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Optimization of Comfort Properties of Single Jersey Knitted Fabrics

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Abstract
The main goal of this study was to investigate the influence of the knitting structure, loop length, thigtness factor, fibre type and yarn properties on the mechanical and comfort properties of single jersey knitted fabrics. Four different blends of fibres (cotton 50%: viscose 50%, cotton 50%: polyester 50%, cotton 40%: polyester 60%, cotton 30%: polyester 70%) were used to produce a 20 tex yarn count. Each of these yarns was used to manufacture single jersey knitted fabrics. The knits were manufactured on a single feeder sample knitting machine. Twelve different types of single jersey knitted fabrics were produced with different blend ratios and three different densities (loose, medium, tight). All experiments were carried out in a standard atmosphere condition. The goals of our research were to study changes in the mechanical properties of weft knits as a function of the structure and density and to investigate relationships between the hand, knit structure and density. This study was to ensure that the quality of fabric production was maintained according to specific constraints and objectives without producing the comfort properties desired. Statistical analysis using Design Expert Analysis 6.06. also indicates that the results are significant for the air permeability, bursting strength and water vapour permeability of the fabrics.

Key words: *single jersey, bursting strength, air permeability, water vapour permeability, comfort optimization.*

Introduction

Knitting is one of the methods most frequently used in fabric formation. Knitting is a process of fabric formation that involves the interlooping of yarn in a series of connected loops by means of needles. Knitted fabrics have been extensively used in readymade apparel owing to their higher level of excellent mechanical and comfort properties. The last few years have witnessed growing interest in knitted fabrics due to their simple production techniques, low cost, high levels of clothing comfort and wide product range. Knitted fabrics are known to possess excellent comfort properties as they not only allow for stretching and ease of movement, but they also have good handling characteristics for the body. They also possess high extensibility under low load, allowing comfortable fit on any part pulled. Furthermore they are also light weight and flexible [1]. These attributes make knitted fabrics the commonly preferred choice for sportswear, casual wear and underwear. Knitted fabrics have therefore long been preferred as fabrics in many kinds of clothing. Efforts have been made to make knitted fabrics more comfortable by incorporating different fibres, altering yarn parameters like twist, bulk, count and finishing treatments, knitting factors like stitch length, course, wale and fabric aerial mass, and by adopting new or different finishes [2]. This is because of the increased versatility of techniques, the adaptability of new manmade fibres and the growth in consumer demand for wrinkle resistant, stretchable, snug fitting fabrics, particularly in the greatly expanding areas of sportswear and other casual wearing apperal.

The effects of various knit structures on the dimensional, mechanical and comfort properties of knitted fabrics have been analysed by many researchers. Some researches describe the relationship between the knitting parameters and mechanical properties of knitwear. Sharma, Mukhapadhyay and Agarwal (1986) studied the dimensional and mechanical properties of single jersey knitted fabrics from open-end and ring spun acrylic-viscose blended yarns [3]. Choi & Ashdown (2000) studied changes in the mechanical properties of weft knits as a function of structure and density and investigated relationships between the hand, knit structure and density [4]. Li (2001) stated that the type of fibre, spinning technology, yarn count, yarn twist, yarn hairiness, fabric thickness, fabric cover factor, fabric porosity and finish are some of the factors which play a decisive role in determining the comfort properties of fabrics [5]. Slah, Amine and Faouzi (2005) predicted knitted fabric global quality, which includes several properties, by using a neural network. They also used an algorithm for the generalization of this prediction [6]. Gün, Ünal & Ünal (2008) researched dimensional and some physical properties of single jersey knitted fabrics made from 50/50 bamboo/cotton blended yarns. The results show that the weight, thickness and air permeability values are independent of the fibre type [7]. Oglakcioglu, Çelik & et. al (2009) studied the thermal comfort properties of cotton/angora rabbit fibre blended rib knitted fabrics and found that the mixing of Angora fibre beyond 25% affected the thermal comfort properties significantly [8]. Bivainyte & Mikucioniene (2011) investigated the influence of knitting structure parameters and raw materials on the air and water vapour permeability of double layered knits used for leisure sports [9]. Emirhanova, Kavuşturan (2011) researched changes in the dimensional and physical properties of 80% lambs-20%wool polyamide blend knitted fabrics as a function of their structure and investigated the relationship between the relaxation condition and dimensional properties of weft knits [10]. Mikucioniene, Milasiüte, Baltusnikaite & Milasius (2012) conducted investigations showing that an increase in the loop length of the fabric investigated increases its permeability to air, likewise an increase in the linear density of yarn decreases the permeability to air of knits. In addition it was estimated that the correlation between the tightness factor of the knit and its permeability to air is strong. The main structure parameters which have an influence on the air permeability of knits are the structure and linear densities of yarns, as well as the course and wale densities and knitting pattern [1]. Kane, Patil and Sudhakar (2013) carried out a study to understand the effect of the structural cell stitch length and different structures on ring and compact yarn weft knitted fabric properties. The yarn, stuctures and their respective loop length were significantly responsible factors for the finished knitted fabric properties, comfort, handle and other properties [11]. Prakash and Ramakrishnan (2013) present the thermal comfort properties of single jersey knitted fabric structures made from cotton, regenerated bamboo and cotton-bamboo blended yarns. The thermal conductivity of the fabrics was generally found to decrease with an increase in the proportion of bamboo fibre. The relative water vapour permeability and air permeability of the fabrics were observed to increase with an increase in the bamboo fibre content [12].

