Volume 10, Issue 6, June – 2025 International Journal of Innovative Science and Research Technology
ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun397

The Impact of Cognitive-Motor Dual-Task Training on Executive Function and Soccer-Specific Skills in Recreational Soccer Players: A Single Blind Randomized Controlled Trial

Jerin M Joy[1*]; Rejimol Jos Pulicken[2]; Remya N[3]; Manju Unnikrishnan[4]; Jisha Thampi[5]; Chinchu Alwin[6]; Rakhi Balagopal[7]; Anumol C[8]; Reeba Roy[9]

[1]Postgraduate (Musculoskeletal and Sports), Department of Physiotherapy, Little Flower Institute of Medical Science and Research, Angamaly, Kerala
[2,6]Associate Professor, Department of Physiotherapy, Little Flower Institute of Medical Science and Research, Angamaly, Kerala
[3]Professor and HOD, Department of Physiotherapy, Little Flower Institute of Medical Science and Research, Angamaly, Kerala
[4]Professor, Department of Physiotherapy, Little Flower Institute of Medical Science and Research, Angamaly, Kerala
[5,7,8,9]Assistant Professor, Department of Physiotherapy, Little Flower Institute of Medical Science and Research, Angamaly, Kerala

Corresponding Author: Jerin M Joy[1*]

Publication Date: 2025/06/14

Abstract: Soccer is a highly demanding game in the world. It requires a great deal of physical, biomechanical, mental, and tactical skill to execute well. Cognitive-motor dual task training is being used recently in athletes. Studies shows that this training is effective and it helps in task preparation and decision-making functions due to improved brain processing. The executive functions play a crucial role in a successful sports performance by aiding in adapting to new situations, sustaining focus, and remembering game strategies. The primary executive functions consist of cognitive inhibition, working memory, and cognitive flexibility, which involve creative thinking and promptly adjusting to new situations. Cognitive motor dual task training increases cognitive load and helps players to manage and allocate their mental resources effectively. There is lack of evidence about the effect of cognitive motor dual task training for executive function and soccer specific skills. Hence, this study is trying to find out the impact of cognitive motor dual task training on executive function and soccer specific skills in recreational soccer players.

Keywords: *Cognitive Motor Dual Task Training; Conventional Training; Executive Function, Soccer Specific Skills; Recreational Soccer Players.*

How to Cite: Jerin M Joy; Rejimol Jos Pulicken; Remya N; Manju Unnikrishnan; Jisha Thampi; Chinchu Alwin; Rakhi Balagopal; Anumol C; Reeba Roy (2025) The Impact of Cognitive-Motor Dual-Task Training on Executive Function and Soccer-Specific Skills in Recreational Soccer Players: A Single Blind Randomized Controlled Trial. *International Journal of Innovative Science and Research Technology*, 10(6), 513-526. https://doi.org/10.38124/ijisrt/25jun397

I. INTRODUCTION

Soccer or football is a widely practiced activity and extremely demanding game in the world, where performance is impacted by physical, biomechanical, technical, mental and tactical variables.[1] Monitoring athletic performance and setting up training regimens correctly are essential to maximizing success in this game Globally, soccer is acknowledged as the most popular sport. Within addition to physical strength and highly developed motor skills to perform expert movement patterns under difficult metabolic conditions, A fast-paced, dynamic, and team-oriented approach is necessary. The players are continuously evaluating the circumstances, linking recent occurrences to previous encounters, investigating

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun397

options, and promptly determining whether to proceed with or alter predetermined strategies.[2]

Recreational soccer involves fewer players than competitive games and is played on smaller fields. Studies have found that participating in recreational sports encourages socialization and helps individuals stay motivated. This may increase adherence and compliance to physical activity, encouraging a physical active lifestyle. Participating in soccer offers individuals the opportunity to acquire diverse athletic abilities, participate in group activities, enjoy themselves, and cultivate lifelong skills like a love for the sport.[5]

Cognitive assessment is essential for connecting competitive stressors and emotions. Athletes who viewed stressors as opportunities for growth and improvement had a stronger sense of empowerment and adaptability, resulting in increased positive emotions. On the other hand, individuals who perceive stressors as threats were more inclined to feel a lack of control and have negative feelings. The research emphasizes the importance of cognitive assessment in influencing how young football players deal with and manage challenges arising from competitive pressures. At present, as far as we know, there is insufficient literature backing the efficacy of cognitive training for improving soccer performance, focusing on enhancing both motor skills and positive psychological abilities.

Soccer players need to maintain concentration through players analyze the game and predict the actions of their rivals. Moreover, it is essential to be able to respond effectively in unpredictable circumstances while playing soccer. Players with cognitive abilities can easily adjust to unforeseen circumstances. and make split second decisions based on their analysis of the game.[7]Athletes require a well-organized training approach. Cognitive-motor dual task training has gained more attention recently as it involves completing both physical and cognitive training simultaneously in one task. Furthermore, research has demonstrated that the advantages resulting from cognitive motor dual task training may be attributed to enhanced brain processing, particularly in task preparation and skills in making decisions .[8]

Executive functions, also known as higher-order cognitive functions, play a crucial role in recognizing talent in the sports industry. The main executive functions consist of inhibition, working memory, and cognitive flexibility. Inhibition regulates urges and interruptions, working memory handles data for task completion, and cognitive flexibility allows for easy transitions between ideas, essential for skilled problem-solving and promoting creativity. The role executive functions play in successful sports performance is crucial because they help in adapting to new situations, staying focused, and remembering game strategies.[9,10]

Excelling in executive functioning skills is crucial for success in soccer and could potentially serve as a predictor of future achievements. There are no studies done on recreational soccer players on this aspect. So, the study is trying to find out the impact effects of cognitive motor dual task training on soccer-specific skills as well executive function in recreational player.

- *Context:*
  Cognitive-motor dual task training is being used recently in athletes. Studies shows that this training is effective and it helps in task preparation and decision-making functions due to improved brain processing.

- *Objective:*
  To determine the effect of cognitive motor dual task training on executive function and soccer specific skills in recreational soccer players.

- *Design:*
  Randomized controlled trial*Setting:*
  Playgrounds in Thrissur and Ernakulum districts

- *Patients or Other Participants:*
  Thirty-eight male subjects with male recreational soccer players divided into group cognitive motor dual task training group and conventional training group.

- *Intervention(s):*
  Both groups performed the intervention 3 times a week for 6 consecutive weeks. Pre scores were taken before the intervention; post scores were taken after 6 weeks.

- *Main Outcome Measure(s):*
  Stroop test and Wisconsin card sorting test for executive function. Loughborough soccer passing test for soccer specific skills

- *Results:*
  Cognitive motor dual task training has significant effect over conventional training on executive function and soccer specific skills in recreational soccer players. There is statistically significant difference in executive function and soccer specific skills in between both the groups. cognitive motor dual task training group shows more statistical significance than conventional training group ($p<0.05$.

