



# Revitalising Kambli: From Insight to Intervention

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## Abstract:

Each region in India has its unique fabric, which has its own cultural significance and is created using traditional weaving techniques. The Kambli fabric is woven from Deccani wool, which is inherently coarse. This study aimed to understand the shortcomings that hinder this fabric's effectiveness. To study the craft in-depth, a field study was conducted in the village of Karagaon in Belgaum, Karnataka. A systematic design intervention was formulated to devise methods to address the issues of coarseness and stiffness of the fabric. Experiments were conducted to test treatments and analyse results. The results of the experiments conclude that Kambli swatches prewashed and desized with soap nut, when agitated and scrubbed in hot water, are an effective way to reduce coarseness.

## I. Acknowledgements

The author is grateful to all the shepherds, spinners and weavers who cooperated for this research study. This research is a collaborative project with Vimor Handloom Foundation for their 'The Kambli Project' which aims to uplift the weavers of Karagaon, Belgaum, Karnataka.

## II. Introduction:

The Indian handloom industry significantly contributes to the country's economy, providing employment to over three million people<sup>[1]</sup> and generating an annual turnover of approximately Rs.49,476 crores.<sup>[2]</sup> Apart from silk and cotton, wool is a major raw material used to weave shawls, blankets, floor coverings, jackets and much more as per the demand and preferences of the consumers.

Wool is considered one of the oldest natural fibres used in the world and is obtained from sheep, alpacas, goats, and llamas. Wool is versatile and known for its warmth, durability, and flexibility.

The Kurubas, a pastoral tribe spread across Karnataka, have been involved in sheep rearing and weaving of coarse woollen blankets for over 500 years.<sup>[3]</sup> The community rears black Deccani sheep, which provide them with coarse wool. This wool is spun and woven into traditional blankets or druggets known as Kambli.

Kambli weaving is prevalent in North Karnataka, where it has a multipurpose use as blankets, coverings and rugs and is more than just a fabric for the community. As the Kurubas revere their sheep, they believe the Kambli to be a physical manifestation of their devotion. Its deep connection with the community is the reason for the weaving techniques to be free from any synthetic chemical or mechanised tools.

Despite modernisation, the weavers of Kambli have retained their traditional practices. All facets of sustainability -social, economic, and environmental are captured by the processes followed by the community. However, the Indian wool market has shifted to softer, longer-staple wool from New Zealand, Australia, and the Middle East, leading to a decline in traditional occupations, artisan migration to cities for employment and the loss of livelihoods.

### III. Kurubas and Kambli:

The Kurubas are a pastoral community whose name originates from the Canarese root 'Kuru' and Tamil root 'Kori,' meaning sheep, and 'ba,' meaning to protect.<sup>[3]</sup> They are known for their sheep rearing and also as wandering pastoralists.

According to Edgar Thurston<sup>[3]</sup>, they are descendants of 'Undala Padmanna', who was blessed by Lord Shiva to rear sheep. The Kurubas also believe they were created by Lord Shiva, who created the black sheep from his matted hair for them. The evidence of Kurubas being an ancient tribe comes from their mention in the Vayupuran as *Kumanas* and in the *Matysapuram* as *Kupathas*.<sup>[4]</sup>

The Kurubas are descendants of the *Pallavas*, a ruling clan of Southern India<sup>[5]</sup> from the 4th century to the late 9th century<sup>[5]</sup>. With the decline of the *Pallava* dynasty in the 8th century and the Chola dynasty's rise in the late 8th century<sup>[3]</sup>, the Kuruba authorities were affected. During *Chola* King *Adondai*, the Kurubas were scattered all over the Deccan. Some fled to Nilgiris, Wayanad and Coorg and were named *Kurumbas*.

Kambli weaving is a fundamental part of Kuruba culture and identity, embodying their artistic, economic, and social values. Kambli is much more than just a piece of woven cloth to the Kurubas; it is an integral part of their lifestyle. It serves a practical purpose by protecting nomadic shepherds from harsh weather conditions, and it is also an important source of income for many Kuruba families who have passed down the craft through generations as a family tradition.

