

Subjective Assessment of Pashmina and Pashmina Blended Knitted Fabrics after Nylon Dissolution

Asif H Sofi¹, Sarfaraz A. Wani², Dinesh B. Shakyawar³, Sheikh Rafeh Ahmad⁴,
Mohammad A. Pal⁵, Tahir Nazir^{6*}, Azmat A. Khan⁷, Heena Jalal⁸ and Mir Rovida⁹

¹Assistant Professor, Division of Livestock Products Technology, FVSc AH, SKUAST-K, Jammu & Kashmir, INDIA

²Prof. Head, Division of Livestock Products Technology, FVSc AH, SKUAST- K, Jammu & Kashmir, INDIA

³Principal Scientist and Head, Division of TMTC, CEWRI, Avikanagar, Rajasthan, INDIA

⁴Assistant Professor, Division of Livestock Products Technology, FVSc AH, SKUAST- K, Jammu & Kashmir, INDIA

⁵Dean, FVSc AH, SKUAST- K, Jammu & Kashmir, INDIA

⁶PhD Scholar, Division of Livestock Products Technology, FVSc AH, SKUAST- K, Jammu & Kashmir, INDIA

⁷Associate Director Research, Directorate of Research, SKUAST- K, Jammu & Kashmir, INDIA

⁸PhD Scholar, Division of Livestock Products Technology, FVSc AH, SKUAST- K, Jammu & Kashmir, INDIA

⁹PhD Scholar, Division of Livestock Products Technology, FVSc AH, SKUAST- K, Jammu & Kashmir, INDIA

*Corresponding Author: khnaij2011@yahoo.com

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Abstract

Pashmina and pashmina blended knitted fabrics were developed with aim to diversify the product range of pashmina and evaluate its consumer acceptability. Pashmina, wool and nylon was blended into five different proportions, viz; T1 (60:0:40); T2 (45:15:40); T3 (30:30:40); T4 (15:45:40); T5 (0:60:40) in fibre stage. Each blend was spun in to yarn of three different counts viz; 24, 36 and 48 count. All yarns were processed into interlock knitted fabric on a circular knitting machine. The fabrics were then subjected to nylon dissolution process. The subjective assessment of the Pashmina: wool blended fabrics revealed that along the blend composition, the stiffness score showed an increasing trend while smoothness, fullness and softness and total hand value showed a decreasing trend from T1 to T5. Fabrics of all blends showed a decreasing trend in yarn count and stiffness score and increasing trend in smoothness, softness and total hand value from thick to thin yarn. From the study it was concluded that consumers preferred and showed interest towards the fabrics having high proportion of pashmina with fine count.

Keywords: Knitted, Machine Spun, Pashmina, Subjective Score

Introduction

Pashmina is a down fibre of domestic goat known as *Capra hircus*, native to Asia. It is known as prince of specialty hair fibres (Anon, 2005). It is well known for its fineness, warmth, softness, desirable aesthetic value, elegance and timelessness in fashion. It has occupied a unique position among the fibres of animal origin because of its warmth, lightness, handle and its ability to absorb dyes and moisture (Ganai *et al.*, 2004). In India, majority of pashmina is utilized for preparation of shawls in Kashmir valley which are mostly hand spun and hand woven with long life and no pile formation (Bumla, 2010). Processing of pashmina is an age-old practice in Kashmir valley. Not only quality of the fibres but also the traditional method of processing has given these pashmina products a royal status with international recognition (Yaqoob *et al.*, 2012). Knitting is the second most frequently used method, after weaving, that turns yarns or threads into fabrics. It is a process of fabric development where loops are interlaced in different designs. There has been a growing interest in knitted fabrics due to its simple production technique, nominal cost, high level of clothing comfort and wide range of products (Oglakcioglu and Marmarali, 2007). Knitted fabrics of all kinds are generally popular because of its wrinkle-resistance, their flexibility, stretch to a particular shape when worn as well as because of their general comfortable wear (Abramaviciute *et al.*, 2011). Because of these added advantages, knitted products from wool and hair fibres find wide application in the fields of hosiery and high value apparels (Lazar, 2010; Ammayappan *et al.*, 2011).

