

A COMPARISON OF THE BURSTING STRENGTH OF  
SELECTED KNIT FABRICS MEASURED ON  
TWO TYPES OF INSTRUMENTS

by

SHEILA EILEEN O'CONNELL

B. S., Hunter College, 1956

---

A THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Clothing and Textiles

KANSAS STATE COLLEGE  
OF AGRICULTURE AND APPLIED SCIENCE

1958

LD  
2668  
T4  
1958  
032  
C-2  
Document

11

## TABLE OF CONTENTS

INTRODUCTION .....	1
Growing Use of Knit Fabrics .....	1
Knitting, a Method of Fabric Construction .....	2
Fibers Used in This Study .....	4
REVIEW OF LITERATURE .....	5
METHOD OF PROCEDURE .....	8
Bursting Strength Machines .....	8
Selection of Fabrics .....	9
Analysis of Service Qualities .....	10
Analysis of Data .....	10
FINDINGS AND DISCUSSION .....	11
Physical Analysis of Fabrics .....	11
Analysis of Bursting Strength Data .....	16
SUMMARY AND CONCLUSIONS .....	20
ACKNOWLEDGMENT .....	23
LITERATURE CITED .....	24

## INTRODUCTION

Prior to the development of synthetic fibers the majority of knit fabrics were made of either cotton, wool, or a blend of the two fibers. With the many new fibers being produced it seemed important to investigate the qualities of knit fabrics made of these fibers blended with natural fibers. The limited research which has been done on knit fabrics does not include any comparative studies of all cotton knit fabrics with blends of cotton and man-made fibers, or with blends of two or more man-made fibers.

### Growing Use of Knit Fabrics

Knit fabrics have inherent characteristics which make them especially serviceable as underwear fabrics. They are elastic and pliable, allow for ventilation, fit without binding, and are not bulky. Another factor to be considered is their ease of care (Wingate, 22).

Knit garments compose an important part of the wardrobes of adults and children, especially in underclothing and sports clothes. According to Textile Organon (12) the consumption of knit underwear decreased in 1953, yet the amount of blended yarns used in undergarments increased. Figures from the United States Department of Commerce indicate a rise of 71 per cent in the value of circular knit fabric of the polo shirt type shipped from 1947 to 1954, and an increase of 383 per cent in the value of warp knit underwear fabrics shipped for the same period (21). The William Carter Company predicted a 16 per cent increase in knit goods

consumption during 1956 due to the increased birth rate in the United States (5). The increased use of knit fabrics has created an interest in the service qualities of cotton knit fabrics, and of cotton and man-made fiber blends in knit fabrics.

In 1952, 5000 dozen units of Dynel blend underwear were purchased, and by 1955 the number of units purchased was 90,000 dozen. Most of the articles made with Dynel contained 25 to 50 per cent Dynel with the remainder combed cotton. Cotton contributes moisture absorption, while Dynel adds warmth, launderability, and softness of hand. These factors contribute to the growing popularity of Dynel blend underwear and sleepwear (6).

In his report on the knitting business Blore (2) showed that there is now more diversification in underwear knitting mills than at an earlier time. Many mills which formerly produced only T-shirts now manufacture children's wear and sports wear. In general the knit underwear outlook is good. From 1954 through 1956 there was a steady increase in knit underwear production in the United States. During this period the production of men's underwear increased more than 7500 thousand dozen units; women's underwear almost 10,000 thousand dozen units; girls' underwear more than 300 thousand dozen units; and babies' underwear more than 200 thousand dozen units.

#### Knitting, a Method of Fabric Construction

Knit cloth is made on needles by a process which forms one or more yarns into a series of interloopings (Linton, 13). The two methods of knitting are warp knitting and filling knitting.

Warp knits are machine knit using one or more yarns which are placed side by side as yarns are in weaving. They are always flat knits. Warp knits are stronger than filling knits and do not stretch as easily. They are either run-resistant, or run proof, depending on whether they are of one or two bar tricot construction (Hollen and Saddler, 10).