The sect of Kurubas involved in Kambli weaving is known as 'Devanga Kambli'.<sup>[3]</sup> The Bellary Manual of 1872<sup>[3]</sup> mentions that the Kamblis were great articles for export and were also sent across the country. Kambli weaving was a thriving industry which fell apart over time.

The Kambli is a durable and warm fabric ideal for harsh terrain use. Understanding the cultural heritage associated with this fabric is crucial to revive the craft. Unfortunately, many varieties of Kambli have become obsolete, and the craft clusters have faded away due to low wages and people moving to urban areas. The fact that this utilitarian fabric is gradually disappearing from our memory and the lack of recognition given to this industry is a matter that requires attention.

### IV. Specific Objectives of the Study:

1. To identify gaps and shortcomings in the weaving process that hinder the effectiveness of the blanket.
2. Explore possibilities of introducing sustainable methods that reduce the stiffness and coarseness of the fibres of the Kambli fabric.

## V. Methodology:

The study had a descriptive design combined with an exploratory research method. The study aimed to understand the shortcomings that hinder the Kambli fabric's effectiveness. To study the craft in-depth, a field study was conducted in the village of Karagaon in Belgaum, Karnataka. A systematic design intervention was formulated to devise methods to address the issues of coarseness and stiffness of the Kambli fabric. This involved investigating existing wool treatments worldwide and customising them for Kambli artisans. Experiments were conducted to test treatments and analyse results.

## VI. Deccani Wool:

The Kurubas rear the Deccani sheep, an indigenous North Karnataka breed. The wool yielded from Deccani sheep is called Deccani wool- the primary raw material in Kambli weaving. Among the Indian indigenous breeds, Deccani and Marwari breeds are the most important.<sup>[7]</sup> The wool produced by Deccani sheep is coarse and stiff. Due to its coarse nature, the Deccani wool fails to compete with the imported softer wool like Merino wool, leading to a diminishing market for Deccani wool and its woven fabric- Kambli.



Fig 1- Deccani sheep grazing on a sugarcane field

The most crucial factor in determining a fibre's grade and spinnability is its diameter, followed by its staple length. Moreover, one characteristic feature of Indian wool is medullation- a longitudinal hollowness in the fibre that gives carpets much-needed strength. Medullation is counted in three terms: hetero, hairy and kempy, and almost all coarse fibres are medullated.<sup>[6]</sup> With a projection microscope, the diameter of the medulla is measured.<sup>[6]</sup>

Most of the wool produced in India is of coarse grade and unfit for usage in apparels. Only 5% of the wool produced in India is used to make carpets, even though 85% is appropriate for that purpose.

The South Indian states of Karnataka, Andhra Pradesh, and Tamil Nadu provide 25% of India's total wool production.<sup>[6]</sup> The main sheep breeds in south India that produce wool are Deccani, Bellary, and Coimbatore breeds. The primary purpose of raising these breeds is for meat, not for wool. Their wool is extremely coarse, has fibres larger than 50 microns in diameter, and contains a higher percentage of medullated kemp fibre. <sup>[6]</sup>

There is opposition to the Deccani wool in the clothing industry since the garments woven would be stiff, scratchy, and prone to shedding from fibre breakages.<sup>[8]</sup> Therefore, there is a need to utilise this wool creatively and effectively. Efficient processes that are technologically and environmentally significant need to be discovered to add value to this wool which will help sustain livelihoods and preserve the indigenous breeds.

Apart from its use in textiles, it has been suggested that coarse wool can be used in agriculture as a water conservation medium.<sup>[6]</sup> Wool has the property of retaining moisture which can aid in plant growth. Wool also comprises high quantities of nitrogen, sulphur and carbon. It can also act as a slow-release fertiliser during its partial breakdown by alkaline hydrolysis. <sup>[6]</sup>

Coarse wool can also be used in acoustic ceiling panels, bed covers, filtration, buildings and insulation sheets. It has the potential to be transformed into a versatile material with the help of biotechnology, nanotechnology and other enzyme treatments.<sup>[6]</sup>

However, experimentation on the Deccani wool to soften its fibres using various enzyme treatments has yielded some positive results. Enzymes are considered natural substances and can be easily broken down in the environment. They are efficient in carrying out their functions without leaving any harmful residue, and they also have the ability to soften fibres.<sup>[8]</sup> Enzymes have been used in the textile industry for a long time, mainly for cellulosic fibres. The use of enzymes for protein fibres is limited, but it is possible to alter the properties of these fibres through enzyme treatments such as proteases which can be used for processing wool and silk.<sup>[8]</sup> However, many indigenous communities do not have access to enzyme treated wool or possess the skills required to conduct these experiments on their own.

