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Effect of Tuck Loops on Fabric Properties of Cardigan Derivative Structures

Selanik ve Türevi Yapılarda Askının Kumaş Özelliklerine Etkisi

Berna Cüreklibatır Encan [1*], Arzu Marmaralı [2]

[1] Ege Üniversitesi Emel Akın Meslek Yüksekokulu, İzmir, TÜRKİYE
[2] Ege Üniversitesi Mühendislik Fakültesi Tekstil Mühendisliği Bölümü, İzmir, TÜRKİYE
Sorumlu Yazar / Corresponding Author *: berna.encan@ege.edu.tr

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Abstract

Exploring the effect of tuck loops on fabric properties of some knitted structures was aimed in this study. Samples were produced on a Stoll V-bed knitting loom with 100% acrylic yarn. Five types of knit structures (1x1 rib, half cardigan, double half cardigan, cardigan and double cardigan) were knitted with identical machine settings. Test results revealed that double cardigan fabric has the highest fabric thickness, thermal resistance and coefficient of friction. Double half cardigan provides the highest air permeability, whereas 1x1 rib structure has the highest relative water vapor permeability, mass per unit area and loop length. Half cardigan has the highest bending rigidity. Half cardigan and double half cardigan both have the best pilling results. It was observed that test results of half cardigan-double half cardigan and cardigan-double cardigan are generally similar as pairs. However, dimensional, mechanical and comfort characteristics of 1x1 rib fabric seem quite different.
Keywords: *Tuck loop, Knitted fabric, Cardigan, Half cardigan, 1x1 rib, Thermal comfort*

Öz

Bu çalışmada, askının bazı örme yapıların kumaş özellikleri üzerindeki etkisini incelemek amaçlanmıştır. Numuneler V-yataklı Stoll örme makinesinde %100 akrilik iplik kullanılarak örülmüştür. Beş farklı örgü yapısında (1x1 rib, yarım selanik, çift askılı yarım selanik, selanik ve çift askılı selanik) kumaş aynı makine ayarlarında üretilmiştir. Test sonuçları çift askılı selanik kumaşın en yüksek kumaş kalınlığı, ısıl direnç ve sürtünme katsayısına sahip olduğunu göstermektedir. Çift askılı yarım selanik kumaş en yüksek hava geçirgenliği değerine sahipken, 1x1 rib kumaş ise en yüksek bağıl su buharı geçirgenliği, gramaj ve ilmek iplik uzunluğuna sahiptir. Yarım selanik kumaş ise en yüksek eğilme direncine sahiptir. Yarım selanik-çift askılı yarım selanik ve selanik-çift askılı selanik kumaşların test sonuçlarının kendi aralarında benzer olduğu gözlenmiştir. Ancak, 1x1 rib kumaşın boyutsal, mekanik ve konfor özellikleri selanik ve türevlerinden oldukça farklıdır.
Anahtar Kelimeler: *Askı, Örme kumaş, Selanik, Yarım selanik, 1x1 rib, Isıl konfor*

1. Introduction

Nowadays, exercising and having an active life has become an inseparable part of people's lives both in terms of health and social relations. As people seek more activity, they also seek more comfort from their clothes. Comfort expectations can be met by knitted garments with their elasticity, warmth, softness, and easy fit to body shape. The dress code in work-life has loosened in the past decade which resulted in more usage of knitted garments not only in leisure time but also in daily life. That is why consumers expect new and appealing designs from designers and producers. Therefore, patterning is a thriving area in the knitting industry. Patterning with stitch, tuck and miss loops is a simple and frequently used way. Many fabric constructions and designs can be formed by combining these stitch types.

A tuck loop is formed when a needle already holding a stitch, receives a further loop. This second loop is tucked in behind the held stitch. The distinctive appearance of a tuck loop is a diagonally laid yarn on an extended stitch. Patterning can be done with a tuck loop on a needle or several tuck loops on consecutive needles. Moreover, uneven or thick yarns can be added to the knit structure. Tuck loops cause some alterations in fabric properties. Such as, a tuck loop placed on a stitch leads to an extension widthwise direction in fabric, thus the fabric width increases [1]. Furthermore, the tuck loop increases fabric weight and thickness, also provides more porosity than other fabrics [2].

