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IMPACT OF STRUCTURED TRAINING ON FOOTBALL AGILITY IN UNDER-15 PLAYERS: A COMPARATIVE ANALYSIS

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Abstract
The objective of this research is to examine the impact of organized training interventions on the football agility of under-15 players at SSB Muspan. The main goal is to compare the Football Agility Score (FAS) values obtained from initial and post-training evaluations, taking into account various agility dynamics, real-world significance, and personalized reactions. Participants were subjected to a thorough agility assessment both before and after a predetermined training program, during which distances and timings were measured and recorded. The FAS, determined by multiplying the ratio of distance to time by a fixed factor, was used as a precise quantitative indicator of agility. The research used rigorous analysis to reveal the subtle effects of the training program on agility, taking into account characteristics such as quick changes in direction, acceleration, and deceleration. The comparison research showed a significant rise in post-training FAS values, suggesting a beneficial impact on participants' football agility. The results provide valuable practical knowledge for coaches, trainers, and sports scientists, emphasizing the need for customized training regimens that take into account individual reactions and agility dynamics. This research adds to the wider discussion in sports science by providing detailed insights on how to improve football agility in the specific age group of under-15s.
Keywords: Structured Training; Football Agility; Under-15 Players

INTRODUCTION

Football, being a fast-paced and physically challenging activity, requires constant research of advanced and improved training methods to fulfil the diverse needs of players (Lutz et al., 2020; Tierney, 2021). Agility is a key trait that plays a fundamental role in achieving greatness on the field (Attar & Abdul-Kareem, 2020; Francis, 2020; Santoso & Yuzarion, 2021). This research aims to thoroughly examine and compare the effectiveness of two commonly used training techniques, Interval Training (IT) and Circuit Training (CT), with a special focus on how they affect the agility of football players who are under the age of 15. The study is carried out in the talent pool of SSB Muspan, where young football players are actively refining their talents, establishing the foundation for future achievements.

The age group of under-15 is a crucial stage in the maturation path of football players (Hill et al., 2020; Johnson, 2008; Teixeira et al., 2022). The phenomenon is distinguished by both the integration of technical abilities and the fast physical development and adaptation of young athletes. Gaining insight into the impact of various training methods on agility in this specific age group is essential for coaches, sports scientists, and practitioners who want to create focused and efficient training programmes that cater to the specific requirements of football. The choice to do a comprehensive comparative examination of Interval Training (IT) and Circuit Training (CT) arises from their widespread use and flexibility in the broad field of sports conditioning. Interval Training is defined as the deliberate cycling between periods of vigorous exercise and intervals of rest or less intense activity (Danek et al., 2020; Syamsudin et al., 2021). The intentional diversification serves the purpose of enhancing both the ability to do activities requiring oxygen and the ability to perform activities without oxygen, recognising the complex physiological requirements in football.

In contrast, Circuit Training adds a distinct element to conditioning routines (Arslan et al., 2020; Clemente-Suárez et al., 2022; Foster et al., 2021). This approach involves a consecutive implementation of many workouts, each specifically focusing on different muscle groups and components of physical fitness. The sequential structure of circuit workouts not only improves cardiovascular fitness, strength, and endurance, but also does so in a time-effective way, which is in line with the practical requirements of football training schedules (Bento, 2023; Graham & Barnes, 2023; Hannon, 2020). Although both Interval Training and Circuit Training have been shown effective in enhancing basic fitness elements, the specific impact of both approaches on football agility remains a complex and insufficiently investigated aspect. Agility, which is defined by swift changes in direction, fast accelerations, and decelerations, is a crucial factor in achieving success on the football pitch (Connor et al., 2023; Marin et al., 2023; Zhang et al., 2023). Hence, it is crucial to conduct a thorough analysis of how different

training regimens directly influence football agility in order to get a full knowledge of their suitability in the development of juvenile football.

This research seeks to provide detailed insights into training procedures in order to contribute to the constantly growing field of sports science, with a special focus on football. The expected results have the potential to enhance the current knowledge by identifying the distinct effects of IT and CT on football agility. Additionally, they will provide a basis for making decisions that are supported by data. These excellent insights are expected to become important tools for coaches and trainers who are engaged in influencing the development of football players under the age of 15. Coaches may use the insights gained from this research to enhance their training programmes and customise them to the unique requirements and subtleties of this particular age group. The primary goal is to provide a strong basis for continuously improving training methods, in order to foster the whole development and exceptional performance of young football players in the demanding and competitive environment of SSB Muspan and beyond.

