CHAPTER-V

SUMMARY AND CONCLUSION

Knitwear industry is emerging as the fastest growing segment of Indian garment exports compared to all other segments, including woven garments and the synthetic garments. Within the textile industry, the role of knitwear sector is increasing by the day.

Knitting is the most common method of interlooping and is the second only to a weaving as a method of manufacturing textile products. It is estimated that over 7 million tons of knitted goods are produced annually throughout the world. Knitting requires a relatively fine, smooth, strong yarn with good elastic recovery properties. The worsted system has proved particularly suitable for spinning yarns used for knitwear, outerwear and socks, and the combed cotton system for underwear, sportswear and socks.

Cotton/wool blended fabrics are growing in popularity, due to increased consumer demand for styling, comfort, and natural fibers. Wool cotton blends for apparel fabrics combine comfort with exceptional aesthetic apparel. The cotton/cashmere blends are used for light weight sweaters. The wool/cotton blend is superior in durability to all wool fabrics. There is a resurgence of interest in blending these two natural fibers throughout the developed world, where such blends in garments traditionally made from cotton are seen as conferring desirability and exclusivity in high quality dress wear and shirting fabrics. Production of these fabrics to provide completely washable products in appropriate fabric densities requires total engineering beginning with the wool and cotton fiber selection, the wool preparation, cutting, blending, yarn manufacturing, fabric construction, dyeing and finishing.

In today’s world of modernization in terms of industrialization and consumer choice and taste, there is need to bring innovative changes and new designs in clothing. Khadi industry is also under continuous pressure to meet growing consumer aspiration and demand through constant product innovation, improved quality and competition.
Khadi sector based on wool fiber produces various woollen products viz. blanket, knitwear, tweed, apparels etc. This sector is providing employment to rural masses. *Charkha* spinning and handloom weaving are mainly used for manufacturing of products.

Cotton and wool blended knitted fabrics are much suitable in Indian climate, especially in the month of September to March, that’s why the demands for such blends are increasing day by day.

In the present study researcher has made an attempt to produce cotton: wool knitted fabrics/garments for khadi sector by utilizing hand spinning and flatbed knitting machines.

**Objectives-**

1. To test the physical properties of cotton and wool fibers.

2. To blend cotton with wool in different ratios and prepare blended yarns

3. To study the properties of blended yarns.

4. To prepare the khadi fabrics with blended yarns on flat bed hand knitting machine

5. To study the properties of knitted fabrics

6. To prepare knitwear products and evaluate their acceptability

Initially different varieties of cotton and wool fibers were selected to find out most suitable cotton: wool blend combination. Yarns were prepared and properties tested. The result showed that Indian crossbred wool- Rambouillet/local sheep of Jammu and Kashmir and Himachal Pradesh can be blended with cotton Mech I to produce good quality even handspun yarn which can be easily processed on flatbed knitting machine.
Therefore, these two fibers were selected for the study. Various fiber properties such as fineness, length and strength were determined under standard atmospheric conditions.

Cotton (Mech I ) and wool (Indian cross bred- Rambouillet/local sheep of Jammu and Kashmir and Himachal Pradesh) fibers were blended in three ratios 90% cotton-10%wool, 80% cotton-20% wool and 70% cotton-30% wool in hand spinning system and hand spun yarns were prepared in count from 55.55 62.5 and tex. 100% cotton yarn was also prepared for base reference and comparative purpose. Physical properties of yarns viz. yarn count, yarn twist, yarn strength and elongation were tested by standard procedures.

Double jersey knit fabrics were prepared on flatbed hand knitted hosiery machine of 10-12 gauge at Central Sheep and Wool Research Institute, Avikanagar. Finishing treatment such as scouring of developed knitted fabric was done. Various fabric properties of double jersey knitted fabrics were tested by standard procedures.

Selected prototypes for women’s outer garments were constructed for females of 16-18 years age group in large size. The garments were: jackets, sweaters and top. Dyeing was done by the researcher at yarn/fabric stage as per the color scheme and design of the garments. Two bath dyeing process was followed. In first stage, wool component was dyed with acid dyes and in second stage; cotton component was dyed with direct dyes. Garments were evaluated on the basis of colour combination, aesthetic appeal, uniqueness in design and cost by a panel of fifty judges. Three point rating scale was used to determine acceptability of developed prototypes.