The influence of knit structure and existence of tuck loops on various properties of knitted fabrics have widely been investigated in previous studies. Ertekin and Marmaralı (2011) studied the effects of tuck and miss stitches on thermal comfort properties of plain knitted fabrics. They produced single jersey fabric samples systematically containing tuck and miss stitches. Air permeability, relative water vapor permeability, thermal conductivity and thermal resistance values of the samples were measured [1]. Uyanik et al. (2016) explored the relation between the number and location of tuck stitches and bursting strength in single jersey derivate fabrics [2]. Choi and Ashdown (2000) investigated the effect of changes in knit structure and density on the mechanical and hand properties of weft knitted fabrics by using KES-F system. They examined 1x1 rib, half-cardigan, half-milano rib, interlock, single piquet and crossmiss interlock structures [3]. Kane et al. (2007) researched the influence of knit structure and stitch length on single jersey fabric properties knitted with ring and compact yarns. Single jersey, single pique, double pique and honeycomb structures were tested for air permeability, water absorbency, thermal insulation value, mechanical properties (with KES-F system), bursting and pilling [4]. Emirhanova and Kavusturan (2008) studied the effects of knit structure on dimensional and physical properties of various winter outerwear knitted fabrics. Dimensional properties, pilling resistance, abrasion resistance, bursting strength, air permeability and bending rigidity properties of fourteen knit structures were analysed [5]. Islam (2014) observed the effect of wale-wise increased tuck and miss loops on spirality of single jersey derivative fabrics [6]. Senthilkumar and Suganthi (2019) examined the influence of tuck stitch in wale direction on thermal comfort properties of four bi-layer rib knitted fabrics. Inner layers were knitted with microfiber polyester and outer layers were made up of modal yarn. Tuck stitches were located on the fourth, tenth, fourteenth and eighteenth wales of the samples. Thermal conductivity, air permeability, water vapor permeability, wicking, moisture absorbency, drying behaviour and moisture management properties of the specimens were tested [7]. Assefa and Govindan (2020) investigated the physical properties of single jersey derivative cotton fabrics with tuck and miss stitches. Air permeability, drapeability, shrinkage, stretch and recovery, and low-stress mechanical properties of the specimens were measured [8]. Asif et al. (2015) researched the effect of knit structure (single jersey, single lacoste and double lacoste) on several fabric properties such as dimensional stability, spirality, resistance to pilling, color fastness to washing, color fastness to light and color fastness to rubbing [9]. Oğlakcioğlu and Marmarali (2007) investigated thermal comfort properties of single jersey, 1x1 rib and interlock structures made out of cotton and polyester yarns [11]. The effect of tuck loops on fabric characteristics was examined in the literature. However, a systematical study focusing on the effect of tuck loops on fabric properties of cardigan derivative structures was not encountered. Therefore, exploring the effect of tuck loops on dimensional, mechanical, and thermal comfort characteristics of cardigan derivative fabrics was aimed in this study.

2. Material and Method

2.1. Material

Different stitches and stitch combinations affect the properties of knitted fabrics. Physical properties of a knitted fabric mostly depend on loop structure, stitch density, types of yarn (ring, rotor, compact, etc.), type of fiber material, the composition of yarn, twist level, and so on [8]. Hence, in order to focus on the effect of the tuck loop in various knit structures, the same yarn was used for knitting all fabric samples. 100% acrylic yarn (yarn count Nm 14, yarn twist 180 T/m) was fed to the needles as two-ply. Samples were produced on a 10-gauge Stoll V-bed knitting loom using 70 needles. Five types of knit structures (1x1 rib, half cardigan, double half cardigan, cardigan, and double cardigan) were knitted with identical machine settings. Fabric properties, views, and stitch diagrams are given in Tables 1 and 2, respectively.

2.2. Method

Samples were kept in standard atmosphere conditions (20 ± 2ºC temperature, 65% ± 2 relative humidity) for at least 24 hours prior to testing. Fabric mass per unit area (TS EN 12127), fabric thickness (TS 3374 ISO 1765), number of courses and wales per inch (TS EN ISO 14971), pilling (TS EN ISO 12945-1), bending rigidity (ASTM D 4032), coefficient of friction (Frictorq instrument), thermal resistance (Alambeta instrument), air permeability (TS 391 EN ISO 9237) and relative water vapor permeability (Permetest instrument, ISO 11092) of the samples were measured according to related standards. Test results were evaluated using the software PASW Statistics 18 with a 95% confidence interval. The statistical method analysis of variance (ANOVA) was applied to determine the statistical importance of the variations. The probability values or p-values were examined to determine whether the parameters were significant or not. If the p-value of a parameter is greater than 0.05 ($p>0.05$), the parameter was accepted as insignificant and was ignored. When the p-value was stated as lower than 0.05 ($p<0.05$), then Student-Newman-Keuls (S-N-K) post-hoc test was used for homogeneous variance and Tamhane's T2 post-hoc test was used for heterogeneous variance.

