Synthetic Ecological Engineering
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Experimental Study on the Effect of Blend Proportion on Physical Parameters of Ring Spun Polyester/Cotton Blend Yarn

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KEYWORDS

blend
unevenness
breaking force
yarn property
geometrical structures

ABSTRACT

This study examined the influence of polyester/cotton (P/C) blend ratios on the structural, physical, and mechanical properties of ring-spun yarns. Polyester and cotton fibers were blended at ratios of 30:70, 50:50, and 70:30 (P:C) and processed using ring spinning to evaluate the effects of blend composition on yarn performance. A comprehensive analysis was conducted on yarn unevenness, mass variation, twist behavior, hairiness, tensile strength, elongation, and fiber packing characteristics. The results revealed that increasing the proportion of polyester significantly enhanced yarn uniformity, with both optical unevenness and mass variation decreasing consistently across the blend ratios. A notable improvement in yarn regularity and reduced surface hairiness was observed when polyester content increased from 30% to 50%. The 70:30 P/C blend exhibited the most favorable performance, displaying the lowest hairiness values, the highest degree of fiber compactness, and superior yarn structural stability. Mechanical properties also improved substantially with higher polyester content. Tensile strength and elongation increased progressively, with the 70% polyester blend achieving the greatest breaking force and extensibility among all blends. These improvements were attributed to polyester's higher fiber uniformity, greater tenacity, and stabilizing influence within the yarn cross-section. Generally, the study confirms that polyester content is a key determinant of yarn quality, influencing both mechanical robustness and surface characteristics. The findings identify the 70:30 polyester/cotton blend as the optimal ratio, delivering the best balance of structural regularity, reduced hairiness, and enhanced mechanical performance, making it highly suitable for high-quality woven and knitted textile applications.

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ARTICLE INFO
Received: 2 November 2025 | Revised: 27 November 2025 | Accepted: 29 November 2025 | Published Online: 30 November 2025

1. Introduction

The performance characteristics of synthetic fiber products are predominantly governed by the intrinsic properties of the polymer matrix and the geometric configuration of the fiber form, which subsequently influences yarn and fabric properties [1-4]. Contemporary advancements in polymer technology and fiber spinning methodologies have revolutionized the textile industry, establishing sophisticated techniques for producing high-strength and elongation fibers. Consequently, the production of manmade fibers and their blended compositions has emerged as a dominant force in the highly competitive, quality-conscious consumer marketplace [5,6].

The fundamental demand for textile quality is increasingly defined by critical aspects of yarn uniformity, encompassing regularity in mass distribution, diameter consistency, twist homogeneity, and the mitigation of yarn faults and imperfections. In conjunction with these structural attributes, uniformity in fiber arrangement throughout the yarn structure represents a crucial determinant of fiber utilization efficiency, which directly impacts yarn performance in downstream processing operations and ultimate end-use applications, including woven and nonwoven fabric production [7-11]. Recent investigations have extensively examined comparative analyses of yarn properties within various spinning systems, with numerous researchers addressing fundamental questions regarding the intrinsic nature of different spinning processes and their corresponding mechanisms [11-18]. These investigations have established that spinning process parameters constitute critical determinants of yarn quality and end-use performance characteristics [19-24].

Considerable research efforts have been devoted to elucidating the influence of blend composition and spinning parameters on yarn quality attributes. Multiple studies have systematically investigated the effects of blend ratios and spinning process variables on rotor and air-jet spun yarn characteristics [25-30]. Critical yarn quality indicators, including yarn count, twist level, unevenness, thin and thick places, yarn strength, and elongation at the breaking point, represent primary properties that have been extensively documented in the literature [31,32]. Basil and Oxenham (2003) conducted a comprehensive investigation utilizing seven different polyester and cotton blend ratios, processed through vortex and air-jet spinning systems to produce yarns of 20 tex. The experimental findings demonstrated substantial variation in production values, with unevenness, imperfections, and hairiness values of vortex yarns achieving minimum (optimal) levels [17]. Subsequently, Kilic and Okur (2011) investigated the properties of cotton-tencel and cotton-promodal blended yarns processed via ring and compact spinning methodologies [33-35]. Their results indicated that unevenness, imperfections, diameter, and roughness values decreased systematically, while tenacity, breaking elongation, density, and abrasion resistance increased proportionally with regenerated cellulose fiber content in the blend composition [35,36]. Furthermore, the performance and physical properties of blended yarns have been demonstrated to be significantly influenced by different fabric end-use applications, including characteristics such as tenacity, moisture absorption, and thermal insulation [36,37].

