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POLYESTER KNIT CONSTRUCTION INFLUENCES SWEAT RATE DURING BADMINTON MATCH PLAY

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ABSTRACT
Introduction: Sportswear helps regulate the body's temperature, manage moisture and provide physiological comfort during sports activity. While polyester is the most popular fibre used in sportswear, little research is available that investigates the effects of various polyester knits on sweat rate during actual badminton match play.
Background: The study's goal was to quantify the impacts of three 100% polyester sportswear fabrics, having different knit constructions, on sweat rate during badminton match play among competitive male athletes.
Design and methods: The study was done in 2 phases. Phase 1 was a cross-sectional survey of 100 competitive male badminton players in order to find the most popular polyester sportswear knit constructions. According to the survey results, three representative 100% polyester fabrics were chosen for experimental evaluation, and they were all knitted using different fabric constructions, namely plain knit, dot knit and mesh knit. The experimental design for Phase II was a randomized repeated measures experimental design with 12 competitive male badminton players (17.24 ± 1.67 years). All participants played three game sessions in each of the experimental fabrics, presented in random order. The sweat rate was determined using the loss in body weight, fluid intake and urinary output. Data were analysed with a one-way repeated measures ANOVA with Bonferroni-adjusted post hoc comparisons.
Results: Knit construction was discovered to positively impact sweat rate ($F(2, 30) = 8.91$, $p = .002$, partial $\eta 2 = 0.45$). The sweat rate of the mesh knit polyester fabric was the lowest mean sweat rate of 0.82 ± 0.06 $L \cdot h^{-1}$, followed by the dot knit polyester fabric (0.89 ± 0.05 $L \cdot h^{-1}$) and the plain knit polyester fabric (0.94 ± 0.07 $L \cdot h^{-1}$). Bonferroni post hoc analysis indicated that the mesh knit fabric had significantly lower sweat rates than either the plain knit ($p = .004$) or dot knit ($p = .018$) fabric; the plain knit and dot knit fabrics were not significantly different ($p = .072$).
Conclusion: The use of knit construction during competitive badminton match play had an effect on sweat rate and not the fibre composition. The findings reveal that during HIIT, knit structure optimization of the polyester mesh knit fabric resulted in the best thermophysiological response of all the tested fabrics, indicating that optimizing the knit structure can improve moisture management and thermophysiological comfort in HIIT. The findings will be useful in designing and selecting sportswear for athletes, coaches, sportswear manufacturers and textile researchers.

KEYWORDS: Badminton, polyester, knit construction, sportswear, sweat rate, thermoregulation, moisture management, thermophysiological comfort.

1. INTRODUCTION
During physical activity, sportswear can impact thermoregulation, hydration management, and comfort as a critical part of a person's performance. When people exert themselves during exercise, their bodies generate a large amount of metabolic heat, and the most effective way of cooling the body is by allowing sweat to evaporate from the skin's surface. The efficiency of this thermoregulatory process is not only affected by environmental temperature and exercise intensity, but also depends on the type of clothing that the athletes have on. Sportswear fabrics that have a better moisture transport, air permeability and rapid drying properties enable efficient heat dissipation, decrease thermal discomfort and maintain physiological function and thermal comfort during exercise (Havenith & Nilsson, 2004; Li & Holcombe, 1992).
Badminton is intermittent, high intensity racket sport involving rapid movements in several directions, jumping, lunging and acceleration and deceleration. These high intensity repeated actions lead to high metabolic heat production and sweat loss during match play. If body fluid balance is not maintained through other means, excessive sweating can have a negative impact on athletic performance, be a barrier to thermal comfort, and cause dehydration. Thus, the choice of the appropriate sportswear became important for the badminton player especially in warm and humid conditions where heat dissipation plays a crucial role for maintaining physiological function and optimum performance (Cabello Manrique and González-Badillo, 2003; Phomsoupha and Laffaye, 2015).