Studies suggest that while dealing with traditional communities, an effort is required to provide a solution that, taken as a whole, can be reasonable yet sensitive to a holistic social design.<sup>[9]</sup> For a long time, rural India has had micro and small-scale enterprises that relied on traditional skills. Entrepreneurship has recently become a more modern and dynamic concept.<sup>[10]</sup> It is essential to devise methods that make rural businesses self-sustainable within their scope of knowledge and resources. Therefore, there is a need to develop effective strategies to develop the Deccani wool industry using methods which empower the community and aid their financial growth.

## VII. Craft Cluster of Karagaon:

Karagaon is a small village of the Kuruba community located in the Chikodi taluka of Belgaum district, about 8 km away from the nearest town, Chikodi. It covers an area of 1130.2 hectares and has a population of 3,308 people, with 1,666 males and 1,642 females.<sup>[11]</sup> Previously, the village used to produce 100 Kamblis per day through weaving, but due to decreased demand, the weavers have now turned to other livelihoods such as farming, animal husbandry, and daily wages labour.

The village of Karagaon has less recognition from the outside world. Presently, there is only one family in the village which practices Kambli weaving full-time. The preliminary survey shows that many residents of the village know Kambli weaving however only weave occasionally. Besides, many of the younger generation have little knowledge about their community's rich history. Few social workers and master weavers connected to Kambli are aware of the importance of Kambli weaving and are actively involved in preserving this heritage.

Apart from the limited market for the weavers of Kambli, Karagaon faces challenges of less infrastructural developments like proper transport facilities and being unexposed to the modern markets. The weavers are also hesitant to adapt to the changing market demands as they have a staunch belief in their traditions and cultural identity.

Vimor Handloom Foundation started a design upskilling and training programme for the weavers of Karagaon in 2019. 'The Kambli Project' aims to uplift the weavers and help them adapt to the modern market. With constant support and market awareness programmes, the weavers are slowly gaining confidence to weave and are opening up to new ideas.

The major challenge faced by the weavers to sell the Kambli is the coarseness of the fabric. The field study showed that for the weavers to grasp the required design interventions, the interventions should be within the scope and knowledge of the weavers. This should involve the effective use of locally available materials and traditional knowledge to create sustainable and context-specific solutions for the weavers of Karagaon.



### VIII. Weaving Process of Kambli:



Fig 2- Kambli weaving in progress

The weaving practised in Karagaon is an example of the weaving done in ancient India. The weavers use a primitive make-shift pit loom to weave the Kambli. The entire loom is fashioned using 12-13 sticks, with no heald shafts or foot pedals. The entire loom is constructed on the spot while weaving and then dismantled. The loom is called *Kuni magga* by the weavers, and weaving is known as *udhyoga*.

The weavers use locally available materials during weaving. There is an absence of any synthetic material in any process. The weaving process checks all three facets of sustainability- environmental, social and economic viability.

#### Carding and spinning:

- Wool is sourced from local shepherds and carded using the carder's bow.
- Thigh reeling technique and drop spindle are used for spinning.
- No dyeing is involved, and natural colours of wool are used.
- Women perform both carding and spinning.

#### Warping:

- Warping takes place at a 45-degree angle using a makeshift warping frame made of 3-4 sticks.
- The entire family helps in the process.
- Tamarind seed paste is used to size the warp yarns with the help of dry brush root called *kuchigi*.
- The warp is left to dry overnight or as required.
- The *bechhari*, an attachment resembling a heald or reed, is rustled up.
- The warp yarns are counted and measured using sticks.
- Only the two master weavers of Karagaon, know how to construct a warp.