Despite these advances, a critical research gap persists in understanding the comprehensive behavior of polyester/cotton blend fibers with respect to their spatial arrangements during the blended yarn manufacturing process, particularly when incorporating three distinct blended fiber forms. Moreover, the interactive effects of blend proportion and physical parameters on ring spun polyester/cotton blend yarn performance and their subsequent impact on fabric properties remain inadequately characterized. Therefore, the present investigation aims to address this knowledge gap by conducting a systematic experimental study to elucidate the behavior of blend polyester/cotton fibers regarding their structural arrangements during blended yarn manufacturing with three different blended fiber configurations. Additionally, this research attempts to comprehensively evaluate the interactive effects of blend proportion and physical parameters of ring spun polyester/cotton blend yarn on resultant fabric properties.

2. Materials and Methods

2.1. Materials

Cotton fibers were systematically selected for blending with polyester fibers to execute the present experimental investigation. The polyester/cotton blend compositions were formulated at three distinct ratios: 50:50%, 30:70%, and 70:30% of polyester as illustrated in Figure 1 (Cotton (P: C) ratio). Polyester fiber and cotton fiber were blended utilizing three differentiated ratio configurations and subsequently processed via ring spinning systems. The polyester/cotton blended yarns were procured from commercial sources in Bursa, Turkey. The cotton utilized in this research comprised cotton of 30s Ne count. The comprehensive physical characteristics of these fibers are systematically presented in Table 1.

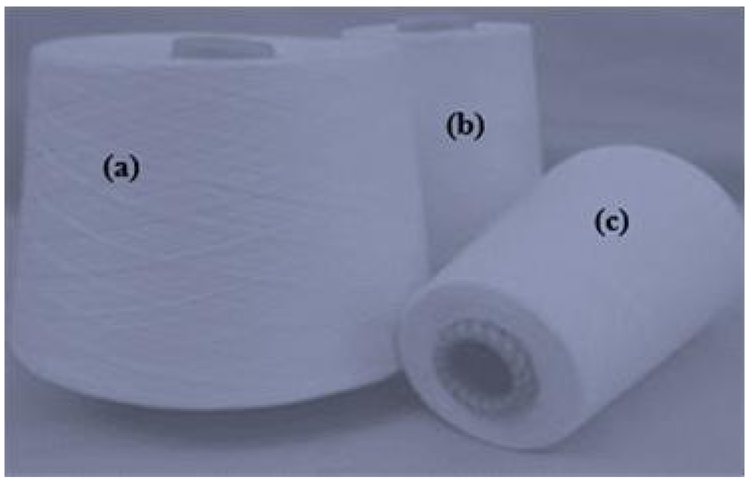

Figure 1. The polyester/ cotton blend yarn: (a) 30:70 %, (b) 50:50 % and (c) 70:30 % of P: C ratio.

Table 1. Physical properties of selected fibers [38].

Parameters	Polyester	Cotton
Fiber length (mm)	32	10–25
Fineness (dtex)	1.5	3 to 5 micronaire (fine to coarse)
Tenacity (gram per denier)	3.0	3-5
Breaking extension (%)	15	4-8

2.2. Methodology

2.2.1. Tensile Property Testing

The tensile properties of blended yarn, including elongation at break and breaking strength, were evaluated using a single yarn strength tester (Shaoxing Yuanmao) under controlled testing conditions of 50 cm clamping gauge length, 150 mg tension weight, and a load cell of 10kN at a constant testing speed of 20 mm/min. Stress-strain curves of the yarns were generated using the methodology prescribed in ASTM standard test method D-3822.

Multiple textile quality parameters, including yarn tenacity, breaking elongation, Young's modulus, and compliance ratio, were systematically calculated from these experimental curves [39].