Mean, SD and CV% of data was calculated. Correlation coefficient was determined to find out relation between two variables. Moreover, data was analyzed through the t-test and ANOVA to know whether there is significant difference in properties of developed yarns and fabrics (parameters).
Major findings of the study are-

Fiber properties

Mech I cotton fiber is finer than Indian crossbred wool fiber whereas wool fiber is longer than cotton fiber. Strength of cotton fiber is higher than wool fiber. More variation is observed in wool fiber in comparison to cotton fiber.

Yarn properties

Not much difference is found in U% of pure and blended yarns. Besides, no particular trend has been found in unevenness of yarns. However, 70 C-30 W yarn is found to be most irregular with very high number of thin places and neps whereas 90 C-10 W and 80 C-20 W yarns are comparatively less irregular. Pure cotton yarn also show high irregularity with highest number of thick places and neps.

No particular trend has been observed with regard to yarn hairiness.

Marginal difference in strength of 100 C, 90C-10W, 80C-20W and 70C-30W yarns is found. Yarn elongation increases slightly when wool is blended with cotton fiber except in 70C:30W yarn.

Fabric properties

1. Course/inch and Warp/inch of pure as well as blended fabrics are same. Stitch density and Ks value increases in blended fabrics as compared to pure cotton. Loop shape factor does not show any particular trend.

2. No particular trend is visible in weight per unit area of pure and blended fabrics. After incorporating 10% wool weight has decreased. It has slightly increased when 20% wool is added and then again decreases on further increasing the wool percentage. Difference in weight of pure and blended fabrics is not significant.
3. Assessment of dimensional stability of knitted fabric shows linear percent change in dimension. There is extension in course wise direction and shrinkage in wale wise direction after wetting treatment. In general, arial shrinkage in blended fabrics is more than in pure fabric. Besides, it is increasing with increase in wool content with the exception of 80 C: 20 W fabrics.

4. Bursting strength of fabrics has decreased after blending wool with cotton fiber. The reason is that wool fiber is weaker than cotton fiber. Bursting strength of a knitted fabric has significant correlation with yarn evenness and yarn strength. Bursting strength increases with increase in yarn strength and decreases with decrease in yarn evenness. Positive correlation is found between yarn strength and bursting strength of fabrics. This indicates that yarn strength has affected bursting strength to some extent. On the other hand, negative low correlation is found between yarn unevenness and bursting strength showing yarn unevenness of cotton-wool blended yarn is not a factor affecting strength of blended fabrics.

5. 90 Cotton-10 Wool and 80 Cotton-20 Wool fabrics show negative skewness whereas 100 cotton and 70 Cotton-30 Wool show positive skewness.

6. Evaluation of fabric handle indicates that thickness of blended fabrics decreases when 10% wool is blended with cotton. But on further increasing the wool content to 20% and 30%, thickness of fabric has increased. This trend is observed in case of T2, T100 and ST. Fabric thickness is directly affected by yarn thickness. Diameter of blended yarns is more than pure cotton yarn. Further, yarn diameter has increased with increase in wool percent that is why fabric thickness has also increased. On the other hand, released surface thickness of blended fabrics is less than pure cotton fabric.
7. No particular trend is seen in relaxation shrinkage of fabrics after blending 10-30% wool with cotton fiber. In wale wise direction, hygral expansion of blended fabric is less than pure cotton fabric but in course wise direction, no specific trend is visible. Formability of cotton-wool blend fabric is less than 100% cotton fabric in wale wise direction. Thus it has decreased after blending wool.

8. Bending rigidity of blended fabrics has decreased compared to pure cotton fabric. Thus incorporation of wool fiber in blends has profound positive impact on bending rigidity of fabrics. Wool fiber is soft and pliable whereas cotton is comparatively stiff. That is why considerable decrease has been found in stiffness of blended fabrics. Shear rigidity of fabrics has increased after blending wool with cotton.

9. Pilling grade of 100 C and 90 C: 10 W fabrics is 5 as very few pills (0-4) formed on fabric surface. On the other hand pilling grade of 80 C: 20 W and 70 C: 30 W blended fabrics is 4 indicating slightly more pilling (5-10) in 80 C: 20 W and 70 C: 30 W blended fabrics in comparison to pure cotton and 90 C: 10 W fabrics.

10. Crease recovery of fabrics has improved after blending wool with cotton fiber. Increasing the wool content from 10% to 30% has slightly enhanced crease recovery of blended fabrics. The resiliency and elastic recovery of wool fiber is better than cotton fiber. That is why it recovers easily from strains imposed during use and care.