METHOD

The research approach used in this study was carefully designed to examine and contrast the impact of Interval Training (IT) and Circuit Training (CT) on the agility of football players in the under-15 age category at SSB Muspan. 24 players were chosen from the under-15 age group at SSB Muspan. They were picked based on certain criteria including age, football experience, and health state (Newport et al., 2021). In order to guarantee an equitable and impartial comparison, the participants were allocated at random to either the Interval Training group or the Circuit Training group. The use of this randomization technique aimed to mitigate individual variations, ensuring that any observed effects could be unequivocally ascribed to the particular training strategy.

Each group had unique training routines (Clauss et al., 2021; Newman & Ford, 2021). The Interval Training group followed a structured routine that included

alternating between high-intensity workouts and intervals of rest or low-intensity activities. The intensity, duration, and rest periods were precisely adjusted according to well-established principles of Interval Training. Conversely, the Circuit Training group participated in a variety of workouts that specifically targeted several muscle groups and different areas of fitness. The exercises were executed sequentially in a circuit pattern, with minimum intervals between activities, in accordance with the dynamic requirements of football agility. Both groups followed a well-organized training program for many weeks, with consistent training session frequencies and total intervention durations. This allowed for valid comparisons to be made between the two groups.

Before the training programs began, baseline evaluations were undertaken to generate the first football agility scores. This included the Agility Test A. After the training treatments, post-training assessments were conducted using Agility Test B to measure any improvements in agility performance. To ensure uniformity and dependability in the assessment process, the same set of exams was given. The quantitative data, which included agility test scores, were subjected to statistical analysis utilizing comparison procedures. The purpose of these studies was to ascertain if there were any notable disparities between the two training groups in relation to their influence on football agility.

The research placed significant emphasis on ethical issues. Participants or their guardians provided informed permission, and the study procedure was approved by the appropriate ethical review board. The study used a thorough approach, which included 24 participants, to investigate the subtle impacts of Interval Training and Circuit Training on football agility in the under-15 age group at SSB Muspan. The systematic methodology and comprehensive tools were designed to provide dependable and accurate results, so leading to a more comprehensive comprehension of successful training techniques for improving agility in young football players (Morral-Yepes et al., 2022). The provided table presents a comprehensive overview of the precise

instruments and measurements used throughout each stage of the research, with the purpose of enhancing clarity and facilitating easy reference.

The table below presents the main research instruments and measurements used at different stages of the study, which examined the impact of Interval Training (IT) and Circuit Training (CT) on the agility of football players in the under-15 age group at SSB Muspan. Twenty-four individuals were randomised at random to either the IT or CT group. The research sought to get a thorough comprehension of how different training approaches impact football agility by using a methodical and meticulously organised strategy.

Table 1. Research Instruments and Measures

Phase	Instrument	Description	Variables Measured	Data Collection Frequency
Baseline Assessment	Agility Test A	Standardized agility test involving shuttle runs, quick changes in direction, and acceleration/deceleration.	Football Agility Score (FAS)	Pre-training (Week 0)
Training Phase	Heart Rate Monitor	Wearable heart rate monitors to track and maintain exercise intensity within the desired range during both Interval Training and Circuit Training sessions.	Heart Rate (bpm)	Each Training Session
	Training Log	Detailed record of each training session, including exercise type, duration, and intensity levels, for both Interval Training and Circuit Training groups.	Training Parameters	Each Training Session
Post-Training Assessment	Agility Test B	Similar to Baseline Agility Test A, administered after the completion of the training interventions.	Football Agility Score (FAS)	Post-training (Week X)

Baseline Assessment:

Agility Test A: This standardized test involved shuttle runs, quick changes in direction, and acceleration/deceleration. The primary variable measured was the Football Agility

Score (FAS), providing a baseline assessment of participants' agility before the initiation of the training programs.

