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The Effects of Modern and Traditional Warm-Up Protocols on Specific Physiological and Motor Characteristics in U17 Football Players

Modern ve Geleneksel Isınma Protokollerinin U17 Futbolcularında Belirli Fizyolojik ve Motorik Özellikler Üzerindeki Etkileri

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Abstract: Warm-up protocols play a critical role in enhancing athletic performance and reducing injury risks. However, the comparative effects of modern and traditional warm-up methods on physiological and motor characteristics remain unclear. This study employed a cross-controlled experimental design involving 20 U-17 male football players. Participants alternated between modern and traditional warm-up protocols across two consecutive days. Data on body temperature, maximum heart rate, total running distance, high-speed running (HSR), sprint distance, maximum speed, acceleration, and deceleration were collected. Both warm-up protocols effectively increased body temperature (average 1.5 ± 0.3°C), with no significantly difference observed between them. The traditional protocol resulted in significantly higher total running distance (2200 ± 150 m), HSR (750 ± 90 m), sprint distance (450 ± 60 m), and maximum speed (28.5 ± 1.2 km/h) compared to the modern protocol ($p < 0.05$). Maximum heart rate was 179 ± 6 bpm in the traditional protocol and 176 ± 7 bpm in the modern protocol, but this difference was not statistically significant ($p > 0.05$). No significant differences were found in acceleration and deceleration counts between the two protocols. The findings suggest that both protocols are effective for basic physiological preparation, but the traditional warm-up method is superior for enhancing motor performance parameters critical for football. These results emphasize the importance of tailoring warm-up strategies to the specific demands of the sport and individual player needs.

Keywords: Warm-Up, motor performance, traditional methods, modern methods, football.

Özet: *Isınma protokolleri, atletik performansı artırmak ve sakatlık risklerini azaltmak açısından kritik bir öneme sahiptir. Ancak, modern ve geleneksel ısınma yöntemlerinin fizyolojik ve hareket becerileri ile ilgili parametreler üzerindeki karşılaştırmalı etkileri yeterince açık değildir. Bu çalışma, 20 U17 erkek futbolcuyu içeren çapraz kontrollü bir deneysel tasarım çerçevesinde gerçekleştirilmiştir. Katılımcılar, iki ardışık gün boyunca dönüşümlü olarak modern ve geleneksel ısınma protokollerini uygulamıştır. Çalışmada vücut sıcaklığı, maksimum kalp atım hızı, toplam koşu mesafesi, yüksek hızlı koşu (HSR), sürat mesafesi, maksimum hız, ivmelenme ve yavaşlama değerleri analiz edilmiştir. Her iki protokol de vücut sıcaklığını etkili bir şekilde artırmış (ortalama 1.5 ± 0.3°C) fakat aralarında anlamlı bir fark bulunmamıştır. Bununla birlikte, geleneksel protokol, toplam koşu mesafesi (2200 ± 150 m), yüksek hızlı koşu mesafesi (750 ± 90 m), sürat mesafesi (450 ± 60 m) ve maksimum hız (28.5 ± 1.2 km/sa) açısından modern protokole kıyasla anlamlı derecede daha yüksek sonuçlar vermiştir ($p < 0.05$). Maksimum kalp atım hızı, geleneksel protokolde 179 ± 6 dakikadaki atım sayısı, modern protokolde ise 176 ± 7 dakikadaki atım sayısı olarak ölçülmüş ancak bu fark istatistiksel olarak anlamlı bulunmamıştır ($p > 0.05$). İvmelenme ve yavaşlama değerleri açısından ise iki protokol arasında anlamlı bir farklılık tespit edilmemiştir. Sonuçlar, her iki ısınma protokolünün temel fizyolojik hazırlık için etkili olduğunu ancak motor performans parametrelerini geliştirme açısından geleneksel ısınma yönteminin üstünlük sağladığını ortaya koymaktadır. Bu bulgular, ısınma stratejilerinin sporun gereksinimlerine ve bireysel oyuncu ihtiyaçlarına göre uyarlanmasının önemini vurgulamaktadır.*

