrics are attractive and drapes well. Typical fabrics woven are brocade, damask and tapestry and curve and large size figures weaves are used for jacquard. Through this weave intricate design are possible and jacquard mechanism controls thousands of heddles which lift one or more warp yarns independently or others without the use of harness.

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2. OBJECTIVE:

To study the effect of structural design on the physical properties of eri union fabrics.

3. MATERIALS AND METHODS:

The plain and patterned Eri union fabric prepared and used in the experiment – and this was woven with – Eri silk in warp direction and red eri silk, cotton, polyester, rayon and acrylic yarns were selected for weft direction of the study.

For warp, wooly white spun Eri silk yarn of 2/140 NM count was selected.

For weft, five different types of yarns were selected to match with the selected eri warp as mentioned below:

- red eri yarn of 2/140 NM count
- cotton yarn of 2/80NM count
- polyester yarn of 50 Denier
- rayon yarn of 50 Denier
- acrylic of 2/36 NM count were selected to match with the selected eri yarn to be used for warp.

Punch (perforated) cards are most essential for making structural i.e patterned fabrics and 41 Cards were used to create a geometrical design for the jacquard attachment. Eri silk as warp was interwoven with red eri cotton, polyester, rayon, acrylic at fly shuttle frame loom, to produce of five plain weave samples and five structurally designed samples using jacquard attachment.

Constructional details of plain and pattern union fabrics are as follows-

Table 1. Constructional details of eri union fabrics- plain and patterned

Sl. No.	Yarn used union	weave	Warp	Weft	Nomenclature	Yarn type	Reed counts	Card
1	**Eri x Red Eri**	**Plain**	Eri	Red Eri	EEp	2 ply	72	-
		Patterned			EEd			41
2	**Eri x Cotton**	**Plain**	Eri	Cotton	ECp	2 ply	72	-
		Patterned			ECd			41
3	**Eri x Polyester**	**Plain**	Eri	Polyester	EPp	2 ply	72	-
		Patterned			EPd			41
4	**Eri x Acrylic**	**Plain**	Eri	Acrylic	EAp	2 ply	72	-
		Patterned			EAd			41
5	**Eri x Rayon**	**Plain**	Eri	Rayon	ERp	2 ply	72	-
		Patterned			ERd			41

Table: 2.Name of **Physical properties and method used for determine the properties of – plain and patterned eri union fabric.**

Sl. no	Name of physical properties/ experiment	Unit	Instrument required to test experiment	Method used
1	**Fabric elongation**	**%**	Instron strength tester	Raveled strip method. ASTM test method: 22561, 1968
2	**Fabric abrasion resistance**	**cycles**	'Martindale Abrasion Resistance Tester'	IS test method: 12673-1989.
3	**Fabric pilling**	**ratings**	Martindale pilling tester	ASTM D4970
4	**Fabric stiffness**	**cm**	Shirley's tester.	BS test method: 3356-1961
5	**Fabric tearing**	gm	Elmendorf tearing tester	ASTM D1938

Physical properties of woven eri union – plain and patterned fabrics
Fabric elongation (%)

Table .3. (a). Elongation of eri union fabric- plain

Sl. No.	Samples (plain)	Elongation (%)	
		Warp	Weft
1	EEp	17.74	15.30
2	ECp	16.77	14.51
3	EPp	13.87	17.51
4	EAp	16.12	17.74
5	ERp	15.16	15.80
	S.Ed	0.292	0.280
	CD	0.610	0.587
	CV (%)	2.903	2.752

The elongation of plain woven eri union fabrics samples were evaluated and data presented in table : 3.(a) From the table it was observed that the elongation of all the samples in warp way have less difference with each other. In warp direction sample EEp shows highest elongation (17.74), and lowest sample -EPp (13.87) respectively, and in weft direction sample EAp (17.74), and least sample -ECp (14.51) showed results. The lowest elongation sample found EPp (13.87) in warp direction and ECp (14.51) in weft direction.