In this study, as a contribution to the literature, this paper investigated the influence of different loop lengths and different fibre blend ratios of single jersey knitted fabrics on the mechanical and comfort properties thereof. The purpose of this study was to ensure that the quality of fabric production was maintained according to specific constraints and objectives without producing the comfort properties desired. Twelve weft knits were produced with four different mixtures and three different densities (loose, medium, tight). Single jersey knitted fabric was selected for this study, since it is widely used. The structure and three densities chosen were based on the kinds of stitch structures and methods currently used in the industry. The goals of our research were to study changes in the mechanical and comfort properties of polyester/cotton and polyester/viscose blended knitted fabrics as a function of their structure, and to investigate the relationship between the relaxation condition and dimensional properties of weft knits.

Materials and methods

Experiments were carried out with cotton (Greece), viscose (Lenzing, Austria) and polyester (Turkey) blend yarns with a 20 tex linear density and smilar twist level. Such yarns are regularly used in knitting processes for various textile products. Cotton is the most widely used natural cellulose fibre, viscose - a well-known and widely used man-made cellulose fibre, and polyester synthetic fibre is more and more popular fibre and currently widely used. The fibres used in the study are given in ***Table 1***. Twelve variants of fabrics were knitted from these yarns in a single jersey knitting pattern on the same gauge of a one needle-bed sample circular weft-knitting machine. The single jersey pattern was chosen because it is a simple and widely investigated structure.

Table 1. *Characteristics of cotton, polyester and viscose.*

Fibres	Fibre length, mm	Linear density, dtex	Tenacity, cN/tex
Cotton	28.2	1.90	37
Polyester	32.0	2.22	55
Viscose	30.0	3.75	28

Table 2. *Properties of the yarn used in knitted fabric samples.*

Yarn types	PES 50%/ CV 50%	PES 70%/ CO 30%	PES 50%/ CO 50%	PES 60%/ CO 40%
Uniformity U, %	11.09	11.31	10.95	11.11
Mass variation of coefficient CVm, %	14.06	14.39	13.95	14.1
Thin places, -50%	13.3	5.0	1.7	4.2
Thick places, +50%	66.7	107.5	118.3	78.3
Neps, +200%/km	49.2	246.7	300.8	157.5
Hairiness, H	2.65	5.36	5.37	3.91
Linear density, dtex	30.1	29.6	28.7	29.3
Neps +140%/km	218.3	775.8	993	535.8
Breaking force, cN	377.5	423.3	348.1	327.5
Elongation, %	15.80	9.19	7.57	9.70
Tenancity, Strength Rkm (kgf·Nm)	19.17	21.5	17.68	16.64
Breaking work, J	1762.5	1084.6	787.2	1004.0

All experiments were carried out in a standard atmosphere of 65% RH and 20 ± 2 °C temperature for testing according to Standard ISO139 (2002) [13]. The following mechanical and comfort characteristics of the yarns were determined: yarn count, evenness and tensile strength. For yarn evenness, faults and hairiness, an Uster Tester 4SX (Switzerland) test device was used. Yarn strength was tested in accordance with EN ISO 2062 (2010) [14]. The main characteristics of the yarn used are given in ***Table 2***.