Filling knits are made using only one yarn which is carried back and forth across the fabric, or is knit completely around to make a circular fabric. An ordinary filling knit is neither run-resistant nor run-proof, but may be made run-resistant by knitting it in such a way as to lock the stitches and thereby reduce the number of runs. Filling knits have a definite right and wrong side, unless they are made with a combination stitch which employs both a plain knit stitch and a purl stitch. The purl stitch is the exact reverse of the plain knit stitch, since the loops are connected on the back of the fabric rather than on the front (Johnson, 11).

The loops in filling knit fabrics form a series of lengthwise chains, each called a wale. The loops also form a line across the fabrics at right angles to the wales, each line called a course. The compactness of the wales and courses determines the density of the knit fabric. Filling knits stretch and shape easily, and may be fashioned to shape through the increasing or decreasing of stitches during the knitting process (Merrill, et al., 15).

The purpose of this study was to compare the bursting strength, and certain other service qualities of knitted fabrics made of all cotton, with those made of cotton blended with nylon,

and with Dynel, and to obtain, if possible, a factor as a means of comparing the results obtained from two types of bursting strength instruments.

### Fibers Used in This Study

Cotton, the most widely used of all the textile fibers, in 1957 accounted for 65.5 per cent of the world's fiber consumption. It is used not only by itself but with most other fibers in blends of varying percentages (8).

Cotton is much in demand because of its physical properties. It is the most launderable of the cellulose fibers because bleaching, boiling and hot irons do not affect the fiber. Cotton is absorbent due to its available hydroxyl groups, however, it is low in resiliency and wrinkles do not fall out readily (Hollen and Saddler, 10).

Chemically, cotton is sensitive to dilute mineral acids, and less sensitive to the action of organic acids. Alkalis, if not used in too concentrated solutions, are not harmful to the fiber.

"Nylon is the generic term for any long chain synthetic polymeric amide which has recurring amide groups as an integral part of the polymer chain" (Mauersberger, 14). It can be produced with a wide range of properties depending upon the use for which it is intended.

Tensile strength and elongation vary considerably in nylon yarns. When wet, nylon retains from 80 to 90 per cent of its dry strength. The greater the tenacity of the fiber the less its elongation. Nylon has high elasticity and good recovery. Nylon



has great resistance to abrasion, and low water absorbency. It is not heat resistant and can easily be damaged by a hot iron (Moncrieff, 16). Because of its ability to be heat set, nylon is often used in blends to dimensionally stabilize the fabric. Chemically, nylon is extremely stable, neither concentrated acids nor alkalis will seriously affect it.

Swalm (20) described Dynel as Union Carbide's acrylic type fiber which was first produced in 1950. It is made from a 60-40 ratio solution of vinyl chloride and acrylonitrile, and is produced only in staple form.

Carolan (3) reported that Dynel is strong, approximately twice as strong as the best apparel wools, and its tenacity and elongation are almost the same when wet as when dry. Dynel is warm to the hand and is resilient without being bulky. Dynel, however, is susceptible to stiffening and shrinking when exposed to even moderately high temperatures, and can only be ironed at the lowest possible temperature. It will burn in the presence of a flame but upon removal of the source of combustion is self extinguishing.

Chemical resistance is one of the most important characteristics of Dynel. The fiber is among the most chemically inert of all the man-made textile fibers and because of this is unaffected by strong alkalis and acids.

#### REVIEW OF LITERATURE

The literature reveals very little research has been done on knit fabrics.

Bispham (1) reported that fiber blends are becoming more important in the textile picture. The importance of blends is that, in the proper percentages they improve the service qualities of the fabric. Each fabric created through blending must be tested to determine its effectiveness. There is no such thing as the perfect fiber, either natural or synthetic, and the fibers that are combined in blends must be combined with the end use of the fabric as the prime factor of importance. The addition of 10 to 15 per cent nylon to a fabric of cotton, wool, or rayon, will greatly increase its abrasion resistance and impart added strength.

The combinations of fibers used to produce blended fabrics are many and varied, each percentage and fiber change in the fabric changes its characteristics. The selection of fiber and blend levels is important, but the fabric construction must also be considered for the weavers, knitters, and converters must understand the fibers with which they are working (1).

Fletcher, et al. (9) reported on the dimensional change in laundering of knit fabrics with 32 and 40 courses per inch, made from cotton, wool, viscose rayon, and nylon yarns. The fabrics were of both plain and plated knit construction and were knitted in the laboratory. Each fabric specimen was laundered five times and the dimensional change was determined after each laundering.