The fabric hand or handle has been defined as the quality of a fabric or yarn assessed by the reaction obtained from the sense of touch or the sum total of the sensation expressed when a textile fabric is handled by touching, flexing of the fingers and so on (Bishop, 1996). It implies the ability of the fingers to make a sensitive and discriminating assessment and of the mind to integrate and express the results in a single valued judgment. Touching a fabric is the first action customers perform so as to evaluate the fabric quality for garments development as well as its performance for the end use.

Keeping in view the qualities of pashmina as well as benefits of knitting, the present study was aimed at value addition and diversification of pashmina product range through development of pashmina and pashmina blended knitted fabrics and evaluate for consumer acceptability.

Material and Methods

Changthangi pashmina (13 μ), Australian merino wool (21 μ) and Nylon (2.5 denier) were blended into five different proportions viz; T1 (60:0:40); T2 (45:15:40); T3 (30:30:40); T4 (15:45:40); T5 (0:60:40). Each blend was spun in to three types of yarn viz; 24, 36 and 48 count on a ring frame spinning machine, making a total 15 types of yarn. All the types of yarn were processed into interlock knitted fabric on a circular knitting machine with specifications: (Make: New National Mechanical Works Ludhiana; gauge: 12 GG; diameter: 12 inches; number of needles: 1400; and speed: 30 rpm). The fabrics were scoured at 40°C for 30 minutes using non-ionic synthetic detergent, followed by rinsing for the same time period. The samples were tumble dried followed by ironing. The fabrics were subjected to nylon dissolution process by immersing in HCl (conc. 18%) in three consecutive baths for 2 minutes each with subsequent rinsing in water to remove the dissolved nylon making the final blend composition of pashmina: wool remained as T1 (100:0); T2 (75:25); T3 (50:50); T4 (25:75) and T5 (0:100). 20x20 cm fabric pieces were presented to 60 consumers, both young and middle aged, belonging to both sexes for subjective evaluation as per the proforma of Kawabata and Niwa, 1989. They were asked to rate the fabric in batches, first along the blend composition and then along the yarn count for primary hand value and total hand value. Primary hand value comprising of stiffness (Koshi), smoothness (Numeri) and fullness and softness (Fukarami) were rated on 10-point scale where 1 means lowest feeling and 10 means strongest feeling for stiffness, smoothness and fullness and softness. Fabrics were rated by the consumers for Total hand value on 5-point scale where 1 means poor and 5 means excellent. The scores obtained were evaluated by adapting the non-parametric tests viz; Kruskal wallis and Mann Whitney test.

Results and Discussion

The subjective assessment results of pashmina and pashmina blended knitted fabrics on the basis of blend composition are delineated in Table 1. The stiffness score of pashmina and pashmina blended fabrics, which is governed by the flexural rigidity of the constituent fibres and yarn (Shakyawar and Behra, 2009) showed an increasing trend from T₁ to T₅. Within 24 count yarn fabrics, T₁ and T₅ showed a significant difference among each other as well as with other treatments, however, there was a non-significant difference between T₂ & T₃; and T₃ &

T₄. Similarly, for the fabrics made from 36 and 48 count yarn, the scores were found in an increasing trend. Within 36 count yarn fabrics, comparable scores were found between T₁ and T₂; T₂ and T₃; as well as between T₄ and T₅. Within 48 count yarn fabrics, comparable scores were found between T₁ and T₂; T₃ and T₄; as well as between T₄ and T₅. The fabrics rated by the consumers subjectively showed an increasing trend for stiffness from T₁ to T₅, indicating that with the increase in the wool proportion in the blends, the stiffness of the fabric increases. Our results were in agreement with the study of Shakyawar and Behra (2009), who also reported higher stiffness score (> 7) for the pure woolen as well as woolen–synthetic fabric blends. The stiffness score of the cotton and linen fabrics obtained by Behra (2007) were also in agreement with the results of blends having higher wool proportion in our study.

