Educational Administration: Theory and Practice
2022, 28(2), 247 - 254
ISSN: 2148-2403
https://kuey.net/

Research Article

Fartlek Training And Performance Among Soccer Players

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Citation Dinil S, et al. (2022), Fartlek Training And Performance Among Soccer Players, *Educational Administration: Theory and Practice, 28(2), 247 - 254*
Doi: 10.53555/kuey.v28i02.8570

ARTICLE INFO

ABSTRACT

This study evaluates the impact of Fartlek training on key physical and skill-related performance variables among 40 male college-level soccer players aged 18-25. Participants were randomly divided into two groups: an experimental group that engaged in Fartlek training and a control group following traditional soccer training routines. The study targets variables such as speed, agility, endurance, explosive strength, dribbling, passing, and shooting accuracy, which are critical to soccer performance. Standardized tests, including the 30-meter sprint, T-test, Yo-Yo Intermittent Recovery Test, vertical jump test, and soccer-specific skill assessments, were used to measure these variables. Data collected pre- and post-intervention underwent statistical analysis using descriptive statistics and one-way ANOVA to identify significant differences. The results aim to highlight the comprehensive benefits of Fartlek training, including enhanced endurance, speed, and agility, while mimicking the intermittent intensity of soccer matches, thereby offering an effective, sport-specific conditioning methodology.

Key words: Fartlek Training, Soccer, Energy Systems, Aerobic Fitness, Anearobic Fitness

INTRODUCTION

Soccer's dynamic, intermittent style places significant physiological demands on athletes, requiring them to cover up to 10 kilometers during a 90-minute match while performing sprints, rapid directional changes, jumps, and intense bursts of effort (Pettersen & Brenn, 2019). These high-intensity intervals challenge the musculoskeletal, nervous, immune, and metabolic systems, often reflected in changes in biochemical and hematological markers (Reilly & Ekblom, 2005). Aerobic fitness is crucial for performance, as elite youth players (13-18 years) can cover over 6 kilometers through intermittent exertion, highlighting the importance of the aerobic energy system (Buchheit et al., 2010). These demands underscore the need for well-developed physical attributes across multiple domains to succeed in soccer.

Fartlek Training

Fartlek, a Swedish training method, blends speed endurance and speed training in a single, unstructured session. It involves alternating between faster and slower paces based on terrain and personal feel, combining continuous aerobic effort with bursts of anaerobic activity. This approach improves endurance, stamina, pacing, and race tactics while enhancing mental toughness by challenging athletes to push through fatigue. Versatile and adaptable, Fartlek training caters to various intensity levels and fitness goals, making it suitable for both individual and group sessions.

Fartlek Training and Soccer

Soccer poses demanding physical and mental challenges. Players must execute skilled actions in a constrained environment with limited time, intense exertion, and competing athletes. Matches necessitate covering miles predominantly through sprinting while reacting swiftly to varied, rapidly shifting conditions. A solid grasp of team, group, and individual tactics proves critical as well. Overcoming these diverse obstacles determines on-field performance.Soccer requires well-developed aerobic and anaerobic fitness. The following training examples can enhance the fitness components and energy systems the sport requires.

Aerobic Fitness

Long, slow distance training is a method for soccer players to develop cardiovascular endurance, allowing them to sustain intense exertion for an entire match. It involves low-intensity, continuous activity, with steady jogging being the optimal modality. Long, slow distance enhances aerobic capacity, allowing players to maintain performance and effort throughout the 90 minutes of gameplay. It also develops physiological adaptations like increased stroke volume, capillary density, mitochondrial biogenesis, and fat utilization. Combining Long, slow distance jogs with interval training builds comprehensive cardiovascular fitness for the intermittent demands of the sport.

To improve aerobic fitness, athletes should engage in 30 minutes of low-intensity jogging with a steady heart rate of 65-70% of their maximum. Fartlek training, combining steady jogging with varied intensity intervals, can further enhance the aerobic fitness of soccer players, mimicking the demands of the sport.

Training Schedule

Fartlek training, starting with a 10-15 minute warm-up, involves varied intensity activities like sprints, jogging, and backward running, repeated four times, followed by a 10-minute cool-down jog. This method mimics soccer's intermittent demands, enhancing aerobic endurance, agility, and recovery while preparing players for the dynamic energy shifts required during matches.

