CHAPTER-1
INTRODUCTION

Knitwear industry is one of the fastest growing segment of Indian garment exports in comparison to woven and the mill-made garment segments. (http://en.wikipedia.org/wiki/Knitting).

There are several reasons for the growth of knitting industry – low capital investment for starting a new knitting unit, high productivity of machine, faster and simpler operation and possibility to manufacture more flexible styles and designs. (Ajgaonkar, 1998)

Gupta et.al (2005) explains many other reasons for tremendous popularity of knitting within recent years. Firstly the technique is very versatile; secondly many new manmade fibers can be used for knitting and thirdly there is increased growth in the consumer demand for knit wears.

Knitted fabrics have many desirable characteristics than woven fabrics of same weight. Knitted fabrics are softer and highly extensible. These characteristics make knitted fabric less rigid and more comfortable when body movements are made. Knitted fabrics also have high elasticity which gives shape fitting and wrinkle-resistance properties. The air pockets created by the knitting serve as insulator and add both the warmth and the absorbency to knitted fabric. Due to above reasons knitting have overcome weaving. (Mini Textile Encyclopedia &www.differencebetween.com)

Knitting is a technique of converting thread or yarn into cloth. Knitted fabric consists of continuous rows of loops, called stitches. The stitches are held on a needle until another loop can be passed through them. As each row progresses, a new loop is pulled through an existing loop. This process ultimately results in a final product, which may be fabric or garment. Different yarns and knitting needles may be used to prepare different end products giving the final piece a different color, texture and weight.

Knitting may be classified into weft knitting and warp knitting. In weft knitting, the wales are perpendicular to the course. On the other hand in warp knitting, the wales and courses run roughly parallel. In weft knitting, the entire fabric may be prepared from a single yarn,
by adding stitches to each wale in turn, moving across the fabric. By contrast, in warp knitting, every wale requires separate yarn. Since a typical piece of knitted fabric may have hundreds of wales, warp knitting is usually done by machine, whereas weft knitting can be done by both hand and machine. There are two types of knitting machines— the flat bed type and circular type. (en.wikipedia.org/wiki/knitting)

Knitted garments are no longer limited to innerwear and stockings only. There has been a revolution in knitwear products. The range of styles that can be handmade or purchased is constantly expanding. (http://sourcing.indiamart.com/apparel/apparel-industry/buyers-guide-knitted-garments/indian-knitting-industry/).

The use of knitted fabrics ranges from hosiery, underwear, sweaters, slacks, suits, and coats to rugs and other home furnishings. Today knitting is a complex industry, which has two main segments. One segment produces knitted fabrics for garment manufacturers, for the sewing centers, for consumers and for others. The other segment produces completed garments such as hosiery, sweaters and underwear. (Gupta, et.al.2005)

Yarn is the basic component of a knitted fabric. The characteristics of the fibers and the way they are assembled determine the characteristics of the yarn. The characteristics of the yarns and the way they are assembled determine the characteristics of the fabric. (Joseph, 1986)

Yarn quality is even more important for knitting than it is for weaving. A relatively fine, smooth, strong yarn with good elastic recovery property is needed for knitting. Any unevenness in the yarn is multiplied fourfold, because each loop is four yarns diameter wide. Thermoplastic yarns can be heat-set for greater stability, even if the fabric structure is open. (Fritz and Cant, 1986)

Till the innovation and recent development of manmade fibers, the most common yarns used in weft knitting were made either from wool or cotton, though silk was also used to a very small extent in stocking. (Ajgaonkar, 1998)

The worsted system is specifically suitable for spinning yarns used for knitwear, outerwear and socks and the combed cotton system is suitable for underwear, sportswear and socks. (Spencer, 2001)
Cotton is a most sought after textile fibre on account of its superior comfort properties. Cotton continues to remain established as the most widely used textile material in the world. During 2000-05; the production of cotton world-wide has grown by a whopping 25% fuelling the growth of the natural fibre sector as a whole. Its current market share is 56 percent for all fibers used for apparel and home furnishings and sold in the U.S (Hedge et al, 2004). In India also, the cotton production has taken a giant leap forward to 280 lakh bales and the increased availability has fuelled consumption as well to the extent of 10-12% annually. The productivity although is far lower than world average (Srinivasan & Venkatakrishnan, 2007)

Cotton yarns for knitting are either carded or combed but preferably, combed cotton yarns are required for soft surfaced garments, worn to the skin. Less amount of twist than that is required for weaving yarn is given to yarns for knitting. They are called soft twisted yarns. Cotton yarns are generally waxed for knitting so that needle will not break frequently and yarn will not become hairy due to friction (Fritz and Cant, 1986). Although cotton knitted fabrics are most comfortable, blends with other fibers are always preferred for fulfillment of functional and aesthetic requirements that cannot be met by only one type of fiber (Chattopadhyay, 2004).

Wool was the foremost natural fiber used in knitting industry. Wool is the hair like covering on sheep. While sheep’s hair is normally used as wool, hairs of other animals are also occasionally used as wool. There are over 200 breeds of sheep in the world. Wool is a protein fiber. Wool has crimp and scale due to this it is easy to spin the fleece. Resiliency and elasticity of wool fiber is excellent as it can be bent 30,000 times without danger of breaking or damage. Wool fiber is hydrophilic in nature. Wool ignites at a higher temperature than cotton. It has lower rate of flame spread. It is resistant to static electricity. Wool has insulating property due to this it provides warmth. (Fritz and Cant, 1986)

India possesses quite large sheep population of 48.0 million but produces only 43.5 million kg of wool which is the sixth largest sheep rearing country having approximately 4.22% of world sheep population and producing about 1.82% of total world wool. This wool comes from several breeds and interbreeds. There are 44 descript sheep breeds
spread over a wide range environmental conditions. The Indian breeds produce wool differing in fineness from 25-60 microns. As per economic survey, Government of India, the country produced about 45 m kg of raw wool in 2007. Out of the total production of raw wool about 5% was apparel grade, 85% carpet grade and 10% coarse grade.