- *Conclusions:*
  The aim of the study is to find out the impact of cognitive motor dual task training on executive function and soccer specific skills in recreational soccer players. It can be concluded that recreational soccer players executive function and soccer-specific skills can be effectively improved by cognitive motor dual task training.

II. MATERIALS AND METHODS

- *Participants*
  Participants were recruited from playgrounds of Ernakulam and Thrissur districts subjects of male recreational soccer players were selected for this study via simple random sampling Inclusion Criteria consisted of Male recreational soccer players subject who plays soccer at least twice a week Age group between 18-25 years Exclusion criteria include subjects unwilling to participate musculoskeletal injuries in past 6 months medically unstable subjects Psychiatric and non-cooperative subjects, any visual or hearing impairment, Acute

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun397

inflammatory, degenerative, musculoskeletal and neurological conditions. Lower extremity fracture, pain, oedema and movement restrictions within the past 6 months. Active infections Subjects with cardiac problems and chronic respiratory conditions malignancy Autonomic instability subjects who participate in other regular exercise Subjects who have fulfilled all inclusion requirements were recruited for the study after clearance from the institutional review board and ethical committee, The study was concluded after receiving informed consent.

➢ *Study Design*

The study was a single blind randomized control trial Subjects were randomly divided into two groups by the lottery method (1) cognitive motor dual task training group, (2) conventional training group.

➢ *Procedure*

After getting approval from the Institutional Review Board and Ethical committee, recreational soccer player subjects were selected for this study according to our inclusion criteria. Informed consent was obtained and subjects were allocated randomly in two groups by using the lottery method the participants were split into two groups at random which are cognitive motor dual task training group and Conventional training group.

CMDT group received cognitive motor dual task training along with conventional training, while the conventional training group spent six weeks receiving only conventional training. Treatment started after initial assessment and were given for 6 weeks thrice weekly each session lasting for 40 minutes. Pretreatment scores of Stroop test, Wisconsin card sorting test and Loughborough soccer passing test were collected on the first day before the therapy, and the results were collected after the training session on 4th and 6th week. Comparison of the scores was done on within the group and between group of CMDT training group and conventional training group.

➢ *Intervention*

Subjects in cognitive motor dual task training group had received cognitive motor dual task training along with conventional training exercises for three days every week. For about 40 minutes. It includes 10 minutes of conventional training and 30-minutes of cognitive motor dual task training session, followed by cooldown, Frequency: Cognitive motor dual task training exercises (3 days a week). Intensity: Three sets of eight repetitions each, followed by a 30-second break Session time :40 minutes per session followed by cooldown. Subjects of Conventional training group had received conventional training exercises for 3 days per week for about 40 minutes. Frequency: Conventional training exercises (3 days a week). Intensity: Three sets of eight repetitions each, followed by a 30-second break., Session time: 40 minutes per session followed by cooling down.

III. CMDT TRAINING

Table 1 Cmdt Training

Exercises	Repetitions
Shooting the ball and target identification	3×8
Reaction ball catching and math problem	3×8
Juggling the ball and naming fruits	3×8
Heading the ball and auditory discriminations	3×8
•Three coloured cones are placed on the playing field. •Three smaller soccer goals are spaced approximately 5 meters apart, each associated with a number (1-3). •The coach gives a voice command indicating a sequence of colours to touch as quickly as possible and a number corresponding to the soccer goal in which to score	3×8
•playing field is set up with small red targets and coloured cones. The red targets form four distinct numbers from one to four. •In front of each number, two different coloured cones are placed approximately 1.5 meters apart. Two smaller soccer goals (100 × 50 × 80 cm) are positioned about 5 meters apart; each associated with a name: "right" and "left."	3×8
•The coach or sports psychologist instructs the young athlete to touch a sequence of coloured cones placed in the first row of cones as quickly as possible. •The athlete needs to memorize the order in which the cones were touched and then touch the cones in reverse order in the second row of coloured cones. •Finally, the athlete is instructed to score a goal in the soccer goal indicated by the voice command. This task tests the athlete's ability to remember and replicate a sequence of actions, as well as their physical coordination in executing the task accurately	3×8

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun397

Table 2 Conventional Training

CONVENTIONAL TRAINING Duration- 40 minutes	
Exercise	**Repetitions**
1. Running exercises, 8 minutes (opening warm-up, in pairs; course consists of 6-10 pairs of parallel cones):	
Running, straight ahead	2
Running, hip out	2
Running, hip in	2
Running, circling	2
Running and jumping	2
Running, quick run	2
2. Strength, plyometrics, balance, 10 minutes (with 3 levels of progression):	
The plank:	
Level 1: both legs	3×20-30 seconds
Level 2: alternate legs	3×20-30 seconds
Level 3: one leg lift	3×20-30 seconds
Side plank:	
Level 1: static	3×20-30 seconds (each side)
Level 2: dynamic	3×20-30 seconds (each side)
Level 3: with leg lift	3×20-30 seconds (each side)
Single leg balance:	
Level 1: holding ball	2×30 seconds (each leg)
Level 2: throwing ball with partner	2×30 seconds (each leg)
Level 3: testing partner	2×30 seconds (each leg)
Squats:	
Level 1: with heels raised	2×30 seconds
Level 2: walking lunges	2×30 seconds

➢ *Statistical Analysis*

The minimum sample size for the present study was calculated using the equation.

$$n = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2 \quad 2\sigma^2}{(\mu_1 - \mu_2)^2}$$

Where, σ = pooled standard deviation = .24

μ_d = Clinically significant difference = 0.22

$Z_{1-\alpha}$ standard normal variate for level of significance = 1.96

$Z_{1-\beta}$ standard normal variate for power = 0.84

Therefore, the minimum sample size required for study is 19 for each group SPSS version 2.0. was used to analyse the collected data with a sample size of thirty-eight, and baseline homogeneity was evaluated using the Shapiro-Wilk test. The baseline characteristics of the data were presented using descriptive statistics Mean and standard deviation were used to present all quantitative variables, whereas as frequency and percentages were used to represent qualitative variables. For every result, corresponding p-value of less than 0,05 was considered significant

IV. RESULTS

Normality assessment of the study variables among cognitive motor dual task training group and Conventional training group. Given that the sample size was under fifty, Shapiro- Wilk test was used for estimated normality. For the executive function and soccer specifics skills, the p-value is < 0.05, which shows that the variables are not normally distributed.

Baseline characteristics of data in cognitive motor dual task training group and conventional training group This section deals with the distribution and comparison of baseline characteristics of the cognitive motor dual task training group and conventional training group. The baseline parameter considered in the study is age. The tabular and graphical methods of the results are given below.