3. Results

Test results of the samples are given in Table 3. The mean values are marked with the letters 'a', 'b', 'c' and 'd'. The letters 'a' and 'd' represent the lowest and highest values, respectively. If the mean values were not significantly different, they were marked with the same letter.

Table 1. Fabric properties

Tablo 1. Kumaş özellikleri

Fabric code	Fabric structure	Courses per inch (cpi)	Wales per inch* (wpi)	Stitch density (stitch/inch^2)	Loop length (mm)	Mass per unit area (g/m^2)	Fabric thickness (mm)	Fabric density (g/m^3)
R	1x1 Rib	12	8	96	10.2	483	3.59	134,540
HC	Half cardigan	10	5	50	9.33	394	4.03	97,766
DHC	Double half cardigan	10	5	50	9.55	413	4.03	102,481
C	Cardigan	11	4	44	9.78	363	4.62	78,571
DC	Double cardigan	11	4	44	9.79	416	4.68	88,888

*Wales per inch were counted on technical face side only

Table 2. Views and stitch diagrams of the samples

Tablo 2. Numunelerin görünümü ve iğne diyagramları

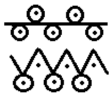
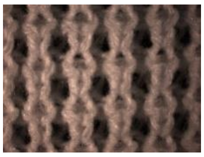
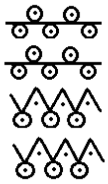
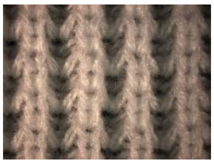
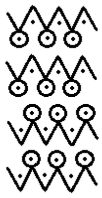
Fabric code	Fabric structure	Fabric view	Stitch diagram
R	1x1 Rib		
HC	Half cardigan		
DHC	Double half cardigan		
C	Cardigan		
DC	Double cardigan		

Table 3. Test results of the samples

Tablo 3. Numunelerin test sonuçları

Fabric code	Air permeability (l/m2s)	Relative water vapor permeability (%)	Thermal resistance (m2K/W)	Bending rigidity (N)	Coefficient of friction	Pilling grade
R	859 a	30.87 c	0.0806 a	10.98 a	0.4656 a	3-4
HC	1095 b	26.77 b	0.0999 b	13.32 b	0.5181 a	4-5
DHC	1663 d	29.83 c	0.1036 b	12.32 ab	0.5681 a	4-5
C	1387 c	22.43 a	0.1264 c	11.55 a	0.8004 b	3
DC	1596 d	22.50 a	0.1342 d	11.10 a	0.8888 b	4

3.1. Dimensional and physical properties of the fabrics

Analysis of variance test showed that there is a significant difference between mass per unit area (p=0.000), loop length (p=0.001) and fabric thickness (p=0.000) values of the samples. According to the test results, the highest mass per unit area, loop length, and thickness values belong to the 1x1 rib, 1x1 rib, and double cardigan respectively. The minimum values for the same properties have been seen on the cardigan, half cardigan, and 1x1 rib samples.

Although tuck loops increase fabric weight [2], 1x1 rib structure, which is made of loops only, has the highest mass per unit area. This could be explained by course per inch (cpi) and wales per inch (wpi) values of the samples (Table 1). 1x1 rib fabric has the highest cpi and wpi values. On the contrary, samples containing tuck loops have lower values of cpi and wpi. As stated by Asif et al. (2015), knitted fabrics with tuck stitches are usually thicker than fabrics having only knit stitches because of yarn accumulation at tucking places [9]. Parallel to that knowledge, 1x1 rib structure has the lowest fabric thickness value. Number of tuck loops in unit stitch diagram is an important indicator for fabric properties, as well. When unit stitch diagrams are examined, it is observed that half cardigan and double half cardigan samples contain 4 tucks and 12 loops, while cardigan and double cardigan samples have 8 tucks and 8 loops (Table 2). Correspondingly, fabric thickness increases as number of tuck loops increases in unit structure. Conversely, increase of tuck loops in unit structure results in lower fabric density. Moreover, number of tuck loops in walewise direction may influence fabric characteristics. As seen in Table 2, 1x1 rib samples has 100% loops, whereas half cardigan and double half cardigan has 75%, cardigan and double cardigan has 50% loops longitudinally. As percentage of tuck loops in walewise direction increases fabric thickness increases, though fabric density decreases.