2.2.2. Yarn Evenness Measurement

Yarn evenness measurements were conducted using a UT-3 evenness tester for the quantitative assessment of unevenness and imperfections in yarns. Five replicate readings with a gap of 100 m at a constant yarn speed of 200m/min for 2.5 min were acquired from each cop, with 10 such cops tested for each yarn type per ASTM standard protocol [39].

2.2.3. Twist Measurement

Twist per inch (T.P.I) was calculated using the following formula:

$$T.P.\ I = T.M(count)\ 1/2* \qquad (1)$$

Where T.M represents the twist multiplier coefficient.

2.2.4. Hairiness Parameters Measurement

The hairiness parameters of the blended yarns were evaluated using a YG172A single yarn hairiness tester (Shanxi Changing Textile Mechanical & Electronic Technological Co., LTD, China) at a controlled speed of 30m/min. Hairiness value (H) is defined as the relationship between the hair length and the yarn length and represents a non-dimensional quantity. For instance, if H = 3 cm, this indicates that the total length of protruding ends from the yarn body is 5 m to the measuring field of 1m [39].

2.2.5. Yarn Specific Volume and Packing Fraction Measurement

Yarn diameter was measured using a Leica Q500 MC Image analyzer system. Average diameter and diameter coefficient of variation (CV%) were calculated by acquiring over 1000 independent readings. Yarn specific volume and packing fraction were computed using yarn diameter measurements and yarn linear density data [40].

3. Results and Discussion

3.1. Results

It is well-established that, in addition to the morphological architecture of yarn, the mechanical properties, hairiness characteristics, and other comprehensive performance indicators and physical attributes of blended yarns constitute the primary determinants that must be systematically considered during the selection process for their potential practical applications [40]. Consequently, the influences of blend ratio variations on the physical and mechanical yarn properties were comprehensively investigated in the subsequent sections.

3.1.1. Yarn Irregularity and Imperfection Characteristics in P/C Blend Yarn

The mass or weight variation per unit length of yarn is fundamentally defined as unevenness or irregularity. Yarn spinning and yarn blended mechanisms exert a statistically significant effect on yarn unevenness characteristics. The influence of blend ratio composition on P/C yarn unevenness was systematically observed through optical unevenness analysis and yarn unevenness values, with the results presented in conjunction with measurement of different spinning parameters, as illustrated in Table 2. The experimental data revealed that the maximum yarn unevenness value of 30:70 % P/C blended yarn exhibited a coefficient of variation (CVm%) of 14.25% when its linear density was recorded as 1.5 dtex. Conversely, the minimum yarn unevenness value of this blend configuration was CVm%=10.52% when its linear density was measured at 2.5 dtex. Similarly, for the 50:50 % P/C blended yarn composition, the minimum yarn unevenness value demonstrated CVm%=13.78% when its linear density was recorded as 1.39 dtex, while the maximum yarn unevenness value was CVm%=14.91% when its linear density was documented as 2.72 dtex. For the 70:30 % P/C blended yarn configuration, the minimum yarn unevenness value of 14.41% was observed when the linear density was recorded as 1.44 dtex, whereas the maximum yarn unevenness value reached CVm%=16.37% when its linear density was recorded as 2.84 dtex. These findings indicate a systematic relationship between blend ratio, linear density, and yarn irregularity, suggesting that optimal unevenness characteristics can be achieved through precise control of these parameters.

3.1.2. Yarn Structural Properties of P/C Blended Yarn

For all three yarn blended types investigated, an increase in twist factor values in blended yarn demonstrated corresponding increases in the measured twist intensity, representing a significant characteristic with direct implications for yarn structural integrity. The magnitude of these results follows a hierarchical pattern based on their respective P/C yarn blend ratios. The experimental analysis revealed that the minimum yarn unevenness value of 70:30% P/C blended yarn was CVm%=15% when subjected to a twist factor value of 24. Conversely, the maximum yarn unevenness value for the same blend composition was CVm%=16% when its twist factor was recorded as a value of 36. For the 50:50% P/C blended yarn configuration, the minimum yarn unevenness value demonstrated CVm%=13.5% when its twist factor was recorded at a value of 24, while the maximum yarn unevenness value of this composition was CVm%=16.5% when subjected to a twist factor value of 36.