Table 3 Distribution of Age in Cognitive Motor Dual Task Training Group and Conventional Training Group

Age	**CMDT training group**		**Conventional training group**	
	Frequency	Percentage	Frequency	Percentage
Mean±SD	22.15±1.95	22.10±2.37		
18-21	10	52.70%	8	42.41%
22-25	9	47.40 %	11	57.90%
Total	19	100	19	100

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun397

Table 4 Distribution of Age in Cognitive Motor Dual Task Training Group and Conventional Training Group

Age	**CMDT training group**		**Conventional training group**	
	Frequency	Percentage	Frequency	Percentage
Mean±SD	22.15±1.95	22.10±2.37		
18-21	10	52.70%	8	42.41%
22-25	9	47.40 %	11	57.90%
Total	19	100	19	100

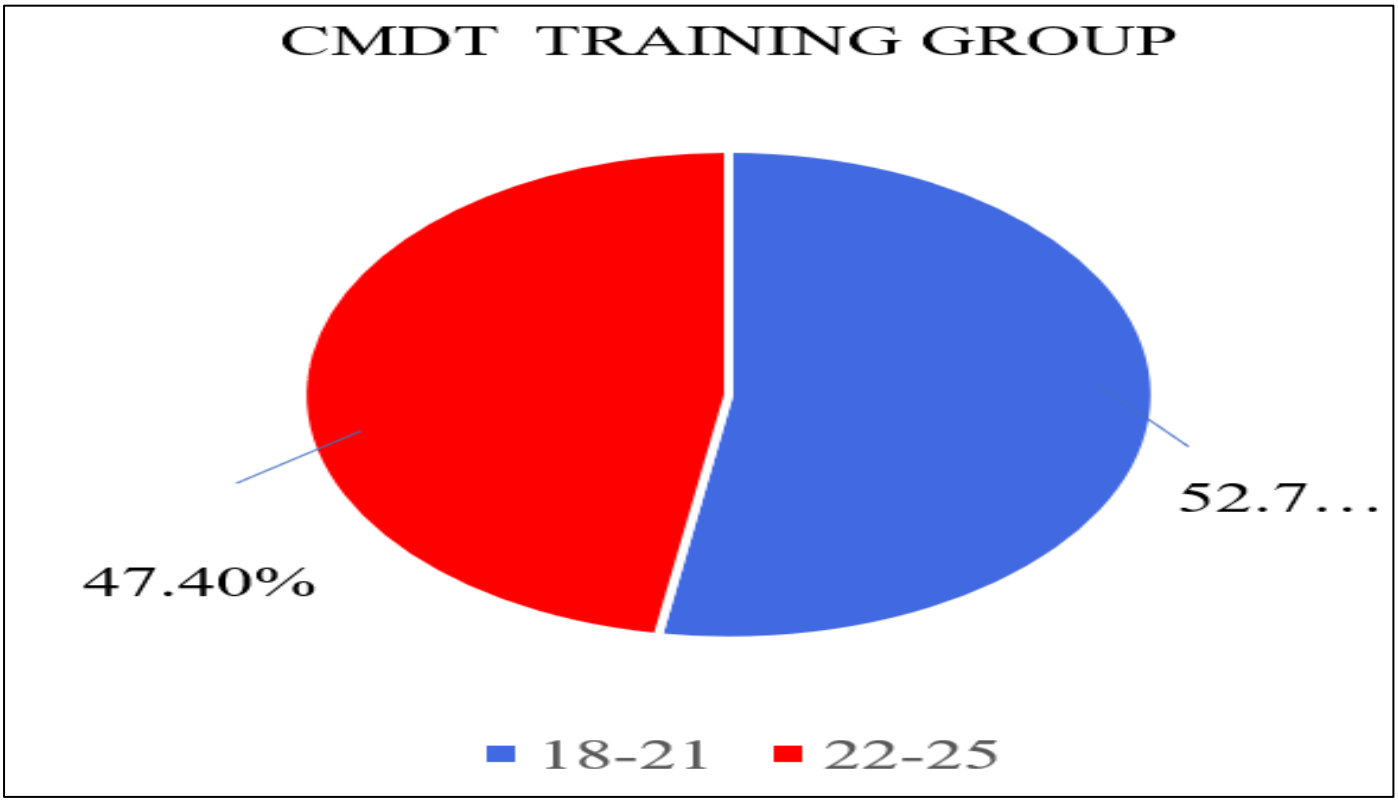


Fig 1 Demographic Representation of Age in Cognitive Motor Dual Task Training Group