The study showed that dimensional change in knit goods is dependent upon the type of construction, number of courses per inch, and the fiber content. Lengthwise shrinkage is generally greater in knit fabrics than in woven fabrics of the same fiber content.



The measurement taken after the first laundering usually showed the greatest amount of dimensional change. The wool fabrics showed progressive shrinkage in both the length and width, as did the plain knit nylon materials. Pronounced progressive shrinkage or stretch did not occur in the other fabrics.

All fabrics with the exception of the plated nylon of 40 courses per inch showed considerable lengthwise shrinkage and several of the fabrics studied stretched or shrank widthwise. Fabrics knit with 40 courses per inch exhibited less lengthwise shrinkage than those knit with 32 courses per inch. Plain knit fabrics shrank more than the plated knit fabrics.

Roberts and Fletcher (17) studied the relationship of the shape of the loops in knit fabrics to the dimensional change after laundering. The width of the loops "w", and the length of the loops "p" varied considerably in the shirts tested. The wale-course spacing ratios ( $w/p$ ) for the unlaundered shirts ranged from 0.85 to 1.10; those for the laundered shirts ranged from 1.17 for the fabrics made of fine yarns to 1.35 for the fabrics made of coarse yarns. The loops in all cases shortened and became wider after laundering.

A linear relationship was found between the dimensional change of the fabric in length and width, and the wale-course spacing ratio. The shirts made of fabrics with a ratio of less than 1.0 showed a great deal of lengthwise shrinkage, and many showed excessive widthwise stretch. After laundering all the fabrics had wale-course spacing ratios of approximately 1.2. The dimensional change in fabrics which had this ratio before laundering changed

approximately 6 per cent in length and width after five screen dryings, while with tumble drying the change was 10 per cent after five launderings, and 12 per cent after 20 launderings. Fabrics which had round loops or loops that were slightly longer than they were wide were more dimensionally stable than those fabrics which had more wales than courses per inch.

Shinn (18) discussed an engineering approach to jersey fabric construction concerned with the basic laws of knitting; with measurement; with calculation; and with prediction. He related such fabric characteristics as weight, stitch length, and thickness to the yarn number and yarn diameter. By geometrical relationship the length of the stitch is related to the yarn diameter.

Shrinkage, which is the biggest problem in the use of knit fabrics is not due to changes within the stitch and must therefore be the result of fabric distortion. Stitch length is an important factor in fabric weight when it is combined with variations in yarn diameter. Finally, Shinn reported that the thickness of jersey fabric is equal to two times the diameter of the yarn.

#### METHOD OF PROCEDURE

Procedures established by Committee D-13 of the American Society for Testing Materials (4), and the Federal Specification, Textile Test Methods (7) were used for the analysis of the fabrics.

#### Bursting Strength Machines

There were two types of machines used for the determination of bursting strength. One type, the Scott Tester with ball burst

attachment, was a constant rate of traverse machine, so designed that the fabric was securely held by a ring clamp mechanism. A polished steel ball pressed against the center of the specimen, and the number of pounds necessary to burst the fabric was recorded. The other type, the Mullen Tester, was a diaphragm tester equipped with an accurate pressure gauge, and a metal ring clamp to hold the fabric. The machine was driven at a constant rate of speed to insure uniform displacement of the pressure medium. The diaphragm rose against the fabric and the pressure necessary to burst the specimen was recorded (ASTM, 4).

#### Selection of Fabrics

The fabrics selected for this study were chosen on the basis of their fiber content, type of knit, and the use for which they were intended. Fabrics from five different types of women's and children's knit pants were selected to be studied and will be referred to as: Fabric I, Fabric II, Fabric III, Fabric IV, and Fabric V.

Fabrics I, II, and III were circular filling knits purchased from the Sears, Roebuck and Company store in Kansas City, Missouri and were labeled "seed pearl". Fabric I was purchased as a 100 per cent cotton knit; Fabric II, as a 90 per cent cotton, 10 per cent nylon knit; and Fabric III, as a 50 per cent cotton, 50 per cent Dynel knit fabric.