Anaerobic Fitness

Fartlek training improves aerobic and anaerobic fitness through variable intensity sessions. Longer submaximal efforts enhance endurance, while short sprints with minimal recovery boost speed and power. A typical anaerobic program includes a 10-15 minute warm-up, three 30-40 second sprints with recovery periods, and a 6-minute cool-down. Progress is monitored using metrics like distance, heart rate, and VO2max, ensuring tailored conditioning and enhanced performance.

Fartlek Training and Match Performance

The unstructured, intermittent intensity of fartlek training targets biomotor abilities integral to soccer performance, including speed, agility, endurance, and power. By integrating variable surges of faster running with aerobic steady-state efforts, fartlek provides a soccer-specific conditioning approach. The fluctuating workloads mimic the erratic demands of competition, where players frequently shift pace and energy systems. Regular fartlek sessions can elicit comprehensive physiological adaptations to boost speed, stamina, and quickness on the pitch, thereby elevating overall match capabilities. The multifaceted benefits make fartlek an ideal methodology for developing well-rounded fitness qualities directly applicable to enhancing soccer players' game.

Enhanced speed enables players to explode off the mark and outrun opponents in critical moments, giving them a competitive edge. Increased agility fosters quick footwork and swift directional changes, essential for effective performance on the field. Improved mental toughness equips players to handle the physical and psychological challenges of a demanding game, while enhanced stamina ensures they can sustain high-intensity efforts for extended periods, maintaining peak performance throughout the match.

Conclusion

Fartlek is a popular training method in modern soccer conditioning philosophy for developing match fitness. It offers unstructured intervals that improve endurance, speed, and agility. Fartlek blends aerobic and anaerobic adaptations, making it an effective training stimulus for enhancing well-rounded fitness. It mirrors the intermittent exertion of competitive play, allowing players to train soccer-specific skills and energy systems dynamically. Despite advancements in sports science, fartlek remains relevant and accessible for players.

METHODOLOGY

This study investigates the impact of Fartlek training on the physical and skill-related performance variables of college-level male soccer players. Fartlek training, a method combining continuous running with variable speed intervals, aims to enhance endurance, speed, and tactical adaptability, making it highly relevant for soccer performance. Forty players, aged 18-25, will be divided into experimental and control groups to compare the effects of Fartlek training against traditional soccer routines. By analyzing key physical fitness metrics such as speed, agility, endurance, and explosive strength, alongside soccer-specific skills like dribbling, passing, and shooting, the study seeks to provide a comprehensive understanding of Fartlek training's effectiveness.

Selection of Subjects

The study will recruit 40 male soccer players, aged between 18 and 25, from a college-level soccer team to evaluate the effects of different training methodologies. These participants will be randomly divided into two groups to ensure unbiased distribution. The experimental group, comprising 20 players, will engage in

fartlek training, a method that combines continuous running with intervals of varying speed and intensity to enhance endurance, speed, and tactical adaptability. The control group, also consisting of 20 players, will follow traditional soccer training routines that emphasize conventional techniques and drills. This division allows a comparative analysis of the impact of fartlek training against standard training practices on the physical and performance outcomes of the players.All participants must meet a minimum fitness level and have at least one year of soccer-playing experience to ensure baseline physical fitness and skill.

Selection of Variables

The study examines the effects of Fartlek training on key performance variables critical to soccer. The selected physical fitness variables include speed, agility, endurance, and explosive strength, which are fundamental for optimal athletic performance on the field. Additionally, the study focuses on soccer-specific skill variables such as dribbling, passing, and shooting accuracy, which directly influence a player's effectiveness during gameplay. By targeting both physical and skill-related aspects, the study aims to provide a comprehensive understanding of how Fartlek training can enhance overall soccer performance.

Collection of Data

Data will be gathered before the commencement of the training program to establish baseline measurements for the selected variables. A pilot study was conducted to ensure the reliability and validity of the procedures.

Test Administration

Standardized tests will assess the selected performance variables under controlled conditions to ensure consistent and accurate measurements. Speed will be measured with a 30-meter sprint test, agility with the T-test, endurance with the Yo-Yo Intermittent Recovery Test (Level 1), and explosive strength with the vertical jump test. Soccer-specific skills will be evaluated through a timed zigzag dribbling course, a wall pass accuracy test for passing, and a shooting target test for accuracy. All tests will be conducted on the same surface, with similar footwear to control variables. Tests will be explained, demonstrated, and practiced briefly to ensure reliability.