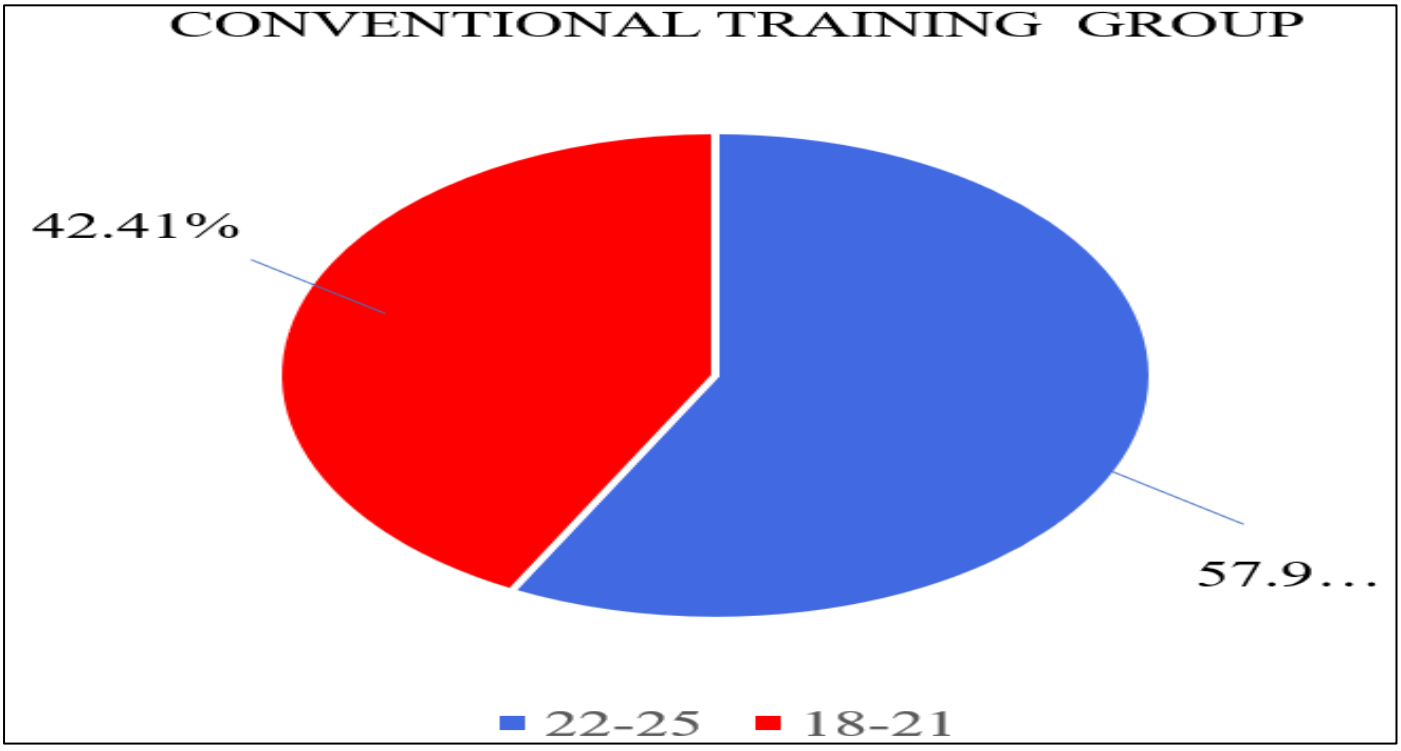


Fig 2 Demographic Representation of Age in Conventional Training Group

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun397

➢ *Consort Flow Chart*

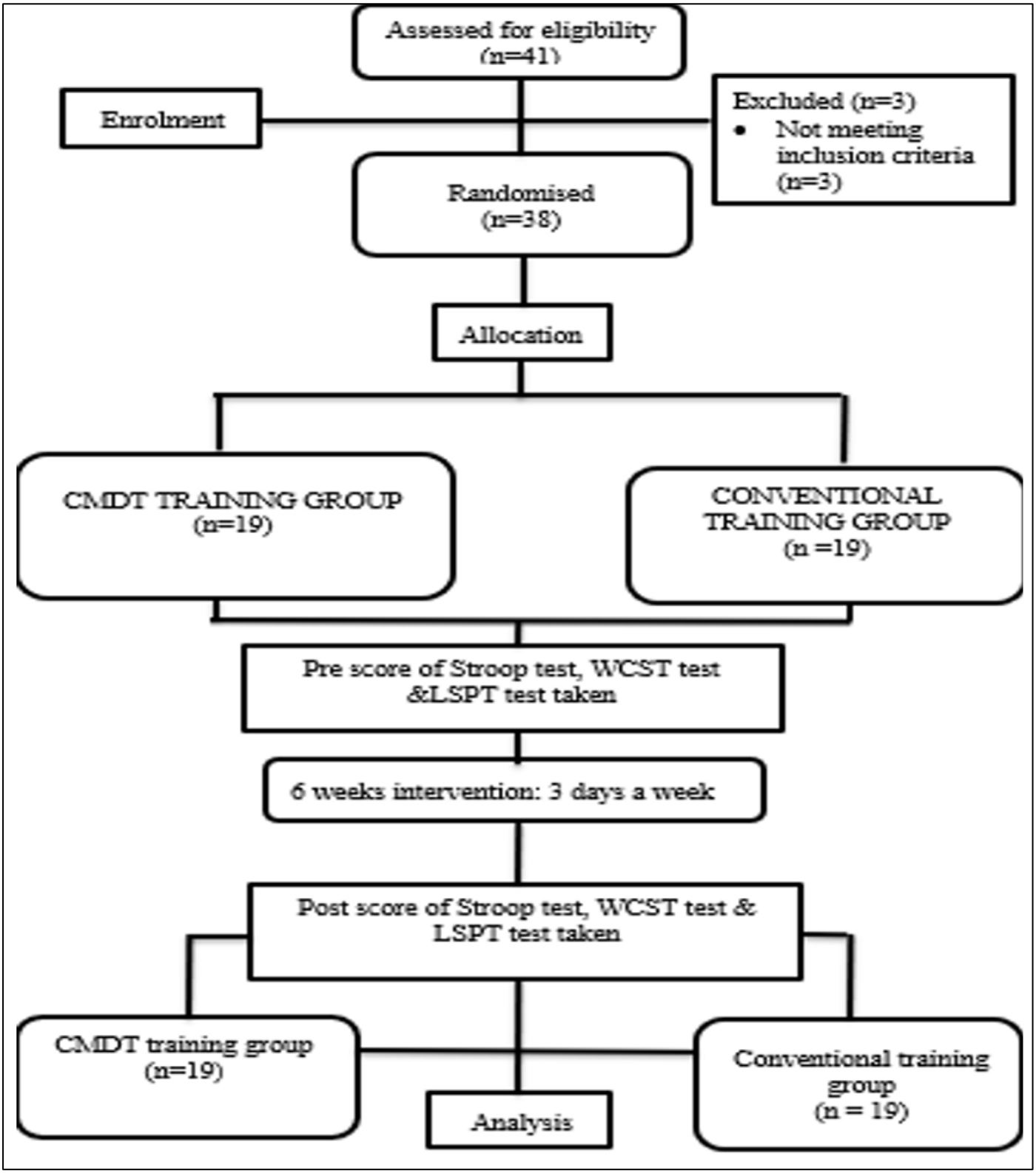


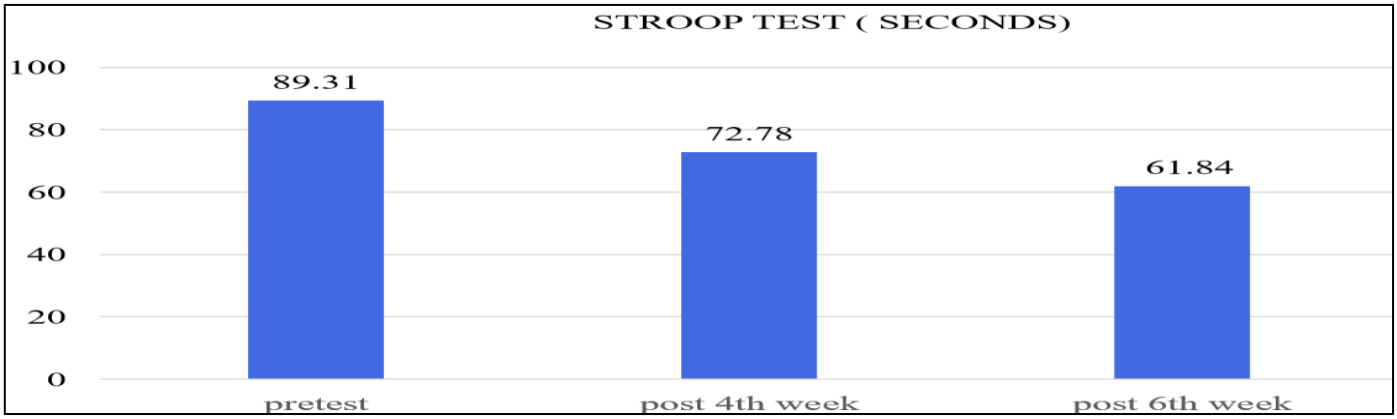
Fig 3 Consort Flow Chart

Table 5 Tabular Representation of Pre-Test and Post-Test Score Comparison of Stroop Test in Cognitive Motor Dual Task Training Group

Stroop test	Mean± SD	z value	p value
Pre test	89.31± 11.35	3.87	0.00
Post test 6th week	61.84±7.49		