Air permeability is the measure of how well the fabric allows the passage of air through it [10]. Difference between air permeability values of the samples was found as significant (p=0.000). According to Table 3, only the difference between values of double half cardigan and double cardigan structures' values were found as insignificant (p=0.781). As can be seen from Figure 1, 1x1 rib has the lowest air permeability value, while double half cardigan and double cardigan have the highest. As it has been reported by Uyanik et al (2016), tuck loops provide higher porosity in fabric structure. Correspondingly, it was observed that air permeability increases as the number of tuck loops increase in the structure, consistent with the earlier findings [1, 4]. Ertekin and Marmaralı (2011) stated that consecutive tuck loops knitted on the same needle leads to higher porosity levels [1]. This situation explaines the higher air permeability values of double half cardigan and double cardigan structures.

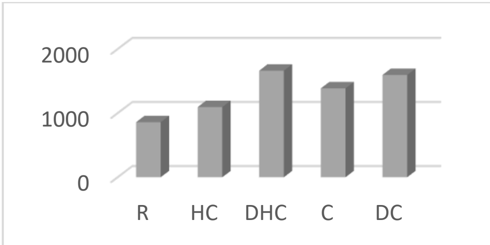


Figure 1. Air permeability values

Şekil 1. Hava geçirgenliği değerleri

3.3. Relative water vapor permeability

Water vapour permeability is the ability to transmit vapor from the body [11]. Relative water vapor permeability is given by the relationship (1):

$$p\% = 100 \text{ x qs/qo} \qquad (1)$$

where q_s is the heat flow value with a sample (W/m^2) and q_o is the heat flow value without a sample (W/m^2) [12]. Significant difference was found between samples' relative water vapor permeability values (p=0.000). 1x1 rib and double half cardigan have the highest, cardigan has the lowest values, respectively (Figure 2 and Table 3).

Gidik et al. (2019) expressed that fabric thickness is an important characteristic affecting water vapour permeability [13]. Water vapor passing through a fabric becomes harder, as fabric gets thicker. As shown in Figure 2 and Table 1, water vapour permeability values of the samples change reversely proportional to fabric thickness values. 1x1 rib fabric with the lowest fabric thickness has the highest relative water vapor permeability value. Conversely, cardigan and double cardigan have the highest fabric thickness and lowest water vapor permeability values.

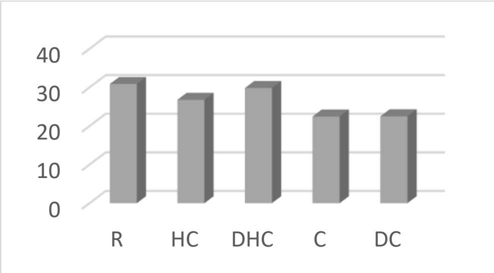


Figure 2. Relative water vapor permeability values

Şekil 2. Su buharı geçirgenliği değerleri

3.4. Thermal resistance

Thermal resistance is a measure of the clothing's ability to resist heat flow through itself [14]. Test results showed that differences in thermal resistance values of the fabrics were statistically significant (p=0.000). As can be seen in Table 3, only the difference between half cardigan and double half cardigan structures' thermal resistance values is insignificant. It was expressed by other researchers that there is a strong and directly proportional relation between fabric thickness and thermal resistance values [15, 16]. In accordance with their findings, the thickest fabric (double cardigan) has the highest and the thinnest fabric (1x1 rib) has the lowest thermal resistance values. Trapped air within the structure results in higher insulation ability. As the fabric becomes thicker, more air is trapped and resistance to heat flow increases.

