ISOLATED AND COMBINED EFFECTS OF SOCCER-SPECIFIC-TRAINING AND ANAEROBIC INTERVAL TRAINING ON AGILITY AND DRIBBLING ABILITY IN WOMEN SOCCER PLAYER

[1] Arun P J & [2] Dr. Narayanasamy T

[1] PhD Scholar, [2] Asst. Professor

[1] Department of Physical Education, Annamalai University, Chidambaram, India

[2]Department of Physical Education, Annamalai University, Chidambaram, India

abstract

This study investigates the isolated and combined effects of soccer-specific training (SST) and anaerobic interval training (IT) on agility and dribbling ability in female soccer players. A total of 45 female athletes, aged 18–23, from Annamalai University, were randomly assigned to three groups: SST, IT, and a combined SST+IT group. The training program lasted eight weeks, with three sessions per week, each lasting 60 minutes. Agility and dribbling performance were assessed using the T-test and Warner Soccer Test respectively, before and after training. The SST group performed skill-based drills, including cone exercises, passing drills, and small-sided games, while the IT group engaged in high-intensity interval runs (30–400m) at progressive intensities. The SST+IT group followed both protocols. A randomized controlled trial design was employed, and data were analysed using ANCOVA to determine performance differences among groups, with Scheffé's post hoc test applied for paired comparisons ($p < 0.05$). The results indicated that the SST+IT group exhibited the most significant improvements, with agility increasing by 6.40% and dribbling by 9.15%, compared to moderate gains in the SST group (1.91% in agility, 6.81% in dribbling) and negligible effects in the IT group. Statistical analysis confirmed that the SST+IT group significantly outperformed the other groups ($p < 0.05$). These findings suggest that integrating soccer-specific training with anaerobic interval training optimally enhances both technical and physical attributes in female soccer players. The study underscores the importance of combining skill-based drills with high-intensity conditioning to develop well-rounded athletes, providing valuable insights for coaches and sports scientists in designing evidence-based training programs.

Keywords: soccer-specific training, Interval training, Agility, Dribbling

INTRODUCTION

Football is an exceptionally physically demanding sport, requiring a combination of technical, tactical, and physical competencies for success. Agility and dribbling speed are critical skills that distinguish outstanding athletes from their counterparts. Agility, defined as the ability to rapidly change direction while preserving balance, is a critical component in football, as rapid movements and directional changes are essential for peak performance. Dribbling speed, defined by the capacity to move the ball while advancing rapidly, is a crucial attribute that allows players to get around opponents and create scoring opportunities. Football training methodologies have significantly evolved, emphasising sport-specific training strategies. Soccer-specific training (SST) seeks to replicate the physiological and biomechanical demands of the sport, using exercises that improve technical skills while simultaneously augmenting physical attributes such as agility and speed. Furthermore,

interval training (IT) is recognised as an excellent method for enhancing both aerobic and anaerobic capacities, crucial for maintaining high-intensity performance throughout a competition. However, limited study has examined the individual and combined effects of soccer-specific training, with and without interval training, on essential performance measures such as agility and dribbling speed, particularly in female soccer players.

Anaerobic interval training (IT) is a systematic workout approach that consists of alternating phases of high-intensity exertion and recovery. It is extensively employed in sports that need explosive movements, swift acceleration, and brief bursts of activity, making it especially pertinent to football. Football players often perform sprints, rapid directional changes, and high-intensity actions, requiring the enhancement of anaerobic capacity. Aerobic endurance has been well examined in football training, although the impact of anaerobic interval training on improving agility, dribbling speed, and overall performance is an increasingly significant field of research **(Faude et al., 2012)**. This research examines the current literature on anaerobic interval training, its physiological advantages, and its efficacy in improving football play. Anaerobic interval training predominantly engages the glycolytic and phosphagen energy systems. In contrast to aerobic workouts, which need prolonged oxygen intake, anaerobic training utilises rapid energy reserves such adenosine triphosphate (ATP) and phosphocreatine (PCr) **(Scott, 2005)**. High-intensity interval training (HIIT), a prevalent type of anaerobic exercise, has demonstrated the ability to augment muscle power, elevate lactate threshold, and promote neuromuscular coordination **(Helgerud et al., 2001)**. These physiological adaptations are essential for football players, who frequently require the ability to execute repeated sprints and recover rapidly during matches. Studies indicate that anaerobic training markedly enhances sprint performance, agility, and muscular endurance **(Krustrup et al., 2010).** Research conducted by **Mujika et al. (2009)** indicated that short-term sprint and power training regimens resulted in significant enhancements in speed and agility in elite junior football players. Moreover, **Bloomfield et al. (2007)** highlighted that elite football players demonstrate exceptional anaerobic fitness, enabling them to maintain high-intensity exertion throughout a match.