Fabric IV was purchased through the Sears, Roebuck and Company catalog as a blend of 80 per cent cotton and 20 per cent nylon in a one by one filling knit. Due to garment construction it was not

possible to determine whether Fabric IV was a circular or flat knit.

Fabric V was purchased as a 100 per cent cotton filling knit from the R. H. Macy store in Kansas City, Missouri. Due to garment construction it was not possible to determine whether or not Fabric V was knit on circular needles.

#### Analysis of Service Qualities

The fabrics as purchased were analyzed to determine yarn count, weight per square yard, yarn type, thickness, resistance to abrasion, resistance to pilling and bursting strength. Procedures recommended by A.S.T.M. (4) were used to determine yarn count, Designation D-231-46; yarn type, Designation D-1244-53T; and resistance to pilling, Designation D-1375-55T using the appearance retention method. The procedures outlined by the Federal Specification, Textile Test Methods (7) were followed to determine weight per square yard, method 5041; thickness, method 5030; resistance to abrasion, method 5308 using a light weight tensioning clamp and a three pound weight; as well as bursting strength, methods 5120 and 5122. All determinations were carried out under standard conditions of temperature and humidity.

#### Analysis of Data

For all the determinations of service qualities except bursting strength the results were averaged to obtain the mean. More complete analysis was performed on the results of bursting strength determinations.

Standard Error was determined as described by Snedecor and Cochran.(19) on the results of the bursting strength determinations from each of the two machines. An analysis of variance was done on the bursting strength data to determine the significance of the results, and to obtain, if possible, a factor as a means of comparing the results obtained from the two instruments. The comparisons made for each machine were: Fabrics I and V; Fabrics II and IV; and Fabrics I, II, and III; as well as the five fabrics as a group.

#### FINDINGS AND DISCUSSION

Fabrics I, II, and III were constructed of a run resistant knit in which the stitches were locked by means of a regularly slipped stitch which was knitted back into the fabric after three rows. Fabric IV was a one by one filling knit; that is, alternating plain knit and purl stitches. Fabric V was a plain circular filling knit (Plate I).

#### Physical Analysis of Fabrics

The physical characteristics of the fabrics which were studied were yarn count, weight per square yard, yarn construction, thickness, resistance to abrasion, and resistance to pilling. The results of the analysis of the fabrics are presented in Table 1.

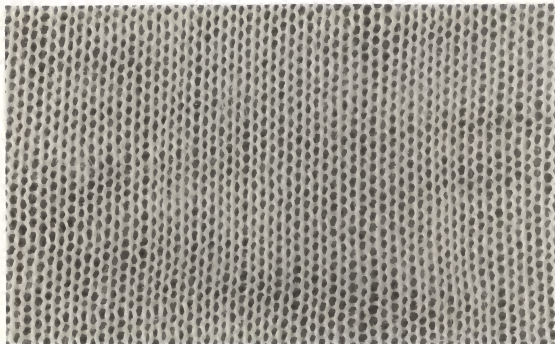
Yarn Count. None of the fabrics studied were balanced as to the number of wales and courses per inch. The most nearly balanced fabrics were Fabric IV and Fabric V. Fabric IV was the only fabric

EXPLANATION OF PLATE I

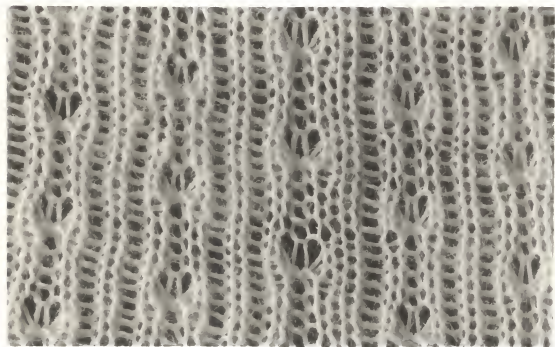
- A. Run resistant "seed pearl" knit.
- B. Plain filling knit.



## PLATE I



B



A

Table 1. Some physical properties of selected knit fabrics.