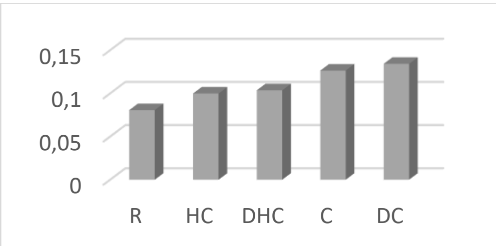


Figure 3. Thermal resistance values

Şekil 3. Isıl direnç değerleri

3.5. Bending rigidity

A fabric's bending characteristic contributes to how well this fabric conforms to the body [3]. Bending rigidity is an indicator for stiffness property, which is a component of the sensorial comfort of fabric. A lower value of bending rigidity means a more positive impression of sensorial comfort [17]. According to statistical evaluation, there is a significant difference between the bending rigidity values of the samples (p=0.012). As presented in Figure 4 and Table 3, the highest and lowest bending rigidity values belong to the half cardigan and 1x1 rib structures, respectively.

As stated by Uyanik et al. [2], tuck loops reduce length-wise elasticity and provide greater stability. Accordingly, a reduction in elasticity is expected to result in a higher value of bending rigidity. It was observed that the 1x1 rib structure, which does not contain any tuck loops, has the lowest bending rigidity. Regarding the structures including tuck loops, stitch density (the product of cpi and wpi) and fabric density are marked as important factors affecting bending rigidity results. It was observed that bending rigidity is directly proportional to these two parameters for cardigan structure and its derivatives. As stitch density and fabric density values of cardigan and its derivatives increase, bending rigidity increases, as well. Increase in both stitch density and fabric density means that the fabric contains more yarn in unit area. This leads to a stiffer structure and, therefore, higher bending rigidity values.

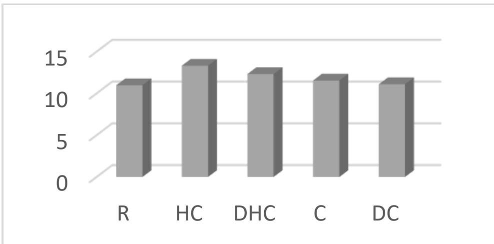


Figure 4. Bending rigidity values

Şekil 4. Eğilme direnci değerleri

3.6. Coefficient of friction

The frictional force is the resistance to the relative motion of one object while sliding over itself or another object. The friction coefficient of fabric is a parameter that determines the degree of fabric smoothness and comfort [18]. Statistical analyses showed that the difference between the coefficient of friction values of the fabric structures is significant (p=0.000).

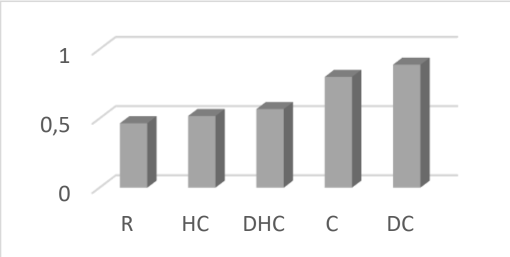


Figure 5. Coefficient of friction values

Şekil 5 . Sürtünme katsayısı değerleri

The existence of tuck loops in a fabric structure causes a dented surface. Therefore, as the tuck loop ratio increases in the structure, fabrics' surfaces become more uneven resulting in a higher coefficient of friction values. Friction coefficient results are observed as directly proportional to tuck loop percentage in the structure. Correspondingly, double cardigan sample has the highest, while 1x1 rib sample has the lowest values of friction coefficient, as seen in Figure 5 and Table 3. When the results of half cardigan-double half cardigan and cardigan-double cardigan are examined as pairs, it can be interpreted that samples formed with consecutive tuck loops knitted on the same needle have higher friction coefficients.

3.7. Pilling

Pilling characteristic affects both appearance and durability of a garment. Therefore, pilling property is a major factor in determining lifespan of a product. As seen from Table 3 and Figure 6, half cardigan and double half cardigan have the best pilling results, whereas cardigan has the worst, as compatible with the findings of Emirhanova and Kavusturan [5].

Frictional force, which is directly proportional to coefficient of friction, is a major factor affecting pilling formation. When the results of pilling and coefficient of friction were examined together (Table 3), it was observed that higher coefficient of friction resulted in lower pilling grade for structures with tuck loops. As the coefficient of friction increases, fabric's surface becomes more rough leading to easier pilling formation.