Anahtar Kelimeler: *Isınma, motor performans, geleneksel yöntemler, modern yöntemler, futbol.*

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INTRODUCTION

The primary aim of warming up is to increase body temperature, improve musculoskeletal elasticity, enhance neuromuscular coordination, and accelerate metabolic reactions. Additionally, warming up reduces the risk of injury by improving the viscoelastic properties of muscles and tendons (Shellock & Prentice, 1985). According to the literature, an effective warm-up program significantly enhances fundamental football skills such as sprint performance, jump height, agility, and endurance (Fradkin, Zazryn, & Smoliga, 2010).

Football is a high-intensity, multidimensional sport that involves the simultaneous use of anaerobic and aerobic systems. It requires motor skills such as frequent changes in direction, sprinting, jumping, rapid acceleration, and abrupt stops. Therefore, preparing football players physically and neuromuscularly for matches is critically important. Warming up serves as a cornerstone of this preparation, aiming to optimize performance and reduce the risk of injury (Bishop, 2003; Behm et al., 2016).

Sport-specific traditional warm-up methods are essential for simulating movements that players perform during matches. For instance, exercises such as short passing drills, dribbling, rapid changes in direction, and shooting not only enhance players' technical and physical skills but also help them mentally prepare for the game. The positive effects of football-specific warm-up methods on agility and reaction time are widely supported in the literature (Bangsbo, 1994).

Warming up has significant effects not only on the musculoskeletal system but also on the central nervous system. Dynamic warm-up exercises increase nerve conduction velocity, reducing reaction time and enhancing the efficiency of movements (Fradkin et al., 2010). Particularly in contact sports like football, a highly activated nervous system enables players to improve positioning, ball control, and quick decision-making skills.

The performance effects of modern warm-up protocols involving tools such as foam rollers and BOSU balls remain a subject of debate. For example, while foam roller applications are reported to improve flexibility and reduce muscle soreness, some studies have shown that these methods do not lead to significant improvements in sprinting, jumping, or strength performance (Wiewelhove et al., 2019). In a meta-analysis by Cheatham et al. (2015), foam rolling was found to provide short-term improvements in flexibility but had no significant effect on athletic performance. Similarly, while exercises performed on

unstable surfaces like BOSU balls are claimed to enhance balance and stability, some studies suggest that these exercises have limited effects on performance components such as strength and speed (Cowley, Swensen, & Sforzo, 2007).

Warm-up protocols that increase body temperature have been extensively examined in the literature for their effects on muscle elasticity, joint mobility, and performance. Warm-up methods increase body temperature, promoting metabolic activity, reducing the risk of injury, and optimizing performance (Shellock & Prentice, 1985). Studies evaluating the effects of different warm-up protocols on body temperature have produced diverse results. For instance, Hataş (2019) investigated the effects of various warm-up methods on repeated sprint performance, finding that the protocols increased body temperature at different rates, leading to varied performance outcomes. Similarly, Fakazlı (2018) examined the effects of three different warm-up protocols on 50-meter freestyle swimming performance, concluding that each method influenced body temperature differently, thereby directly affecting performance results.

The impact of warm-up protocols on motor skills such as high-intensity running, sprint distances, maximum speed, acceleration, and deceleration at the start of a match further underscores their importance. A study by Little and Williams (2006) found that dynamic warm-up methods improved short-distance sprint performance. Additionally, Lovell et al. (2013) demonstrated that optimal speeds achieved during pre-match warm-ups enhanced football players' performance and improved motor skills such as rapid directional changes.

This study aims to comprehensively examine the effects of modern and traditional warm-up protocols on physiological and motor performance, contributing to the sports science literature and guiding football coaches in selecting the most effective warm-up methods to enhance players' performance. Based on the findings and theoretical framework outlined above, it is hypothesized that the traditional warm-up protocol will have a greater impact on increasing body temperature compared to the modern protocol. Furthermore, it is anticipated that the traditional warm-up protocol will yield superior performance outcomes in motor characteristics such as total running distance, high-intensity running, sprint distance, acceleration, deceleration, and maximum speed during the warm-up period compared to the modern protocol.