Table .3.(b) Elongation of eri union - patterned fabrics

Sl. No.	Samples (patterned)	Elongation (%)	
		Warp	Weft
1	EEd	14.50	12.90
2	ECd	12.90	11.29
3	EPd	14.81	20.05
4	EAd	15.16	15.80
5	ERd	14.60	15.16
	S.Ed	0.518	0.490
	CD	1.083	1.024
	CV (%)	0.674	0.602

It was found from Table.3.(b) for patterned eri union samples that the elongation of all the tested sample in warp and weft direction had less difference with each other in both directions. In warp direction sample EAd (15.16 percent) shows highest elongation and lowest seen on sample ECd (12.90percent) respectively while in weft direction, sample EPd (20.05percent) shows maximum elongation and lowest elongation sample ECd (11.29percent). In plain and patterned eri union fabric samples, especially in weft direction, elongation was highest in acrylic and polyester combinations with eri. This may be characteristics of acrylic and polyester yarn. These are synthetic fibre and therefore have high elongation. Eri silk also considered to be more plastic than elastic. This is also in confirmation with the findings of (Konwar and Kaur 2015).

4. Fabric abrasion resistance (cycles):

From figure 1(a), it was seen that plain woven sample EPp, showed highest resistance to abrasion (6.60) in the number of cycles 921, and EEp (2.50) in number of cycles 720 respectively. Highest resistance to abrasion (6.60) was found sample EPp. It may be because of polyester yarn which was finer in structure and have less thickness, resulting in to better abrasion resistance. The least number of cycles also showed the least loss in mass in EEp. It may be due to presence of polyester yarn in the union fabric and may be because the polyester yarn was finer in structure and have less thickness, resulting in better abrasion resistance.