Fabric	Fiber content	courses	wales	per inch	Yarn count	Weight : : per : : square : : yard in : : ounces :	Yarn type	Thickness : : in inches :	Abrasion : : cycles : : to de- :struction :	Rate of :pilling
I	100% cotton	37.5	24.3			5.2	single	0.017	6,910	high
II	90% cotton 10% nylon	36.4	25.7			5.2	single	0.017	13,049	high
III	50% cotton 50% Dynel	36.5	25.3			4.3	single	0.016	1,284	high
IV	80% cotton 20% nylon	35.0	38.2			5.9	single	0.016	100,000*	high
V	100% cotton	41.3	39.9			2.7	single	0.015	31,065	high

\* Abrasion on this fabric was stopped after 100,000 cycles.

studied in which the number of courses outnumbered the number of wales. Fabric V was the most dense of the fabrics studied. Fabrics I, II, and III were similar in yarn count.

Weight per Square Yard. The range of weight per square yard for the five fabrics studied was wide when the fact that they were all constructed for the same purpose was taken into account. Fabrics I, II, and III, which were the same except for fiber content, varied less than one ounce per square yard. Fabric V was the lightest in weight, 2.7 ounces per square yard, while Fabric IV was the heaviest, 5.9 ounces per square yard.

Yarn Construction. Each of the five fabrics were knitted from yarns that were of single ply.

Thickness. There was very little difference in thickness among the fabrics studied. The greatest variation was between Fabrics I and II and Fabric V, which was the thinnest.

Resistance to Abrasion. Resistance to abrasion was the service quality in which there was the greatest variation in the fabrics investigated. Fabric III possessed the least abrasion resistance even using the lightest practical weight on the abradant. The reverse was true with Fabric IV which demonstrated such extremely high abrasion resistance that the machine was stopped after one hundred thousand cycles because that point was well beyond the point of comparison with the other specimens used in this study.

Resistance to Pilling. None of the fabrics studied were resistant to pilling; however, there was a difference in the size of the pills. Fabrics I, II, and III had slightly larger pills than

Fabrics IV and V. In Fabric III the pills were more numerous as well as larger.

Bursting Strength. The variations among the fabrics and between the instruments were great (Table 2). The results of bursting strength determinations using the constant rate of traverse machine varied from 33.9 pounds for Fabric I, to 80.9 pounds for Fabric IV. The bursting strength determinations using the diaphragm type tester varied from 54.0 pounds for Fabric III to 99.5 pounds for Fabric IV. A comparison of the results of bursting strength determinations from the two types of instruments is shown in Fig. 1.

Table 2. Bursting strength of selected knit fabrics.

Fabric	: Arrayed means and standard error				
	: Constant rate of traverse :		: Diaphragm		
	: Pounds :	: S.E. :	: Pounds :	: S.E.	
I	33.0	0.84	55.6	1.02	
II	33.9	0.59	61.1	1.14	
III	33.8	0.51	54.0	1.33	
IV	80.9	2.34	99.5	2.48	
V	52.0	1.87	68.2	1.80	

#### Analysis of Bursting Strength Data

The data from the constant rate of traverse instrument determination showed that as a group there was significant difference among the five fabrics, at the 0.1 per cent level. The difference between Fabric I, 33.0 pounds, and Fabric V, 52.0 pounds, was

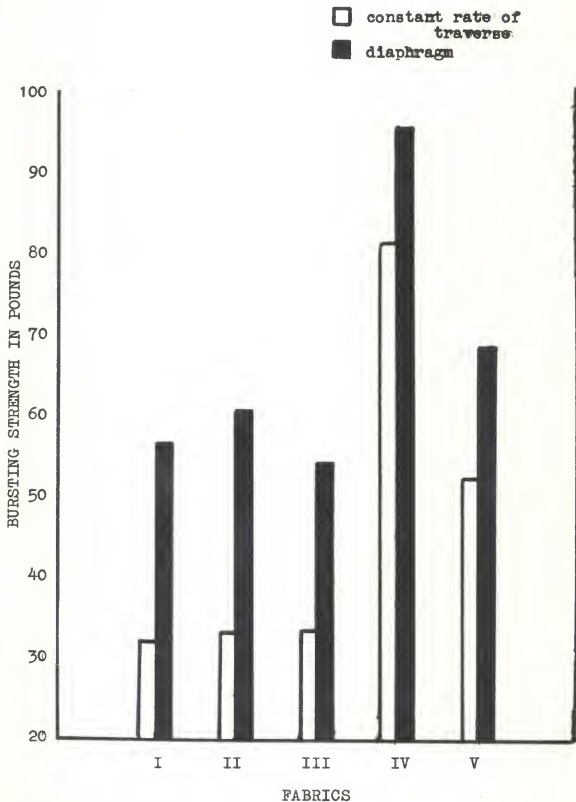


Fig. 1. Comparison of bursting strength data from two types of instruments.