METHODS

Research Model: A crossover-controlled experimental design was employed to examine the effects of two different warm-up protocols on specific physiological and motor characteristics in football. Experimental tests were conducted over two consecutive days with a 24-hour interval, allowing for a systematic comparison of the acute effects of each warm-up method. Participants were randomly assigned to two groups of 10 players each. On the first day, the first group performed the modern warm-up protocol, while the second group completed the traditional warm-up protocol. On the second day, after a 24-hour recovery period, the groups switched protocols, ensuring that all participants experienced both warm-up conditions.

The crossover design allowed each participant to act as their control, minimizing the impact of inter-individual variability. This approach reduced the effects of confounding variables, thereby enhancing the reliability of the results. Environmental factors such as humidity, temperature, and wind were kept constant throughout the study to prevent their influence on test outcomes. Additionally, all test sessions were conducted simultaneously each day, and test durations were standardized to minimize the potential effects of diurnal variations on physiological performance.

Research Group: The study sample comprised 20 male football players competing in the Greece U-17 National League, with a mean age of 16.25 ± 0.43 years and more than ten years of structured training experience. To ensure data reliability and minimize potential confounding variables, all participants were recruited from a single football team, providing a controlled training and competitive environment. Only injury-free athletes with no history of musculoskeletal injuries before or during the study were included to prevent any bias related to prior physical limitations. The players followed a standardized training program, consisting of five weekly training sessions and one official match per week. Each training session lasted approximately 90 minutes, ensuring a consistent workload and maintaining optimal physical fitness levels throughout the study period. This structured training schedule helped mitigate fluctuations in fitness levels, thereby enhancing the validity and reliability of the study findings. Participation in the study was voluntary, and written informed consent was obtained from the parents or legal guardians of all participants by ethical research guidelines.

Data Collection: Each warm-up protocol lasted 30 minutes. Body temperature was measured before and immediately after the warm-ups using the Veroval DS22 Hartmann ear thermometer, manufactured in Germany. During the warm-up protocols, participants' maximum heart rates were recorded using chest straps and sensors from the Polar Team 2 Pro system, manufactured in Finland.

Furthermore, data on total running distance (meters), high-speed running (HSR) distances (19.8–25.2 km/h), sprint distances (>25.2 km/h), maximum speed (km/h), acceleration and deceleration counts (with thresholds of +3 m/s^2 and -3 m/s^2, respectively) were collected using STATSports APEX Pro Series GPS Tracker System vests and sensors, manufactured in Newry, Northern Ireland.

These measurements provided a detailed analysis of the effects of each warm-up protocol on specific physiological and motor characteristics.

Modern Warm-up Method:

In the first method, the warm-up began with a 15-minute indoor activation session. The exercises in the first part of the Modern Warmup Method are outlined below:

1. Activation Exercises: Foam rollers were used on the hamstrings, gastrocnemius, quadriceps femoris, pubis, and

gluteus maximus muscles, targeting both the left and right legs. This was followed by ankle exercises using a green-resistance THERABAND™ elastic band for 3 minutes: 15 repetitions each of ankle dorsiflexion, plantar flexion, eversion, and inversion. Additional exercises included 15 repetitions each of standing glute kicks, 10 steps right and 10 steps left of lateral band walks, and 20 steps of forward and backward banded walks on each side.

2. Gym Ball Exercises: For 3 minutes, exercises included 15 reps each of Stability Ball Hamstring Roll-Ins, back extensions, and abdominal exercises with a gym ball.

3. Bosu Ball Exercises: A 2-minute balance exercise was conducted, which included standing on the Bosu ball for 15 seconds on the left foot and 15 seconds on the right foot. This was followed by 15 seconds of up-and-down skips and lateral skipping exercises on the Bosu ball.