Behera and Shakyawar (1998) opined that “the annual growth of wool production is marginal and wool production has remained static for last 10 years. Wool yield per sheep in India is about 800 g/year. Out of total wool produced in the country about 15m kg is utilized by khadi sector and other industries for manufacturer of different products by hand spinning and weaving. The production of Indian crossbred wool of six monthly clip (Rambouillet crossed with local sheep i.e. Nali/Chokla) of Rajasthan, J&K and Himachal Pradesh is 2-2.5 kg.

There is no perfect fiber. All fibers have good, fair and poor characteristics. Blending is an accepted method of combining the desirable properties of component fibres with a view to derive optimum benefit by mechanically mixing them.

A blend is a mixture of fibers of different composition, length, diameter and color spun together into a yarn. The accepted definition of a blend, as stated by ASTM, is “a single yarn spun from a blend or mixture of different fiber species”. Blending though is a complicated and expensive process, but it enables to combine a number of properties that are permanent. Not only are blend used for better serviceability of fabrics but they are also used for improved appearance and hand. (Charankar, 2007)

Charankar (2007) mentioned that “growing importance of fiber blends in apparels is because of many reasons such as expensive fibers can be extended by blending them with more plentiful fibers, produce fabrics with a better combination of performance characteristics in the product. This is perhaps the most important reason for blending. A small amount of specialty wool may be used to give a buttery or slick hand to wool fabrics. Fabrics with different shrinkage properties are blended to produce bulky and lofty fabrics or fur-like fabrics, obtain cross dyed effects or create new color effects, when fibers with unlike dye affinity are blended together and then piece dyed to improve
spinning, weaving finishing efficiency for uniformity of product as with self blends of natural fibers to improve uniformity.”

He further stated that “wool is blended with cotton in various ratios. Wool contributes warmth, resiliency, and abrasion resistance and drape ability. Cotton adds strength and reduces the cost of the yarn and fabric. Both fibers are absorbent and can be blended to make a comfortable, durable fabric. 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. Developments in shrink resist treatment of the wool component have greatly improved the washability of such materials which offer value, comfort, versatility and styling.”

Blending is done in initial opening stage of the blow room operation. The blending can also be done in the carding stage, drawing or roving stage. (Textilelearner.blogstop.com).

Blended worsted yarns containing approximately equal proportions of wool and cotton have been long used in knit wear, dress wear, under wear, children’s clothing, light weight shirting’s, pajamas clothes and blankets. The original Viyella shirt fabric was a wool/cotton blend. The cotton/merino blends are used for light weight sweaters. Various researches in Central Institute for Research on Cotton Technology and Central Sheep and Wool Research Institute have been conducted to explore the possibilities of blending Avivastra Wool with cotton for producing good quality yarns adopting commercial cotton spinning systems (Charankar, 2007).

Knitted goods and knitwear are produced generally in organized sector. Khadi industry is a cottage based industry.

Khadi industry mainly produces handspun and hand-woven cloth made of cotton, silk, or wool yarns. The yarns are spun on a spinning wheel called charkha and woven on handloom. Khadi industry also produces woven blends called polyvastra, which is blend of cotton or wool with polyester. It is widely accepted in fashion circles. Khadi sector based on wool fiber produces various woolen products viz. blanket, tweed, apparels etc.
Market survey revealed that woolen apparels are coarse; moreover, limited variety and designs are available. This sector is providing employment to rural masses. Charkha spinning and handloom weaving are mainly used for manufacturing of these products. In addition, it also produces woolen sweaters which may be handmade or machine made.

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

**Objectives of the study**

- To test the physical properties of cotton and wool fibers

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

- To study the properties of blended yarns

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

- To study the properties of knitted fabrics

- To prepare knitwear products and evaluate their acceptability

**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. Similar wool is also available in JK and Himachal Pradesh.
• 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.

• Double jersey was used for the construction of the fabric.

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

**Significance of the study**

The world today has suddenly turned its attention towards the natural fibres that are environment friendly and biodegradable. Besides, today’s consumer demands well fitted comfortable, economical and easy to care for garments, which can be washed and worn. This demand is easily met by knits. As mentioned above knitted products, whether fabric or garments, are mainly produced in mills. Their production in khadi sector is limited. Cotton wool blend fabrics are growing in popularity due to increased consumer demand for styling, comfort and for eco-friendly natural fibers. Moreover, in Indian climatic conditions, during pre and post winter season use of cotswool is very popular for apparel purpose. The proposed study allows joining of two natural fibers, wool and cotton, whose complementary properties will be used to create fabric with improved properties for development of apparel articles for khadi hosiery industry.

Main aim of present investigation is to develop trendy knitwear in cotton: wool blended hand knitted fabrics. Study will be useful for producing more varieties in khadi fabrics. It is expected that study will help in providing cost effective jackets, sweaters and top for consumers and unique characteristics of knitted fabrics will also help to attract more consumers. As mentioned before, blending of cotton with wool will help in improving durability of fabric in comparison to 100% wool fabric. Moreover, it will have better dimensional stability. Novelty cross dye effect can be imparted to apparels.
This study may be helpful in making a small but important contribution in accomplishing the gigantic task of finding gainful employment for unemployed person in the rural areas. The study will help to improve aesthetic appeal of khadi fabric. Thus the result will be useful to khadi cottage industry. Consumer will be benefited and get fine and good quality knitted khadi fabrics.