**Loom setting:**

- The warp is wound up on a stick and carried inside the weaving workshop.
- The warp is attached to the rope, wound around the warp beam or *tankol*.
- Another end of the warp frame is wound up to the cloth beam or *Padu*, which is anchored to the *nalige goota*.
- The *jantar*, *agla katti*, *beyoun* (beater and shed sticks) are inserted into the warp and attached.
- The weavers say a small prayer, and the weaving commences.

**Weaving:**

- Only plain weave is woven, and the shed is operated by inserting and removing a large thick wooden stick called *beyoun*.
- The weft is very faintly seen on the surface of the fabric.
- During weaving, the yarns are dampened with water to revive the dried starch.
- If the weaver has to add any design, he has to do it manually.
- Weaving is not complicated; one piece of 5 ft can be finished daily.

**Washing and Drying:**

- After weaving, the fabric is finished, offered to God, and hung in sunlight for a day.
- The fabric is washed with normal-temperature water, and no detergent is used.
- The fabric is dried in sunlight; sometimes, wood ash is rubbed to disinfect it and keep the mites at bay.

**IX. Analysis of Indigenous Wool Treatments:**

To revive the Kambli ecosystem, finding ways to soften the Kambli without disturbing the traditional methods is important. While customers prefer softer blankets, the Kuruba shepherds prefer the coarseness of Kambli for protection. According to master weaver Ningappa Shankar Sannaki, Kambli softens with use, and older ones are softer than newly made ones.

Indigenous communities globally have developed eco-friendly and sustainable methods of processing wool using locally available materials. To help Kambli weavers, a study was conducted on traditional wool processing techniques worldwide to develop a strategy.

Namda is one of the textile crafts which is made of felting wool.<sup>[12]</sup> The Pinjara and Masuri communities of Kachchh are employed in Namada making. Felting is an effective method to utilise coarse wool. Felting is also carried out in places in Maharashtra, where Deccani wool is used to make felts.<sup>[13]</sup> Felts are a versatile material used for a wide range of products. Coarse wool is often utilized by making felts which are then converted into a wide range of products.

There is a popular method used in the manufacture of Pashmina shawls. After carding, powdered rice is sprinkled on the woollen fibres.<sup>[14]</sup> They are covered and left for two nights. After cleaning and spinning, again the yarns are soaked in rice water starch for 2-3 days.<sup>[14]</sup> Rice starch comprises two types of molecules, amylose and amylopectin, which are both polysaccharides.<sup>[14]</sup> Polysaccharides are natural binding agents as they are adhesive and viscoelastic. Initially, the Karagaon weavers had tried to use rice starch instead of their conventional tamarind seed paste, but this experiment did not yield good results as the yarns stuck with each other. Due to the unavailability of a heald shaft and modern looms, the yarns tend to stick with each other and hamper shed formation. Therefore, they avoid using rice starch.

Peruvian weaving by the Quechua community is quite similar to the weaving of Kambli. Here too, the women spin the yarn using the drop spindle technique, and their weaving is also warp-faced.<sup>[16]</sup> Peruvian weaving involves the dyeing of the woollen yarns which is absent in Kambli weaving. The Quechuas wash the woven cloth in warm water and natural soap. Afterwards, the fabric is dried in sunlight and brushed or combed to soften the fibres.<sup>[16]</sup>

After weaving, Kambli was steeped in boiling water during Colonial India and then rubbed against a rough coir mat.<sup>[15]</sup> The fabric was rolled up, and then the weavers rubbed it backwards and forwards across the matting, keeping it wet with hot water all the time. This process took three hours. This made the fabric compact and smoothed it. This same technique was followed in Kurnool<sup>[3]</sup> where *jadi*, or superior quality of Kambli, was woven without the tamarind seed paste. This process was done by rubbing the fabric until the texture became smooth.<sup>[3]</sup>

