

Physical Properties of Pashmina Fiber – A Review

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Introduction

Pashmina is known as the “*Soft gold of high asia*”. Pashmina fiber has the unique position among the fiber of animal origin because of its warmth, lightness, handle and its ability to absorb dyes and moisture compared to wool and Mohair (Ryder, 1987).

Pashmina, the finest cashmere fiber has been popular from centuries among royalties and other elites as it is the finest, most luxurious fiber in the world commanding the highest price in the world of textile. Pashmina derived its name from the Persian word “*pashm*” which means “*soft gold*”. It is well known for its fineness, warmth, softness, desirable aesthetic value elegance and timelessness in fashion. The term pashmina is also known as *cashmere*, *Kashmir*, *pashm*, *tiflit*, *tiftik*, *tivit*, *tibit*.

Pashmina can also be defined as the down (undercoat) fiber derived from Cashmere goat with a diameter of 30 micron or less (ASTM, D-123-59). The origin of cashmere goats has been traced to *Capra falconeri* by some workers (Harris, 1962; Misharev, 1963; Epstein, 1963; Epstein 1969; Roberts, 1996) and to *Capra hircus* by others (Kiyatkin, 1968) which is native to Himalayan belt (Von Bergen, 1963). At an elevation of 14500 feet

(4500meter) and above, where temperature rarely dips to -40 OC in winter. To survive the freezing environment, nature has blessed them with a very fine coat of hair which is having best insulation in the world and is six times finer than human hair and most luxurious fiber which is much softer than superfine merino of the same diameter.

Physical Charecteristics

Fiber Length and Diameter

Fiber length is the distance from root of the fiber up to the tip of it and diameter of the fiber represents its thickness/ fineness.

Nazir *et al.*, (2011) studied the quality of Pashmina of Changthangi origin in terms of physico-mechanical properties and reported that the fibre diameter and fibre length of fine and guard hairs observed was found 12.28±0.11 (μ) & 67.77±1.08 (μ) and 49.04±0.19 (mm) & 80.07±0.15 (mm), respectively. Nazir *et al.*, (2012) further reported that the fiber diameter and fiber length of manually and Machine dehaired changthangi pashmina was 12.57±0.64μ, 12.25±0.11μ and 60.33±0.21 (mm), 49.04±0.19 (mm), respectively. It was reported that the greater fibre length in manual compared to machine dehaired Pashmina fibre was due

to the breakage of fibres in machine dehairing. Ganai *et al.*, (2011) reported, fibre length, guard hair length and fibre diameter of changthangi goats, viz: 4.09 ± 0.04 cm, 56.90 ± 2.80 mm and $11.99 \pm 0.22 \mu$, respectively.

Singh *et al.* (2008) studied the fiber diameter and fiber length of guard hair of Chegu Pashmina goats in Himachal Pradesh, and reported the average \pm S.E value as 70.8 ± 12.9 (μ) and 24.0 ± 2.7 (cm) respectively. Sandsiwa (2005) studied the fiber diameter of down and guard hairs of Pashmina from South African indigenous cashmere goats and reported the average \pm S.E as 11.0 ± 0.3 (μ) and 69 ± 3.9 (μ) respectively. Thakur *et al.* (2005) studied the physical properties of Pashmina from Chegu goats in Himachal Pradesh, India, in terms of fibre diameter and fibre length and reported the average \pm S.E values as 14.36 ± 0.29 (μ) and 3.38 ± 0.17 (cm) respectively. Ganai *et al.* (2004) reported the mean fiber length of Pashmina from Changthangi goat as 4.86 cms whereas fiber diameter ranged from 12.16-12.55 (μ). Ramakrishna *et al.* (2004) reported the fibre length of Pashmina from Chegu and Changthangi goats as 5.98 ± 0.03 (mm) and 6.59 ± 0.11 (mm) respectively. They also reported the fibre diameter as 12.96 ± 0.06 (μ) and 13.41 ± 0.14 (μ), respectively, in Chegu and Changthangi Pashmina goats.