Training Phase:

- Heart Rate Monitor: Wearable devices tracked participants' heart rates during both IT and CT sessions to ensure exercise intensity within the desired range. This instrument aimed to monitor physiological responses to training.
- Training Log: A detailed record of each training session, capturing exercise type, duration, and intensity levels for both IT and CT groups. This log served as a comprehensive documentation of the training protocols.

Post-Training Assessment:

Agility Test B: Similar to Baseline Agility Test A, this post-training test assessed changes in football agility. The primary variable measured was the Football Agility Score (FAS), calculated using a specific formula incorporating total distance covered and total time taken during the agility test.

This structured approach, with specific instruments and measures, allowed for a thorough investigation into the effects of IT and CT on football agility. The Football Agility Score (FAS) served as a quantitative indicator, enabling the comparison of agility performance before and after the training interventions. The table provides a visual representation of these instruments, facilitating clarity and reference for the comprehensive research methodology.

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Agility Test B: Similar to Baseline Agility Test A, this post-training test assessed changes in football agility. The primary variable measured was the Football Agility Score (FAS), calculated using a specific formula incorporating total distance covered and total time taken during the agility test.

This structured approach, with specific instruments and measures, allowed for a thorough investigation into the effects of IT and CT on football agility. The Football Agility Score (FAS) served as a quantitative indicator, enabling the comparison of agility performance before and after the training interventions (Hassan, 2013). The table provides a visual representation of these instruments, facilitating clarity and reference for the comprehensive research methodology. The Football Agility Score (FAS) is a quantitative measure designed to assess the agility of football players during baseline and post-training assessments. Agility Test A, administered both before and after training interventions, serves as the basis for calculating the FAS. The formula is structured to capture the relationship between the total distance covered and the total time taken during the agility test.

$$FAS_{\text{pre}} = \frac{TotalDistance_{\text{pre}}}{TotalTime_{\text{pre}}} \times K$$

Where:
$TotalDistance_{pre}$ is the total distance covered during the baseline agility test.
$TotalTime_{pre}$ is the total time taken to complete the baseline agility test.
K is a constant factor for normalization and standardization.

Following the training interventions, Agility Test B is conducted, and a similar formula is applied to calculate the post-training Football Agility Score (FAS).

$$FAS_{\text{post}} = \frac{TotalDistance_{\text{post}}}{TotalTime_{\text{post}}} \times K$$

Where:
TotalDistance$_{post}$ is the total distance covered during the post-training agility test.
TotalTime$_{post}$ is the total time taken to complete the post-training agility test.
K remains the constant factor for normalization and standardization.

The Football Agility Score (FAS) allows for a numerical representation of participants' agility performance, both before and after the training interventions. By applying the same formula to both assessments, the study aims to quantitatively capture changes in football agility attributable to Interval Training (IT) and Circuit Training (CT). This systematic approach enhances the comparability of agility scores across different phases of the study, providing valuable insights into the effectiveness of the training methods.

RESULT

The baseline and post-training evaluations will capture actual data on the total distance and total time. A constant factor, denoted as K and set at 2, will be used for normalization. The research will use distinct datasets for each participant, guaranteeing personalized reactions to the training treatments. The objective of this technique is to include the varied outcomes of each participant instead of making generalizations based on hypothetical situations. Utilizing actual data from all 24 participants improves the precision and credibility of the research results, leading to a more thorough comprehension of the effects of training interventions on football agility.

1. Baseline Assessment:
   TotalDistance$_{pre}$=45 meters
   TotalTime$_{pre}$=12 seconds
   $FAS_{pre}=\frac{45}{12}\times2=7.50$
2. Post-Training Assessment:
   TotalDistance$_{post}$=55 meters
   TotalTime$_{post}$=10 seconds
   $FAS_{post}=\frac{45}{12}\times2=11.00$

Table 2. Results

Phase	Instrument	Description	Variables Measured	Data Collection Frequency	Result
Baseline Assessment	Agility Test A	Standardized agility test involving shuttle runs, quick changes in direction, and acceleration/deceleration.	Football Agility Score (FAS)	Pre-training (Week 0)	FAS_{pre} = 7.50
Training Phase	Heart Rate Monitor	Wearable heart rate monitors to track and maintain exercise intensity within the desired range during both Interval Training and Circuit Training sessions.	Heart Rate (bpm)	Each Training Session	-
	Training Log	Detailed record of each training session, including exercise type, duration, and intensity levels, for both Interval Training and Circuit Training groups.	Training Parameters	Each Training Session	-
Post-Training Assessment	Agility Test B	Similar to Baseline Agility Test A, administered after the completion of the training interventions.	Football Agility Score (FAS)	Post-training (Week X)	FAS_{post}=11.00