Polyester is the most popular fibre in sportswear due to its qualities of lightness, durability, minimal moisture absorption and quick drying. In addition to fibre composition, however, the knit construction of a fabric is also important for thermophysiological performance. The different kinds of knit construction such as plain, dot, and mesh knit affect the porosity, air permeability, and moisture transport of the fabric as well as its evaporative cooling, which all impact thermal comfort and moisture management during exercise. The preceding studies on textiles have shown that variations in knit construction can significantly affect the heat and moisture transfer properties even if the fabric is made of the same fibre composition (Fan & Chen, 2002; Das et al., 2010; Das & Alagirusamy, 2010).

Nowadays few studies have explored the effect of badminton sportswear knit constructions on physiological responses in real match play, although many laboratory-based tests have been conducted on the performance of sports textiles using standardized testing protocols and thermal manikins. In the past, most of the investigations have been concerned with the evaluation of thermal insulation, moisture vapour transmission, moisture management and subjective comfort in laboratories, with little evidence available on sweat rate responses under realistic competitive playing conditions. Therefore, there is limited scientific evidence in selecting suitable polyester sportswear knit constructions for badminton players.

Hence, present study was conducted to examine effect of various 100% polyester sportswear fabrics with various knit construction on sweat rate during the play of badminton in male athletes. A preliminary survey, based on opinions of competitive badminton players, was conducted to determine the most preferred commercially available polyester sportswear fabrics among the competitive badminton players during training and competitions. The survey results were used to determine the three most frequently preferred knit constructions: plain knit, dot knit and mesh knit (100% polyester) for evaluation. All experimental fabrics were made of 100% polyester and only varied by knit construction to remove the effect of fibre composition on the results.

The hypotheses were that the differences in knit construction would have a significant effect on sweat rate related to different levels of ventilation, air permeability, moisture transport, and evaporative cooling properties. The results of study are expected to give scientific evidence on the influence of polyester knit construction on sweating rate during badminton match play and can be useful to select and develop the sportswear that can improve thermal comfort, moisture management and performance during badminton match. The results can also be useful for athletes, coaches, sportswear manufacturers and researchers in the field of textiles involved in the design and investigation of performance garments.

2. MATERIALS AND METHODOLOGY

2.1 Design of the Study

The recent study was done in two stages to determine the effect of polyester sportswear knit construction on sweat rate during badminton match play.

The first phase was a preliminary cross sectional survey of 100 badminton competitive male sportswear in which the most commonly used commercially available polyester sportswear garments during training and competition were identified. These selected garments were then sorted by knit construction (plain knit, dot knit and mesh knit). From the survey results, three fabrics from the 100% polyester category were chosen for experimental testing, which were identified as knit constructions and the most commonly preferred sportswear fabrics.

In Phase II, a randomized repeated-measures experimental design was used in which each participant got three experimental sessions with one of the three selected experimental fabrics. A counterbalanced design was used to ensure that there was no order effect in the sequence of fabric use. All the participants were tested under all three conditions, which meant that each participant acted as his own control, which decreased inter-individual variability and increased statistical power.

2.2 Participants

Using purposive sampling, 12 male badminton players aged 16-18 years who were registered with Onamkulam Badminton Club, Vengola of Ernakulam, Kerala, India were recruited as the competitive players. Participant badminton experience had to be a minimum of two years of competitive play, badminton training at least 4 sessions per week, and at least one State level badminton tournament over the past 12 months.

All participants were briefed on the goals, methods, benefits and possible hazards of the study prior to involvement. All participants gave their written informed consent before taking part. In addition, for children under age of 18. Their parents or legal guardians were asked for their written informed consent.

Inclusion Criteria

- Male badminton players aged 16 - 18 years.
- Regular badminton training.
- Competition in one or more state level badminton tournament in the last year.
- At least 2 years of competitive badminton playing experience.
- Commitment to participate, and to give informed consent in writing.

Exclusion Criteria

- Past cardiovascular, metabolic, respiratory, neurological or other medical conditions that may affect exercise performance or thermoregulation.
- Any current musculoskeletal injury, pain or ongoing rehabilitation.
- Use of medications or nutritional supplements which are known to alter hydration status, sweat production or thermoregulatory responses.

- Acute illness or fever, infection or dehydration during the testing period.
- Not attending all three experimental sessions or non-conformance to study protocol.