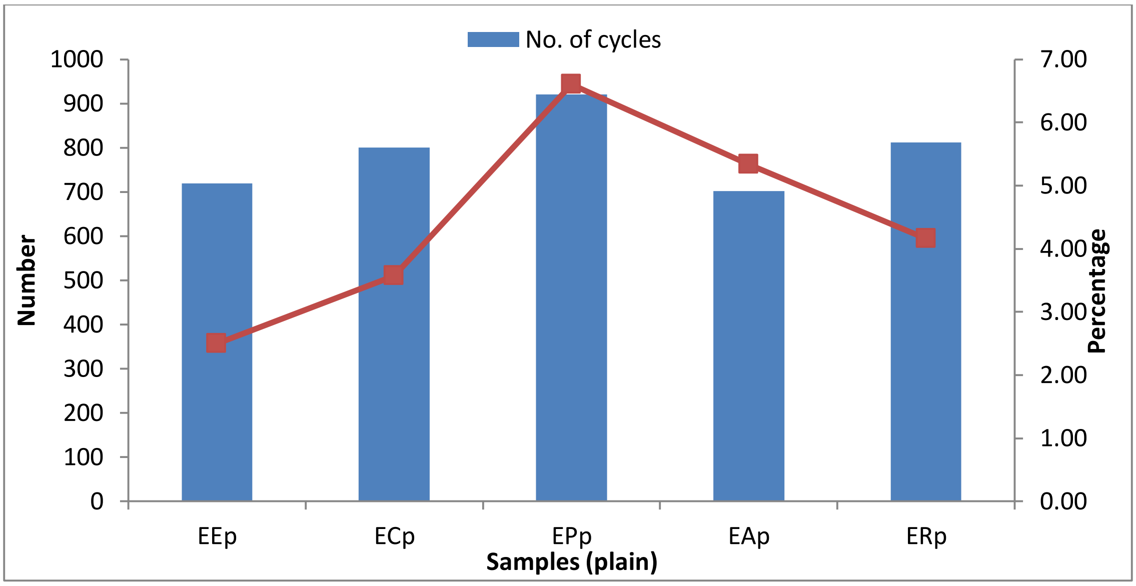

Figure. 1.(a). ABRASION RESISTANCE OF ERI UNION FABRICS- PLAIN

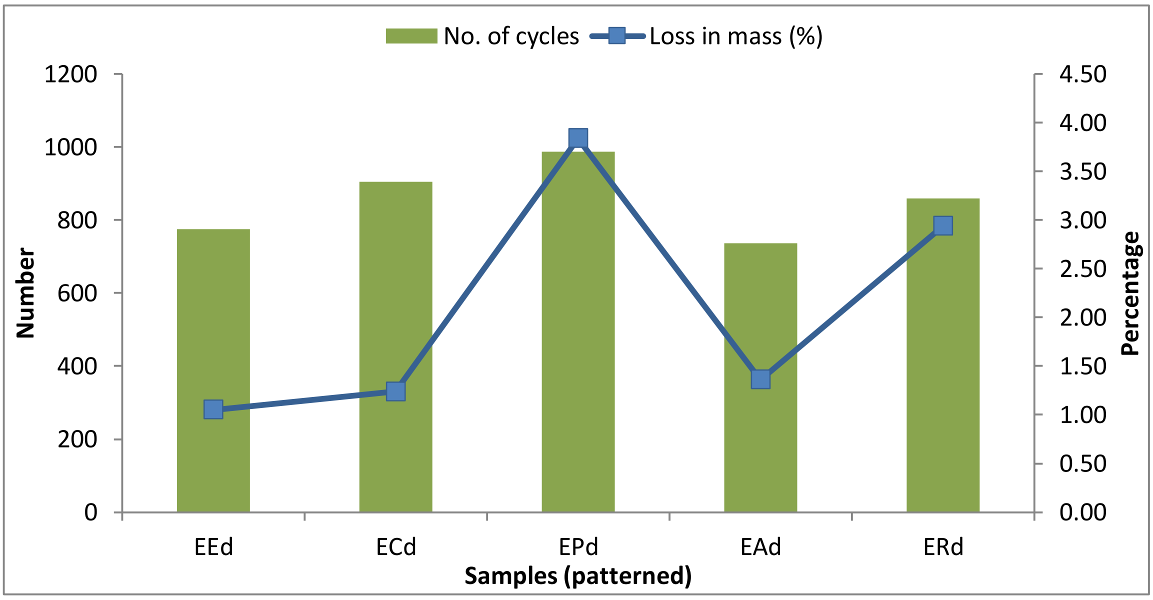

Figure. 1(b) Abrasion resistance of eri union fabric- patterned fabrics

Abrasion resistance of eri union patterned fabric were depicted in Figure.1(b) Patterned eri union sample-EPd i.e. eri +polyester designed showed highest resistance to abrasion (3.84) with cycle 987, and EEd i.e .Eri+ red eri designed (1.05) with cycle 776 respectively. It may be because of polyester yarn which was finer in structure and have less thickness, resulting in to better abrasion resistance From the tabulated data it was found that plain eri union and patterned eri union fabric sample-EPp i.e Eri+ Polyester plain and EPd i.e. Eri+Polyester designed have highest number of cycles compared to other samples. It may be due to the increasing tensile strength of eri union fabric. A fabric resistance to abrasion is affected by many factors, such as fibre type, the inherent mechanical properties of the fibres, the construction and thickness of the fibres (Wang *et al* 2008 and Saikia., 2014). Increasing surface contact increases the abrasion resistance of the fabric. Low twist yarns may present greater surface to the abradant, however, too little twist may leave loose fibres protruding from the yarn body which may be snagged or broken during abrasion. High twist reduces the abrasion resistance of the yarn (Wang *et al*., 2008).

5. Fabric pilling (ratings):

Table: 4. Fabric pilling of - plain and patterned eri union fabric

Sl. No.	Samples (plain)	Pilling (rating)	Samples (patterned)	Pilling (rating)

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1	EEp	3	EEd	3
2	ECp	1	ECd	1
3	EPp	2	EPd	2
4	EAp	3	EAd	3
5	ERp	2	ERd	2
	SEd	0.528	SEd	0.564
	CV (%)	38.030	CV (%)	0.8

Table.4 depicted the pilling resistance of plain and patterned woven eri union fabrics. Among them Sample EEp(Eri +red eri plain), EAp (Eri+ Acrylic plain) and EEd(Eri+ red eri designed), EAd(Eri +Acrylic designed) showed hairy and pill more severely. Sample EPp(Eri + Polyester plain), ERp(Eri +rayon plain) and EPd(Eri+ Polyester designed), ERd(Eri+ Rayon designed) showed hairy and slight pilling. Sample ECp and ECd showed hairy but no pill.