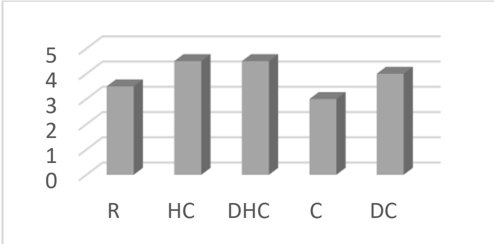


Figure 6. Pilling grades

Şekil 6. Boncuklanma değerleri

4. Discussion and Conclusion

Knitted fabric structures are widely preferred in daily life due to their elasticity, warmth, softness, and easy fit to the body. Therefore, consumers consistently demand different and tempting designs. One of the simple ways of patterning in the knitting industry is using knit, tuck, and miss loops. Effect of tuck loops on various fabric properties was investigated in former research. Yet, a systematical study focusing on the effect of tuck loops on characteristics of cardigan derivative structures was not come across in literature. Thus, examining the effect of tuck loops on dimensional, mechanical, and thermal comfort characteristics of cardigan derivative fabrics was aimed in this study.

Test results reveal that there are statistically significant differences in fabric thickness, mass per unit area, loop length, air permeability, relative water vapor permeability, thermal resistance, coefficient of friction, and bending rigidity results. It is observed that number of tuck loops in unit stitch diagram and percentage of tuck loops in walewise direction have significant effects on fabric thickness. Because of yarn accumulation at tucking points, fabric thickness increases with increasing number of tucks and longitudinal tuck loop percentage. Results present that relative water vapor permeability characteristic is inversely affected from fabric thickness. 1x1 rib structure has the lowest thickness and highest relative water vapor permeability, while cardigan and double cardigan have the highest thickness and lowest relative water vapor permeability values. Fabric thickness is quite effective on thermal resistance values, as well. The thickest fabric (double cardigan) has the highest thermal resistance due to larger amount of trapped air within the structure.

Tuck loops create gaps in the structure, leading to higher porosity. Therefore, 1x1 rib sample, which is formed only by loops, has the lowest air permeability. Correspondingly, double half cardigan and double cardigan structures have the highest values due to consecutive tuck loops knitted on the same needle which provide larger gaps.

Existence of tuck loops in the structure reduce elasticity, resulting in higher bending rigidity values. Correspondingly, 1x1 rib structure, which does not contain any tuck loops, has the lowest bending rigidity. When structures involving tuck loops are considered, stitch density and fabric density are observed as prominent factors directly affecting bending rigidity results.

Tucked yarn on the former loop causes a dented and uneven surface. Results show that friction coefficient of the samples are directly proportional to tuck loop percentage of the structure. Accordingly, double cardigan has the highest and 1x1 rib sample has the lowest friction coefficient values. Additionally, it is observed that consecutive tuck loops knitted on the same needle result in higher coefficient of friction values. Furthermore, friction coefficient and pilling results are determined as inversely related to each other. Higher friction coefficient leads to a rougher surface, which results in easier pilling formation.

Consequently, double cardigan fabric has the highest fabric thickness, thermal resistance, and coefficient of friction. The double half cardigan provides the highest air permeability, whereas 1x1 rib structure has the highest relative water vapor permeability, mass per unit area, and loop length. While the half cardigan has the highest bending rigidity value, half cardigan and double half cardigan both have the best pilling results.

As can be seen from the results, tuck loops have significant effects on fabric properties, besides physical characteristics. It was observed that test results of half cardigan-double half cardigan and cardigan-double cardigan are generally similar as pairs. However, dimensional, mechanical and comfort characteristics of 1x1 rib fabric seem quite different.

4. Tartışma ve Sonuç

Esneklik, sıcaklık, yumuşaklık ve vücuda uyumları sebebiyle örme kumaşlar günlük hayatta sıklıkla tercih edilmektedir. Bu sebeple, tüketiciler sürekli olarak yeni ve ilgi çekici tasarımlar talep etmektedirler. Örme endüstrisinde desenlendirmenin en kolay yöntemlerinden biri ilmek, askı ve atlama yapılarını kullanmaktır. Askının kumaşların çeşitli özelliklerine etkisi önceki çalışmalarda ele alınmıştır. Ancak, askının selanik türevi yapıların özellikleri üzerindeki etkisini inceleyen sistematik bir çalışma ile karşılaşılmamıştır. Bu sebeple, çalışmada askının selanik türevi kumaşların boyutsal, mekanik ve ısıl konfor özellikleri üzerindeki etkilerinin araştırılması amaçlanmıştır.