significant beyond the 0.1 per cent level. A comparison between Fabric II, 33.9 pounds and Fabric IV, 80.9 pounds also was significant beyond the 0.1 per cent level. The comparison among Fabric I, 33.0 pounds, Fabric II, 33.9 pounds, and Fabric III, 33.8 pounds was not significant using the constant rate of traverse instrument (Table 3).

Table 3. Analysis of variance of the selected knit fabrics using the constant rate of traverse type instrument.

Source	df	Ss	Ms	F
Fabrics	4	17,239.72	4,309.93	240.38***
I vs. V	1	1,802.45	1,802.45	103.87***
II vs. IV	1	11,045.00	11,045.00	616.01***
I, II, III	2	8.87	4.44	0.25 ns
Garment same fabric	20	509.00	25.45	0.75 ns
Position of specimen	1	52.02	52.02	2.90 ns
Fabric x position	4	135.88	33.97	1.89 ns
Remainder	20	358.66	17.93	
Total	49	18,295.22		

The data from the diaphragm type instrument bursting strength determinations showed that as a group there was significant difference among the five fabrics studied. A comparison of Fabric I, 55.6 pounds, and Fabric V, 68.5 pounds, was significant at the 0.1 per cent level. The difference between Fabric II, 61.1 pounds, and Fabric IV, 99.5 pounds, was significant at the 0.1 per cent level. A comparison among Fabric I, 55.6 pounds, Fabric II, 61.1 pounds, and Fabric III, 54.0 pounds was significant at the 0.1 per cent level (Table 4).



Table 4. Analysis of variance of the selected knit fabrics using the diaphragm type instrument.

Source	df	Ss	Ms	F
Fabrics	4	13,891.50	3,472.88	263.49***
I vs. V	1	793.80	793.80	60.23***
II vs. IV	1	12,373.42	12,373.42	931.24***
I, II, III	2	277.40	138.70	10.50***
Garment				
same fabric	20	765.40	38.37	0.70 ns
Position of				
specimen	1	0.34	0.34	0.02 ns
Fabric x position	4	217.94	54.48	4.13 *
Remainder	20	263.72	13.18	
Total	49	15,138.90		

In eliminating the sources of variation for each of the two instruments it was found that the variations among the fabrics when bursting strength was determined using the constant rate of traverse machine was entirely due to the difference among the five fabrics. When the sources of variation among the fabrics were eliminated, using the diaphragm type instrument, it was found that the position from which the specimen was taken within the same fabric showed a significant difference at the 5.0 per cent level. However, it was noted that this difference was due to Fabric IV rather than being evenly distributed over the five fabrics.

The comparison of data obtained from the two machines showed no consistent relationship between the two sets of results.

## SUMMARY AND CONCLUSIONS

The purpose of this study was to compare the bursting strength and certain other service qualities of knitted fabrics made of all cotton, with those made of cotton blended with nylon, and with Dynel, and to obtain, if possible, a factor as a means of comparing the results obtained from two types of bursting strength instruments.

The results of the study show:

The two fabrics made of all cotton, Fabric I and Fabric I were very different. Fabric V which was the more dense yet lighter weight fabric was considerably more resistant to abrasion than Fabric I. The bursting strength of Fabric V was one and one-half times that of Fabric I using the constant rate of traverse machine, while the results of the bursting strength determinations using the diaphragm type instrument showed less variation between the two fabrics.

Fabric II and Fabric IV were cotton and nylon blends of varying percentages. The abrasion resistance of Fabric IV was extremely high. Fabric IV, the more compact of the two fabrics had more wales than courses per inch. In weight per square yard the two fabrics were similar. The constant rate of traverse machine showed Fabric IV to be more than twice as strong as Fabric II, while the results of bursting strength determinations using the diaphragm type instrument showed less variation between the two fabrics.