Wool naturally tends to felt as it has microscopic scales on its surface. When subjected to moisture, heat and agitation, the scales lock together to form felt. Fulling is a method of producing felted fabric from an already woven or knitted fabric. This technique is usually done to revive old woven textiles or to soften the fabric.<sup>[17]</sup> After fulling, usually the fabric becomes fuzzy and is sheared. The amount of shearing and teaseling would depend on the type of wool. Fabric made from curly wool would need to be sheared multiple times.<sup>[17]</sup>

Fuller's Earth was used for the fulling process in Cyprus around 5000 BC.<sup>[19]</sup> The usage of fuller's earth has been recorded in Medieval Europe, Ancient Egypt and Ancient Rome.<sup>[19]</sup> In Mesopotamia, materials like soda ash were used to full the wool.<sup>[19]</sup> Fulling was avidly practised in almost all wool manufacturing communities.

Another ingredient to wash wool and soften it was soda ash.<sup>[18]</sup> This method originated in Ancient Greece. It involves boiling the wool in water, soda ash, and oil for several hours.<sup>[18]</sup> The Egyptians used animal fats or vegetable oil mixed with a soda ash substance called 'Trona'. The alkaline soda ash and the oil, soften the wool fibres and make them more pliable.<sup>[18]</sup>

Washing is an essential part of caring for the clothes. In Ancient India, the job of washermen was to clean clothes and restore their colour and smoothen them. *Manu*<sup>[7]</sup> had written down rules for washing clothes. He suggested that woollens and tasar silk be washed with alkaline earth, Tibetan shawls (*kutupa*) with *arista*, and fine silk with the pulp of a *bact* fruit and linen with a ground paste of white colza seeds (*svetasarsapa*).<sup>[7]</sup>

The methods to wash fabric have been described in papyrus coming from Egypt.<sup>[20]</sup> The most common method of washing woollens and linen was soaking them in urine. It was believed that ammonia present in urine acted as a stain remover and cleaning agent. This method is believed to originate in Ancient Rome.<sup>[20]</sup> Many parts of Europe in medieval times also practised this method of washing wool.<sup>[17]</sup>

While scouring wool, the wool is clean of all impurities, including grease. Sometimes grease in the form of lanolin or oils is reapplied to the wool to make them softer and more durable. Lanolin is a natural wax found in sheep's wool that is washed away during scouring. Lanolin is extracted and made into lanolin wax which is reapplied to wool during carding or spinning.<sup>[21]</sup> Archaeologically this process was widely used in Ancient Rome.<sup>[20]</sup> Other than lanolin, the wool is soaked in an oil bath in some parts of the world. This oil bath contains warm water mixed with oils like olive, lard, coconut, castor or sesame.<sup>[24]</sup> Oil is also added during the cleaning of wool fabric, it is added to soapnut<sup>[25]</sup> or soda ash bath<sup>[18]</sup>. Kuruba women, while 'thigh-reeling' also add sesame oil to the wool, which helps soften them and prevent skin abrasion.

Using locally available materials were popular before the advent of synthetic detergents. Many South Asian communities used soapnuts to wash their clothes. Pashmina is also washed with soapnut after weaving.<sup>[14]</sup> Studies have shown that soap nuts contain 17.2% extractable saponins, which have cleansing properties.<sup>[23]</sup> Uppal and Sarin, in the work 'Detergent Value of Soapnut'<sup>[23]</sup> hypothesised that certain gums present in soap nuts would have a sizing effect on the fibres. This study concluded that soap nut powder is a highly effective washing agent.

According to 'Surface Analysis of Fermented Wheat and Rice Starch Used for Coating Traditional Korean Textiles', fermented starch from wheat, rice, potato and jaggery was found to be more effective in washing laundry because it showed significant

improvement in the physical properties of textiles, their smoothness, gloss, whiteness and comfort. Moreover, it also provided an antiseptic effect.