All knitted fabrics were investigated in a "grey" state, i.e. without finishing, but after 1-week relaxation in a free state in standard atmospheric conditions. All testing was carried out in the standard atmosphere. Under these conditions, we measured the course/cm, wale/cm, loop length in mm, fabric thickness in mm, aerial mass per unit in g/m^2, water vapour permeability (I), air permeability in mm/s, and bursting strength in kPa. Structure parameters of the knitted samples were analysed according to the standard.

Course and wale density values per cm were taken into account for the study in accordance with Standard EN 14971(2006) [15]. The yarn loop length was determined in accordance with Standard EN 14970 (2006). The fabric thickness and mass per unit area of knitted fabrics are characteristics values related to the drape and fullness of clothing [16]. The mean mass per unit area was determined in accordance with Standard EN 12127 (1999) [17]. Similarly the thickness was determined in accordance with Standard EN ISO 5084 (1998) [18]. Under these conditions, we measured the loop length, mass per unit area and fabric thickness, which were tested in different places with the help of a Shirley thickness gauge (UK). On the fabric thickness gauge, the fabric whose thickness is to be determined is kept on a flat anvil and a circular pressure foot is pressed on to it from the top under a standard fixed load. Then the dial indicator directly gives the thickness in mm. To measure the air permeability of the sample fabrics, an SDL Atlas Air Permeability tester was used with a 100 kPa pressure difference. The air permeability was investigated according to Standard EN ISO 9237 (1995) [19]. The air permeability of a fabric is defined as the amount of air passed over a surface under a certain pressure difference in a unit time. This value has signifiance with respect to the usage area. Water Vapour Permeability Index results were obtained from the SDL Atlas Water Vapour Permeability tester (UK). The water vapour permeability was tested to the standard of BS 7209 (1990) [20].

The rate of moisture vapour transfer was measuring using the cup method. Samples with a diameter of 10 cm were kept on a round cup containing water of 40°C temperature in controlled condi-

Table 3. Experimental data for the single jersey blended knitted fabrics; Pes: Polyester, CV: Viscose, Co: Cotton.

Single jersey knitted fabrics	Fabric density	Course density, course/cm	Wale density, wale/cm	Loop length, mm	Fabric thicknes, mm	Mass per unit area, g/m2	Bursting strength, kPa	Air permeability, mm/s	Water vapour permeability, l
Pes 50%/ Cv 50%	Loose	10	9	0.51	0.75	0.939	142.60	6270	1.0844
	Medium	12	11	0.40	0.66	1.084	171.80	4590	1.0716
	Tight	18	10	0.30	0.61	1.234	187.60	3060	1.0895
Pes 50%/ Co50%	Loose	10	11	0.50	0.86	0.961	161.20	6730	0.9684
	Medium	11	11	0.42	0.63	1.065	181.30	4760	0.9505
	Tight	20	11	0.30	0.59	1.320	198.60	2950	1.0030
Pes 60%/ Co 40%	Loose	10	9	0.50	0.87	0.958	176.40	6270	0.9881
	Medium	12	10	0.40	0.65	1.075	187.70	5020	0.9895
	Tight	18	11	0.31	0.62	1.337	206.20	3030	1.0575
Pes70%/ Co 30%	Loose	10	9	0.52	0.80	0.982	201.40	6480	1.0432
	Medium	12	11	0.42	0.66	1.049	215.00	4920	1.0641
	Tight	18	10	0.30	0.61	1.490	250.00	2630	1.0721

tions (an air temperature of 25 °C and relative humidity of 50%) for a duration of 1 hour. Five tests per sample were performed. The bursting strength in kPa, tested using a James Heal TruBurst (UK) bursting strength tester, was determined by the standard of TS 393EN ISO 13938-2 (1999) [21]. This was tested with the help of a Bursting strength tester at ten different places per sample. The reading was noted in kPa.