Fabric I, Fabric II, and Fabric III, which were the same in fabric construction but differed in fiber content, were similar in physical characteristics except for weight per square yard; Fabric III was one ounce lighter than the other two. Abrasion resistance varied considerably; Fabric III showed the least resistance to abrasion, while Fabric II had the highest resistance to abrasion. The three fabrics were similar in bursting strength, however, the diaphragm type tester showed a significant difference between Fabric II, the strongest, and the other two fabrics, which were the same. The constant rate of traverse machine showed no significant difference among the fabrics.

The bursting strength of the five fabrics varied on each of the two machines used. Fabric IV showed the highest bursting strength. In relation to the other fabrics included in the study Fabric IV was the heaviest in weight per square yard but was not the thickest of the fabrics studied. Fabric IV showed abrasion resistance far greater than that of any of the other fabrics.

The data obtained from the determination of bursting strength using the constant rate of traverse instrument and the diaphragm instrument varied considerably, and without a consistent relationship between the two machines. In the comparison of Fabric I, Fabric II, and Fabric III, the constant rate of traverse machine showed no significant difference in the results while the results obtained using the diaphragm type instrument showed a significant difference between Fabric II, and the other two fabrics.

The greater sensitivity of the diaphragm type instrument made it impossible to obtain a factor as a means of comparing the

results obtained from the two types of machines.

Satisfactory service qualities in knit fabrics are dependent upon fiber content and fabric construction.

## ACKNOWLEDGMENT

Sincere appreciation is expressed to Miss Esther Cormany, Associate Professor of Clothing and Textiles, for her assistance and guidance in directing this study.

## LITERATURE CITED

- (1) Bispham, E. K.  
"Improved Fabrics through Blending." Journal of Home Economics. October 1957, 49 (8): 641.
- (2) Blore, James H.  
"What's Happening in the Knitting Business." Textile World, April 1958, 108 (4): 59-68.
- (3) Carolan, Hugh L.  
"Dynel." Journal of Home Economics, October 1957, 49 (8): 637.
- (4) Committee D-13.  
In A.S.T.M. standards on textile materials. Philadelphia. American Society for Testing Materials, January 1956.
- (5) "Continued Birthrate Boom Sparks Carter Company Expansion." America's Textile Reporter, October 10, 1957, 71 (41): 15.
- (6) "Dynel Trend in Warm Underwear Cited." The Underwear News, Official Organ of the Underwear Institute, March 1956, 23 (3): 18.
- (7) "Federal Specification Textile Test Methods." CCT-191b, Washington 25, D.C.: General Services Administration, May 15, 1951.
- (8) "Fiber Consumption." American Textile Reporter, March 27, 1958, 72 (13): 7.
- (9) Fletcher, Hazel M., Mary Ellen Duensing, and Jane F. Gillman.  
"Dimensional Changes of Knit Goods in Laundering." Institute News, Official Organ of the Underwear Institute, August 1953, 20 (8): 18-24.
- (10) Hollen, Norma, and Jane Saddler.  
Textiles, New York: The Macmillan Company, 1952.
- (11) Johnson, George H.  
Textile Fabrics, New York: Harper Brothers, 1927.
- (12) "Knit Cloth for Sale." Textile Organon, July 1954, 25 (7): 102-103.
- (13) Linton, George E.  
The Modern Textile Dictionary, New York: Duell, Sloan and Pearce, Little-Brown, 1954.



- (14) Mauersberger, Herbert R., Editor.  
Matthews Textile Fibers, Sixth Edition, New York: John Wiley and Sons, 1954.
- (15) Merrill, Gilbert R., Alfred R. MacCormac, and Herbert R. Mauersberger.  
American Cotton Handbook, New York: Textile Book Publishers, Inc., 1949.
- (16) Moncrieff, R. W.  
Man Made Fibers. New York: John Wiley and Sons, Inc., 1957.
- (17) Roberts, S. Helen, and Hazel M. Fletcher.  
"Relationship of Loop Shape to Dimensional Change in Laundering of Plain Knit Cotton T-Shirts." Journal of Home Economics, May 1958, 50 (5): 355.
- (18) Shinn, W. E.  
"An Engineering Approach to Jersey Fabric Construction." Textile Research Journal, March 1955, 25 (3): 210.
- (19) Snedecor, George W., and William G. Cochran.  
Statistical Methods, Fifth Edition, Ames, Iowa: The Iowa State College Press, 1956.
- (20) Swalm, J. M.  
"Inertness, Covering Power and Thermal Pliability Characterize Dynel." Textile Research Journal, September 1957, 27 (9): 739-744.
- (21) U. S. Department of Commerce Industry Trend Series 14,  
"Growth in Textiles, Apparel and Leather." Washington: 1957.
- (22) Wingate, Isabel B.  
Textile Fabrics and Their Selection, New York: Prentice Hall, Inc., 1952.