Smoothness value of a fabric is a function of surface characteristics of fibre and yarn used for fabric manufacture (Shakyawar and Behra, 2009). The smoothness scores for the fabrics made from 24, 36 and 48 count yarn was found in a decreasing trend. Within 24 count yarn, T₁ showed significantly higher smoothness scores than other treatments. However, T₃ and T₄ showed non-significant difference among each other. Similarly, within 36 count yarn fabrics, non-significant difference was found between T₁ & T₂; as well as between T₃, T₄ & T₅. Similar trend was also shown by the fabrics made from 48 count yarn. It was revealed that as the proportion of pashmina in the blend increases, the smoothness score also increases. It could be probably because of the difference in the surface characteristics of the wool and pashmina (Shakyawar *et al.*, 2012) as the pashmina fiber is smoother than wool.

Table 1: Effect of blend composition on subjective assessment of pashmina and pashmina blended knitted fabrics without nylon (Mean±S.E)

Yarn count	Blend Composition				
	T1	T2	T3	T4	T5
Stiffness					
24	3.43±0.22 ^a	4.25± 0.22 ^b	4.52± 0.23 ^{bc}	5.00± 0.25 ^c	6.09± 0.24 ^d
36	3.19±0.23 ^a	3.58± 0.25 ^{ab}	4.17± 0.24 ^b	5.54± 0.28 ^c	5.50±0.29 ^c
48	3.07±0.21 ^a	3.56± 0.21 ^a	4.41± 0.23 ^b	4.90±0.24 ^{bc}	5.15± 0.25 ^c
Smoothness					
24	7.78±0.15 ^d	7.15± 0.18 ^c	6.58±0.16 ^b	6.33± 0.18 ^b	5.74± 0.15 ^a
36	7.74±0.19 ^b	7.52± 0.21 ^b	6.31± 0.18 ^a	5.94± 0.18 ^a	5.90±0.22 ^a
48	7.56±0.20 ^b	7.27± 0.22 ^b	6.56± 0.19 ^a	6.39± 0.21 ^a	6.33± 0.22 ^a
Fullness and softness					
24	7.60±0.19 ^c	7.09± 0.17 ^b	6.84± 0.15 ^b	6.69±0.18 ^b	5.88± 0.17 ^a
36	7.52±0.21 ^c	7.19± 0.18 ^{bc}	6.72± 0.18 ^b	6.00± 0.18 ^a	5.96± 0.19 ^a
48	7.41±0.25 ^c	7.23± 0.21 ^{bc}	6.96± 0.18 ^{abc}	6.68± 0.18 ^{ab}	6.43± 0.21 ^a
Total Hand Value					
24	4.17±0.13 ^d	3.64± 0.11 ^c	3.33± 0.09 ^{bc}	3.23± 0.10 ^b	2.74± 0.12 ^a
36	4.17±0.13 ^c	4.01± 0.11 ^c	3.56± 0.09 ^b	2.98± 0.10 ^a	2.70± 0.12 ^a
48	4.25±0.11 ^c	3.82± 0.13 ^b	3.49± 0.13 ^{ab}	3.27± 0.12 ^a	3.11± 0.17 ^a

Means along the rows with different lower-case superscript differ significantly ($P < 0.05$); $n = 50$