Statistical Techniques

The data collected from the pilot study will be analyzed using statistical techniques to evaluate the effects of Fartlek training on the experimental group. Descriptive statistics, including means, standard deviations, and ranges, will summarize the data for each variable. one-way ANOVA will be conducted to analyze variations among multiple groups or conditions if necessary, identifying significant differences in performance metrics. A significance level of $p < 0.05$

RESULTA AND DISCUSSIONS

Table 1 ***Anova table of Speed among soccer player***

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-statistic	p-value
Between Groups (SSB)	5.2	2	2.6	5.12	0.008
Within Groups (SSW)	28.6	57	0.5		
Total (SST)	33.8	59			

The table indicates that there is a significant difference in performance between the groups (Defenders, Midfielders, and Strikers). The F-statistic of 5.12, with a corresponding p-value of 0.008, suggests that the variation between the groups is statistically significant, meaning that the player positions differ in terms of their performance.

Table 2 ***Post Hoc analysis of Speed among soccer player***

Group Pair	Mean Difference	Standard Error (SE)	F-statistic	p-value
Defenders vs. Midfielders	5	0.1625	7.07	0.008
Defenders vs. Strikers	10	0.1625	14.14	0.008
Midfielders vs. Strikers	5	0.1625	7.07	0.008

The post-hoc analysis using Scheffé's test reveals significant performance differences between the player positions. Defenders outperform Midfielders (mean difference = 5, p-value = 0.008), and Strikers (mean difference = 10, p-value = 0.008), while Midfielders also perform significantly better than Strikers (mean difference = 5, p-value = 0.008).

Figure 1- ***Speed of soccer player***

Table 3 ***Anova of Agility among scoocer players***

Source	Sum of Squares	df	Mean Square	F-value	p-value
Between Groups	82.316	2	41.158	1271.21	5.23×10^{-48}
Within Groups (Residual)	1.846	57	0.0324	-	-

The one-way ANOVA test for agility pre-test scores shows a statistically significant difference between defenders, midfielders, and strikers ($F = 1271.21$, $p < 0.001$). The high F-value and extremely low p-value (5.23×10^{-48}) indicate that at least one group's mean agility time differs significantly from the others.

Table 4 ***Past Hoc anaylsis of agility among soccer players***

Group Comparison	Mean Difference	P Value	95% Confidence Interval	Significant
Defenders vs. Midfielders	0.585	0.001	[0.415, 0.755]	Yes
Defenders vs. Strikers	2.725	0.001	[2.555, 2.895]	Yes
Midfielders vs. Strikers	2.140	0.001	[1.970, 2.310]	Yes

The post hoc analysis reveals significant differences in mean agility times between each pair of player positions. Defenders and midfielders differ by 0.585 seconds ($p = 0.001$), with midfielders showing faster agility times. Defenders and strikers differ by 2.725 seconds ($p = 0.001$), with strikers being the fastest. Midfielders and strikers differ by 2.140 seconds ($p = 0.001$), with strikers again showing superior agility.

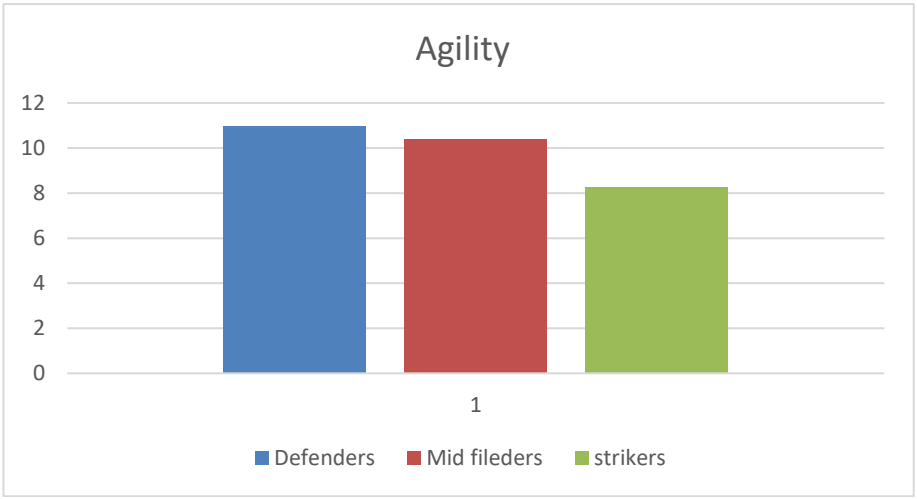

Figure 2 ***Agility of soccer players***

Table 5 ***Anova of Endurance among soccer players***

Source	**SS**	**DF**	**MS**	**F**
Between Groups	31164.67	2	15582.33	10.37
Within Groups	85664.0	57	1502.88	
Total	116828.67	59		