Statistical analyses were made by Design Expert Analysis 6.0.6 of Variance (ANOVA) software. We evaluated the results based on the F ratio and the probability of the F-ratio (prob > F). Statistically the effect of the fabric blend ratio and loop length were investigated. Design Expert software 6.06 was used to predict optimum process parameters for air and water permeability.

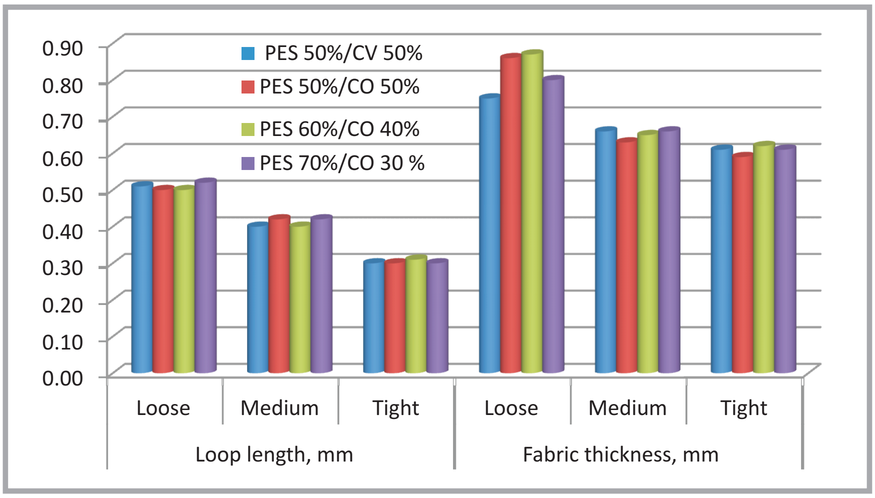

***Figure 1.** Influence of the loop length and fibre blend on the fabric thickness of knits.*

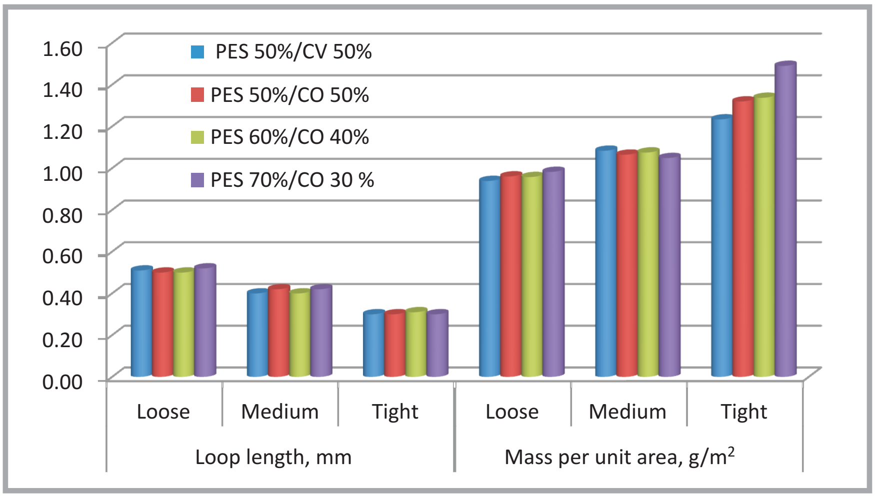

***Figure 2.** Influence of the loop length and fibre blend on the mass per unit area of knits.*

Results and discussion

This paper investigated the influence of different loop lengths and different fibre blend ratios of single jersey knitted fabrics on the mechanical and comfort properties thereof ***Table 3*** give the experimental data obtained according to the standard methods explained above for single jersey blend fabrics produced using a 20 tex yarn count.

The loop length was the major factor which affected all the other properties i.e the course, wale and tightness factors. We concluded that when the loop length increased, the wales per cm, course per cm and tightness factor decreased correspondingly, and the trend was the same for rotor yarn.

The fabric thickness decreased with the increased loop length. The thickness of the knitted fabric depended on the count, structure and relative closeness of the loops. The fabric aerial mass of knitted fabrics depends on their structure, yarn count and dimensional properties . When the fabric density is more, then the fabric aerial mass is also higher. It is clearly seen from ***Table 3*** that the fabric aerial mass decreased when the loop length increased.