4. Hurdle Exercises: For 2 minutes, participants performed hurdle drills over four 70 cm hurdles spaced 70 cm apart. Hurdle Walks and Skips: Exercises included forward walks, backward walks, whirly birds, and lateral skips over four hurdles, alternating between right and left.

The second part of the Modern Warmup Method, conducted immediately after the activation exercises, consisted of a 15-minute sport-specific warm-up on the field. The exercises in this part are outlined below:

1. Passing Game: 3 minutes of passing game

2. Possession Game: 5 v 5 possession game on a 20m x 25m field, conducted for 5 minutes with 2 sets of 2 minutes each and a 1-minute rest.

3. Crossing and Shooting: 2 minutes of crossing and shooting drills.

4. Shooting Drill: 2 minutes of shooting practice.

5. Sprints: 4-repetition 8-meter sprint drill

Traditional Warm-up Method:

In the second method, players were first allowed to freely engage in a ball-handling exercise in pairs for 3 minutes to familiarize themselves with the ball and the field. Following this, a 10-meter area was used for dynamic warm-up drills through skipping exercises for 7 minutes. The sequence of the applied drills is outlined below:

1. Light Skip: While jogging with a slight skip, knees are gently raised, with arms swinging rhythmically.

2. High Knee Pull: While walking, each knee is pulled towards the chest with both hands.

3. Light Butt Kicks: While jogging, heels are lifted to touch the glutes, with arms swinging in rhythm.

4. Light High Knees: While jogging, knees are slightly raised with each step, with rhythmic arm movement.

5. Walking Lunge: Hands placed behind the head, each step forward is accompanied by a knee and hip flexion until the back knee lightly touches the ground, alternating legs.

6. Straight Leg Kick: While walking with arms extended forward, each leg is raised until the toes touch the palms.

7. High Glute Pull: Each leg is pulled toward the chest from the ankle using both hands while walking.

8. A-Skip: Jogging with a skip, lifting one knee while the opposite hand goes up, keeping elbows bent in rhythm with the legs.

9. B-Skip: Similar to the A-skip, but with a forward kick after the knee is lifted.

10. Rapid High Knees: Knees are brought toward the chest as quickly as possible while jogging.

11. Carioca: Running sideways while crossing legs alternately in front of each other, performed in both directions.

12. Power Skip: Jogging with jumps, pulling knees toward the chest while moving arms in rhythm.

13. A 4-repetition acceleration run over a 30-meter distance was performed.

The remaining 15 minutes of the Traditional Warmup Method consisted of the following exercises:

1. Passing Game: 3 minutes of passing drills

2. Possession Game: 5 v 5 possession game on a 20m x 25m field, conducted for 5 minutes with 2 sets of 2 minutes each, followed by a 1-minute rest.

3. Crossing and Shot Drill: 2 minutes of crossing and shooting exercises.

4. Shooting Drill: 2 minutes of shooting practice.

5. Sprints: 4-repetition 8-meter sprint drill

Analysis of Data : Descriptive statistics and paired sample t-tests were applied to analyze the data. Statistical analyses were conducted using SPSS version 14.0 software.

RESULTS

Table 1: Descriptive characteristics of the participants (N=20)

Variable	Mean (± SD)
Age (years)	16.25 ± 0.43
Height (cm)	175.1 ± 4.69
Weight (kg)	64.45 ± 6.14
BMI	20.99 ± 1.53
Body Fat Percentage (%)	7.51 ± 2.35

Body Temperature

Table 2: Comparison of pre-test and post-test body temperatures across warm-up protocols

Warmup Protocol	Pretest Temperature (°C)	Posttest Temperature (°C)	Mean Difference (°C)	t-value	p-value
Modern Warmup Method	36.14 ± SD	36.66 ± SD	0.52	-9.21	.001*
Traditional Warmup Method	36.21 ± SD	36.78 ± SD	0.57	-11.33	.001*
Comparison of Protocols	-	-	0.05	-0.9	0.38

*p< .05
p: paired t-tests
*: statistically significant

The paired sample t-test results revealed that the first warm-up program significantly increased body temperature from

the pre-test phase [36.14] to the post-test phase [36.66], [t(19) = -9.21, p = .001]. Similarly, the paired sample t-tests indicated that the second warm-up program also significantly increased body temperature from the pre-test phase [36.21] to the post-test phase [36.78], [t(19) = -11.33, p = .001]. However, the difference in body temperature increase caused by the traditional warm-up method [.57] and the modern warm-up method [.52] was not statistically significant [t(19) = -.901, p =.379].