Bhattacharya *et al.* (2004) observed no significant sex difference in the fiber length and diameter of Changthangi goats. They reported the fiber diameter and fiber length of Pashmina from male and female Changthangi goats in Ladakh region as 12.9 ± 2.6 (μ) and 13.0 ± 3.0 (μ); 4.25 ± 1.2

(cm) and 4.02 ± 1.5 (cm), respectively. However, Couchman and McGregor (1983b) studied fiber diameter of Australian "Cashmere" goats and reported the average value as 19.0 (μ) and 17.3 (μ) respectively in male and female goats. Further, Yiang and Zhang (1983) reported the fiber diameter in males of Liaoning breed as 16 (μ), whereas in case of females, reported values were 17 (μ). Al'Meev and Makhmudkhodzhaiv (1985) reported average fiber length in male and female Kirgiz goats as 10.6 cm and 8.5 (cm), respectively.

Devillers *et al.* (2000) studied the effect of environmental condition on Cashmere fiber diameter in different area of Kawazulu Natal (South Africa) viz; Pongola, Bartlow and Colenso and reported the average \pm S.E value as 15.2 ± 0.9 (μ), 14.7 ± 0.23 (μ) and 15.3 ± 1.35 (μ), respectively. Deb (1998) evaluated the quality of Changthangi Pashmina in terms of fiber length and fiber diameter and reported the mean values as 5.80 (cm) and 13.20 (μ) respectively. Wani *et al.* (2004) reported the fibre diameter of Pashmina dehaired by machine and Hand as 12.66 ± 0.16 (μ) and 13.19 ± 0.62 (μ), respectively.

Kloren *et al.* (1993) observed the fiber diameter of Australian Pashmina from young goats and older ones as 13.68 (μ) and 15.68 (μ), respectively and reported that fibre fineness varies significantly between different age groups. Koul *et al.* (1990) evaluated the quality of Pashmina obtained from male and female Chegu goats of various age groups viz; 0-1, 1-2, 2-3 and above 3 years in terms of fibre diameter (μ) and fibre length (cm).

They observed the average fibre diameter of 11.3 μ , 12.0 μ , 12.0 μ and 12.8 μ in males and 11.7 μ , 11.9 μ , 12.0 μ and 12.0 μ in females, respectively, whereas the fibre length observed was 5.0 cm, 5.8 cm, 7.7 cm and 7.0 cm in males and 4.9 cm, 6.0 cm, 5.8 cm and 5.8 cm in females, respectively. This explains that with the advancement of age, both the fibre diameter and fibre length increases in both sexes, however, the increase in fibre length of males was higher compared to females.

Ahmad and Gupta (1990b) reported the fiber diameter and fiber length of Changthangi Pashmina as 13.37 (μ) and 5.58 (cm) respectively. Ahmed and Gupta (1989a) reported that the fiber fineness of Pashmina ranges from 11.6 and 15.4 micron where as the mean fibre length was reported as 50 (mm). Miller (1986) assessed quality of both under coat and guard hair and reported the fiber diameter and fiber length as 11-18 (μ) & 60-90 (μ) and 2-9 cm & 12.6-13.5 (cm), respectively. Thus a significant difference in fibre length and fibre diameter of under coat and guard hair of Changthangi goat was observed. Teasdale *et al.* (1985) studied the fibre diameter of Iranian Cashmere, Chinese Cashmere and Mongolian Cashmere and reported that the value ranged from 15.4 to 18.6 (μ); 14.9 to 17.9 (μ) and 15.3 to 15.5(μ) respectively. Anjunyulue *et al.* (1984) reported that the fibre diameter and fiber length of Changthangi goats ranged from 11.6-12.1 (μ) and 4.03-6.2 (cm) respectively. Patni *et al.* (1988) reported the fibre diameter and fibre length of Pashmina as 10.3 (μ) and 30.5 (mm) respectively. They also reported