The blend ratio and loop length have a significant effect on the bursting strength. As is seen in ***Table 3***, with an increase in the amount of polyester, the bursting strength of the fabric blends increased. When we made a comparison at the same rate of polyester/cotton blends with the polyester/viscose blend, the strength was higher. As seen in ***Figure 3***, when the loop length was increased, the bursting strength decreased.

As we can see from ***Table 3***, as the loop length increased, the airflow resistance decreased. The resistance to airflow decreased with an increase in the loop length. Investigations of the influence of the knit structure, i.e. linear density of yarns, loop length, and the tightness factor of the knit on garment permeability to air are presented in this paper. For fabric with a looser structure, small changes in the tightness factor give a marked change in the permeability to air. Meanwhile when the structure of the knit is thick, even a great change in the tightness factor gives a low variation in the permeability to air. It is obvious that an increase in the loop length increases the permeability to air and comfort of the wearer. An increase in the thickness of knits decreases comfort and the possibility of the person being more comfortable; they cannot function satisfactorily if they feel uncomfortable or, even worse, become incorpacitated due to excessive heat stress. Therefore the dependence between permeability to air and the tightness factor was obtained (see ***Figure 4***).

It is estimated that an increase in the loop length of the fabric investigated increases their permeability to air, whereas an increase in the linear density of yarns decreases the permeability to air of the knits. When the loop length of the knit and linear density of yarn are considered as one parameter, the tightness factor can be used for fabric air permeability forecasting. The high correlation between the permeability to air and tightness factor confirms this.

Airflow through textiles is mainly affected by the pore characteristics of fabrics. The pore dimension and distribution in a fabric is a function of fabric geometry. The yarn diameter, knitting structure, course and wale density are the main factors affecting the porosity of knitted fabrics [22].

Water vapour permeability is the ability to transmit vapour from the body. The ability of clothing to transport water vapour is an important determinant of physiological comfort [23, 24]. Sweat should be removed from the surface of

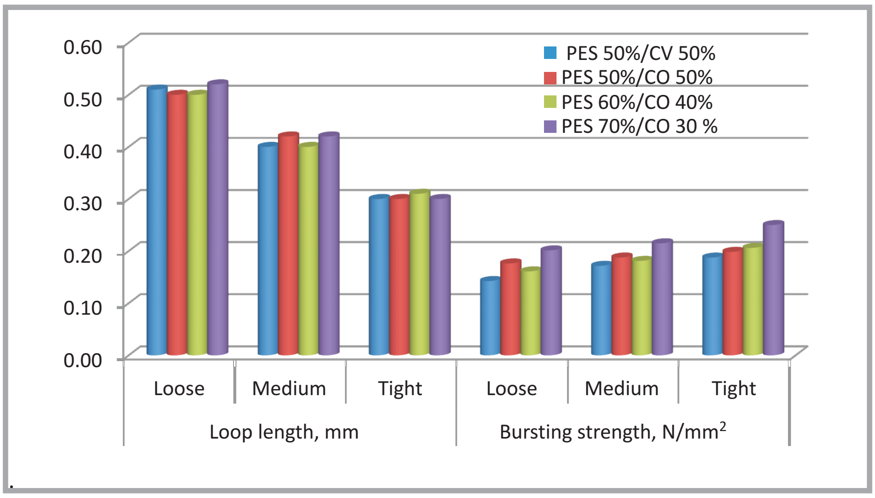

Figure 3. *Influence of the loop length and fibre blend on the bursting strength of knits.*