Similarly, the structural analysis of 30:70% P/C blended yarn revealed a minimum yarn unevenness value of CVm=14% when its twist factor was recorded at a value of 24, whereas the maximum yarn unevenness value of 30:70% P/C blended yarn was CVm=14.80% when its twist factor was recorded as a value of 36. When its linear density was recorded at 1.80 dtex, these structural parameters exhibited consistent trends across all blend ratios examined. The twist factor significantly influences the packing density and structural cohesion of fibers within the yarn structure. As the twist factor increases, the helical angle of fiber orientation becomes more pronounced, resulting in enhanced inter-fiber friction and improved structural stability. However, excessive twist can lead to increased yarn unevenness due to fiber migration and structural distortion during the twisting process. The data suggest that an optimal twist factor range exists for each blend ratio, where yarn unevenness is minimized while maintaining adequate structural integrity.

3.1.3. Yarn Hairiness Properties of the P/C Blended Yarn

The comprehensive evaluation of yarn quality is conducted in terms of yarn spinning systems performance, as systematically illustrated in Figure 2. It is well-documented that the measurement of hairiness constitutes a critical parameter for assessing hairiness variation in both 100% cotton and cotton blended yarn production mechanisms. The experimental investigation revealed that the hairiness values of P/C blended yarn demonstrated measurements of 0.35, 5.47, and 8.30 for the 30:70%, 50:50%, and 70:30% P/C yarn blend ratios, respectively. These results indicate a direct positive correlation between polyester content and hairiness magnitude, suggesting that increased synthetic fiber proportion in the blend composition results in elevated hairiness levels. The hairiness phenomenon in blended yarns is primarily attributed to several interrelated factors, including fiber migration during the spinning process, differential fiber properties (such as length, fineness, and surface characteristics), and the mechanical processing parameters employed during yarn formation. The higher hairiness values observed in polyester-rich blends can be attributed to the lower surface friction coefficient of polyester fibers compared to cotton, which results in reduced fiber anchorage within the yarn structure and increased propensity for fiber protrusion from the yarn surface.

Furthermore, the statistical analysis demonstrates that the relationship between blend ratio and hairiness follows a non-linear trend, with the rate of hairiness increase accelerating as polyester content exceeds 50%. This observation has significant implications for end-use applications, particularly in fabric manufacturing processes where yarn hairiness can influence weaving efficiency, fabric appearance, and textile finishing operations. The optimal blend ratio selection must therefore balance the desired mechanical properties with acceptable hairiness levels, considering the specific requirements of the intended application.

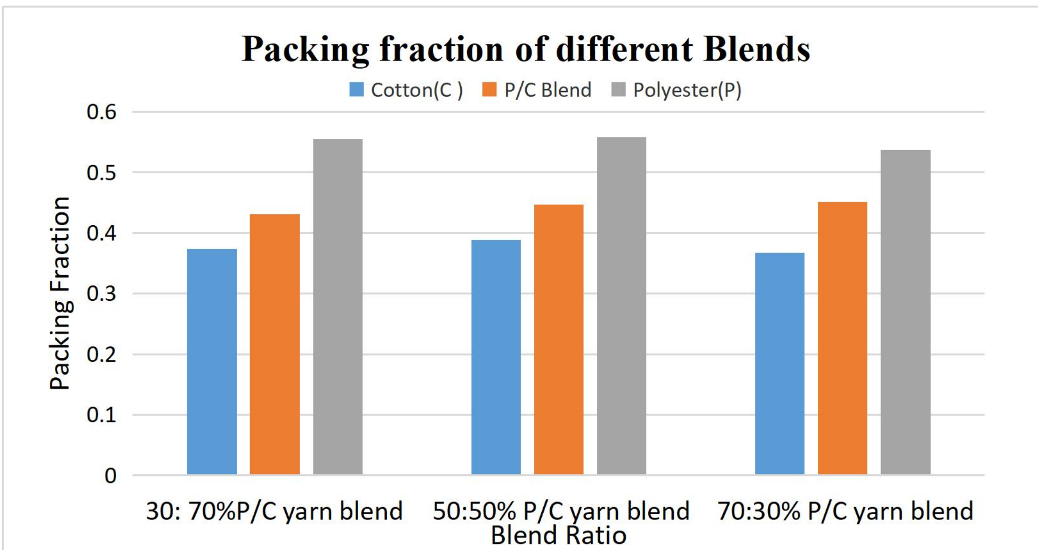

Figure 2: Effect of packing on the physic mechanical properties of yarn during blend