Table 1. Features of Participants (n = 12)

Variable	Mean ± SD
Age (years)	17.24 ± 1.67
Height (cm)	171.83 ± 5.14
Body Mass (kg)	65.48 ± 6.32
Body Mass Index (kg/m²)	22.18 ± 1.74
Playing Experience (years)	6.08 ± 2.31

2.3 Selection and Characteristics of Sportswear Fabrics

A preliminary cross-sectional survey was carried out to determine the most commonly utilized commercially available polyester sportswear garments which were used during the training and competition of 100 competitive male badminton players. The participants chose their preferred sports wear based on the perception about their comfort, breathability, moisture management, durability and overall playing performances. After the survey, the garments selected were scrutinized and categorized based on their knit construction. To perform an experimental investigation, three representative 100% polyester sportswear fabrics were selected based on the frequency of usage, which corresponded to the most common preferred knit constructions, namely plain knit, dot knit and mesh knit.

Table 2. Distribution of Preferred Polyester Sportswear Garments Identified in the Preliminary Survey (n = 100)

Sportswear Fabric Type	Frequency (n)	Percentage (%)
Plain Knit Polyester	16	16.0
Dot Knit Polyester	14	14.0
Mesh Knit Polyester	12	12.0
Polyester–Spandex Blend	10	10.0
Microfiber Polyester	9	9.0
Coolmax® Polyester	8	8.0
Recycled Polyester	7	7.0
Nylon	6	6.0
Cotton Blend	5	5.0
Bamboo Fabric	5	5.0
Modal	4	4.0
Tencel	4	4.0
Total	100	100.0

Table 3. Characteristics of the Experimental Sportswear Fabrics

Fabric Code	Fibre Composition	Knit Construction	Typical Functional Characteristics
Fabric A	100% Polyester	Plain Knit	Conventional sportswear fabric with moderate ventilation and moisture management
Fabric B	100% Polyester	Dot Knit	Knit structure designed to improve ventilation and moisture transfer
Fabric C	100% Polyester	Mesh Knit	Open knit structure designed to enhance air circulation and evaporative cooling

To remove the effect of fibre composition, the materials used to make all experimental garments were polyester 100%. The only experimental variable was knit construction. Therefore, it was suggested that the differences in sweat rate during badminton match play was mainly because of the variations in knit construction and not the fibre composition.

2.4 Experimental Procedure

The study was conducted on the indoor badminton court with fixed playing conditions on three consecutive test days. As far as possible, environmental conditions such as ambient temperature and relative humidity were kept constant during the test period. The three different experimental sportswear fabrics (Fabric A, Fabric B, or Fabric C) were used with each participant in the three experimental sessions.

Participants completed a standardized best of three singles badminton game, according to the official badminton rules, where each game was played to 21 points. A counterbalanced schedule was used to help reduce order, learning, or fatigue effects the sequence of which the fabric was used. The same indoor court, shuttlecock type, match protocol, testing equipment and measurement procedure were kept throughout the study.

All participants wore the same type of badminton shorts, socks, and footwear except for the experimental sportswear fabric for each testing session. The participants were asked to:

- Take in normal fluids before every test.
- No strenuous activities 24hrs prior to testing.
- Do not consume caffeine, alcohol or other stimulants before testing. Eat their regular meals prior to their regular sessions. •
- Report to the testing venue in a well-rested condition.
- Do not take any medication or nutritional supplement that may affect hydration and sweating for the duration of the study.

2.5 Sweat Rate Measurement

Sweat rate was measured as difference between pre- and post-match body wt. and fluid intake and urine output. BM was determined before and after each match with a calibrated digital weighing scale (accuracy, ±0.01 kg). The participants were weighed in minimal dry clothing to reduce the error of weighing. Intake of fluids during the match was monitored on a graduated drinking bottle and urine output was collected immediately on finishing the match in a graduated container.