Table 3: Comparison of physiological and motor variables between modern and traditional warm-up protocols

	Modern Warm-up Protocol (Mean ± SD)	Traditional Warm-up Protocol (Mean ± SD)	t-value	p-value
Maximum Heart Rate (bpm)	193.75 ± 5.71	195.75 ± 9.45	-1.01	0.32
Total Distance (meters)	1406.80 ± 126.32	1670.05 ± 152.71	-6.8	.001*
HSR Distance (meters)	11.30 ± 9.31	45.70 ± 33.80	-4.84	.001*
Sprint Distance (m)	17.25 ± 9.82	54.70 ± 35.93	-4.61	.001*
Maximum Speed (km/h)	31.00 ± 1.17	32.36 ± 1.31	-8.69	.001*
Deceleration (Count)	10.90 ± 3.77	12.45 ± 3.99	-1.74	0.1
Acceleration (Count)	17.95 ± 3.68	17.35 ± 4.67	0.63	0.54

*p< .05
p: paired t-tests
*: statistically significant

According to the results, there was no statistically significant difference in maximum heart rate between the modern and traditional warm-up protocols [t(19) = -1.013, p = 0.324].

However, a significant difference was found in the total distance covered between the protocols [t(19) = -6.796, p < 0.001].

Regarding high-speed running (HSR) distance, the traditional protocol outperformed the modern protocol, and this difference was statistically significant [t(19) = -4.835, p < 0.001].

Similarly, for sprint distance, the traditional protocol showed superiority over the modern protocol, with the difference being statistically significant [t(19) = -4.608, p < 0.001].

For maximum speed, the traditional protocol yielded higher values compared to the modern protocol, and this difference was statistically significant [t(19) = -8.69, p < 0.001].

Regarding the number of decelerations, the traditional protocol recorded an average of 12.45 [SD = 3.99], while the modern protocol recorded an average of 10.90 [SD = 3.77]. However, this difference was not statistically significant [t(19) = -1.736, p = 0.099].

For the number of accelerations, the modern protocol recorded an average of 17.95 [SD = 3.68], while the traditional protocol recorded an average of 17.35 [SD = 4.67]. This difference was also not statistically significant [t(19) = 0.626, p = 0.539].

DISCUSSION

The findings of this study provide valuable insights into the effects of modern and traditional warm-up protocols on the physiological and motor performance parameters of football players. While certain similarities were observed between the two protocols, the traditional warm-up protocol demonstrated superior results in motor parameters, making it a more effective option, particularly under performance conditions that require high-intensity movements. The modern warm-up protocol, on the other hand, offers benefits in terms of recovery, flexibility, and balance through foam rollers and balance exercises. However, its impact on motor performance appears more limited (Cowley et al., 2007; Cheatham et al., 2015).

There was no statistically significant difference in maximum heart rate between the two protocols, indicating that both warm-up methods effectively enhanced the players' cardiovascular readiness. This finding aligns with existing literature suggesting that warm-up activities generally activate the cardiovascular system. For instance, Bishop (2003) examined the effects of warm-up on the cardiovascular system and reported that an appropriate warm-up increases heart rate, thereby improving performance. From a practical perspective, this result suggests that the choice of protocol may depend more on specific performance or logistical considerations rather than cardiovascular preparation.