Wilcoxon signed Rank test, $p<0.05$ shows statistically significant

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun397

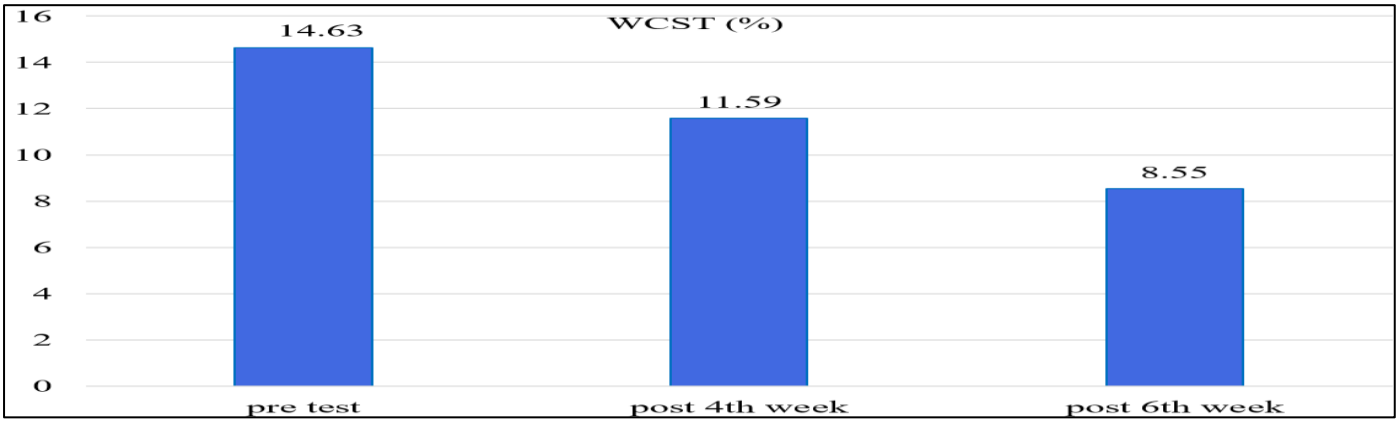


Graph1 Graphical Representation of Pre-Test and Post-Test Score Comparison of Stroop Test in Cognitive Motor Dual Task Training Group

Table 6 Tabular Representation of Pre-Test and Post-Test Score Comparison of WCST in Cognitive Motor Dual Task Training Group.

WCST	Mean± SD	z value	p value
Pre test	14.63±3.17	3.83	0.00
Post test 6th week	8.55± 1.75		

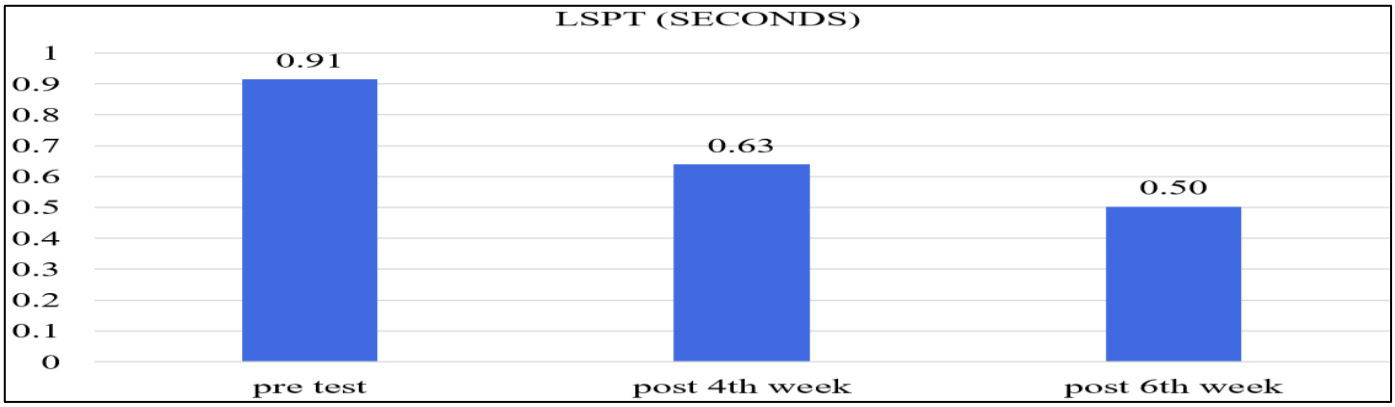
Wilcoxon Signed Rank test ,p<0.05 considered as statistically significant



Graph 2 Graphical Representation of Pre-Test and Post-Test Score Comparison of WCST in Cognitive Motor Dual Task Training Group.

Table 7 Tabular Representation of Pre-Test and Post-Test Score Comparison of LSPT Test in Cognitive Motor Dual Task Training Group

LSPT	Mean± SD	z value	p value
Pre test	0.91±0.23	3.82	0.00
Post test 6th week	0.50±0.04		

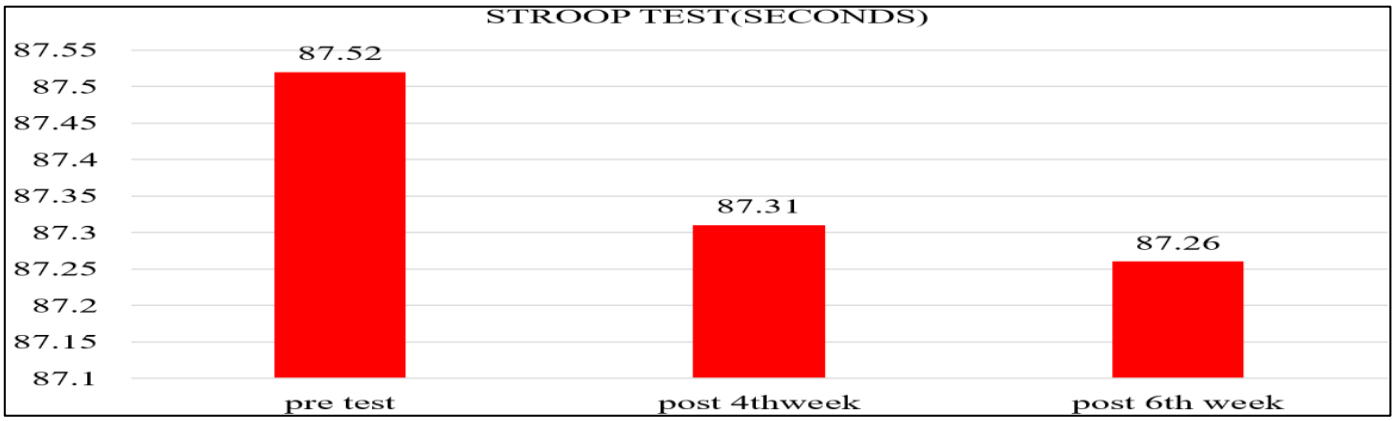


Graph 3 Graphical Representation of Pre-Test and Post-Test Score Comparison of LSPT in Cognitive Motor Dual Task Training Group

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun397

Table 8 Tabular Representation of Pre-Test and Post-Test Score Comparison of Stroop Test in Conventional Training Group

