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# Testing relationship of bending rigidity with drape coefficient for silk viscose blended knitted fabrics

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**Abstract**

Aesthetic behavior of any fabric is largely determined by its property to drape. It has an important bearing on how good a garment looks in use. Knitted fabrics known for their high elastic properties often have high drape characteristics. In the present investigation, the influence of bending rigidity of fabrics in prediction of drapability of weft knitted fabric, have been determined. Knitted fabrics blended in proportion of 50: 50 silk and viscose, have been developed in two yarn counts. And their bending rigidities and drape coefficients were obtained. Statistical analysis has been done for the findings indicating that draping has linear correlation with bending rigidities.

**Keywords:** Bending, drape, fabric, knitted, rigidity

## 1. Introduction

The trade of knitting has gone through brisk changes in relation to trends and customer interests. User requirements have been modified a lot in the recent years in terms of character and nature of fabric. High fashion fabrics with high perfection are demanded. In this context, the property of drape plays as significant role as deciding end use of the fabric.

The term 'drape' can be defined as the ability of a fabric to assume graceful appearance in use. According to Glock and Kunz[1], drapability relates to how fabric falls when it hangs, its ability to form graceful configurations. Although drape is a subjective quality as it pertains to appearance, attempts have been made to objectively define and measure drape in fabric form [2]. Subjective evaluation of drape is related to psychological factors like human perceptions, whereas, objective evaluation of fabric drape involves measurement of drapability in terms of drape coefficient. Fabric drape is not an independent property [3]. It is influenced by many other properties of fabric, one of which is bending rigidity. As opined by Adanur [4], bending rigidity is resistance of fabric to bending. It is the resistance which is observed when the fabric is bent back and forth between the fingers. The higher the rigidity of structure, lesser it will bend under a given load [5]. Flexural rigidity is one of factors perceived through the human body sensory mechanisms [6]. In this paper, the impact of bending rigidity in prediction of drape ability of fabric has been determined.

## 2. Materials and methods

Blended yarns in proportion of 50 % silk: 50% viscose, in two different yarn counts *viz.* 15 Nm and 20 Nm were utilized for fabric construction. Knitting was carried out on sinker circular knitting machine and single jersey structures were obtained on 10 gauge. Physical parameters of blended knitted fabrics were analyzed.

Drape is a unique physical property that allows a fabric to be bent in more than one direction with double curvature [7]. Drapabilty being a significant measure for end use of a fabric, was also analyzed for its dependence and influence of other related parameters. Drape coefficient was measured using drapemeter. A circular sample was cut with a diameter of 10 inches and was kept over a supporting metal disc of diameter 5 inches. During this, the unsupported sides of fabric fell under the influence of gravity and draped over the edges of supporting disc. Drape coefficient was calculated by using below formula:

$$F = \frac{A_s - A_d}{A_D - A_d}$$

Where,

$A_D$ = The area of specimen

$A_d$ = The area of supporting disc

$A_s$ = The actual projected area of the specimen

The drape coefficient F, is the ratio between the projected area of specimen and its undraped area, after deduction of the area of the supporting disc.

Bending rigidity of knitted fabrics was computed by using cantilever stiffness tester. A fabric strip of 6 inch x 1 inch was mounted on a horizontal plateform in such a way that overhangs like a cantilever and bends downward. The scale of equipment was in cms of bending length which can also be used for cutting specimen to exact size. The fabric was moved a little to the right side and stopped when it bends and coincides with the slanting line in the mirror. The bent length was measured. Specimens were tested both coursewise and walewise. Mean values were calculated for further calculation of flexural rigidity.

Bending length C = Lf1 (θ)

Where $f_1(\theta) = 41\ ½°$

Also, 41 ½ ° = ½

Therefore, C = L/2

L = Mean length of the overhanging portions

$$W = \frac{\text{Average weight of samples}}{\text{Average area of samples}}\ g/cm^2$$

Flexural rigidity lengthwise direction ($G_1$)

$(G_1) = W_1 \times C^3 \times 10^3$ mg/cm

Flexural rigidity widthwise direction ($G_2$)

$(G_2) = W_2 \times C^3 \times 10^3$ mg/cm

## 3. Results and Discussion

**Table 1:** Drape properties of knitted fabrics blended in proportion of 50% silk: 50% viscose

| Fabric blend | Yarn count | Drape coefficient |
|---|---|---|
| 50% silk: 50% viscose | 15 | 38.040 |
| 50% silk: 50% viscose | 20 | 32.870 |

Drape coefficient for 15 Nm yarn was calculated as 38.040, whereas, it was 32.870 for 20 Nm. According to Gnanavel and Ananthakrishnan [8], a low drape coefficient indicates easy deformation of a fabric and a high drape coefficient indicates less deformation. This is because higher projected area means less drapability.

Findings of bending rigidity elucidate that fabric knitted with 15 Nm yarn count has bending rigidity of 203.142 mg/cm in the direction of wales. In course wise direction, bending rigidity was calculated as 152.393 mg/cm. In case of fabrics blended in 20 Nm yarn count, bending rigidity values were 168.202 mg/cm and 96.699 mg/cm for wale wise and course wise direction.

**Table 2:** Bending rigidity of knitted fabrics blended in proportion of 50% silk: 50% viscose

| Fabric blend | Yarn count | Direction | Bending rigidity (mg/cm) |
|---|---|---|---|
| 50% silk: 50% viscose | 15 | Wales | 203.142 |
| 50% silk: 50% viscose | 15 | Course | 152.393 |
| 50% silk: 50% viscose | 20 | Wales | 168.202 |
| 50% silk: 50% viscose | 20 | Course | 96.699 |

**Table 3:** Correlation between drape coefficient and bending rigidity

| Fabric blend | Yarn count | Direction | Correlation coefficient (r) |
|---|---|---|---|
| 50% silk: 50% viscose | 15 | Wales | 0.9831 |
| 50% silk: 50% viscose | 15 | Course | 0.2605 |
| 50% silk: 50% viscose | 20 | Wales | 0.9607 |
| 50% silk: 50% viscose | 20 | Course | 0.9229 |

Under the present investigation, correlation coefficient was calculated for assessing the impact of bending rigidity over drape coefficient. The attempt was carried out all the four fabric blends. The findings have been furnished in table 3. Data thus obtained reveals that in case of fabric knitted by using 15 yarn, there is a strong positive relationship between drape coefficient and bending rigidity, in the direction of wales. The value of R was 0.983. 1This means which means that high drapability values go with high bending rigidity figures and vice versa. In course wise direction, the value of R had been calculated as 0.2605. Although technically a positive correlation has been witnessed between two variables, the relationship between drape coefficient and bending rigidity was weak in this case.

As regards to fabrics knitted by using 20 Nm yarns, drape and bending rigidity figures carry a powerful positive relationship in the wales wise direction. Values of drape coefficient increase with rise in bending rigidity. Correlation coefficient calculated for this relationship was 0.9607. In case of course wise direction, the value of R was found to be 0.9229. A strong positive relationship was observed in this direction as well.

## 4. Conclusion

Findings of the experiment clearly say that there is a positive impact of bending rigidity over drape coefficient and a rise in one variable leads to an increase in other variable. When bending and shear hysteresis are large, drape coefficient percentage will be large and unstable [9].

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