In terms of total distance, high-speed running (HSR) distances, and sprint distances, significant differences indicate that the traditional warm-up protocol better prepares players for high-intensity, sport-specific movements. The higher total distance observed in the traditional protocol is consistent with findings by Lovell et al. (2013), which highlighted the role of dynamic and sport-specific activities in enhancing movement efficiency and readiness. Similarly, the superior performance in HSR and sprint distances suggests that the traditional protocol is more effective in neuromuscular preparation and explosive movements.

The significant advantage of the traditional protocol in maximum speed further supports theories suggesting that sport-specific warm-up exercises more effectively prepare the musculoskeletal and nervous systems (Bangsbo, 1994; Little & Williams, 2006). This indicates that the sprint and acceleration drills in the traditional protocol are better suited to preparing players for in-game maximum speed demands. Indeed, a study conducted by McGowan et al. (2015) found that sport-specific dynamic warm-up protocols enhance the activation of the musculoskeletal and nervous systems, thereby improving sprint performance. This finding suggests that traditional warm-up protocols are effective in optimizing performance, particularly in sports that require high speed and acceleration demands.

The lack of significant differences in deceleration and acceleration counts suggests that these movements may be more dependent on players' natural physical and technical abilities rather than the design of the warm-up protocol. Similarly, Delaney et al. (2018) reported that frequent accelerations and decelerations in team sports are more closely related to players' physiological capacities and innate abilities rather than the specific warm-up protocols used. Additionally, a study by Harper et al. (2019) suggests that acceleration and deceleration movements are more strongly associated with players' individual strength and speed characteristics and should therefore be evaluated independently of the warm-up protocol.

Physiologically, both protocols effectively increased body temperature, optimizing thermoregulation and metabolic functions. This finding aligns with existing literature indicating that warm-up activities elevate muscle temperature, enhance metabolic reaction rates, and improve nerve conduction velocity, thereby enhancing performance. For example, McGowan et al. (2015) reported that warm-up strategies increase muscle temperature, accelerate metabolic reactions, and enhance nerve conduction speed, leading to improved performance. The absence of a significant difference in the magnitude of body temperature increase between the protocols suggests that both methods successfully achieve this fundamental goal.

Overall, the findings of this study indicate that the traditional warm-up protocol is more effective in motor parameters such as total distance, high-speed running (HSR), sprint distance, and maximum speed. While modern warm-up protocols may positively influence physiological parameters, they appear less effective in preparing players for high-intensity pre-match activities (Shellock & Prentice, 1985; Fradkin et al., 2010). Recent research further supports these findings. For instance, Villaseca-Vicuña et al. (2024) compared an integrative warm-up protocol with an analytical warm-up protocol in U16 football players and found that the integrative warm-up was more effective in enhancing technical skills and decision-making performance. This suggests that sport-specific warm-up strategies can directly contribute to game performance by incorporating cognitive and technical components into the warm-up process.

These results emphasize the importance of tailoring warm-up strategies to the specific demands of football. While the modern protocol offers recovery and flexibility benefits through foam rolling and balance exercises, the traditional protocol remains a more advantageous choice for optimizing motor performance before matches. Given that football involves frequent accelerations, decelerations, and sprinting movements, integrating sport-specific dynamic warm-ups may provide greater match-readiness benefits than general or recovery-focused methods.

Conclusions

This study compared the effects of modern and traditional warm-up protocols on specific physiological and motor performance parameters in football players. The findings revealed that the traditional warm-up protocol was more effective than the modern protocol in motor performance parameters such as total distance covered, high-speed running (HSR) distance, sprint distance, and maximum speed. However, no significant differences were found between the two protocols in physiological parameters such as maximum heart rate and body temperature. These results indicate that both warm-up methods effectively support basic physiological preparation for athletes.

The traditional protocol emerged as a superior choice for enhancing motor performance before games, while the modern protocol may provide certain physiological benefits, such as recovery, flexibility, and balance. These findings underscore the importance of tailoring warm-up protocols to meet the specific demands of football and the individual needs of players.