6. Fabric stiffness:

The stiffness of eri union fabrics- plain and patterned union fabrics were examined and presented in the following table-

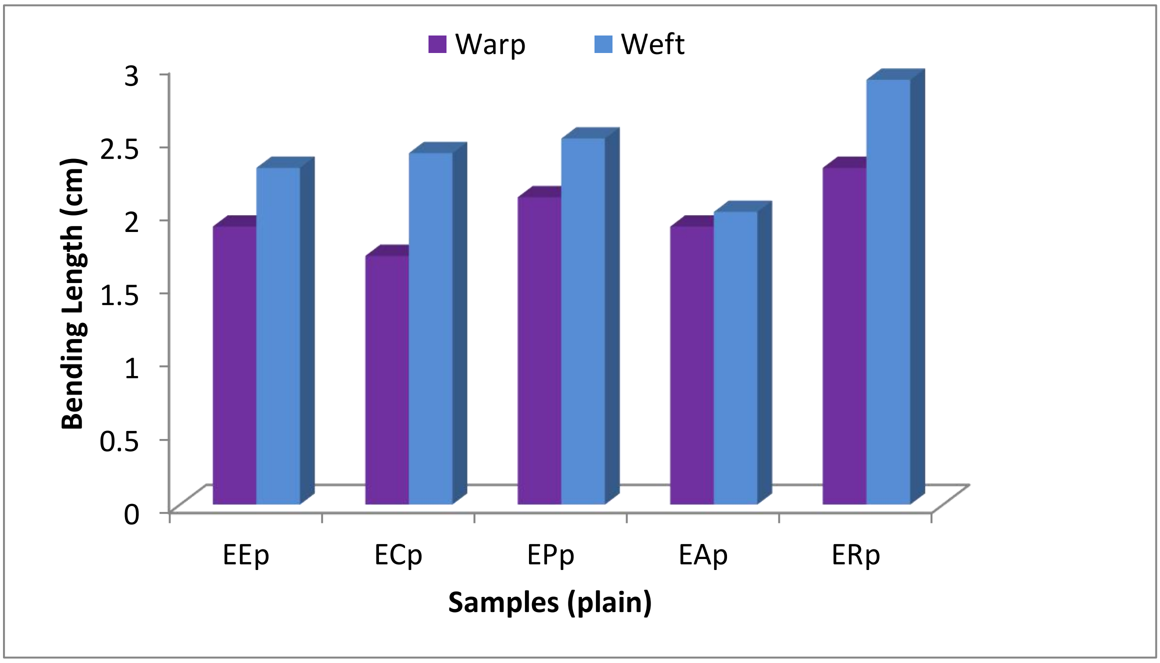

Figure. 2(a) Fabric stiffness of eri union fabrics- plain

Figure.2 (a) revealed that the stiffness of plain Eri union fabrics plain eri union fabric samples. The result illustrated that among all the test samples highest bending path was shown by sample ERp i.e. Eri + Rayon plain woven eri union fabrics (2.3 cm) in warp and weft (2.9 cm) direction for plain woven fabric. The lowest bending length were found sample EC p i.e Eri + Cotton plain (1.7) in warp and EAp i.e Eri+ Acrylic plain (2.0) in weft direction, which may be due to yarn type, compactness of weave, greater cloth weight and thickness. Table showed, least bending length was exhibited by sample ECp i.e Eri + Cotton -plain woven eri union fabric in warp (1.7 cm) and sample-EAp i.e Eri+ Acrylic plain in weft (2.0 cm) direction may be due to least weight of acrylic yarn. It may be due to the softness of the cotton and acrylic yarn.