3.2. Discussion

3.2.1. Yarn Irregularity and Imperfection in P/C Blend Yarn

The present findings reveal that the blend ratio plays a statistically significant role in determining yarn irregularity in polyester/cotton (P/C) blended yarns. A consistent decrease in yarn unevenness was observed as the proportion of polyester increased from 30:70 → 50:50 → 70:30 (P:C). This pattern supports earlier reports indicating that yarn produced with a higher polyester content generally exhibits improved uniformity due to the fiber's higher linear density and reduced variability in length. Several scholars have also emphasized that polyester fibers contribute to a more stable fiber arrangement within the yarn structure, which minimizes mass variation during spinning. These findings align with previous investigations where 30/70 cotton-rich blends were typically associated with greater irregularity due to cotton's inherent variability in fiber length and fineness. Conversely, yarns spun from 70/30 polyester-rich blends displayed lower CVm% and hairiness values, consistent with the present results. The improvement in yarn evenness at higher polyester proportions may be attributed to the fiber's narrower distribution of physical properties compared to cotton, a phenomenon widely documented in textile science literature. The study further showed that yarn unevenness consistently decreased with increasing fiber linear density, supporting earlier conclusions that fiber thickness and stiffness contribute to improved packing efficiency during spinning. This trend is also in agreement with researchers who reported that fiber blending behavior—especially fiber length, fineness, and cross-sectional uniformity—directly influences yarn mass variation.

Furthermore, the findings confirm that yarn irregularity is highly dependent on the interactive effects of material properties and blend composition. Previous studies have similarly noted that fiber positioning within the cross-section, the number of fibers in the yarn, and the blend homogeneity are critical parameters influencing yarn quality. The present work reinforces these assertions, demonstrating that optimizing the P/C blend ratio can significantly enhance the physical and mechanical characteristics of yams intended for woven and knitted applications.

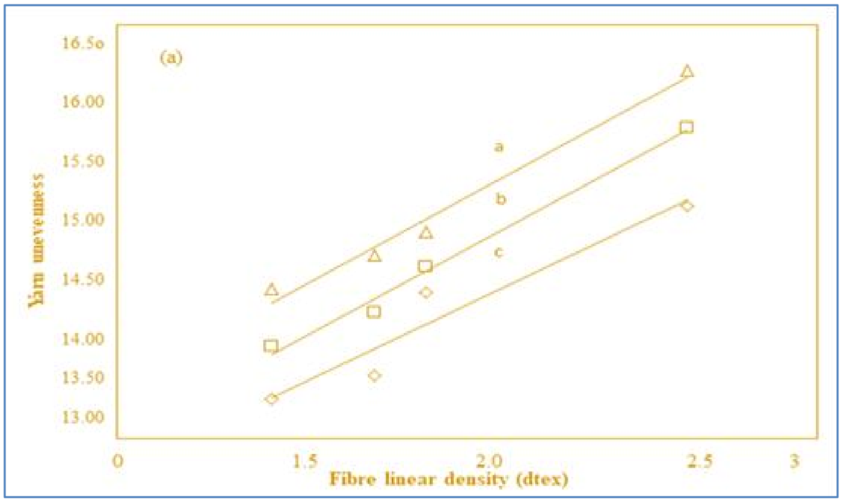

Figure 3. Relationship between yarn unevenness and linear density of P/C blend yarn: (a) 30:70 %, (b) 50:50 % and (c)70:30 % of P/ C blend ratio.