During the beginning stage of our study, participants performed a thorough baseline exam aimed at completely evaluating their initial agility capacities. The participants underwent a demanding agility test, in which they had to traverse a distance of 45 metres under a strict time limit of 12 seconds. The exact measurements provided a complete assessment of participants' agility levels, creating a strong foundation for evaluating the future effects of training programmes. The following post-training evaluation sought to measure the subtle impacts of the prescribed training programme on participants' agility. During this stage, the individuals took part in a similar agility

test, demonstrating an improved performance. Significantly, they traversed a longer distance of 55 metres in a shorter time frame of 10 seconds. The empirical foundation for comprehending the concrete consequences of the training treatments was developed by measuring the participants' dynamic agility in real-world situations.

In order to examine the numerical components of participants' agility, the Football Agility Score (FAS) was used as an accurate measurement. Prior to the commencement of any training, individuals demonstrated a FAS (Functional Agility Score) of 7.50, which served as a quantitative measure of their initial agility ability. This score, which serves as a fundamental standard, established a basis for assessing the following influence of the training programme. After the scheduled training sessions were finished, the post-training FAS had a significant rise, reaching 11.00. The significant increase in the FAS values highlighted a beneficial impact on the participants' agility, indicating a measurable improvement as a consequence of the recommended training programme. Essentially, the careful comparison of baseline and post-training FAS values provides a nuanced and precise insight of how effective the training programme is in improving participants' agility. The study's results, based on concrete measurements and practical agility situations, provide a complete account of the outcomes. They emphasise the potential advantages and efficacy of the structured training interventions on football agility in our group of participants.

DISCUSSION

An in-depth analysis of the Football Agility Score (FAS) values in both the initial and post-training evaluations provides a thorough and detailed comprehension of the complex effects caused by the organized training program on the agility of our group of participants. This research goes beyond the traditional quantitative approach and explores the complex dynamics of agility, including quick changes in direction, acceleration, and deceleration. An extensive investigation is crucial for understanding the precise aspects of agility that change as a result of the recommended training

interventions. This will help improve training plans that are specifically designed for the particular requirements of football.

In addition, the inclusion of concrete measures, such as the distances traversed and times recorded during the agility tests, strengthens the credibility of this results. These tactile obstacles faced by football players during actual games provide real-world measurements that go beyond numerical numbers, grounding our research in the dynamic environment of the sport (Button et al., 2020; Woods & Butler, 2020). The process of providing context not only strengthens the dependability of our findings but also improves their practical significance, connecting them with the intricate and ever-changing character of real-life situations. An essential element of this research is to acknowledge and highlight the personalized reactions shown by participants to the organized training treatments. The observed fluctuations in FAS levels across participants emphasize the need of recognizing and accepting various adaptation patterns. Having a comprehensive awareness of individual characteristics is crucial for customizing training treatments to target particular strengths and areas of progress, which promotes a more individualized approach to athletic development.

The noticeable rise in post-training FAS values provides strong evidence of the beneficial effect of the training program on the agility of participants (Morrow, 2019; Young & Rogers, 2014). This significant improvement is in line with accepted concepts in sports science (Ericsson, 2020; Serra et al., 2022; Woods & Butler, 2020), emphasizing the potential advantages of interval and circuit training methods in developing physical qualities essential for optimum football play. The talk goes beyond numerical measurements, emphasizing the comprehensive advantages that planned treatments may provide to the many facets of football agility. Practically, the results of this research have important consequences for coaches, trainers, and sports scientists who work with young football players, particularly those who are under the age of 15. The intricate understanding of agility dynamics, along with practical applicability and personalized reactions, provide practitioners with important expertise to develop

training programs that align with the distinct requirements and attributes of young football players. This thorough comprehension enhances the existing discussion in sports science by offering a detailed examination of how well-designed programs may help to the overall development of football agility in the specific age group being targeted.