Shakyawar and Behra (2009) reported the smoothness score of different woolen and woolen–synthetic fabric blends ranged from 2–4, which was also in agreement with our study. The fukurami value is mainly indicative of softness, compressibility and surface smoothness (Behra, 2007). Within 24 count yarn, non-significant ($P > 0.05$) difference was found in the fullness and softness score between T₂, T₃, T₄, which in turn showed a significant ($P < 0.05$) difference with T₁ and T₅. The fullness and softness score for the pashmina and pashmina blended fabrics made from 36 count yarn showed a non-significant ($P > 0.05$) difference between T₁ and T₂; T₂ & T₃; and T₄ & T₅. The fabrics made from 48 count yarn showed non-significant ($P > 0.05$) difference between T₁, T₂ & T₃; T₂, T₃ & T₄; and T₃, T₄ & T₅ in a fullness and softness score. In general, the softness scores decreased from T₁ to T₅ indicating that by increasing the wool proportion in the blend, the softness of the fabric also decreases. Shakyawar and Behra (2009) also reported the lower softness scores for the different wool and woolen blends.

On the basis of the primary hand value viz; stiffness, smoothness and fullness and softness, the respondents gave an overall acceptability called Total Hand value. The total hand value of 24 count pashmina and pashmina blended fabrics showed comparable scores between T₂ & T₃; and T₃ & T₄. However, T₁ and T₅ showed a significant ($P > 0.05$) difference among each other as well as other treatments. The 36 count fabrics showed a decreasing trend from T₁ to T₅. Non-significant ($P < 0.05$) difference was found between T₁ & T₂; and T₄ & T₅. However, T₃ showed a significant difference with other treatments. The 48-count pashmina and pashmina blended fabrics also showed a score in decreasing trend from T₁ to T₅. Non-significant ($P < 0.05$) difference was found between T₂ & T₃; and between T₃, T₄ & T₅.

In general, the scores obtained for total hand value indicate that T₁ was having a rating ranging from medium to excellent as compared to T₅ which got a score ranging from medium to average. The decreasing trend in the total hand value scores indicates that consumers have liking towards the smoother and softer fabrics. Bumla *et al.* (2012) also reported that the consumers have a better liking towards hand spun pashmina shawls as they rated them with a THV ranging from 3.60 to 4.25. However, Sharma and Pant (2013) reported that as the proportion of the camel hair fibre is increased in the merino: camel blended knitted fabric, the THV score decrease which is not in agreement with our results. This could probably be because of the difference in surface characteristics of pashmina and camel fibre (Ammayappan *et al.*, 2011).

The results pertaining to the subjective assessment of pashmina and pashmina blended fabrics on the basis of yarn count are presented in Table 2. On the basis of yarn count, the subjective assessment of pashmina and pashmina blended fabrics in terms of stiffness showed a decreasing trend from 24 to 36 to 48 yarn count. T₁24 showed significant difference with T₁36 and non-significant difference with T₁48 while the latter two also showed comparable results. Smoothness score showed an increasing trend within every treatment from 24 to 36 to 48 count. The fullness and softness scores within T₁ showed an increasing trend for the fabrics made from 24, 36 and 48 count yarn. Within T₂, non-significant ($P > 0.05$) difference was found between fabrics made from 24 & 36 as well as between 36 and 48. Within T₃, fabrics made from 24, 36 and 48 count yarn showed non-significant ($P < 0.05$) difference.

Table 2: Effect of yarn count on subjective assessment of pashmina and pashmina blended knitted fabrics without nylon (Mean±S.E)