A COMPARISON OF THE BURSTING STRENGTH OF  
SELECTED KNIT FABRICS MEASURED ON  
TWO TYPES OF INSTRUMENTS

by

SHEILA EILEEN O'CONNELL

B. S., Hunter College, 1956

---

AN ABSTRACT OF A THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Clothing and Textiles

KANSAS STATE COLLEGE  
OF AGRICULTURE AND APPLIED SCIENCE

1958

The limited research which has been done on knit fabrics does not include any comparative studies of all cotton knits with blends of cotton and man-made fibers, or with blends of two or more man-made fibers.

The purpose of this study was to compare the bursting strength and certain other service qualities of knitted fabrics made of all cotton, with those made of cotton blended with nylon, and with Dynel, and to obtain, if possible, a factor as a means of comparing the results obtained from two types of bursting strength instruments.

The knit fabrics selected for this study were five different types of fabrics used in women's and children's undergarments and will be referred to as: Fabric I, Fabric II, Fabric III, Fabric IV, and Fabric V. Fabrics I, II, and III were of the same sun resistant, circular filling knit construction. Fabric I was of 100 per cent cotton; Fabric II was a 90 per cent cotton, 10 per cent nylon blend; and Fabric III, a 50 per cent cotton, 50 per cent Dynel blend. Fabric IV was an 80 per cent cotton and 20 per cent nylon blend, one by one filling knit, and Fabric V was a 100 per cent cotton filling knit.

The fabrics were analyzed to determine yarn count, weight per square yard, yarn type, thickness, resistance to abrasion, resistance to pilling, and bursting strength. Bursting strength was determined using a constant rate of traverse instrument, a Scott Tester with ball burst attachment, and a diaphragm type instrument, the Mullen Tester. Procedures established by Committee D-13 of the American Society for Testing Materials, and the Federal

Specification, Textile Test Methods were used for the analysis of the fabrics.

The data obtained from the bursting strength determinations were analyzed statistically to determine the significance of the results.

The yarn count of each of the fabrics studied was unbalanced. In all but Fabric IV the number of courses outnumbered the number of wales. The fabrics varied in weight per square yard with Fabric IV being the heaviest while Fabric V was the lightest. The five fabrics studied were constructed of single yarns. There was very little variation in thickness among the five fabrics. Resistance to abrasion varied among the fabrics. Fabric III showed little resistance to abrasion, while Fabric IV showed great resistance. The rate of pilling was high for all the fabrics studied because each fabric evidenced low resistance to pilling. However, the difference among the fabrics was not in the number of pills but in the size of the pills. The results of bursting strength determinations showed variations among the fabrics and between the instruments. The greatest bursting strength was observed with Fabric IV.

A comparison of the results of the bursting strength determinations showed that of the two all cotton fabrics, Fabric V was significantly stronger at the 0.1 per cent level than Fabric I. Of the two cotton and nylon fabrics, Fabric IV was significantly stronger at the 0.1 per cent level than Fabric II. A comparison of the three fabrics which were similar in construction but different in fiber content showed the Fabric II, the cotton and nylon

blend, was significantly stronger than the other two fabrics, I and II, at the 0.1 per cent level when bursting strength was determined using the diaphragm type instrument. However, the bursting strength data obtained from the constant rate of traverse type instrument showed no significant difference among the three fabrics.

The results of this study showed that satisfactory service qualities in knit fabrics are dependent upon fiber content and fabric construction, and that due to the greater sensitivity to fabric differences of the diaphragm type tester it was not possible to obtain a factor as a means of comparing the results obtained from the two types of instruments.