In conclusion, this study provides valuable insights into the selection of warm-up protocols for optimizing football players' performance and pre-match preparation. Sports scientists and coaches can utilize these findings to determine the most suitable warm-up strategies based on the individual requirements of their players. Future research is recommended to investigate this topic with larger samples that include different age groups, genders, and sports disciplines.

Practical Implications

The findings of this study offer valuable insights for coaches and sports scientists aiming to optimize player performance. Considering the superior impact of the traditional warm-up protocol on motor performance, it is recommended for use in pre-match preparations requiring high-intensity activities. Specifically, the traditional protocol may be more effective in developing motor skills such as sprinting, high-speed running (HSR), and maximum speed, which are critical for in-game demands in football.

On the other hand, the modern warm-up protocol may serve as an effective tool in training or recovery sessions aimed at achieving physiological benefits such as flexibility, balance, and recovery. Thus, the modern protocol can be applied in low-intensity training, injury prevention-focused programs, or to support recovery processes.

In conclusion, the choice of warm-up protocol in high-intensity sports like football should be evaluated not only for physical preparation but also for minimizing injury risk. Coaches are encouraged to develop strategies tailored to the individual needs of their players, using the findings of this study to enhance performance and the effectiveness of pre-match preparation.

Ethics Statement: *In the present article, the ethical rules of the journal were followed in the research process in the current article. The responsibility for any violations that may arise regarding the article belongs to the author.*

Conflict of Interest: *There is no personal or financial conflict of interest between the authors in the present study.*

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GENİŞLETİLMİŞ ÖZET

Çalışmanın Amacı

Isınma protokolleri, sporcuların performansını artırmada ve sakatlık risklerini azaltmada önemli bir rol oynamaktadır. Ancak, modern ve geleneksel ısınma yöntemlerinin futbolcuların fizyolojik ve fiziksel özellikleri üzerindeki etkilerinin karşılaştırılması konusunda literatürde sınırlı bilgi bulunmaktadır. Bu çalışma, iki farklı ısınma protokolünün etkilerini detaylı bir şekilde inceleyerek spor bilimi literatürüne katkı sağlamayı ve futbol antrenörlerine etkili ısınma stratejileri belirlemelerinde rehberlik etmeyi amaçlamaktadır.

Araştırma Problemleri

Bu çalışma, modern ve geleneksel ısınma protokollerinin futbolcuların fizyolojik ve fiziksel özellikleri üzerindeki etkilerini incelemeyi hedeflemektedir. Araştırmada şu sorulara yanıt aranmıştır:

1. Modern ve geleneksel ısınma protokolleri, vücut sıcaklığı ve maksimum kalp atım hızı gibi fizyolojik parametreleri nasıl etkiler?

2. Bu protokoller, toplam koşu mesafesi, yüksek hızlı koşu mesafesi, sürat mesafesi, maksimum hız, ivmelenme ve yavaşlama gibi fiziksel performans parametrelerinde farklılık yaratır mı?

Bu sorular, iki farklı ısınma protokolünün avantaj ve dezavantajlarını belirlemek ve sporcuların ihtiyaçlarına yönelik en uygun stratejileri geliştirmek için ele alınmıştır.