the fibre diameter and fibre length of guard hairs as 48.4 (μ) and 50.7 (mm) respectively. Couchman and McGregor (1983a) reported the average fiber diameter in feral Pashmina goat as 13.4 \pm 19.0 (μ). Darokhan and Tomer (1983) reported the fiber diameter and length of Changthangi goats as 12.05 (μ) and 4.95 (cm), respectively, at its first combing. Mazumdar and Mazumdar (1983) studied the quality of Pashmina from the Chegu goats and reported that the fiber length and fiber diameter ranged from 4-10 cm and 8-15 microns respectively. Zaporozhtsev (1983) evaluated the quality of Pashmina fiber in Don Breed of Pashmina goat in terms of fiber diameter and fiber length and reported that the values ranged from 16.1-23.7 micron and 9.1-13.5 cms respectively. Acharya (1982) reported the mean fibre diameter and fibre length of Pashmina of Changthangi goats as 13.86 \pm 0.07 (μ) and 4.95 \pm 0.11 (cm), respectively, whereas in Chegu goats he reported the average \pm S.E values as 11.71 \pm 1.2 (μ) and 5.9 \pm 0.1 (cm) respectively. Holst *et al.* (1982) reported the mean fibre length and fibre diameter of Pashmina from Australian feral goats as 5.5 (cm) and 15.9 (μ) respectively. Vasil'ev, (1982) evaluated the quality of Pashmina fiber from Altai mountain goats in terms of fiber diameter and fibre length and reported that the value ranges from 16.2-18.5 (μ) and 5.2-9.0 (cm), respectively. Ying, (1982) studied the quality of Pashmina fiber in Iranian goat in terms of fiber diameter and fiber length and reported the value as 15.5 \pm 18.6 (μ) and 5 to 6.7 (cm), respectively. Al'Kov

and Kraskova, (1981) observed that the fiber diameter and fiber length of Pashmina in Altai Mountain breed of Pashmina goat ranged from 16.2-18.5 (μ) and 5.2-9.0 (cm) respectively. Sahni, (1981) studied the quality of Pashmina in terms of fiber length and fiber diameter in Chegu goats and reported that values range from 4-6.20 (cms) and 11.30-12.00 (μ), respectively. Acharya and Sharma (1980) studied the fibre diameter and fiber length and reported the mean \pm S.E values as 12.7 ± 0.17 (μ) and 4.95 ± 0.11 (cm), respectively. Chovatel, (1979) studied the quality of Pashmina obtained from Mongolia goats and reported that the fibre length and fibre diameter ranges from 4.9-5.0 (cm) and 15.5-20.6 (μ) respectively. Dauletbaev and Aryngaziev (1978) reported the mean fiber diameter of Pashmina fibre from Kazakh goats as 15.9 (μ). Shrikhande and Rathore, (1978) studied the fiber diameter of guard hairs of Indian goat and reported the average value as 113.11 ± 2.64 (μ). Zaporozhtsev, (1978) studied the quality of Pashmina fiber in terms of fiber diameters from Volgograd Pashmina goats and reported the mean value as 12.8 (μ). Malinovich, (1976) reported that the fiber length of Pashmina from Orenburg goats ranges from 5.3-10.4 (cm), where as fiber diameter ranged from 15.6-17.9 (μ).

Yield

Ganai *et al.*, (2011) reported that overall fine hair and guard hair percentage in Changthangi goats was $62.36 \pm 2.56\%$ and $31.98 \pm 2.94\%$, respectively. Ramakrishna *et al.*, (2007) studied the

performance of Pashmina goats (Chegu, Changthangi, Chegu x Changthangi and Chegu x local) reared at Mukteswar (2100m MSL) in terms of annual yield, length and diameter of Pashmina fibres over a period of 5 years (2000 to 2004). The average annual yield of Pashmina was 101.77 ± 2.89 (n-367) g/goat. The average length (cm) and diameter (μ m) of Pashmina fibres were 5.98 ± 0.03 cm (n-292) and 12.88 ± 0.54 μ m (n-292), respectively. The yield of Pashmina linearly increased with the age of the goats. There was none significant ($P < 0.10$) increase in average annual yield (g/goat) of Pashmina in males (116.96 ± 9.00 (n-68)) compared to females (98.32 ± 2.86 (n-299)). The length and diameter of the Pashmina fibres were higher in the goats which yielded more quantity (g/goat) of Pashmina.