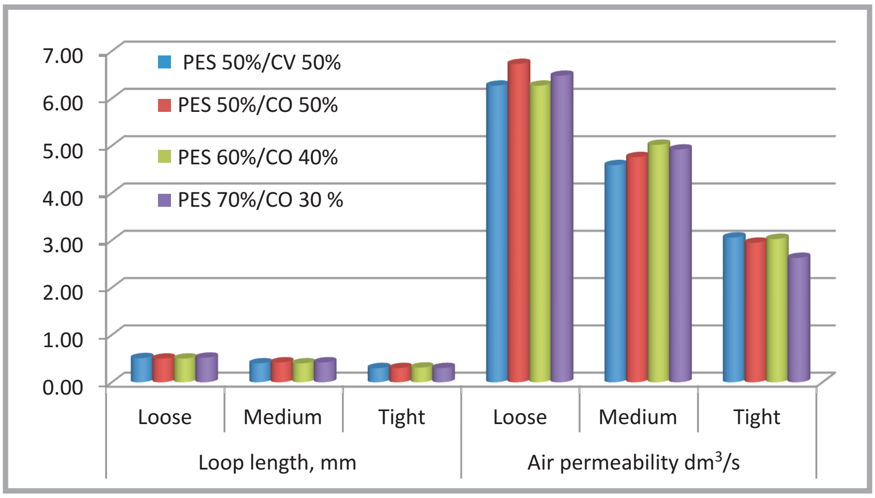

Figure 4. *Influence of the loop length and fibre blend on the air permeability of knits.*

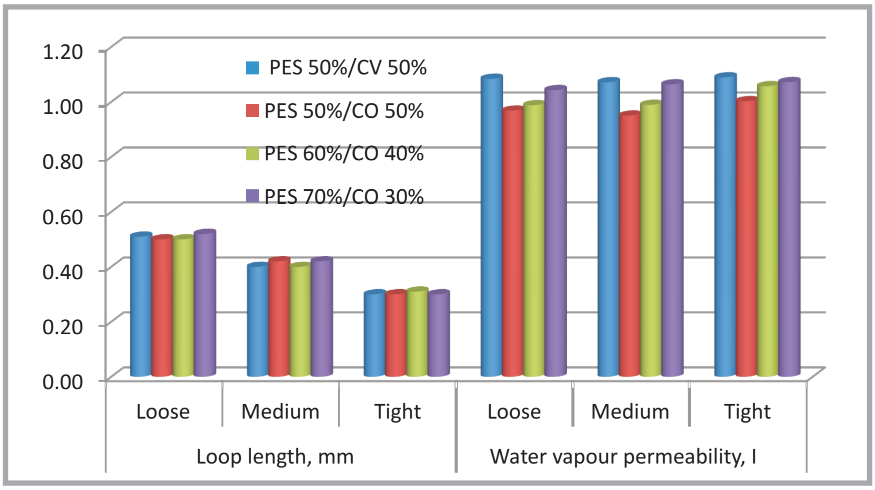

Figure 5. *Influence of loop length and fibre blend on the water vapour permeability of knits.*

skin to that of the fabric of the next-to-skin clothing. After the body has stopped sweating, the textile fabric should release the vapour held in the atmosphere in order to reduce the humidity on the surface of the skin.

The investigation shows that an increase in the loop length of the fabric investigated increases its water vapour permeability, likewise an increase in the linear density of the knit decreases its permeability to water vapour (***Figure 5***). In ad-

Table 4. Statistical analysis of data.

Std	Run	Block	Factor 1 A:Hammadde	Factor 2 B:siklik	Responsore 1 course	Responsore 2 wale	Responsore 3 loop length	Responsore 4 thickness	Responsore 5 weight	Responsore 6 air permeability	Responsore 7 bursting strenght	Responsore 8 water permeability
1	10	Block 1	Pes 50/CV50	Loose	10	9	0.51	0.75	0.939	6270	142.6	1.0844
2	7		Pes 50/Co50		10	11	0.50	0.86	0.961	6730	176.4	0.9684
3	12		Pes 60/Co40		10	9	0.50	0.87	0.956	6270	161.2	0.9881
4	1		Pes 70/Co30		10	9	0.52	0.80	0.982	6480	201.4	1.0432
5	3		Pes 50/CV50	Medium	12	11	0.40	0.66	1.084	4590	171.8	1.0716
6	2		Pes 50/Co50		11	11	0.42	0.63	1.065	4760	187.7	0.9505
7	6		Pes 60/Co40		12	10	0.40	0.65	1.075	5020	181.3	0.9895
8	9		Pes 70/Co30		12	11	0.42	0.66	1.049	4920	215.0	1.0641
9	11		Pes 50/CV50	Tight	18	10	0.30	0.61	1.234	3060	187.6	1.0895
10	8		Pes 50/Co50		20	11	0.30	0.59	1.320	2950	198.6	1.0030
11	4		Pes 60/Co40		18	11	0.31	0.62	1.337	3020	206.2	1.0575
12	5		Pes 70/Co30		18	10	0.30	0.61	1.490	2630	250.0	1.0721

Table 5. Model summary statistics.