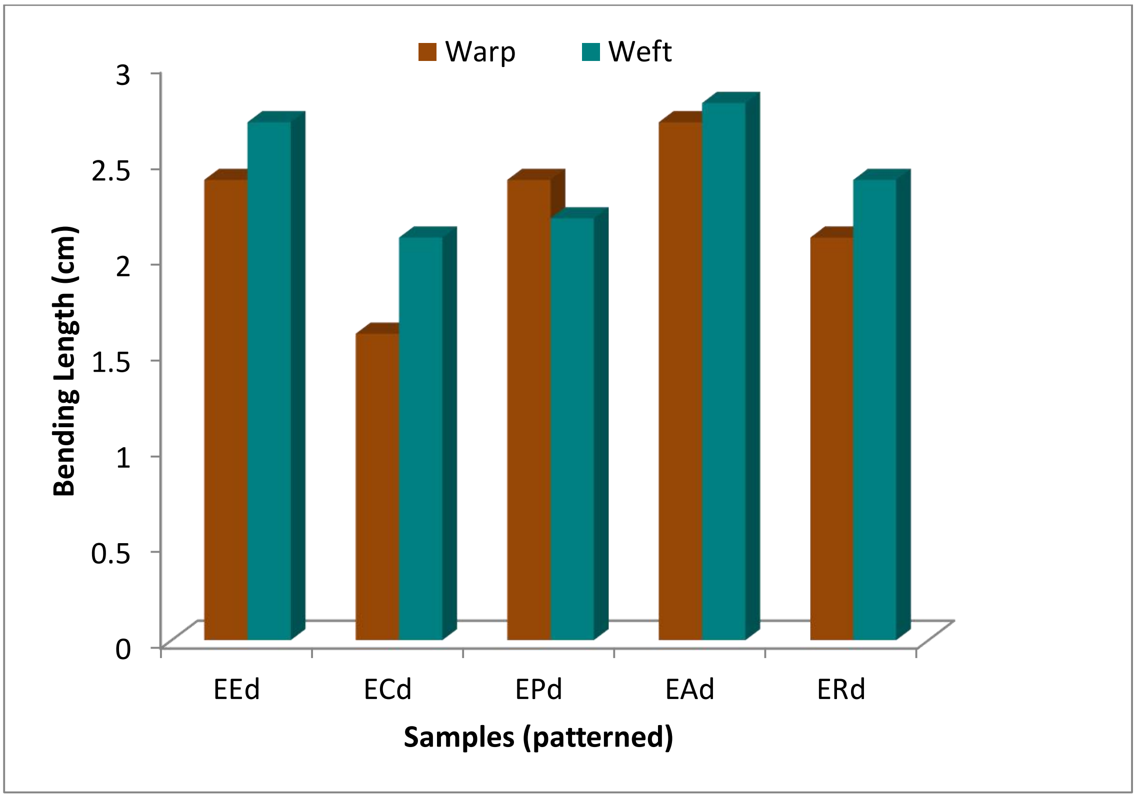

Figure. 2(b). Fabric stiffness of eri union fabrics- patterned

Figure. 2(b) illustrated patterned fabric samples- highest bending path was found by EAd in both warp (2.7 cm) and weft (2.8 cm) direction, which may be due to yarn type, Compactness of weave, and least bending length was exhibited by ECd (1.6 cm) in warp and (2.1) cm in weft direction. "Bending rigidity value of red eri fabric is higher than white Eri". The bending rigidity value reduces in each variety of fabric with increase of weft yarn count in the fabric because of number fibre reduced in the yarn cross section. This is due to the fact that cross section shape and size of fibre in the fabric influences the bending rigidity of the fabrics. Red eri fibre has higher and elongated triangular than white eri as results in bending rigidity of fabric is higher than white eri silk. This property is desirable in garment manufacturing (Kariyappa *et al.*, 2011).