Agility and Dribbling in Football

Agility and dribbling speed are essential for effective football play, particularly in rapid competitive settings. Agility enables athletes to surpass opponents, maintain positional superiority, and respond rapidly to evolving game circumstances. The speed of dribbling improves a player's capacity to progress the ball effectively while retaining control, essential for offensive tactics and scoring chances. A systematic training program focused on these traits can markedly enhance a player's performance in competitive situations. Considering the physical and technical requirements of football, comprehending the impact of particular training regimens on enhancing these qualities is essential. Soccer-specific training often encompasses drills like cone exercises, passing sequences, shooting practices, and small-sided games, all designed to replicate actual match situations and enhance motor abilities. Interval training, defined by alternating phases of high-intensity exertion and rest, is extensively employed to improve endurance, strength, and recovery. The amalgamation of several training techniques may yield a more holistic strategy for enhancing performance. Despite the well reported advantages of both SST and IT, a study vacuum persists regarding their individual and synergistic impacts on agility and dribbling speed, especially among female football players. Prior research has predominantly concentrated on male athletes or generic training adaptations, neglecting sex-specific physiological responses. The recent increase in women's football has prompted research focused on customising training methods to enhance performance in female athletes. Examining the effects of soccer-specific training, both with and without interval training, on agility and dribbling speed provides significant

insights into the optimal training protocols for female football players. This study seeks to ascertain if the amalgamation of SST and IT provides more advantages than SST in isolation and to clarify the physiological mechanisms that support these enhancements. The results will have practical ramifications for coaches, trainers, and sports scientists in formulating evidence-based training protocols for female football athletes.

Objectives of the Study

1. To investigate the exclusive impact of soccer-specific training on agility and dribbling in female soccer athletes.

2. To examine the impact of integrating soccer-specific training with interval training on agility and dribbling

3. To evaluate the efficacy of these training methodologies in improving performance-related characteristics.

Significance of the Study

This work is significant for its contribution to the optimisation of football training programs, especially for female athletes. Anaerobic interval training is vital for improving agility and dribbling speed, both of which are critical for elite football performance. This study addresses a significant vacuum in research by examining the effects of anaerobic training on female football players, hence facilitating the development of more customised and successful training regimens. The results provide essential insights for coaches, trainers, and sports scientists in formulating evidence-based conditioning regimens that incorporate anaerobic and soccer-specific exercises. The study underscores the significance of neuromuscular coordination and energy system efficiency in enhancing game-specific performance, consequently furthering the comprehension of training approaches in professional football.

Materials and methods

This study involved 45 female football players from Annamalai University in Chidambaram, Cuddalore District, Tamil Nadu, aged 18 to 23. Agility and dribbling were the selected dependent variables, assessed before and after the training program via the T-test and Warner football test. The randomly selected participants were assigned to Experimental Group I, Experimental Group II, and Experimental Group III in an equitable way. Experimental Group I had soccer-specific training. Experimental Group II was exposed to interval training while Experimental Group III was exposed to mixed soccer specific training and anaerobic interval training. The duration of testing period was 8 weeks. The soccer-specific training featured skills-based workouts and particular movements such short sprints, leaps, agility drills etc. The interval training consisted 30,50,80,100,150,300,400 meters run at varied intensities. The starting intensity was set at 75% before being increased by 5% every two weeks. The individuals ran these distances at their most relaxed speed and with the indicated intensity. Detailed timetable of the training program given below,

S.NO	DETAILS	DURATION
1	Number of weeks	8 Weeks
2	Number of sessions per week	3 Weeks

3	Duration of each session	60 mins
4	Warming up	7 to 10 sec
5	Rest intervals between repetitions	30 sec to 2 mins

Analysis of data

This is done by applying covariance analysis (ANCOVA), where the final means have been corrected for discrepancies in the initial mean and the corrected means have been checked for significance. The scheffe's post hoc test was performed to find the paired means significant difference when the modified post-test mean was significant. The level of significance was set at 0.05 level of confidence which was considered adequate the purpose of the study.