Fabric properties	Source	Sum of squares	DF	Mean square	F-Value	Prob > F	Std deviation	R^2	Adjusted R^2
Course	Quadratic	16.67	1	16.67	25.00	0.0154	0.82	0.9879	0.9555
Wale		1.50		1.50	3.00	0.1817	0.71	0.8182	0.3330
Loop length	Linear	0.084	4	0.021	239.09	<0.0001	9.38	0.9927	0.9886
Fabric thickness		0.093		0.023	8.59	0.0078	0.031	0.9748	0.9076
Fabric aerial mass		0.31		0.077	12.69	0.0025	0.078	0.8788	0.8096
Air permeability		2.48		6.21	119.55	<0.0001	227.91	0.9856	0.9773
Bursting strength		8040.1		2010.0	42.58	<0.0001	6.87	0.9605	0.9380
Water vapour permeability		0.023		5.872	14.64	0.0016	0.020	0.8933	0.8323

Table 6. Statistical significance analysis of data for single jersey knitted fabrics.

Fabric properties	Fabric blended ratio			Loop length			Fabric blends x loop length
	F-Value	P-Value	Contribution %	F-Value	P-Value	Contribution %	Contribution %
Course/cm	0.13	0.9393	0.15	216.75	0.0007	97.73	2.12
Wale/cm	1.50	0.3735	27.27	4.00	0.1393	42.42	30.30
Thickness, mm	0.86	0.5471	2.17	96.33	0.0022	90.62	7.21
Aerial mass, g/m²	0.66	0.6027	3.42	48.79	0.0002	89.86	6.72
Air permeability, mm/s	0.38	0.7712	0.23	477.08	0.0001	98.55	1.22
Bursting strength, kPa	33.95	0.0002	57.44	68.47	0.0001	38.69	3.87
Water vapour permeability, l	17.55	0.0012	80.27	5.94	0.0450	12.85	6.88

dition, it was estimated that the correlation between the tightness factor of the knit and its permeability to water vapour permeability is strong.

Statistical significance analysis

The experimental results were statistically evaluated using Design Expert Analysis of Variance (ANOVA). The Design expert program for 12 different types of fabric is placed in ***Table 4***. Analysis was performed according to the values.

The experimental results were statistically evaluated using Design Expert Analysis of Variance (ANOVA) software with F values at a significance level of $\alpha = 0.05$, with the intention of exploring whether there is any statistically significant difference between the variations obtained. We evaluated the results based on the F ratio and the probability thereof (prob > F). The lower the probability of the F-ratio, the stronger the contribution of the variation and the more significant the variable. ***Table 5*** gives model summary statistics.

The statistical significance of the blend ratio of the fabrics and loop length were analyzed. The contribution of each parameter s was examined. ***Table 6*** gives a statistical significance analysis for the single jersey knitted fabric data.

The statistical analysis indicates that the contributions of the fabric blended ratio and loop length have a significant influence on the course/cm, wale/cm, fabric thickness, fabric aerial mass, air permeability, bursting strength and water vapour permeability. The course/cm, wale/cm, thickness, weight and air permeability are influenced by the fabric blend ratio by approximately 2 - 3%, as a minor factor, and by 97 - 98% for the loop length, which becomes a major parameter. Contributions of the fabric blend ratio of 57% and loop length of 39% have a significant influence, along with the bursting strength contribution, on single jersey knitted fabrics. The fabric blend ratio, as major factor, has a great influence on the water vapour permeability, with an approximate contribution of 80%. The loop length becomes a minor factor, with a contribution of around 13%. These results of the analysis should be considered within the limited concept and data of our experimental examinations.

Fabric comfort optimisation

The Design expert analysis program was used in a numerical optimization program. We conducted an analysis using the desirability function in dependence on three factors: the objective given to

Table 7. Limit values for knitted fabric comfort optimisation.