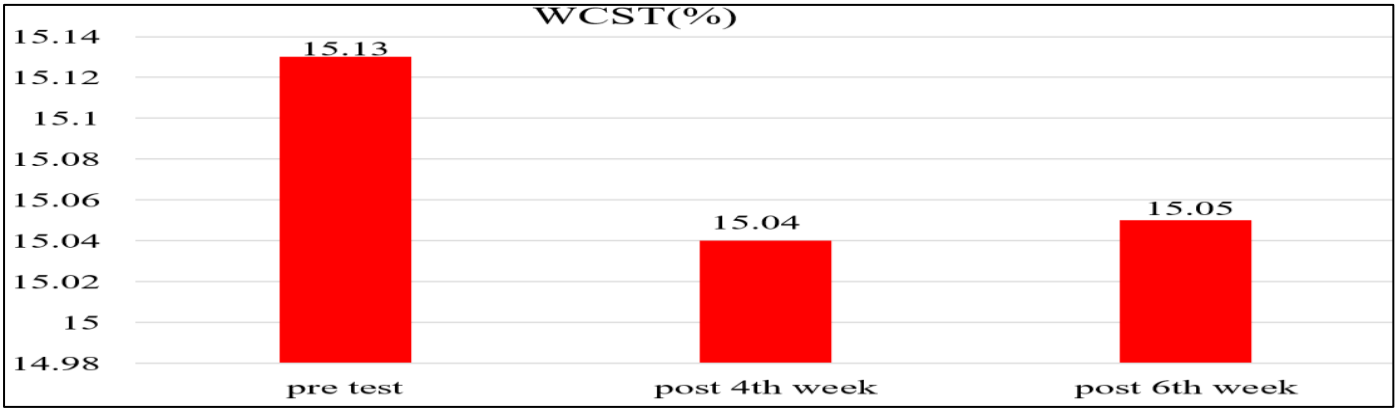
Stroop test	Mean ± SD	z Value	p Value
Pre test	87.52±24.83	1.67	0.70
Post test 6th week	87.26±24.59		



Graph 4 Graphical Representation of Pre-Test and Post-Test Score Comparison of Stroop Test in Conventional Training Group.

Table 10 Tabular Representation of Pre-Test and Post-Test Score Comparison of WCST Test in Conventional Training Group.

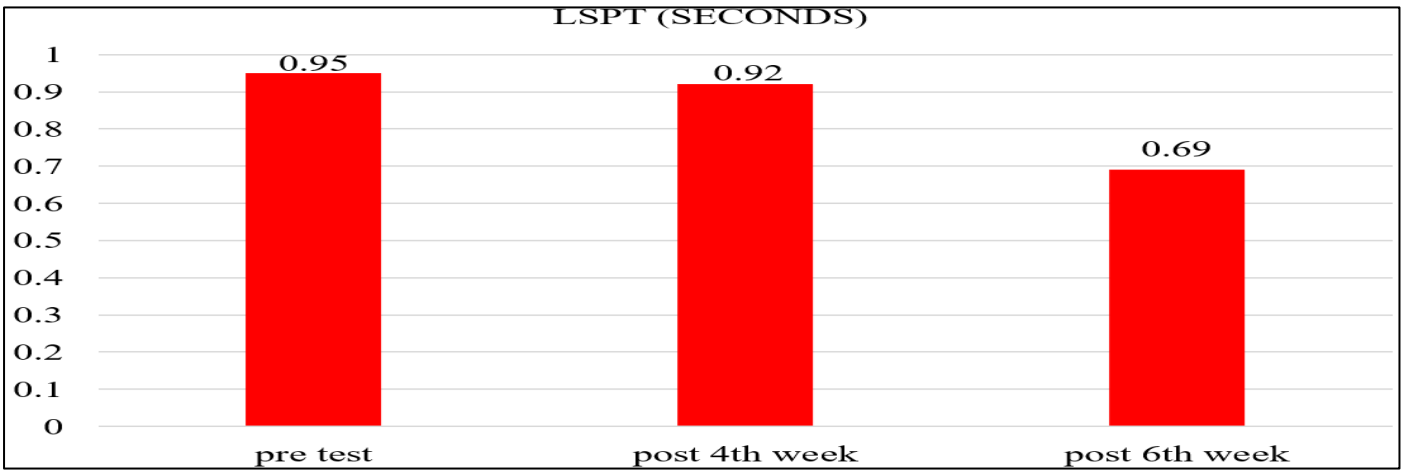
WCST	**Mean ± SD**	**z Value**	**p Value**
Pre test	15.13 ±3.53	0.11	0.89
Post test 6th week	0.69±0.21		



Graph 5 Graphical Representation of Pre-Test and Post-Test Score Comparison of WCST Test in Conventional Training Group

Table 11 Tabular Representation of Pre-Test and Post-Test Score Comparison of LSPT Test in Conventional Training Group.

LSPT	**Mean ± SD**	**z Value**	**p Value**
Pre test	0.95±0.20	3.82	0.00
Post test 6th week	0.69±0.21		

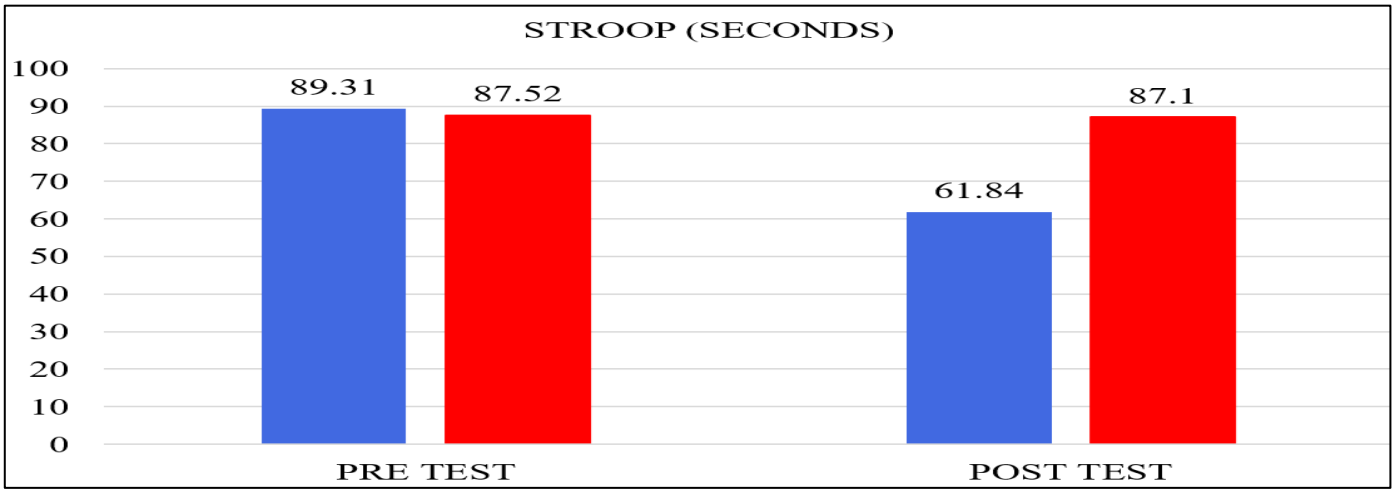


Graph 6 Graphical Representation of Pre-Test and Post-Test Score Comparison of LSPT in Conventional Training Group