11. Values of dynamic frictional resistance are higher than the values of static frictional resistance in course wise direction. Frictional resistance has increased in blended fabrics in course wise direction because fabrics are made of coarse yarns.

12. One more possible explanation may be increase in hairiness of yarn. Protruding fibers on fabric surface are one of the most significant factors affecting smoothness and frictional properties. As hairiness of 90 Cotton:10 wool and 80 Cotton: 20 wool blended yarn is higher, it has increased frictional resistance in course wise direction.
13. Air permeability of blended fabrics has slightly decreased compared to pure cotton fabric. It is also observed that air resistance is continuously increasing with increase in wool content.

14. In general thermal resistance of knitted fabrics has increased after incorporating wool fiber in cotton.

15. Rate of moisture absorption of 90 C-10 W and 80 C-20 W fabrics is higher than 100 C fabric although 70 C-30W shows decrease. Thus wettability has improved after blending wool.

16. Subjective analysis of hand of garments exhibits that hand of fabric dyed garment of different blends has been found different by experts. Hand of the fabrics deteriorates as the ratio of wool increase in blended fabrics. 90-10% blend feel moderate to soft, whereas hand of 80-20 blend has been rated moderate and 70-30% fabric is found hard to feel.

17. On the other hand, hand of yarn dyed fabrics of all the blends (90-10, 80-20 and 70-30%) has been rated similarly by consumers. Fabrics have been found very soft to touch. This might be due to the reason of dyeing of yarn is done after all cleaning treatments. So yarn becomes more regular and soft.

18. Fabric dyed garments of different blends were preferred differently by consumers. Sweater of blend 80 C-20 W got maximum weight mean score value in terms of colour combination, aesthetic appeal, uniqueness in design. Maximum consumers have found cost appropriate. Top of 90 C-10 W blend has obtained second highest weighted mean score for colour combination, aesthetic appeal, uniqueness in design and cost. 70 C-30W jacket is least preferred by consumers as it has got lowest weight mean score. So it can be concluded that sweater has been most accepted by
consumers. Top has also been found aesthetically pleasing as it has been rated good to very good. Jacket (70-30%) is lowest in the rating scale of consumers.

19. Comparing consumer preference for yarn dyed garments, it is evident that top of 90 C-10 W has got highest preference in terms of colour combination, aesthetic appeal, uniqueness and cost has been found appropriate by all the consumers. 100% consumer’s opinion was that they would love to buy this top since it has been found most attractive. Second preference is given to sweater for its good colour combination, good aesthetic appeal, uniqueness and cost is accepted by 76% consumers. Jacket has been least preferred in this group as it is lowest in rating scale of consumers, colour combination, aesthetic appeal, and uniqueness. However, cost of jacket is accepted by 80% consumers.

Some properties of yarn and fabrics did not reveal any particular trend which might be due to two reasons. One is hand spinning (khadi) system used to manufacture yarn where chances of variation are high. Other reason may be the fact that only 10-30% wool fiber was blended with cotton.

It can be concluded that cotton fabrics are more durable than cotton wool blended knitted khadi fabrics as their strength and abrasion resistance is better with no pilling. On the other hand cotton wool blended knitted khadi fabrics as they have good air resistance and thermal insulation value with good moisture absorption, better crease recovery property, less bending rigidity. These fabrics are suitable for producing light weight winter apparels for consumers. As mentioned earlier, present study is a step towards product innovation and explores the possibility of creating cotton and cotton blended knitted fabrics for khadi sector. Since results showed that these can be constructed in Khadi Village Industries.

DELIMITATIONS:-

- Study was limited to one variety of cotton (Mech –I) and Indian crossbred wool fiber of six monthly clip (Rambouillet crossed with local sheep i.e. Nali/Chokla) of Rajasthan.
• The study was limited to cotton wool blended yarns in three different ratios viz. 90:10, 80:20 and 70:30.

• The study utilized the yarn of 55-62 tex.

• Only double jersey fabric was constructed because it

• The study was restricted to the construction of women outer garment only such as jackets, sweaters and top

Further scope of the study:—

No research work is complete and adequate in itself. There is always scope for further research. The present study opens avenues for future research of which few could accomplished in further course of action.

Study can be conducted with other knitting stitches and performance of resultant fabric can be evaluated. Research work can be planned on cotton and acrylic knitted khadi blends and its comparative analysis can be done between blends of cotton: wool and cotton: acrylic.

Finishing studies of cotton wool blends can be undertaken to improve some properties specially hand off blend fabric.