3.2.2. Yarn Structural Properties of P/C Blended Yarn

The results also revealed that yarn imperfections increased with twist factor for all three blend proportions, although the degree of increase varied according to the blend ratio. This observation is consistent with earlier reports suggesting that increased twist tends to compact fibers more tightly, reducing mobility but simultaneously increasing the likelihood of neps and thick-and-thin places when the fiber mix is not homogeneous. The 70:30 P/C blend demonstrated superior structural performance, showing lower unevenness values, minimum neps, and fewer diameter fluctuations. This agrees with previous studies indicating that polyester-rich blends produce yarns with enhanced cohesion and smoother surface properties due to polyester's consistent geometric characteristics. Conversely, the 30:70 cotton-rich blend exhibited the highest irregularity, supporting earlier findings that cotton's natural variability contributes to increased imperfection levels in mixed-fiber yarns. Several scholars have noted that blended yarns should be manufactured with the minimum twist required to maintain structural integrity, as excessive twist increases imperfections without proportionally improving strength. The present findings correlate with this viewpoint, especially in the cotton-rich blend where imperfections rose significantly at higher twist levels. The observed variation in yarn diameter with twist factor is also consistent with prior literature, which states that polyester/cotton blended yarns exhibit diameter reduction due to increased compactness under higher twist. Researchers have similarly documented that cotton-rich blends tend to show greater diameter irregularity owing to the variability in cotton fiber fineness. Overall, the present study confirms that the 70:30 P/C blend ratio yields the most structurally stable yarn, exhibiting superior evenness and fewer imperfections compared to the other two blends. These outcomes agree with earlier studies concluding that polyester contributes to dimensional stability, whereas cotton increases softness but introduces greater structural variation. Thus, the optimized balance of polyester and cotton remains essential in producing yarns suitable for high-performance textile applications.

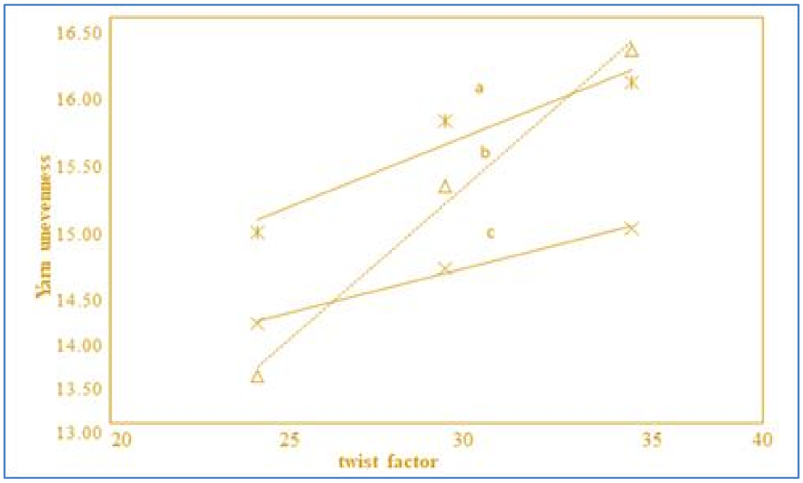

Figure 4. Relationship between yarn unevenness and twist factor of P/C blend yarn: (a) 70:30 %, (b) 50:50 % of and (c) 30:70 % P/C blend ratio.

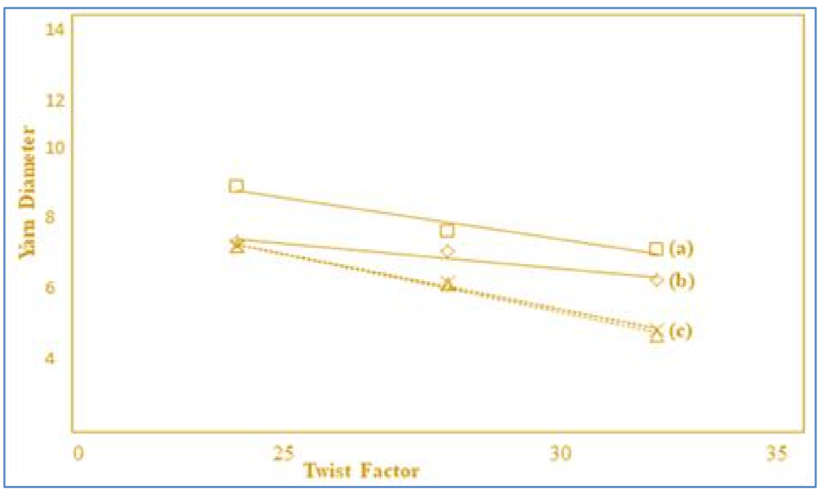

Figure 5. Effect of twist factor on the yarns diameter (Cross-sections): (a) 30:70 %, (b) 50:50 % and(c) 70:30 % of P/C blend ratio