Constraints	Limit values for fabric comfort optimisation					
Name	Goal	Lower limit	Upper limit	Lower weight	Upper weight	Importance
Raw material	is in range	Pes50/CV50	Pes70/CO30	1	1	3
Loop length	is in range	loose	tight	1	1	3
Course	is in range	10	20	1	1	3
Wale	is in range	9	11	1	1	3
Measured loop length	is in range	0.3	0.52	1	1	3
Fabric thickness	is in range	0.59	0.87	1	1	3
Fabric aerial mass	is in range	0.939	1.49	1	1	3
Air permeability	**maximise**	**2630**	**6730**	**1**	**1**	**5**
Bursting strength	is in range	142.6	250	1	1	3
Water permeability	**maximise**	**0.9505**	**1.0895**	**1**	**1**	**5**

Table 8. Optimum values for knitted fabrics.

Production parameter		Values of parameters measuring and testing the optimization proposed								Target
Raw material	Loop length, cm	Course/cm	Wale/cm	Measured loop length, cm	Fabric thickness, mm	Fabric aerial mass, g/m^2	Air permeability	Bursting strength, kPa	Water perme-ability	D
Pes50/cv50	loose	10	9	0.51	0.75	0.939	6270	142.6	1.0844	0.925
Pes70/Co30	loose	10	9	0.52	0.80	0.982	6480	201.4	1.0432	0.791
Pes70/Co30	medium	12	11	0.42	0.66	1.049	4920	215.0	1.0432	0.676
Pes50/cv50	medium	12	11	0.40	0.66	1.084	4590	171.8	1.0641	0.645

each property in the global knit quality definition, such as maximising, minimising or reaching the target value, the acceptance interval defining the lower and upper limits for each property in which the consumer is satisfied, and the consumer's requirement level. Thus when we want to maximise a property, such as the air permeability, water permeability and bursting strength, we use the desirability function. The knitted fabric's global quality is a result of different components, such as the comfort of use, lasting appearance, usability and other mechanical characteristics. In this research, we studied the following aspects: weight, wale/course direction, air permeability, water permeability and bursting strength. The aim was optimisition in accordance with the performance characteristic constraints selected, and at the same time achieving the purpose in some cases; two or more may be required. Therefore the maximum air permeability and maximum water vapour permeability of knitted fabrics for optimisation were applied. Upper and lower limit values of sample fabrics were determined on the basis of measurements. In ***Table 7***, upper and lower limit values and target values for knitted fabrics are given.

Constraint values of knitted fabrics for comfort optimisation are given in ***Table 7***. The air permeability and water vapour permeability were determined for the target maximum. In ***Table 7***, using the maximum air permeability and water vapour permeability values, the limit and target were optimised.

Knitted fabrics of comfort with optimum solution values are given in ***Table 8***, for which the constraints given in ***Table 7*** were used. Accordingly, as a result of the best optimization, pes50/cv50 and loose was obtained. Knitted fabric for a maximum comfort of 92% desirability was determined.

Conclusions

The main goal of this study was to investigate the influence of the fibre blend ratio, yarn properties and loop length on the air permeability, water vapour permeability and bursting strength.

It is obvious that an increase in the loop length increases the permeability to air and comfort of the wearer. An increase in the thickness of knits decreases comfort and the possibility of the person being more comfortable; they cannot function satisfactorily. If they feel uncomfortable or even worse, they become incapacitated due to the air of the knits.

It is estimated that an increase in the loop length of the fabrics investigated increases their water vapour permeability, whereas an increase in the linear density of yarns decreases the water vapour permeability of the knits.

Single jersey knitted fabrics from polyester 70%-cotton30% blended yarns have the highest bursting strength values.

For fabrics with a looser structure, small changes in the tightness factor gives a marked change in the permeability to air. Meanwhile, when the structure of the knit is thick, even a great change in the tightness factor gives a low variation in the permeability to air.

This study showed that the fibre, yarn structures and their respective loop length were significantly influential factors for single jersey knitted fabric properties, like dimensional properties, comfort, strength and others.

Without having tested plain knitted fabrics, quality properties such as air permeability, bursting strength, and water vapour permeability were estimated with an optimisation programme. An objective was given to each property in the knit quality definition, such as maximising, minimising or reaching a target value. The acceptance interval was defined as the lower and upper constraints for each property in which the consumer is satisfied.

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