The following equation was used to calculate the sweat rate ($L \cdot h^{-1}$):

Sweat Rate ($L \cdot h^{-1}$) = (Pre-exercise BM– Post-exercise BM+ Fluid Intake – Urine Volume) / Exercise Duration (h)

These variables were measured:

- BM/exercise (kg)
- BM (kg) after exercise.
- Sweat rate ($L \cdot h^{-1}$)
- Fluid intake (mL)
- Urine volume (mL)
- Exercise duration (h)

The effect of badminton match-play on sweat rate during the wearing of knit polyester sportswear was assessed using these measurements.

2.6 Statistical Analysis

IBM SPSS Statistics was used to analyse data. The Shapiro–Wilk test was used to check normality of data. All data are expressed as mean ± SD. Mauchly's Test of Sphericity was used to test assumption of sphericity before conducting inferential analysis.

The variations in sweat rate between the three polyester sportswear knit constructions were examined using a one-way Repeated-Measures ANOVA. Post hoc multiple comparisons (Bonferroni) were used to identify differences across experimental conditions if a significant main effect was discovered. Partial eta squared (partial η^2) was used to calculate effect size. Statistical significance was defined as a p value of less than 0.05.

3. RESULTS

3.1 Participant Characteristics

Table 1 displays participants' descriptive attributes. The study included twelve competitive male badminton players with a mean age of 17.24 ± 1.67 yrs, height of 171.83 ± 5.14 cm, BM of 65.48 ± 6.32 kg, BMI of 22.18 ± 1.74 kg/m², and competitive playing experience of 6.08 ± 2.31 years.

Table 1Features of Participants (n = 12)

Variable	Mean ± SD
Age (yrs)	17.24 ± 1.67
Height (cm)	171.83 ± 5.14
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Playing Experience (years)	6.08 ± 2.31

3.2 Assumption Testing

Assumptions of normality and sphericity were checked before conducting the inferential data analysis. Results revealed that sweat rate data were normally distributed for all three experimental fabric conditions; results of Shapiro–Wilk test were all $p > 0.05$. Mauchly's Test of Sphericity showed that assumption of sphericity was not violated ($W = 0.928$, $p = 0.637$). Thus, there was no need to adjust degrees of freedom and the repeated-measures ANOVA was conducted with original degree of freedom.

Table 2. Assumption Testing for Repeated-Measures ANOVA

Statistical Test	Test Statistic	p-value	Interpretation

Shapiro–Wilk (Fabric A)	0.965	0.861	Normally distributed
Shapiro–Wilk (Fabric B)	0.958	0.742	Normally distributed
Shapiro–Wilk (Fabric C)	0.972	0.914	Normally distributed
Mauchly's Test of Sphericity	0.928	0.637	Sphericity assumption satisfied

3.3 Descriptive Statistics of Sweat Rate

The descriptive statistics for sweat rate under the three experimental fabric conditions are presented in Table 3. The mean sweat rate was highest while wearing Fabric A (Plain Knit Polyester) (0.94 ± 0.07 $L \cdot h^{-1}$), followed by Fabric B (Dot Knit Polyester) (0.89 ± 0.05 $L \cdot h^{-1}$), whereas the lowest mean sweat rate was observed with Fabric C (Mesh Knit Polyester) (0.82 ± 0.06 $L \cdot h^{-1}$).

Table 3. Mean (± SD) Sweat Rate Across the Experimental Polyester Sportswear Fabrics

Experimental Fabric	Mean Sweat Rate ($L \cdot h^{-1}$)	SD
Fabric A (Plain Knit Polyester)	0.94	0.07
Fabric B (Dot Knit Polyester)	0.89	0.05
Fabric C (Mesh Knit Polyester)	0.82	0.06