3.2.3. Yarn Hairiness Properties of the P/C Blended Yarn

The results indicate that the spinning system exerts a statistically significant influence on both yarn hairiness and its variation in polyester/cotton (P/C) blended yarns. This aligns with earlier research highlighting that spinning technology—whether ring, compact, or rotor—plays a critical role in determining fiber migration, surface fiber entrapment, and the extent of protruding fibers in the yarn structure. Several scholars have reported that ring spinning typically produces higher hairiness due to the presence of wrapper fibers, whereas compact spinning minimizes protruding ends through improved fiber control during drafting. The current findings are consistent with these established observations, suggesting that system-related fiber integration strongly affects the hairiness behavior of blended yarns. According to the results summarized in Table 2 and Figure 2, the 70:30 polyester/cotton blend exhibited the lowest hairiness values and the most favorable yarn regularity. This trend supports previous studies that have emphasized polyester's inherently smoother surface, greater uniformity in fiber length, and reduced tendency for fiber-end protrusion. Researchers have consistently argued that the synthetic fiber's stiffness and homogeneity promote a more compact yarn structure, thereby suppressing hair formation. The present findings corroborate these claims, demonstrating that higher polyester content contributes to improved fiber packing and reduced hairiness.

In contrast, the 30:70 polyester/cotton blend showed the highest hairiness levels and lower yarn regularity. This observation is in agreement with earlier investigations that attributed increased hairiness in cotton-rich blends to cotton's natural variability in fiber length, maturity, and fineness. Scholars have highlighted that cotton fibers possess more loose ends, a higher degree of convolutions, and greater surface irregularity—all of which encourage protrusion during spinning. The current results reinforce this widely acknowledged principle, confirming that cotton-rich blends are more susceptible to hairiness due to the fiber's intrinsic physical characteristics. Moreover, the findings align with prior work indicating that blend composition influences fiber migration patterns within the yarn cross-section. Polyester fibers, with their higher rigidity, tend to occupy more central positions in the yarn, while cotton fibers migrate outward more readily. This mechanism explains why the 70:30 blend achieves superior hairiness performance: the higher proportion of polyester stabilizes the yarn core, while the reduced proportion of cotton limits the number of surface-exposed fiber ends. Several studies have documented similar behavior in synthetic–natural blend systems, noting that increasing synthetic fiber content generally reduces hair protrusion and enhances structural compactness.

From a practical standpoint, the reduced hairiness in the 70:30 P/C blend has meaningful implications for textile processing. Previous research has shown that hairiness significantly affects downstream operations such as weaving, knitting, dyeing, and finishing. Lower hairiness contributes to reduced end-breakage rates, improved warp efficiency, fewer fabric surface defects, and enhanced appearance retention. The present findings therefore support the recommendation that the 70:30 P/C blend offers an optimal balance between fiber cost, yarn irregularity, and acceptable hairiness levels for industrial applications.

In summary, the comparison with prior literature confirms that yarn hairiness in P/C blends is highly sensitive to blend ratio and spinning system mechanics. The present study further strengthens the scholarly consensus that polyester-rich blends outperform cotton-rich blends in terms of hairiness and regularity due to superior fiber uniformity and improved structural integrity during spinning. Thus, the 70:30 polyester/cotton blend emerges as the most advantageous option for producing high-quality yarns with minimized surface hairy fibers.

Table 2. Yarn irregularity and hairiness properties of the P/C blended yarns.

P/C blend ratio (%)	Yarn Irregularity (%)	Hairiness
30:70	1.5	0.35
50:50	3.49	5.47
70:30	13.61	8.30

3.2.4. The Effect of Yarn Blend on Tensile Strength of Yarn

The results of the tensile strength evaluation indicate that all three polyester/cotton (P/C) blend ratios exhibited higher tensile strength than the 100% cotton ring-spun yarn, confirming the beneficial influence of polyester fibers on yarn mechanical performance. This observation is consistent with a substantial body of literature that attributes the superior strength of blended yarns to the higher tenacity, lower extensibility, and more uniform structural properties of polyester fibers. Several scholars have reported that incorporating synthetic fibers into cotton improves load-bearing capacity due to enhanced fiber cohesion and reduced weak points in the yarn structure.