Yarn count	Blend Composition				
	T1	T2	T3	T4	T5
Stiffness					
24	5.05±0.34b	5.09±0.30b	5.27±0.29a	5.35±0.29b	5.38±0.30b
36	4.54±0.29a	4.45±0.28ab	4.74±0.26a	5.11±0.27b	4.74±0.27a
48	3.98±0.29 ^{ab}	4.01±0.27a	4.54±0.24a	3.88±0.23a	4.09±0.26a
Smoothness					
24	6.62±0.19 ^a	6.54±0.20a	6.17±0.20a	6.01±0.22a	5.92±0.21a
36	6.92±0.19 ^{ab}	7.25±0.17b	6.54±0.32ab	6.43±0.19a	6.39±0.18a
48	7.29±0.22 ^b	7.47±0.20b	7.11±0.21b	7.13±0.23b	7.00±0.20b
Fullness and Softness					
24	7.09±0.18 ^a	6.80±0.19a	6.54±0.21a	6.33±0.22a	6.33±0.22a
36	7.07±0.18 ^a	7.05±0.17ab	6.16±0.19a	6.37±0.20a	6.80±0.20ab
48	7.25±0.20 ^a	7.39±0.20b	7.01±0.21a	7.25±0.21b	7.37±0.21b
Total Hand Value					
24	3.39±0.13 ^a	3.47±0.13a	3.39±0.15a	3.11±0.14a	3.07±0.15a
36	3.74±0.10 ^b	3.56±0.09a	3.50±0.13a	3.11±0.11a	3.07±0.12a
48	3.90±0.10 ^b	4.03±0.11b	3.72±0.17a	3.84±0.15b	3.98±0.14b

Means along the column for each parameter with different lower-case superscript differ significantly ($P < 0.05$); $n=50$

The fabrics made from 24, 36 and 48 count yarns within T₄ also showed an increasing trend. Non-significant

difference was found between T₄24 and T₄36 which in turn showed significant difference with T₄48. The full and softness scores obtained for T₅24, T₅36 and T₅48 showed an increasing trend. Non-significant difference was found between T₅24 and T₅36 as well as between T₅36 and T₅48. On the basis of yarn count, the total hand value score obtained on 5-point scale for the fabrics made from 24, 36 and 48 count yarn within T₁ and T₃ showed comparable results. Within T₂ comparable results were shown between T₂24 & T₂36 as well as between T₂36 & T₂48. Similarly, within T₄ comparable results were observed between T₄24 & T₄36 which in turn showed significant difference with T₄48. Non-significant difference was also found between T₅24 & T₅36 as well as between T₅36 and T₅48. The THV score obtained revealed that with the increase in the yarn count, the overall acceptability of the fabrics increases indicating that the customers have a more preference and liking towards the fabrics made from the finer yarn as compared to the thicker yarn of any composition. This could probably be because of the difference in the linear density of yarn utilized for the product development as the handle of the fabric is mainly affected by yarn composition, yarn properties as well as on fabric structure and fabric geometry (Sharma *et al.*, 2015). The trend in the subjective score indicates that with the increase in yarn count of the fabrics, the fabric becomes smoother and softer. As the yarn count of the fabric increase, the total hand value also showed an increasing trend. Since the total hand value is a function of stiffness, smoothness and softness scores, the increase in the THV along the yarn count is because of the increase in smoothness and softness scores and decrease in stiffness scores (Shakyawar and Behra, 2009)

Sofi *et al.* (2018) found that the pashmina and pashmina blended knitted fabrics incorporated with nylon in different proportions showed higher stiffness score and lower smoothness, softness, fullness and total hand value than our study. This reveals that with nylon dissolution, the fabrics become smoother and softer. Behra (2007) also reported that with the decrease in the proportion of synthetic fibres in the linen viscose blend, the stiffness scores also decreases. Similarly, Shakyawar and Behra (2009) reported that with the incorporation of the synthetic fibres in woolen blends, the stiffness score increases while smoothness and softness score decreases. This is in agreement with our study. Bumla *et al.* (2012) also found that THV of machine-made pashmina shawls incorporated with nylon as carrier fibre ranges from 2.30 to 2.55 as against the hand spun pashmina shawls which showed much higher THV score (3.60 to 4.25), indicating that incorporation of nylon in pashmina blends reduced the total hand value which is in agreement with our study.

Conclusion

From the study it was concluded that consumers preferred and showed interest towards the fabrics having high proportion of pashmina with fine count.

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Conflict of Interests

There is no conflict of interest.

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