Similarly, pastoral communities in the Gandhara (now Kandahar) region soaked the wool in water, sour milk and jaggery for several days. Casein, which makes up 80% of milk protein, has numerous properties and is widely used as a binding agent in the glue, paint and paper industries.<sup>[22]</sup> The acid in the sour milk breaks down the natural wax coating on the wool fibres, making them softer.<sup>[26]</sup> The slight acidity of sugar can help to break down some of the hard water minerals and soap residues that can contribute to the stiffness of the fabric, resulting in a softer texture. Sugar has humectant properties, which can help attract and retain moisture and further contribute to a softer feel.<sup>[27]</sup> In Mongolia, the Buryat people use fermented mare milk and flour to soften wool fibres. These techniques soften the wool and add unique properties to the material, such as antimicrobial and moisture-wicking qualities.<sup>[28]</sup>

Apart from these, vinegar<sup>[36]</sup>, neem leaves<sup>[31]</sup>, quinoa<sup>[31]</sup>, banana sap<sup>[32]</sup> and wood ash<sup>[20]</sup> are used by many indigenous communities to treat wool and make it functional. These techniques are rudimentary but easily confer to the social dynamics of the community practising them.

### X. Experimentation:

From the insights of indigenous wool treatments followed by various communities worldwide, experiments were performed on 6" x 6" swatches of unwashed Kambli.

These experiments were performed on the field to get real-time results that suit the Karagaon weavers' socio-economic conditions and are also within their scope of knowledge and skills.

Tamarind seed paste, applied as a sizing agent to the yarns, stiffens up the Kambli fabric after it has been woven. Generally, the weavers of Karagaon wash the Kambli fabric in running water as they feel it would soften over time. After washing, the weavers also apply wood ash to the Kambli to prevent damage due to mites.

The aim of these experiments is to deduce a method for the Kambli which helps to soften the coarse woollen yarns with minimal effort. Details of the experiments are discussed below. A comparison of the experiments is shown in Table 1 and 2.



Fig 3- Kambli Washing



Experiments	Aim	Method	Analysis	Cost
1. Washing in running water in intervals	This experiment was conducted to get a clarity on the amount of washes it takes to remove the tamarind starch.	Two Kambli swatches (Swatch A and Swatch B) were washed in running water at room temperature. Swatch A was washed twice and Swatch B was washed four times. No additional detergent or ingredient was added. The swatches were then left to dry in sunlight.	Swatch B was less stiff than Swatch A when wet. However, after drying, Swatch B was found to be stiff and did not record significant change.	n/a
2. Washing using boiling water	Hot water helps to break down any impurities in the fabric and makes them more soluble in water. Moreover, applying agitation to fabric boiled in hot water fulls the fabric. This experiment was conducted to analyse the effectiveness of hot water wash in the removal of tamarind starch from the Kambli fabric.	A 6" x 6" unwashed swatch was boiled for 30 minutes in water in a stainless-steel utensil, and then scrubbed using a cloth brush with occasional dips in hot water.	The hot water wash removed maximum tamarind seed paste and ash used by the weavers to protect the fibres from mites. The removal of the tamarind starch reduced the stiffness of the fabric. However, this raised the naps in the swatch. Minimal stiffness was observed in the swatch after drying.	n/a
3. Washing the swatch using soapnut	Soapnut or <i>reetha</i> is a natural soap extracted from the <i>Sapindus</i> tree. Soapnuts are known for their cleansing and conditioning properties. This experiment was conducted to analyse the effectiveness of soapnut washing of Kambli swatch to remove the tamarind starch and conditioning of the fabric.	The experiment used a 6" x 6" unwashed swatch, which was boiled in a mixture of water and 10 gm of soap nuts that had been soaked overnight. The swatch was boiled for 30 minutes, washed with running water, and left to dry in the sun.	Washing the swatch with soapnut improved its smoothness and cleaned the swatch completely of tamarind starch and ash.	Cost of 1kg soapnuts: Rs 65-70  Total Cost: Rs 0.65/ swatch and Rs 6.5/ 5ft fabric
4. Washing the swatch using vinegar and baking soda	Vinegar is used in traditional wool treatments as a rinse after washing. This is because wool is naturally acidic, and washing with soap or other alkaline substances can make it stiff and brittle. Baking soda possesses mild alkaline qualities which helps to break down grease.	The experiment involved using a 6" x 6" unwashed swatch, which was soaked in a mixture of 5gm baking soda and 20 ml white vinegar diluted with 250ml warm water for 30 mins. The swatch was then washed with running water and left to dry in the sun.	Washing the swatch with vinegar and baking soda did not remove the tamarind starch or ash from the fabric.	Cost of 100 gm baking soda: Rs 30, Cost of 1l vinegar: Rs 40  Total cost: Rs 11.5/ swatch and Rs 115/ 5ft fabric
5. Washing the swatch using soapnut and vinegar with baking soda.	Soapnut is an effective cleaning agent and removes maximum tamarind starch and ash which makes the swatch less stiff. However, this made the fabric swatch fuzzy. Vinegar is acidic in nature and when used with baking soda, it is known to reduce the fuzziness of the fabric.	The experiment used a 6" x 6" unwashed swatch which was boiled in a mixture of soap nuts and water for 30 minutes, then washed under running water. Later, the swatch was soaked in a mixture of baking soda, white vinegar, and warm water for 30 minutes, followed by another round of washing under running water and left to dry in the sun.	This experiment reduced the stiffness of the swatch and showed minimal effectiveness in smoothening down the fuzziness. After drying the fabric retained the smell of vinegar.	Cost of 1kg soapnut: Rs 65-70, Cost of 100 gm baking soda: Rs 30, Cost of 1l vinegar: Rs 40  Total cost: Rs 12.15/ swatch and Rs.