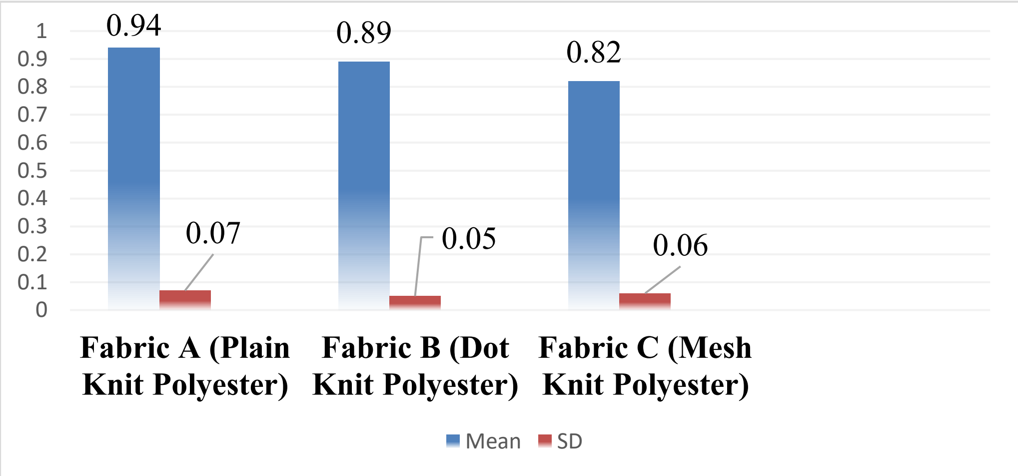

Figure 1. Mean sweat rate across the three experimental polyester sportswear fabrics.

3.4 Inferential Statistics

The three experimental polyester sportswear fabric conditions were compared with regard to sweat rate by one-way Repeated-Measures ANOVA. The main effect of fabric condition on sweat rate was POSITIVELY significant ($F (2, 30) = 8.91$, $p = 0.002$, partial $\eta^2 = 0.45$). The partial eta squared value was a large effect size, indicating that almost 45% of the sweat rate's variance was due to the differences between experimental fabric conditions.

Table 4. One-Way Repeated-Measures ANOVA for Sweat Rate

Source of Variation	SS	df	MS	F	p-value	Partial η^2
Fabric Condition	0.0672	2	0.0336	8.91	0.002*	0.45
Error	0.1134	30	0.0038			

Significant at $p < 0.05$.

3.5 Bonferroni Post Hoc Comparisons

After the large repeated measures ANOVA, post hoc comparisons were conducted using Bonferroni adjustment, to determine pairs of differences between the three experimental fabric conditions. The mean difference sweating rate between Fabric C (Mesh Knit Polyester) and Fabric A (Plain Knit Polyester) was significantly lower ($p = 0.004$) (mean difference $= -0.12$ $L \cdot hr{-}1$). Similarly, Fabric C also had a significantly lower sweat rate than Fabric B (Dot Knit Polyester) (mean difference $= -0.07$ $L \cdot h{-}1$, $p = 0.018$). There was no positive difference among Fabric A and Fabric B ($p = 0.072$).

Table 5. Bonferroni Post Hoc Comparisons of Sweat Rate

Pairwise Comparison	Mean Difference ($L \cdot h^{-1}$)	Standard Error	95% Confidence Interval	p-value
Fabric C vs Fabric B	−0.07	0.021	−0.128 to −0.012	0.018*
Fabric C vs Fabric A	−0.12	0.026	−0.192 to −0.048	0.004*
Fabric B vs Fabric A	−0.05	0.022	−0.111 to 0.011	0.072

Significant at $p < 0.05$.

DISCUSSION

The effects of three 100% polyester sportswear fabrics in badminton sport activity on sweat rate in competitive male athletes were investigated in the present study. The main result was that there was positive difference in sweat rate among three experimental fabric conditions. In particular, Fabric C (Mesh Knit Polyester) had the lowest mean sweat rate followed by Fabric B (Dot Knit Polyester), while Fabric A (Plain Knit Polyester) had the highest mean sweat rate. In addition, repeated-measures ANOVA showed major effect of fabric condition (sweat rate) was positively significant ($F_{(2,30)} = 8.91$, $p = 0.002$) and had a large effect size (partial $\eta^2 = 0.45$).