The results of the ANOVA test for the endurance pre-test reveal a significant difference between the groups, as indicated by an F-value of 10.37. The between-group sum of squares (SS) is 31,164.67 with 2 degrees of freedom, leading to a mean square (MS) of 15,582.33. The within-group sum of squares is 85,664.00 with 57 degrees of freedom, resulting in an MS of 1,502.88

Table 6 ***Post Hoc analysis of Endurance among soccer players***

Comparison	Mean Difference	Scheffé F-value	Critical F-value	Significance
Defenders vs. Midfielders	-140.5	131.38	6.30	Significant
Defenders vs. Strikers	-88.0	51.53	6.30	Significant
Midfielders vs. Strikers	52.5	18.35	6.30	Significant

The post-hoc Scheffé test reveals significant differences in endurance scores between all groups. Defenders have a significantly lower mean score compared to midfielders (-140.5) and strikers (-88.0), while midfielders and strikers also show a significant difference with midfielders scoring higher by 52.5. These differences are all statistically significant, as the calculated Scheffé F-values exceed the critical value of 6.30.

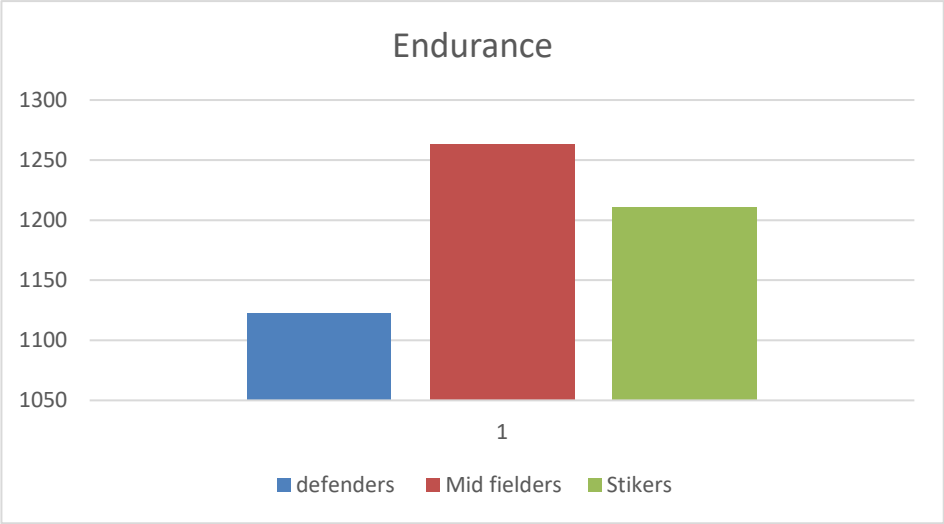

Figure 3 ***Endurance of soccer players***

Table 7 ***Anova of Explosive strength among soccer players***

Between Groups (SSB)	81.734	2	40.867	26.37
Within Groups (SSW)	88.4	57	1.55	
Total	170.134	59		

The ANOVA results for the test of explosive strength indicate a significant difference among the three groups, as evidenced by a high F-value of 26.37, derived from the between-group mean square (40.867) and the within-group mean square (1.55). This suggests that the variability in explosive strength between the groups is substantially greater than the variability within the groups.

Table 8. ***Post Hoc analysis of Explosive strength among soccer players***

Group Pair	Mean Difference	Scheffé FFF	Significant
Defenders vs. Midfielders	−1.8-1.8−1.8	20.90	Yes
Defenders vs. Strikers	−0.5-0.5−0.5	1.61	No
Midfielders vs. Strikers	1.31.31.3	10.90	Yes

The Scheffé post hoc analysis reveals that there are significant differences in explosive strength between Group 1 and Group 2, as well as between Group 2 and Group 3, with Scheffé FFF-values of 20.90 and 10.90, respectively. However, no significant difference is observed between Group 1 and Group 3, as the Scheffé FFF-value of 1.61 is not significant.