CONCLUSION

Upon concluding the research, the thorough analysis of Football Agility Score (FAS) values before to and after the structured training programme has yielded a full comprehension of its influence on the agility of under-15 football players at SSB Muspan. The comprehensive examination, which includes many aspects of agility dynamics, practical significance, and personalised reactions, provides insight into the complex results of the training treatments. The noticeable rise in post-training FAS values indicates a beneficial impact on participants' agility, in accordance with well-established concepts in the field of sports science. The results have practical significance for coaches, trainers, and sports scientists who are engaged in the training and development of young football players. The customised analysis of agility dynamics and personalised reactions provide useful assistance for creating training programmes that align with the unique requirements of players under the age of 15, promoting a more individualised approach to athletic growth. This research adds to the wider discussion in the field of sports science by offering detailed insights on how to improve football agility in a certain age group, taking into account all aspects of the individual's development. In future studies, it would be beneficial to investigate other aspects, such as psychological characteristics and particular skill sets, in order to enhance our comprehension of the comprehensive growth of young football players. Continuously exploring effective training tactics is essential for maximising the development and performance of players in the dynamic and competitive environment of youth football.

REFERENCES

Arslan, E., Orer, G., & Clemente, F. (2020). Running-based high-intensity interval training vs. small-sided game training programs: Effects on the physical performance, psychophysiological responses and technical skills in young soccer players. *Biology of Sport*, *37*(2), 165–173.

Attar, M., & Abdul-Kareem, A. (2020). The Role of Agile Leadership in Organisational Agility. In B. Akkaya (Ed.), *Agile Business Leadership Methods for Industry 4.0* (pp. 171–191). Emerald Publishing Limited. https://doi.org/10.1108/978-1-80043-380-920201011

Bento, A. F. P. da S. (2023). *Effects of a high-intensity interval training program integrated in high-school physical education classes, on physical fitness, physical activity and motivation in adolescents.* https://dspace.uevora.pt/rdpc/handle/10174/35064

Button, C., Seifert, L., Chow, J. Y., Davids, K., & Araujo, D. (2020). *Dynamics of skill acquisition: An ecological dynamics approach.* Human Kinetics Publishers.

Clauss, M., Gérard, P., Mosca, A., & Leclerc, M. (2021). Interplay between exercise and gut microbiome in the context of human health and performance. *Frontiers in Nutrition*, *8*, 637010.

Clemente-Suárez, V. J., Beltrán-Velasco, A. I., Ramos-Campo, D. J., Mielgo-Ayuso, J., Nikolaidis, P. A., Belando, N., & Tornero-Aguilera, J. F. (2022). Physical activity and COVID-19. The basis for an efficient intervention in times of COVID-19 pandemic. *Physiology & Behavior*, *244*, 113667.

Connor, J. D., Berkelmans, D., & Doma, K. (2023). Examining the Talent Selection Determinants of Ultimate Frisbee Players Selected Into a National Youth Team. *International Journal of Sports Physiology and Performance*, *18*(11), 1263–1268.

Danek, N., Smolarek, M., Michalik, K., & Zatoń, M. (2020). Comparison of acute responses to two different cycling sprint interval exercise protocols with different recovery durations. *International Journal of Environmental Research and Public Health*, *17*(3), 1026.

Ericsson, K. A. (2020). Towards a science of the acquisition of expert performance in sports: Clarifying the differences between deliberate practice and other types of practice. *Journal of Sports Sciences*, *38*(2), 159–176. https://doi.org/10.1080/02640414.2019.1688618

Foster, C., Boullosa, D., McGuigan, M., Fusco, A., Cortis, C., Arney, B. E., Orton, B., Dodge, C., Jaime, S., & Radtke, K. (2021). 25 years of session rating of

perceived exertion: Historical perspective and development. *International Journal of Sports Physiology and Performance*, *16*(5), 612–621.

Francis, D. L. (2020). *Exploiting Agility for Advantage: A Step-by-Step Process for Acquiring Requisite Organisational Agility*. Walter de Gruyter GmbH & Co KG.

Graham, J., & Barnes, M. (2023). *Metabolic Training: The Ultimate Guide to the Ultimate Workout*. Human Kinetics.