				121.5/5ft fabric
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Table 2: After wash Treatments

Experiments	Aim	Method	Analysis	Cost
6. Scrubbing and Shearing Method	Fulling is a process that involves shrinking and matting wool fibers to create a dense, compact fabric with improved durability and insulation properties. Fulling is also done to coarser wool fabric to smoothen them.	A 6" x 6" swatch previously washed with soapnut was used. It was boiled in 500ml water and agitated with a cloth brush in a soapy solution of hot water and soapnuts for 30 minutes. The swatch was dried in sunlight and its fuzziness was reduced by dry brushing and shearing the naps with a blade/razor.	The fulling shrunk the fabric swatch 0.5" in warp direction and 1" in the weft direction. The fulling and shearing also helped to reduce the fuzziness of the fabric and made it significantly softer.	n/a
7. Soaking the swatch in an oil bath	Reapplying grease to wool is a common method to smoothen the fibres. This method is used by indigenous communities. Conventionally, lanolin was reapplied to the wool yarns before spinning.	The experiment used a 6" x 6" swatch that was previously washed with soapnut. The swatch was soaked in a solution of 500 ml warm water and 10 ml castor oil for 30 minutes. Then, it was steamed for 15 minutes, washed in running water, and left to dry.	There was a significant reduction in the fuzziness and stiffness of the swatch. However, this method left the swatch greasy.	Cost of 1kg soapnut: Rs 65-70, Cost of 1l castor oil: Rs 80  Total Cost: Rs 1.45/swatch and Rs 14.5/ 5ft fabric
8. Soaking the swatch in buttermilk	Casein in milk helps to condition wool fibres and is avidly used in fabric conditioners. Using buttermilk to soften wool fibres has been used by many indigenous communities.	The experiment used a 6" x 6" unwashed swatch, which was boiled in a mixture of water and 10 gm of soap nuts that had been soaked overnight. The swatch was boiled for 30 minutes, washed with running water, and left to dry in the sun.	6" x 6" washed swatches from the previous experiments were used for this experiment. They were soaked overnight in a bath of 500 ml water, 150 ml milk, and 10 g curd. After soaking, the swatches were washed under running water and then cleaned with hot water.	The Kurubas do not sell the milk of their sheep therefore make milk products from it for their households.
9. Soaking the swatch in fermented milk bath	Sugar has humectant properties which help the fibre to retain moisture. The acid in the sour milk breaks down the natural wax coating on the wool fibres, making them softer.	The 6" x 6" swatch washed with soapnut was dipped into a solution of 250 ml milk, 10 g curd, and 5 g jaggery in a stainless-steel vessel. The vessel was covered with a muslin cloth and left to ferment for 3 days. After that, the swatch was removed from the mixture and washed under running water.	This experiment showed a significant reduction in the stiffness of the swatch. It also helped to reduce the fuzziness of the fabric.	The Kurubas do not sell the milk of their sheep therefore make milk products from it for their households.  Cost of jaggery: Rs 75/kg  Total cost: Rs 0.7/swatch and Rs 7.5/ 5ft fabric

**XI. Analysis:**

Experiments 1, 2, 3, 4 and 5 were conducted to deduce a sustainable and easy way to remove the stubborn tamarind seed paste and ash applied to the Kambli during the weaving process.