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun397

Table 12 Pre-Test and Post-Test Score Comparison of Stroop Test in CMDT Training Group and Conventional Training Group

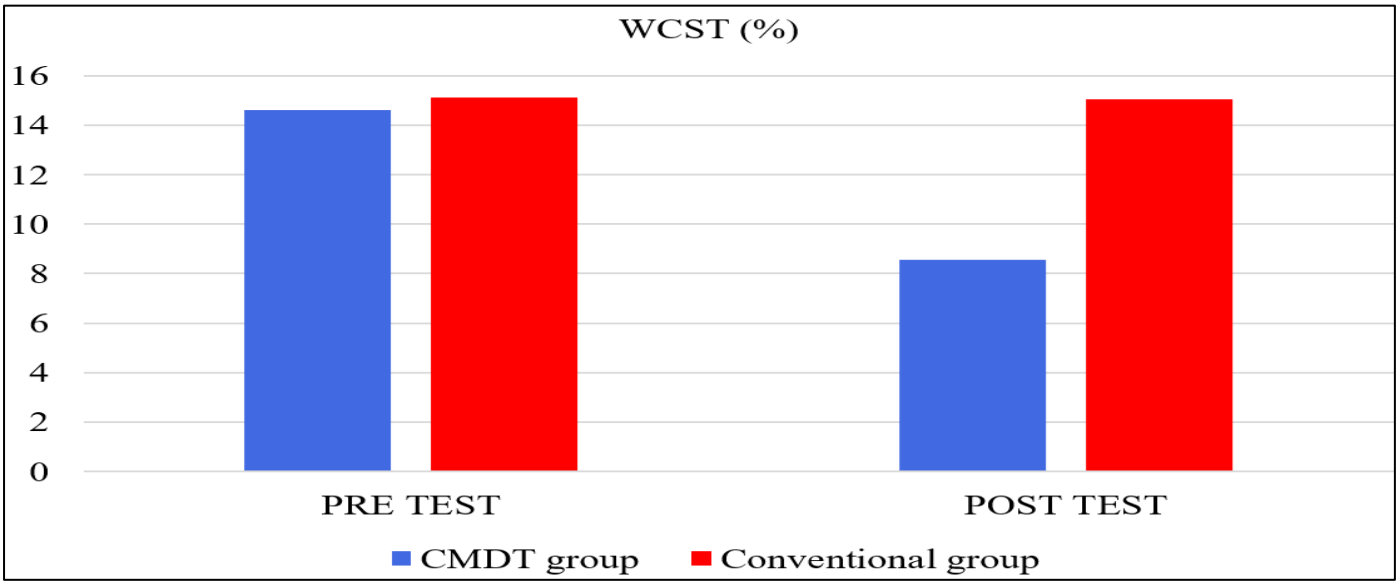
Stroop test	Pre test			Post test		
	Mean ±SD	z Value	p Value	Mean ±SD	z Value	p Value
CMDT training group	89.31± 11.35	1.03	0.93	61.84 ± 7.49	3.52	0.00
Conventional training group	87.52±24.83			87.10±24.75		



Graph 7 Graphical Representation of Pre-Test and Post-Test Score Week Comparison of Stroop Test in CMDT Training Group and Conventional Training Group

Table 13 Pretest and Post-Test Week Score Comparison of WCST Test in CMDT Training Group and Conventional Training Group.

WCST	Pre test			Post test		
	Mean ±SD	z Value	p Value	Mean ±SD	z Value	p Value
CMDT training group	14.63±3.17	0.74	0.75	8.55±1.75	5.08	0.00
Conventional training group	15.13 ±3.53			15.05±3.42		

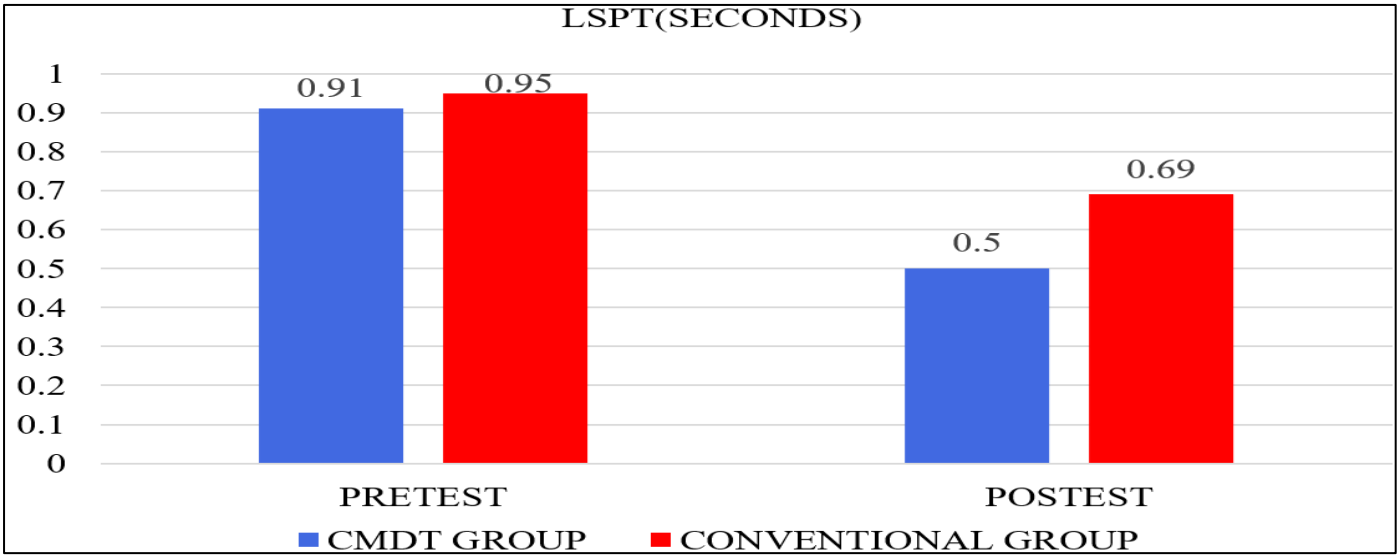


Graph 8 Graphical Representation of Pre-Test and Post-Test Week Score Comparison of WCST Test in CMDT Training Group and Conventional Training Group

Table 14 Pretest and Post-Test Score Comparison of LSPT Test in CMDT Training Group and Conventional Training Group.

LSPT	Pre test			Post test		
	Mean ±SD	z Value	p Value	Mean ±SD	z Value	p Value
CMDT training group	0.91±0.23	0.47	0.48	0.50±.042	4.64	0.00
Conventional training group	0.95±.207			0.69±.216		

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun397



Graph 9 Graphical Representation of Pre-Test and Post-Test Week Comparison of LSPT Test in CMDT Training Group and Conventional Training Group

V. DISCUSSION

The present study aimed to find the impact of cognitive motor dual task training on executive function and soccer specific skills in recreational soccer players. Subjects, who fulfilled the eligibility criteria, were recruited into two groups of nineteen each. The cognitive motor dual task training group received cognitive motor dual task training along with conventional training, whereas the conventional training group received conventional training alone. The total duration of the intervention was for 6 weeks. The outcomes assessed were Stroop test, Wisconsin card sorting test for executive function and Loughborough soccer passing test for soccer specific skills.