The result confirms the study hypothesis, which is that the knit construction (regardless of fibre composition) significantly affects sweat rate during badminton match play. The superior performance of the mesh knit polyester fabric can be attributed mainly to the properties of the fabric and not to the differences in fibre composition since all the experimental garments were made from polyester fabric. Knit constructions have a direct effect on porosity and air permeability of fabric, moisture transport ability, and ability to evaporate cooling, which are all important factors in determining thermophysiological comfort during exercise. In general, mesh knit fabrics have a more open loop structure, permitting more air to pass through it, and to allow more sweat to evaporate from the skin surface. This increased evaporative cooling increases heat dissipation, and helps the body stay cooler during exercise, which decreases the need to sweat more than necessary. Plain knit fabrics, on the other hand, usually have a more compact loop structure and comparatively lower air permeability, which can make them less breathable and slow down sweat evaporation and cause higher sweat accumulation. The behaviour was found to be intermediate for dot knit fabrics providing sweat rate values in between of the plain knit and the mesh knit fabrics. The current results are in line with the previous research on textiles showing that fabric structure is an essential element to the understanding of thermophysiological comfort of textiles. Fan and Chen (2002) found that the thermal insulation and moisture vapour resistance of a textile are greatly affected by differences in its construction, even if the fibre composition is the same.

Similarly, Das et al. (2010) reported that some of the key parameters that determine moisture transfer through textiles include structural properties, thickness and porosity of fabric. Das and Alagirusamy (2010) also noted that the comfort of the clothing depends on not only fibre type but also the geometry of the knitted structure which controls the clothing ventilation, moisture transport and heat dissipation. During exercise, clothing properties also showed to have a significant effect on heat exchange and thermoregulatory responses (Havenith and Nilsson, 2004). These studies as a whole lend strong support to the present results showing that differences in physiological response to exercise can be obtained by changes in the knit construction alone. This is line with previous work showing that structure of textile affects moisture transport, heat dissipation and clothing comfort during exercise, where a lower lower sweat rate was seen with the mesh knit polyester fabric. Fan and Chen (2002) reported that thermal insulation and moisture vapour resistance of cloths are greatly affected by their construction; Das et al. (2010) noted that the moisture transmission properties of textiles are influenced by their porosity and structure. Additionally, Das and Alagirusamy (2010) pointed out the idea that fabrics with different geometry promote ventilation, moisture transfer and thermal comfort. In addition, Havenith and Nilsson (2004) have shown that clothing properties have a significant impact on the interaction between the body and its environment.

The present studies confirm these findings and indicate that the decreased sweat rate recorded for the mesh knit polyester fabric could be linked with the well reported improved ventilation and moisture handling properties of open-knit fabric structures. Badminton consists of short bursts of high intensity running, jumping, multidirectional running, deceleration and acceleration. These movements significantly raise metabolic heat generation and sweat rate, especially during extended periods of high-intensity rallies and in competitive play. Badminton was described by Phomsoupha and Laffaye (2015) as a high-intensity intermittent sport with high physiological demands that requires high recovery rate between rallies. Likewise, Cabello Manrique and González-Badillo (2003) reported that competitive badminton requires a series of high intensity movements which exert a high demand on the cardiovascular and thermoregulatory systems. In such instances, sportswear that is capable of promoting effective heat dissipation and moisture evaporation can support the physiological comfort during training and competition. While this study did not directly assess athletic performance this may help athletes have more thermal comfort during long playing sessions.

The Bonferroni adjusted post hoc analysis indicated that there were significant differences between the mesh knit polyester fabric and the plain knit polyester fabric and the dot knit polyester fabric while there was no statistically significant differences between the plain knit polyester and the dot knit polyester fabrics. This discovery indicates that relatively minor changes in knit construction do not necessarily yield measurable changes in physiology, but that a more open-mesh knit gives a significant increase in ventilation and moisture evaporation. The large effect size found in this study once again supports the notion that knit construction is not a textural characteristic but rather an important physiological response to exercise.

The findings from a practical point of view imply that there are advantages to choosing the right knit structure to enhance thermophysiological comfort during badminton training and competition, especially in warm and humid environments. The present investigation has a number of methodological advantages. Randomized repeated measures design reduced inter-individual variability due to each subject being his own control and completing all three experimental conditions. Furthermore, all experimental garments were made from 100% polyester fibre so that the variations observed were mostly due to the differences in knit construction.