7. Fabric tearing:

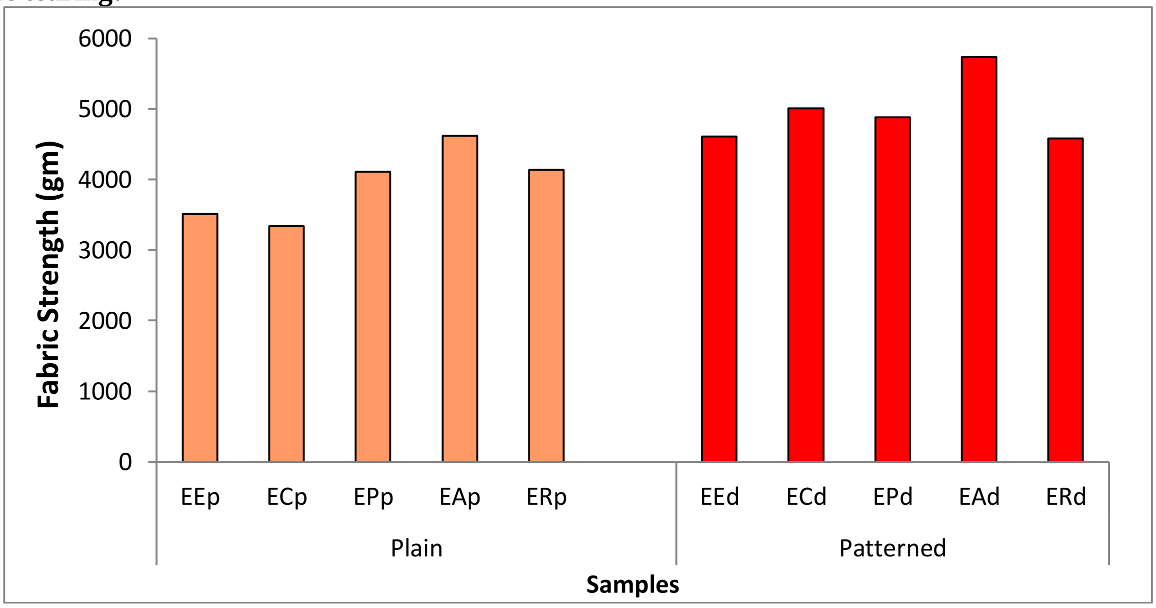

Figure. 3. Comparison of fabric tearing –plain and patterned eri union fabric

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From the figure.3. it was seen that fabric tearing strength was highest of the sample EAp (4620.8gm) followed by ERp(4134.4), EPp(4108.8), EEp(3507.2) and ECp (3340.8) respectively. Samples EAp showed highest fabric tearing with a result of fabric strength 4620.8 gm and lowest ECp with fabric strength 3340.8 gm. For patterned eri union fabrics also, tearing strength was maximum for sample EAd(5734.4gm) followed by ECd(5004.8gm), EPd(4876.8gm), EEd(4608gm) and least for sample ERd(4582.4gm). Maximum fabric tearing strength was found in warp direction for sample EEd (81.4) and sample EAd with fabric strength 5734.4 gm and lowest at sample ERd with fabric strength 4582.4 gm.

Prepared fabric material samples and designed product:

Figure4.(a) : Plain eri union fabric

Figure 4.(b) : Patterned eri union fabric

Neck Tie made from sample- ERd (Eri x Rayon)

Half Jacket and half coat made from sample- EEd- (Eri xRed Eri)

8. CONCLUSION:

From the experimental results, it was observed that- plain and patterned Eri union fabric can be created by making union with- Eri+Red eri, Eri+Cotton, Eri+Polyester, Eri +Rayon , Er + Acrylic and after woven union such fabric become more strength, lighter in weight and special in appearance and provide gorgeous looks along with lusters, good handle and texture. The properties of plain and patterned eri union fabrics were found good by their physical properties and garments were designed from patterned eri union fabric. No adverse remarks were found in preparation of garments after assessment of physical properties. Eri silk is not lustrous as other silks, it can be union with cotton, acrylic, polyester, rayon etc. as union fabrics which not only provides luster but also cost effective. The pattern designed union fabric provide another attraction to the eri silk. Therefore, this type of plain and patterned fabrics can be used for making dresses for fashionista. Development of plain and structure designed union fabrics will provide a new horizon- in the field of apparel, household furnishing and fashion industry.

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