As shown in Table 3, both elongation at break and tensile strength increased progressively with the rising proportion of polyester in the fiber blend. This finding aligns with earlier studies asserting that polyester's higher intrinsic strength and molecular orientation contribute significantly to tensile performance when blended with natural fibers. The 30:70 P/C blend exhibited the lowest breaking strength among the blended samples, while the 70:30 P/C blend exhibited the highest, reflecting the direct influence of polyester concentration on yarn mechanical behavior.

The minimum strength observed in the 30% polyester blend can be attributed to the dominance of cotton fibers, which are known to possess greater variability in fiber length, fineness, and maturity. These characteristics introduce structural inconsistencies and reduce the yarn's ability to distribute stress uniformly. Previous investigations have highlighted that cotton-rich blends often have higher neps and weak spots, leading to reduced tensile properties compared to polyester-rich blends. Conversely, the maximum strength in the 70% polyester blend corresponds with findings from multiple researchers who demonstrated that synthetic-rich yarns exhibit improved fiber alignment, reduced slippage, and greater resistance to deformation. Polyester fibers, due to their smooth surface and stronger inter-fiber bonding, enhance the load-sharing mechanism during tensile loading, leading to superior breaking strength. This behavior has been consistently documented in studies on mixed-fiber yarns, particularly those comparing synthetic-natural blends. Furthermore, the improvement in elongation with increasing polyester content also corroborates earlier work indicating that polyester's elastic recovery and resistance to permanent deformation contribute to higher extension before break. The combined behavior of increased tensile strength and elongation suggests that polyester-rich blends provide a more balanced tensile profile suitable for high-performance textile applications.

In summary, the comparison with previous research confirms that the mechanical properties of P/C blended yarns are strongly dependent on the proportion of polyester fibers. The current findings reinforce the established understanding that polyester enhances tensile strength, promotes improved fiber integration, and reduces structural variability within the yarn. Thus, the 70:30 P/C blend emerges as the most mechanically robust option among the evaluated ratios, making it suitable for applications requiring higher strength and durability.

Table 3. Tensile properties of P/C blended yarn

P/C blend ratio (%)	Elongation at break (%)	Tensile strength (CNtex)
30:70	9.58	13.17
50:50	10.43	17.62
70:30	13.61	22.59

4. Conclusions

This research investigated the influence of polyester/cotton (P/C) blend ratios on the structural, physical, and mechanical properties of ring-spun yarns. The findings demonstrate that the blend ratio plays a decisive role in determining yarn quality, particularly with respect to unevenness, hairiness, and tensile performance. A consistent reduction in optical unevenness and mass variation was observed as the polyester content increased from 30:70 → 50:50 → 70:30 (P:C). This improvement is attributed to polyester's lower variability in fiber linear density and its longer, more uniform fiber length, which enhance fiber integration within the yarn structure. Notably, the transition from 30% to 50% polyester resulted in a marked improvement in yarn regularity and hairiness, while increasing polyester content to 70% produced the most significant gains in tenacity and elongation. Yarn hairiness exhibited a clear relationship with both blend ratio and twist. Although low-twist yarns showed increased hairiness with finer yarn counts, hairiness consistently decreased with higher twist levels. Among all blends, the 70:30 P/C yarn displayed the lowest hairiness and the most uniform structure, confirming the stabilizing influence of polyester within the yarn cross-section. Since hairiness strongly affects fabric appearance, processing efficiency, and surface quality, the superior performance of this blend makes it particularly suitable for applications requiring high-quality woven or knitted fabrics. Overall, the results confirm that incorporating higher proportions of polyester enhances yarn uniformity, reduces surface fiber protrusion, and improves tensile properties. Based on the combined performance metrics, the 70:30 polyester/cotton blend emerges as the optimum ratio, offering the best balance of yarn regularity, mechanical strength, and acceptable hairiness for industrial textile manufacturing.

Publishing Ethics

This article is fully compliant with the Journal's Publishing Ethics.

Funding

The research work is not funded

Conflicts of Interest

The author agreed with the contents of the manuscript and there is no financial interest to report. I certify that the submission is original work and is not under review at any other publication.

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