Test sonuçları kumaş kalınlığı, gramaj, ilmek iplik uzunluğu, hava geçirgenliği, su buharı geçirgenliği, ısıl direnç, sürtünme katsayısı ve eğilme direnci değerleri arasında istatistiksel olarak anlamlı fark bulunduğunu göstermektedir. Birim iğne diyagramında bulunan askı sayısı ve çubuk yönündeki askı yüzdesinin, kumaş kalınlığı üzerinde önemli etkisinin bulunduğu gözlenmiştir. Askı yapılan noktalardaki iplik birikimi sebebiyle, yapıdaki askıların sayısı ve boy yönündeki askı yüzdesinin artışıyla birlikte kumaş kalınlığı artmaktadır. Su buharı geçirgenliği ile kumaş kalınlığı sonuçlarının ters yönlü olduğu saptanmıştır. 1x1 rib kumaş en düşük kumaş kalınlığı ve en yüksek su buharı geçirgenliğine sahipken, selanik ve çift askılı selanik kumaşlar en yüksek kalınlık ve en düşük su buharı geçirgenliğini sağlamaktadır. Kumaş kalınlığı aynı zamanda ısıl direnç üzerinde de oldukça etkilidir. En kalın kumaş olan çift askılı selanik, yapısı içinde daha çok miktarda hava içerdiğinden en yüksek ısıl dirence sahiptir.

Askıların yapıda oluşturdukları boşluklar daha yüksek gözeneklilik sağlamaktadır. Bu sebeple, sadece ilmeklerden oluşan 1x1 rib numune en düşük hava geçirgenliğine sahiptir. Benzer şekilde, çift askılı yarım selanik ve çift askılı selanik yapılar daha büyük boşluklara yol açan aynı iğnede art arda örülmüş askılar içerdiklerinden daha yüksek hava geçirgenliği sağlamaktadırlar.

Kumaş yapısında bulunan askılar esnekliği azaltmakta, dolayısıyla daha yüksek eğilme direncine neden olmaktadır. Buna uygun olarak, askı içermeyen 1x1 rib numune en düşük eğilme direncine sahiptir. Askı içeren yapılar göz önüne alındığında, ilmek ve kumaş yoğunlukları eğilme direncini etkileyen önemli faktörler olarak saptanmıştır.

Önceki ilmek üzerine yerleşen askı düzgün olmayan, pürüzlü bir yüzey oluşturmaktadır. Test sonuçları sürtünme katsayısının yapıdaki askı yüzdesi ile doğru orantılı olduğunu göstermektedir. Buna uygun olarak, çift askılı selanik en yüksek, 1x1 rib kumaş ise en düşük sürtünme katsayısına sahiptir. Ayrıca, aynı iğnede art arda örülen askıların daha yüksek sürtünme katsayısı değerleri verdiği gözlenmiştir. Sürtünme katsayısı ve boncuklanma özellikleri birlikte değerlendirildiğinde, sonuçların ters yönlü olduğu belirlenmiştir. Yüksek sürtünme katsayısının daha pürüzlü bir yüzeyi ifade ettiği, bunun da daha kolay boncuklanma oluşumuna sebep olduğu saptanmıştır.

Sonuç olarak, çift askılı selanik kumaş en yüksek kumaş kalınlığı, ısıl direnç ve sürtünme katsayısına sahiptir. Çift askılı yarım selanik ise en yüksek hava geçirgenliğini sağlarken, 1x1 rib numune en yüksek su buharı geçirgenliği, gramaj ve ilmek iplik uzunluğuna sahiptir. Yarım selanik kumaş en yüksek eğilme direncini göstermekte, buna karşılık yarım selanik ve çift askılı yarım selanik kumaşlar en iyi boncuklanma sonuçlarını sağlamaktadır.

Sonuçlar incelendiğinde askının kumaşların fiziksel özellikleri yanında, kumaş özellikleri üzerinde de önemli etkilerinin olduğu görülmektedir. Yarım selanik-çift askılı yarım selanik ve selanik-çift askılı selanik kumaşların test sonuçlarının kendi aralarında benzer olduğu gözlenmiştir. Ancak, 1x1 rib kumaşın boyutsal, mekanik ve konfor özelliklerinin selanik ve türevlerinden oldukça farklı olduğu saptanmıştır.

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