Criterion measures and selection of tests

VARIABLE	***TEST***	***UNIT***
Agility	*T test*	*Time in seconds*
Dribbling	*Warner soccer test*	*Time in seconds*

RESULTS

Paired 't' test and % of changes on soccer player's agility of ITG, SSTG, CTG&CG

Groups Name	Test periods	Subjects	Mean Value	SD	M D	DM	't' Value	changes in %
ITG	Pre test	15	12.52	.348	.02	.101	.217	0.15
	Post test		12.50	.339				
SSTG	Pre test	15	12.53	.310	.24	.142	1.74	1.91
	Post test		12.28	.565				
CTG	Pre test	15	12.51	.242	.80	.150	5.80	6.40
	Post test		11.63	.582				
CG	Pre test	15	12.51	.396	1.07	.163	6.53	8.55
	Post test		11.44	.415				

df 14 =2.15 (table value) (*significant)

The assessed pre and post-test agility values of three training (ITG, SSTG, CG&CG) groups differ noticeably since the 't' values of ITG (1.74), SSTG (5.80), as well as CT (6.53) groups were greater than the table value (df 14=2.15). following 12 weeks of IT, SST, CT treatment, soccer player's speed performance (ITG =1.91%, SSTG=6.40%,and CTG =8.55%), enhanced greatly.

computation of analysis of covariance of pre-test post- test and adjusted post- test on Agility for experimental groups and control group

	IITG	ISTG	CISTG	CG	Source of Variance	Sum of Squares	df	Means Squares	F-ratio
Pre-Test Means	12.53	12.52	12.51	12.52	BG	.002	3	.001	.006
SD	.310	.242	.396	.348	WG	6.07	56	.108	
Post-Test Means	12.28	11.63	11.44	12.50	BG	11.53	3	3.84	16.2
SD	.565	.582	.415	.339	WG	13.26	56	.327	
Adjusted Post-Test Means	12.28	16.64	11.44	12.50	BG	11.47	3	3.82	16.2
					WG	13.00	55	.237	

Required F (0.05), (df 3,56) = 2.769, (df 3,55) = 2.773 at 0.05, significance.

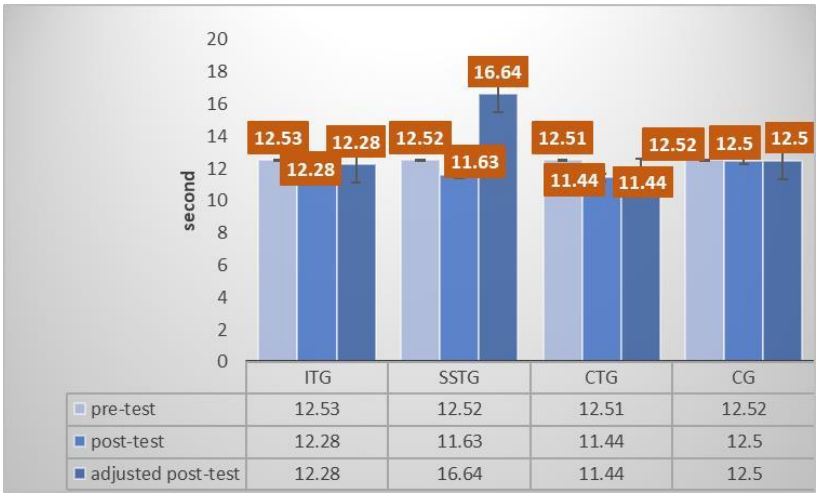
The above table indicates the mean values of the pre-test that belong to the isolated interval, isolated soccer specific, combined and control groups as 12.53,12.52,12.51and12.52 respectively. The measures F ratio .006 for the pre-test was comparatively very low to the table value at 2.77 for degree of freedom 3 and 56 for requisite level of significance at 0.05 fixation. The means of post test scores of the training groups of the isolated interval, isolated soccer specific, combined and control groups were 12.28,11.63,11.44and 12.50 respectively. The F ratio 16.23 obtained for post-test was greater than 2.77 of table value for degree of 3 and 56 necessary for significance level at a value of 0.05. The means of the adjusted post-test of the training groups of the isolated interval, isolated soccer specific, combined and control groups were 12.28,11.64,11.44, and 12.50 respectively. The F ratio 16.2 obtained for post-test was greater than 2.77 of table value for degree of 3 and 55 necessary for significance level at 0.05.