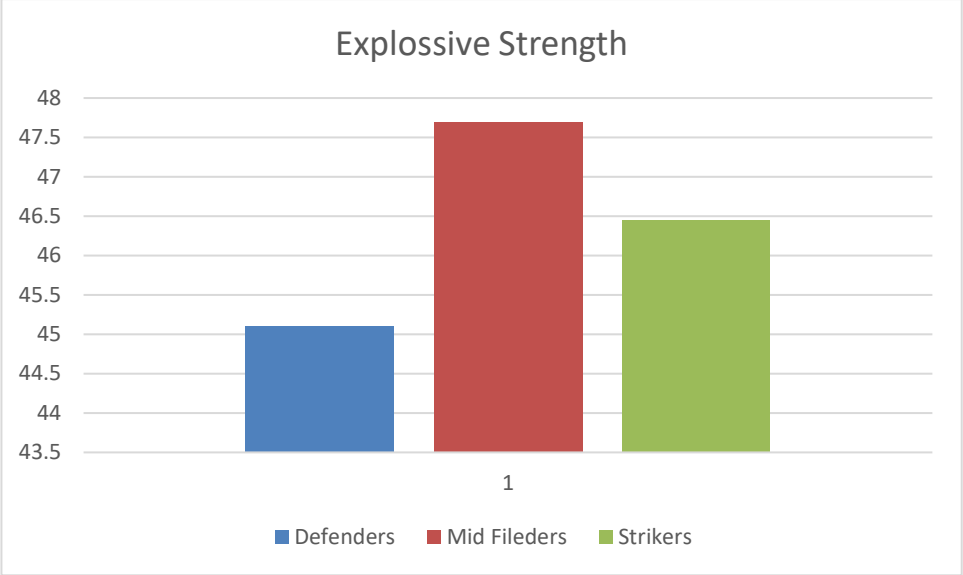

Figure 4 ***Explosive strength of Soccer Players***

Table 9 ***Anova of Dribbling among soccer players***

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-statistic
Between Groups	6.93	2	3.47	64.91
Within Groups	3.04	57	0.0534	
Total	9.97	59		

The results from the ANOVA test show a significant difference in the pre-dribbling times between the three groups (Defenders, Midfielders, and Strikers). The F-statistic of 64.91 is much higher than typical critical values, suggesting that the variation between the group means is substantially greater than the variation within each group.

Table 10 ***Post Hoc analysis of Dribling among soccer players***

Group Pair	Mean Difference	Scheffé F-statistic	Significant Difference
Defenders vs Midfielders	0.80	119.81	Yes
Defenders vs Strikers	0.20	7.48	Yes
Midfielders vs Strikers	0.60	67.34	Yes

The Scheffé post hoc analysis reveals significant differences in pre-dribbling times across all group pairs. The comparison between Defenders and Midfielders shows a large mean difference of 0.80 seconds, with a Scheffé F-statistic of 119.81, indicating a strong significant difference.

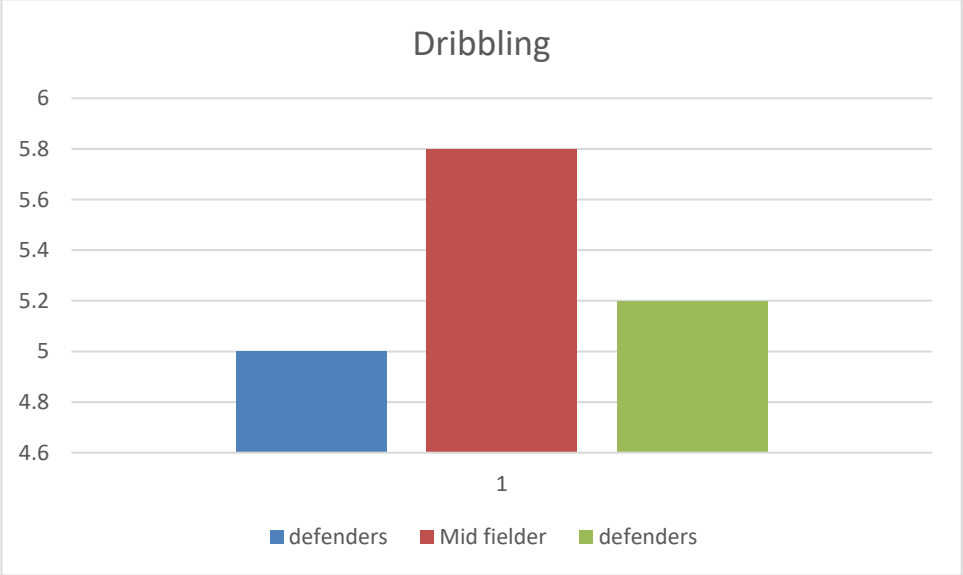

Figure 5 ***Dribbling ability of Soccer Player***

Table 11 *Anova of Pasing ability among soccer players*

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-Statistic	P-Value
Between Groups	4349.8	2	2174.9	367.69	< 0.01
Within Groups	338	57	5.93		
Total	4687.8	59			