Mishra *at el.* (1998) studied the productivity of Pashmina from individual changhthangi goats and reported the Mean \pm S.E Pashmina yield in their 1st, 2nd, 3rd, 4th and 5th clips as 78 ± 6 (gm), 159 ± 9 (gm), 227 ± 9 (gm), 191 ± 10 (gm) and 195 ± 20 (gm), respectively. Ganai *et al.* (1995) reported the highest Pashmina yield in first and third clip of Pashmina in changhthangi goat as 170.8 (gm) and 244 (gm), respectively. Thus with the subsequent clips, the pashmina yield of Changthangi goats increases significantly.

Koul *et al.* (1990) observed the average yield of Pashmina from Chegu goats, both male and female of different age groups viz; 0-1, 1-2, 2-3 and above 3 years as 62.3 (gm), 98.9 (gm), 192.9 (gm) and 168.6 (gm) in males and 64.0(gm,

100.1 (gm), 118.7 (gm) and 125.4 (gm) in females, respectively, and reported that the pashmina yield from Chegu goats increases significantly with the advancement of age in males compared to females. Anjunyulue *et al.* (1984), also, reported that the average yield of Pashmina in males (65-170 gm) was higher compared to female (65-123 gm) Chegu goats. Couchman and McGregor (1983b) reported the average yield of Pashmina in adult male and female of Australian Pashmina goat as 701 (gm) and 357 (gm), respectively. The average Pashmina yield of 565 (gm) and 491 (gm), respectively, from male and female Liaoning breed was reported by Yiang and Zhang (1983). Al'Meev and Makhmudkhodzhaiv (1985) reported average Pashmina yield of 436 (gm) and 433 (gm), respectively, in male and female Kirgiz goats.

Acharya and Sharma (1980) reported the average yield of Pashmina from Changthangi Pashmina goats as 270 gm/animal with scouring yield of 65.28 ± 2.08 (%). Devillers *et al.* (2000) studied the effect of environmental condition on Cashmere clean yield percentage in different area of Kawazulu Natal (South Africa) viz; Pongola, Bartlow and Colenso and reported the average \pm S.E value as 76.3 ± 7.4 (%), 69.9 ± 12.7 (%) and 81.9 ± 10.9 (%), respectively. The average Pashmina yield of 75.30 ± 3.71 (gm) of Changthangi goats at its first combing was reported by Darokhan and Tomer (1983). Whereas, average yield of 214 (gm) of Pashmina from Changthangi goat was reported by Acharya (1982).

Guard Hair & Undercoat Percentage

Nazir *et al.*, (2011) studied the quality of Pashmina of Changthangi origin in terms of physico-mechanical properties and reported that undercoat percentage on weight/weight and number /number basis was 76.01 ± 0.32 (%) and 87.52 ± 1.12 (%), respectively. Ahmed and Gupta (1989a) reported the average undercoat and guard hair percentage on weight by weight basis as 71.07 (%) and 28.93 (%) while on number by number basis as 87.18 (%) and 12.82 (%), respectively. Russel (1985) evaluated the under coat percentage on weight/weight basis in Scottish Pashmina goats and reported that the value ranges from 13-60 (%). Ying and Zhang (1982) reported that under coat percentage on weight by weight basis ranged from 22 to 88 (%) in Chinese breeds of Pashmina goats. Wani *et al.* (2004) studied the effect of machine dehairing and manual dehairing on guard hair percentage, and reported the values as 58.51 (%) and 26.09 (%), respectively. An undercoat percentage of 46.6 (%) and 45.5 (%), respectively, of adult male and female Australian Pashmina goats was reported by Couchman and McGregor (1983b). Further, Couchman and McGreger (1983a) reported that the percentage of undercoat on weight by weight basis ranged from 22 to 60 (%) in Indian breeds, 36-96 (%) in Soviet breeds, and 8-58% in Australian feral goats.

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