Scheffe's confidence interval test scores - Agility

ITG	SSTG	CTG	CG	MD	CI
12.28	11.64			.64*	.51
12.28		11.44		.84*	
12.28			12.50	.22	
	11.64	11.44		.20	
	11.64		12.50	.86*	
		11.44	12.50	1.06*	

*Required C.I Value .071*at 0.05 level

The table presents the results of the Scheffe's Post hoc test. It could be observed that the mean difference among the isolated interval training group and isolated soccer specific training group was .64(P>0.05),isolated interval training group and combined training group was 1.3 (P>0.05) and the measured C.I value was .84 (P< 0.05),isolated interval training group and controlled group was .22 (P>0.05), Isolated soccer specific training group and combined training group was.20 (P>0.05), isolated soccer specific training group and controlled group was .86(P>0.05) and combined training group and controlled group was 1.06 (P>0.05). Measured C.I value was .51 (P< 0.05 in all the cases.



Graphical view of pre, post and adjusted mean data

Paired 't' test and % of changes on soccer player's dribbling of ITG, SSTG, CTG&CG

Groups Name	Test periods	Subjects	Mean Value	SD	M D	DM	't' Value	changes in %
ITG	Pre test	15	12.15	.547	.02	.125	.154	0.16
	Post test		12.17	.424				
SSTG	Pre test	15	12.22	.426	.60	.175	3.45	4.90
	Post test		11.62	.439				
CTG	Pre test	15	12.18	.441	.83	.119	7.00	6.81
	Post test		11.34	.370				
CG	Pre test	15	12.24	.507	1.12	.136	8.20	9.15
	Post test		11.12	.390				

df 14 =2.15 (table value) (*significant)

The assessed pre and post-test dribbling values of three training (ITG, SSTG, CG&CG) groups differ noticeably since the 't' values of ITG (3.45), SSTG (7.00), as well as CT (8.20) groups were greater than the table value (df14=2.15). following 12 weeks of IT, SST, CT treatment, soccer player's speed performance (ITG =4.90%, SSTG=6.81%, and CTG =9.15%), enhanced greatly.

computation of analysis of covariance of pre-test post- test and adjusted post- test on dribbling for experimental groups and control group

IITG	ISTG	CISTG	CG	Source of Variance	Sum of Squares	df	Means Squares	F-ratio

Pre-Test Means	12.22	12.18	12.24	12.15	BG	.07	3	.023	.099
SD	.426	.441	.507	.547	WG	13.08	56	.234	
Post-Test Means	11.62	11.34	11.12	12.17	BG	9.25	3	.3.08	18.59
SD	.439	.370	.390	.424	WG	9.29	56	.166	
Adjusted Post-Test Means	11.61	11.35	11.12	12.18	BG	9.49	3	3.16	20.8
					WG	8.66	55	.158	

Required F (0.05), (df 3,56) = 2.769, (df 3,55) = 2.773 at 0.05, significance.

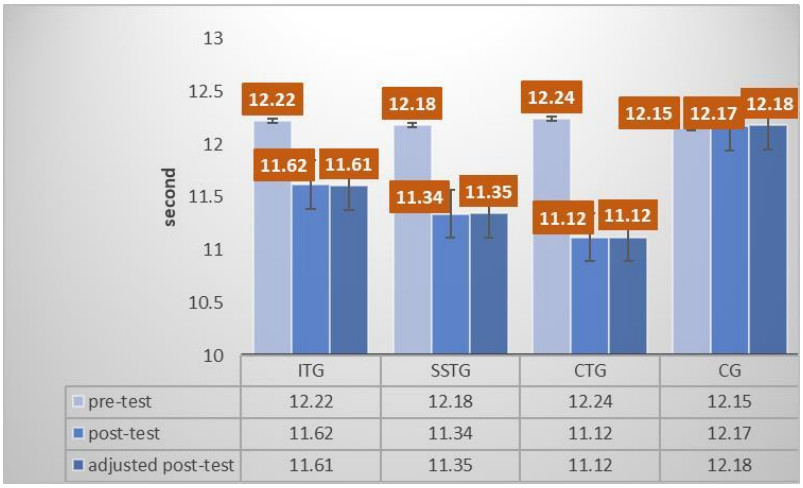
The table indicates the mean values of the pre-test that belong to the isolated interval, isolated soccer specific, combined and control groups as 12.22,12.18,12.24 and 12.15 respectively. The measures F ratio .099 for the pre-test was comparatively low to the table value at 2.77 for degree of freedom 3 and 56 for requisite level of significance at 0.05 fixation. The means of post test scores of the training groups of the isolated interval, isolated soccer specific, combined and control groups were 11.62,11.34,11.12, and 12.17 respectively. The F ratio 5.36 obtained for post-test was greater than 2.77 of table value for degree of 3 and 56 necessary for significance level at a value of 0.05. The means of the adjusted post-test of the training groups of the isolated interval, isolated soccer specific, combined and control groups were 11.61,11.35,11.12, and 12.18 respectively. The F ratio 20.8 obtained for post-test was greater than 2.77 of table value for degree of 3 and 55 necessary for significance level at 0.05.