The study was conducted in natural match play of badminton, which adds further ecological validity and relevance of the results. Some of these assets need to be recognized but, there are also several drawbacks that need to be pointed out.

The results of study may not be generalizable to female badminton players, recreational players, and players of other sports. In addition, only sweat rate was assessed. Other physiological parameters (skin temperature, core temperature, heart rate, thermal sensation, rating of perceived exertion and garment microclimate) were not evaluated. Similarly, laboratory measurements were not made of objective textile qualities as air permeability, moisture management index, thermal resistance, permeability of water vapour, and fabric thickness. Larger and more diverse samples should be used, male and female athletes assessed under varying environmental conditions, and texture engineering evaluations combined with physiological and perceptual measures for a more holistic understanding of sportswear performance in the future.

The results of study indicated that knit construction (regardless of fibre composition) has a significant effect on sweat rate during badminton match play. The best thermophysiological responses were obtained with the mesh knit polyester fabric, which had the lowest sweat rate among the three tested fabrics. The results of study can give scientific support for significance of knit construction in the sportswear design, which can help athletes, coaches, badminton sportswear manufacturer, and athletes' textile researchers to design and select the appropriate sportswear for high-intensity intermittent sports like badminton, to achieve the best thermal comfort and moisture management.

CONCLUSION

The present study illustrated that badminton match play sweat rate significantly changed among 100% polyester sportswear fabrics with various knit construction for competitive male badminton players. The highest sweat rate was recorded in the plain knit polyester fabric, the lowest sweat rate was recorded in the mesh knit polyester fabric and the dot knit polyester fabric recorded a sweat rate in-between. The results show that knit construction is important for thermophysiology during exercise, regardless of fibre composition. The findings indicate that the increased environmental control (ventilation and moisture management) provided by the mesh knit construction could facilitate greater dissipative heat loss and evaporative cooling during high-intensity intermittent exercise like badminton. The possibility of a large effect size was further demonstrated in recent study, indicating practical importance of knit construction on sweat rate in real playing conditions. The study was restricted to competitive male badminton players and sweat rate only, but it does offer good evidence of the importance of the structure of textiles in sportswear performance. Future studies are warranted to expand number & variety of athletes as well as environmental factors and physiological, perceptual, and textile performance variables to gain greater understanding of the connection between fabric construction and athletic performance. Finally, the results of this study have confirmed that knit construction plays significant role in determining sweat rate in badminton match play besides the fibre composition. The findings could help athletes, coaches, sportswear companies and textile researchers develop and choose sports clothing for high activity sports to provide thermophysiological comfort and aid athletic performance.

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INFORMED CONSENT STATEMENT

Before any data was collected, all study participants provided written informed consent.

DATA AVAILABILITY STATEMENT

The accompanying author can provide the data supporting the study's conclusions upon reasonable request.

CONFLICTS OF INTEREST

There is no conflict of interest disclosed by the writers.

Colour meanings are not completely standardised across institutions. Familiar pairings such as blue for resuscitation and red for fire are often recognised, but less common alerts vary between hospitals. Staff who rotate between facilities may therefore import an incorrect interpretation. A single authorised institutional code matrix, visible reference aids and structured induction are practical controls against this risk. [7,8,10,26]

Questionnaire-based studies frequently report favourable attitudes alongside limited participation in drills or practical response roles. Recognition, however, does not demonstrate that a worker can initiate the correct pathway, coordinate with colleagues or perform under time pressure. Survey scores are consequently most useful as baseline organisational diagnostics when they are paired with observed exercises and response-performance measures. [11-14,17,18]

Evidence from multidisciplinary Indian tertiary-care settings is limited, and many published surveys emphasise awareness without separating recognition from rehearsed operational behaviour. This study therefore aimed to quantify knowledge, attitudes, self-reported practices and the composite KAP score; identify item-level preparedness gaps; and explore unadjusted score differences across professional groups. The study was descriptive, and no causal hypotheses were prespecified. [17,18]

The study's practical contribution is the explicit distinction between awareness and rehearsal. Rather than treating a favourable KAP score as sufficient evidence of readiness, the analysis identifies drill exposure and observable response capability as the priority targets for hospital governance.

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