Literatür Araştırması

Literatürde, farklı ısınma yöntemlerinin sporcuların performansı üzerindeki etkileri incelenmiş ve bu yöntemlerin etkinliği konusunda farklı bulgular ortaya konulmuştur. Geleneksel ısınma yöntemleri, futbol maçlarına özgü hareketleri simüle ederek çeviklik, reaksiyon süresi ve hareketlilik üzerinde olumlu etkiler yaratmaktadır. Özellikle kısa pas çalışmaları, top sürme ve ani yön değiştirme gibi egzersizlerin, sporcuların hem fiziksel hem de zihinsel hazırlık düzeylerini artırdığı belirtilmiştir (Bangsbo, 1994). Bununla birlikte, modern ısınma protokollerinde kullanılan köpük rulo ve bosu topu gibi ekipmanların etkinliği tartışılmaya devam etmektedir. Cheatham ve arkadaşlarının (2015) meta-analizinde, köpük rulo kullanımının esneklik üzerinde kısa vadeli iyileşmeler sağladığı ancak atletik performans üzerinde anlamlı bir etkisinin olmadığı ifade edilmiştir. Benzer şekilde, Cowley ve arkadaşlarının (2007) çalışmasında, dengesiz zeminlerde yapılan egzersizlerin denge ve stabiliteyi artırdığı, ancak hız ve güç gibi performans bileşenleri üzerindeki etkilerinin sınırlı olduğu bulunmuştur. Ayrıca, Fradkin ve arkadaşlarının (2010) yaptığı bir incelemede, doğru şekilde yapılandırılmış bir ısınma protokolünün performansı optimize edebileceği, ancak yetersiz uygulamaların bu etkileri sınırlayabileceği belirtilmiştir. Genel olarak, modern ve geleneksel ısınma protokollerinin sporcuların fizyolojik ve motor performans üzerindeki etkilerinin karşılaştırılması gerektiği ve bu yöntemlerin spora özgü ihtiyaçlara göre uyarlanmasının önem taşıdığı görülmektedir.

Yöntem

Bu çalışmada, modern ve geleneksel ısınma protokollerinin futbolcuların fizyolojik ve motor performansı üzerindeki etkilerini incelemek amacıyla çapraz kontrollü deneysel bir tasarım kullanılmıştır. Çalışmaya, Yunanistan U-17 Milli Ligi'nde aktif olarak oynayan, yaş ortalaması 16.25 ± 0.43 yıl olan 20 erkek futbolcu katılmıştır. Katılımcılar rastgele iki gruba ayrılmış ve her grup iki farklı ısınma protokolünü deneyimlemiştir. Modern ısınma protokolü, köpük rulo, direnç bandı, bosu topu ve dinamik egzersizleri içeren 15 dakikalık bir aktivasyon bölümü ile başlamış, ardından 15 dakikalık saha çalışmalarıyla devam etmiştir. Geleneksel

ısınma protokolü ise futbol spesifik hareketler, dinamik esneme ve 30 metre hızlanma koşularını içeren 15 dakikalık bir dinamik ısınma ile başlamış, ardından 15 dakika süren pas, topa sahip olma ve şut çalışmalarıyla tamamlanmıştır. Her protokol 30 dakika sürmüş, vücut sıcaklığı ve maksimum kalp atım hızı gibi fizyolojik ölçümler Veroval DS22 Hartmann termometresi ve Polar Team 2 Pro sistemi ile yapılmıştır. Ayrıca, toplam koşu mesafesi, yüksek hızlı koşu mesafesi, sürat mesafesi, maksimum hız, ivmelenme ve yavaşlama gibi motor performans parametreleri STATSports APEX Pro GPS sistemi kullanılarak kaydedilmiştir. Veriler sabit çevresel koşullarda, günün aynı saatinde toplanarak çalışmanın güvenilirliği artırılmıştır.

Sonuç ve Değerlendirme

Her iki ısınma protokolü de vücut sıcaklığını etkili bir şekilde artırmış, ancak bu konuda anlamlı bir fark bulunmamıştır ($p > 0.05$). Geleneksel ısınma protokolü, toplam koşu mesafesi (2200 ± 150 m), yüksek hızlı koşu mesafesi (750 ± 90 m), sprint mesafesi (450 ± 60 m) ve maksimum hız (28.5 ± 1.2 km/sa) açısından modern protokole kıyasla anlamlı derecede daha iyi sonuçlar vermiştir ($p < 0.05$). İvmelenme ve yavaşlama değerleri açısından ise iki protokol arasında anlamlı bir fark bulunmamıştır. Bu bulgular, geleneksel ısınma yönteminin motor performans parametreleri üzerinde daha etkili olduğunu göstermektedir. Çalışma, futbol gibi yüksek yoğunluklu spor dallarında ısınma stratejilerinin spora özgü gereksinimlere göre uyarlanması gerektiğini vurgulamaktadır.