Scheffe's confidence interval test scores - dribbling

ITG	SSTG	CTG	CG	MD	CI
11.61	11.35			.26*	
11.61		11.12		.49*	
11.61			12.18	.57*	.25
	11.35	11.12		.23	
	11.35		12.18	.83*	
		11.12	12.18	1.06*	

*Required C.I Value .071*at 0.05 level

The table presents the results of the Scheffe's Post hoc test. It could be observed that the mean difference among the isolated interval training group and isolated soccer specific training group was .26(P>0.05),isolated interval training group and combined training group was .49 (P>0.05),isolated interval training group and controlled group was .57 (P>0.05), Isolated soccer specific training group and combined training group was.23(P>0.05), isolated soccer specific training group and controlled group was .83(P>0.05) and combined training group and controlled group was 1.06 (P>0.05). Measured C.I value was .25 (P< 0.05 in all the cases.



Graphical view of pre, post and adjusted mean data

Discussion on results

The outcomes of this study support and augment previous research emphasising the necessity of combining soccer-specific training (SST) with anaerobic interval training (IT) to maximise agility and dribbling skills in female football players. While SST alone yielded moderate improvements in agility (1.91%) and dribbling (6.81%), with IT exerting minimal influence, the combined training approach achieved the most significant enhancements (6.40% in agility and 9.15% in dribbling), highlighting the efficacy of integrating technical drills with high-intensity conditioning. The results correspond with **Young et al. (2001)** and **Sheppard and Young (2006)**, who claimed that agility depends on both physical fitness and neuromuscular coordination, which are best enhanced by sport-specific training in high-intensity environments. **Bloomfield et al. (2007)** substantiated this by demonstrating that elite football players gain the most benefit from agility training that replicates in-game movements, aligning with the structured SST drills utilised in this study. **Little and Williams (2005)** found that agility and anaerobic power significantly improve dribbling speed, supporting the notion that interval training, along with technical exercises, promotes ball control and manoeuvrability in competitive situations. **Mujika et al. (2009)** said that skill acquisition is optimised when athletes practice under conditions of tiredness, explaining why the combined training group exhibited the most substantial improvements in dribbling proficiency.

Faude et al. (2012) and **Helgerud et al. (2001)** confirmed that high-intensity interval training, when integrated with skill-based exercises, enhances both technical proficiency and endurance, a notable finding that is consistent with the results of this study. Furthermore, **Krustrup et al. (2010) and Ford et al. (2010)** underscored the imperative for gender-specific training methodologies, indicating that female athletes exhibit unique physiological responses that require tailored conditioning approaches. The study's findings corroborate their hypothesis, demonstrating that an integrated training regimen of SST and IT is the most efficacious approach for enhancing game-specific performance in female football players. **Williams and Hodges (2005) and Davids et al. (2000)** emphasised the importance of contextual learning in skill acquisition, suggesting that training in match-like environments enhances the transfer of skills to real game situations. This study provides strong evidence for the effectiveness of mixed training approaches, highlighting the need for training programs to integrate physical and technical work to improve player development. The findings have practical implications for coaches and sports scientists, advocating for a holistic training strategy that incorporates agility drills, interval training, and technical skill development to boost overall performance in female football players.

CONCLUSION

This study's findings indicate that a combined approach incorporating soccer-specific training (SST) and anaerobic interval training (IT) is the most effective method for improving agility and dribbling skills in female football players. Although SST enhances technical abilities alone and IT primarily increases endurance, their cooperation fosters superior adaptations in both physical and technical performance. The significant enhancements in agility (6.40%) and dribbling (9.15%) seen in the combined training group suggest that training programs should incorporate both skill-oriented exercises and high-intensity conditioning to improve player development. These findings align with previous studies that emphasised the importance of neuromuscular coordination, sport-specific training, and contextual learning in enhancing football performance. The research underscores the necessity for gender-specific training approaches, since female athletes exhibit unique physiological responses that require tailored conditioning programs. These findings provide crucial insights for coaches, trainers, and sports scientists, highlighting the imperative for evidence-based training methods that integrate technical skill development with anaerobic fitness. Utilising a holistic training methodology allows female football players to significantly improve their agility, dribbling abilities, and overall performance, leading to better match outcomes and improved physical growth.

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