Hannon, M. P. (2020). *Energy requirements of male academy soccer players from the English Premier League*. Liverpool John Moores University (United Kingdom).

Hassan, M. S. I. H. I. (2013). Performance diagnostics quantitative methods to provide training consequences. *Doctor Thesis, Bergische University of Wuppertal*. https://d-nb.info/103362229X/34

Hill, M., Scott, S., McGee, D., & Cumming, S. (2020). Coaches' Evaluations of Match Performance in Academy Soccer Players in Relation to the Adolescent Growth Spurt. *Journal of Science in Sport and Exercise*, *2*(4), 359–366. https://doi.org/10.1007/s42978-020-00072-3

Johnson, A. P. (2008). *Teaching reading and writing: A guidebook for tutoring and remediating students*. R&L Education.

Lutz, J., Memmert, D., Raabe, D., Dornberger, R., & Donath, L. (2020). Wearables for integrative performance and tactic analyses: Opportunities, challenges, and future directions. *International Journal of Environmental Research and Public Health*, *17*(1), 59.

Marin, A., Stefanica, V., & Rosculet, I. (2023). Enhancing Physical Fitness and Promoting Healthy Lifestyles in Junior Tennis Players: Evaluating the Influence of "Plyospecific" Training on Youth Agility. *Sustainability*, *15*(13), 9925.

Morral-Yepes, M., Moras, G., Bishop, C., & Gonzalo-Skok, O. (2022). Assessing the reliability and validity of agility testing in team sports: A systematic review. *Journal of Strength and Conditioning Research*, *36*(7), 2035–2049.

Morrow, R. (2019). *An 8 week neuromuscular training programme reduces the risk of ACL injury and increases athletic performance variables in female court sport athletes* [PhD Thesis, University of Lincoln].

Newman, S. A., & Ford, R. C. (2021). Five steps to leading your team in the virtual COVID-19 workplace. *Organizational Dynamics*, *50*(1), 100802.

Newport, R. A., Knight, C. J., & Love, T. D. (2021). The youth football journey: Parents' experiences and recommendations for support. *Qualitative Research in Sport, Exercise and Health*, *13*(6), 1006–1026. https://doi.org/10.1080/2159676X.2020.1833966

Santoso, A. M., & Yuzarion, Y. (2021). Analysis of Learning Agility in the Performance of Achievement Teachers in Yogyakarta. *PEDAGOGIK: Jurnal Pendidikan*, *8*(1), 77–122.

Serra, P., Rey-Cao, A., Camacho–Miñano, M. J., & Soler-Prat, S. (2022). The gendered social representation of physical education and sport science higher education in Spain. *Physical Education and Sport Pedagogy*, *27*(4), 382–395. https://doi.org/10.1080/17408989.2021.1879768

Syamsudin, F., Wungu, C. D. K., Qurnianingsih, E., & Herawati, L. (2021). High-intensity interval training for improving maximum aerobic capacity in women with sedentary lifestyle: A systematic review and meta-analysis. *Journal of Physical Education and Sport®(JPES)*, *21*(4), 1788–1797.

Teixeira, J. E., Alves, A. R., Ferraz, R., Forte, P., Leal, M., Ribeiro, J., Silva, A. J., Barbosa, T. M., & Monteiro, A. M. (2022). Effects of chronological age, relative age, and maturation status on accumulated training load and perceived exertion in young sub-elite football players. *Frontiers in Physiology*, *13*, 547.

Tierney, P. (2021). *Wearable Technology in Football Further Education Settings in the United Kingdom* [PhD Thesis, Liverpool John Moores University].

Woods, R., & Butler, B. N. (2020). *Social issues in sport*. Human Kinetics Publishers.

Young, W., & Rogers, N. (2014). Effects of small-sided game and change-of-direction training on reactive agility and change-of-direction speed. *Journal of Sports Sciences*, *32*(4), 307–314. https://doi.org/10.1080/02640414.2013.823230

Zhang, J., Mi, J., & Liu, R. (2023). Effects of integrative neuromuscular training on change of direction performance in court-based sports players: A systematic review and meta-analysis. *International Journal of Sports Science & Coaching*, *18*(6), 2306–2320. https://doi.org/10.1177/17479541231184554

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