Washing the swatches only with plain water (Experiment 1) was ineffective in cleaning the Kambli of tamarind seed paste. Cleaning the swatch in boiling water (Experiment 2) showed minimal effectiveness.

However, using soapnuts to wash the swatch (Experiment 3) not only cleaned the swatch of tamarind seed paste and ash but also significantly reduced the swatch's stiffness.

Washing with Vinegar and baking soda (Experiments 4 and 5) did clean the ash fabric but could not completely remove the tamarind seed paste.

The experiments, therefore, conclude that washing the Kambli swatches with soapnut or *reetha* is an effective way to clean the woollen fabric of tamarind seed paste and ash. Soapnut is an organic and, therefore, a safer alternative. Since soapnuts are locally available and economically viable for the weavers of Karagaon, they can be chosen as one of the eco-friendly options to wash the Kambli.

However, removing the tamarind seed paste gave the swatch a fuzzy texture, resulting in naps on the fabric swatch.

Experiments 6, 7, 8 and 9 were conducted to deduce viable and doable methods to soften the Kambli fabric, as Kambli is woven from Deccani wool which is inherently coarse. The coarseness of the wool cannot be fully reversed without using structured treatments. However, it can be softened to an extent and utilised in various products.

Scrubbing and agitating the Kambli swatch in hot water (Experiment 6) gave the fabric a 'Fulled' effect, reducing its coarseness. Shearing off the naps raised during the agitation gave a smooth texture to the fabric swatch. Conditioning the Kambli fabric using oil and buttermilk (Experiments 7 and 8) showed minimal effectiveness in softening the Kambli fabric swatch. However, fermenting the fabric swatch in a solution made of sour milk and jaggery (Experiment 9) significantly reduced the coarseness and fuzziness of the Kambli fabric swatch.

The experiments, therefore, conclude that prewashed and desized Kambli fabric swatches, when agitated and scrubbed in hot water, are an effective way to reduce the coarseness of the swatch, provided that the naps are sheared. This method is easy and requires no special equipment or material to treat the fabric.

A fermentation bath of sour milk and jaggery is another method that effectively reduces the fuzziness of the Kambli swatch.

Kurubas do not sell their sheep's milk but convert it into buttermilk. Excess milk could be used to treat the Kambli. However, this method is more tedious as it is time-consuming and costly given the economic conditions of the weavers, as they can use this milk to feed their families instead.

**XII. Conclusion:**

The traditional Kambli weaving process does not have any method to cater to the stiffness of the fabric. The tamarind seed paste used as a sizing agent adds to the stiffness of the fabric.

It has been observed by the researcher that washing the fabric with soap nut does reduce its coarseness to a large extent. Scrubbing the fabric in hot water was found to reduce the naps formed after washing the fabric. Such softened fabric can be used for more creative purposes.

Fabric woven from Deccani wool is also warm and durable. Therefore, coarse Deccani wool can be used to make other viable products like sacks, bags, bottle holders, durries and other materials for daily use which are found to be stronger and better even for rough weather.

The experiments conducted were designed to fit the socio-economic conditions of the Kambli weavers of Karagaon. The experiments were elementary and formulated using traditional knowledge known to artisans. Therefore, it was easy for the weavers to understand and grasp it. Hopefully, these new suggested weaving techniques would be well received by the weavers. This answers the questions raised by the researcher.

Further research on enhancing the rearing and harvesting of Deccani wool is required. Impact-based research framed to suit a specific community is the need for the hour. It is essential to preserve the rich cultural heritage of traditional indigenous communities of India and recognise their uniqueness. Going forward, detailed research may throw more light on the unanswered aspects of the research questions.

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