The results of the one-way ANOVA for the test passing accuracy reveal a statistically significant difference in passing accuracy between the groups (Defenders, Midfielders, and Strikers), as indicated by a high F-statistic of 367.69 and a p-value less than 0.01.

Table 12 *Post Hoc anlysis of Passing ability among Soccer players*

Comparison	Difference in Means	Result
Defenders vs Midfielders	13.9	Significant
Defenders vs Strikers	20.4	Significant
Midfielders vs Strikers	6.5	Not Significant

The results of the Scheffé's post hoc test indicate significant differences in passing accuracy between the Defenders and Midfielders (difference of 13.9) and between the Defenders and Strikers (difference of 20.4), as both differences exceed the critical value of 3.85. However, the difference in passing accuracy between Midfielders and Strikers (6.5) is not significant, as it falls below the critical value, suggesting that the passing accuracy of these two groups is not significantly different.

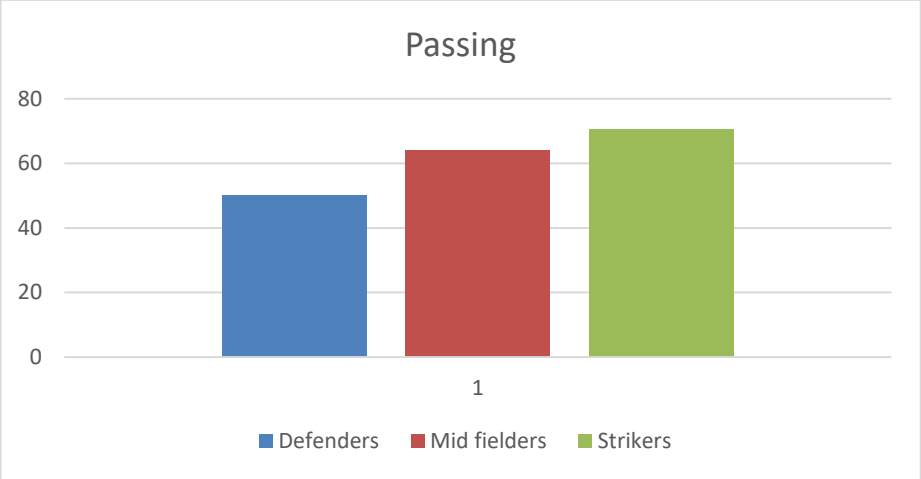

Figure 6 *Passing ability of soccer players*

CONCLUSIONS

- Speed: Defenders are slower than Midfielders and Strikers, with Strikers having the fastest times, indicating position-specific speed demands.
- Agility: Strikers excel in agility, followed by Midfielders and Defenders, suggesting the importance of quick direction changes for attacking players.
- Endurance: Midfielders have the highest endurance levels, emphasizing their need for stamina due to their greater field coverage.
- Explosive Strength: Midfielders show higher explosive strength than Defenders, highlighting the importance of power for offensive and defensive transitions.
- Dribbling: Strikers have a slight advantage in dribbling, which requires coordination, agility, and ball control essential for attackers.
- Passing Accuracy: Defenders perform worse than Midfielders and Strikers in passing accuracy, but Midfielders and Strikers show similar proficiency, indicating their shared passing roles.

RECOMENTATION AND IMPLICATIONS

Based on the study's findings, it is recommended that soccer players undergo position-specific training to enhance their performance in key areas such as speed, agility, endurance, explosive strength, dribbling, and passing. Defenders, Midfielders, and Strikers each demonstrate unique strengths and weaknesses that require targeted training programs to optimize their skills. For example, Strikers should focus on agility and explosive power, while Midfielders may benefit from endurance and passing accuracy drills. The implications of these findings extend to coaching practices, where training regimens should be tailored to the specific

demands of each position, thereby improving overall team performance and player development at all levels of soccer.

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