The baseline age category of subjects ranged from 18-25 years. In CMDT training group 57.7% of subjects were aged between 18-21 years and 47.4% of subject were aged between 22-25 years. In conventional training group 42.1% of subjects were aged between 18-21 years and 57.9% aged between 22-25 years. The CMDT training group's executive function and soccer-specific skills significantly improved, according to the data when compared with conventional training group. Neuroplasticity processes enhance cognitive abilities through cognitive motor dual task training, explaining its impact on individuals with deficits. The brain's ability to adapt allows humans to respond to new situations, form fresh neural pathways, and distribute resources based on the complexity of tasks.[16]

During cognitive motor dual task training, the physiological process combines motor and cognitive functions in the brain. The prefrontal cortex predominantly regulates executive functions like attention and decision-making. This area helps with multitasking by aiding in splitting attention between mental and physical tasks. Furthermore, the parietal cortex, responsible for spatial awareness and sensory integration, also becomes active to process information on both the physical and cognitive aspects of the activities.[25]

According to Wuj j et al (2024) cognitive motor dual task training, when used alongside regular training for sports with high cognitive demands, can decrease the mental workload on working memory. Dual task training increases the cognitive load on athletes, requiring effective handling and distribution of resources. Training in high cognitive load environments can help players improve their decision-making skills under pressure, especially in team sports like ball games. This strategy can help athletes manage the complexities of performing simultaneous cognitive and motor tasks during competition, potentially enhancing their performance. The athlete's ability to quickly and accurately interpret the dynamic elements of the game such as the displacement, direction and velocity of teammates, opponents, and objects like the ball is crucial. Rapidly adapting to these ever-changing spatial and temporal factors is a critical aspect of cognitive-motor coordination. This heightened spatial temporal awareness is essential for making strategic decisions and executing precise physical actions.[26]

In the present study cognitive motor dual task training group had increased cognitive inhibition and had improvement in executive function. Core executive functions include cognitive inhibition, working memory, and cognitive flexibility which encompasses creative thinking, viewing situations from multiple perspectives, and quickly adapting to changing circumstances.[10] Exercises such as shooting the ball and target identification, juggling the ball and naming fruits, and heading the ball and listen to the auditory command, might have increased cognitive inhibition thus leading to improvement in executive function. Inhibitory control, a key executive function, enables us to manage our attention, behavior, thoughts, and emotions by overriding strong internal urges or external temptations to do what is more appropriate or necessary. This control allows us to change our behaviors and make conscious choices, rather than acting out of habit. Although it is challenging, inhibitory control provides the potential for change and thoughtful decision-making, helping us to avoid impulsive and potentially foolish actions .[27]

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun397

Cognitive flexibility is an intrinsic property of a cognitive system often associated with the mental ability to adjust its activity and content, switch between different task rules and corresponding behavioral responses, maintain multiple concepts simultaneously and shift internal attention between them. Cognitive motor dual task training such as reaction ball catching simultaneously with solving math's problem, listening to instructions along with touching color cones and thereafter shooting and short-term memory tasks. It also included progression by task complexity which might have contributed to increased cognitive flexibility and working memory.[28]

The beneficial and compensatory consequences of cognitive motor dual task on concurrent stimulation of motor and cognitive processes, strengthening the connection. between movement and the brain thus, appropriate exercise can enhance brain function in addition to improving movement.[29]Cognitive motor dual task training improves the automatic procedures of body that is automation. The demand for attention is reduced while automation is enhanced. Consequently, dual task training improves the ability to perform secondary tasks at the same time. It improves the coordination between two or even multiple tasks, resulting in improved individual task performance [12]This is a parallel with study of Casella et al. (2022) engaging in dual-task training for cognitive motor skills has been proven to improve executive functions like cognitive flexibility and planning skills. The study on young soccer players found that those who underwent cognitive motor dual task training showed significant improvements in planning abilities and visual search tasks compared to those who only participated in conventional training.[11]When cognitive motor dual task training is combined with conventional physical training, athletes can experience comprehensive benefits. This combination has been observed to enhance not only cognitive functions but also physical performance in sports context. In the present study the cognitive motor dua task training group showed significant improvement in soccer-specific skills compared to the conventional training group. According to Stefania Lucia et al. there is a significant association found between brain activity and cognitive performance in sports and the combination of cognitive and motor tasks can train the brain to process information and respond more quickly. Thus, in the study addition of cognitive training may be the reason for improved executive function and soccer specific skills in recreational soccer players. [8]

Conventional training group though had no significant effect on executive function it had significant effect on soccer specific skills. Conventional training group often focuses on repetitive and predictable tasks, may not stimulate the brain in a way that enhances these higher-order cognitive processes. In soccer-specific skills, the conventional training group did show improvement, though not that effective when compared to the cognitive motor dual task training group. Conventional training focuses more on physical and technical skills without the simultaneous cognitive challenge. While this can improve physical attributes and technical skills, it may not provide the same level of enhancement in cognitive functions that are critical for exceptional soccer performance.

In this study, within and between group analyses reveal that cognitive motor dual task training group is more beneficial in improving executive function and soccer specific skills in recreational soccer players than conventional training. Thus, it can be concluded from the above findings that in addition to traditional training, cognitive motor dual task training plays a significant part in executive function and soccer specific skills in recreational soccer players.

➢ *Limitations*

- Climatic changes might have influenced the results of the study.

➢ *Suggestions*

- Future studies can be conducted to develop Cognitive motor dual task training protocol specific to other team sports such as hockey, kabaddi, and volleyball.
- The same study can be conducted in elite and sub elite players.
- Future studies can be conducted with more sample size
- Future studies with follow up can be done to assess the long-term benefits.

VI. CONCLUSION

The aim of the study is to find out the impact of cognitive motor dual task training on executive function and soccer specific skills in recreational soccer players. It can be concluded that recreational soccer players executive function and soccer-specific skills can be effectively improved by cognitive motor dual task training.

REFERENCES

[1]. Stølen T, Chamari K, Castagna C, Wisløff U. Physiology of soccer: an update. Sports Med. 2005;35(6):501-36
[2]. Svensson M, Drust B. Testing soccer players. J Sports Sci. 2005 Jun;23(6):601-18
[3]. Luo H, Newton RU, Ma'ayah F, Galvão DA, Taaffe DR. Recreational soccer as sport medicine for middle-aged and older adults: a systematic review. BMJ Open Sport—Exercise Medicine. 2018;4(1).
[4]. Krustrup P, Dvorak J, Junge A, Bangsbo J. Executive summary: The health and fitness benefits of regular participation in small-sided football games. Scandinavian journal of medicine & science in sports. 2010Apr; 20:132-5.
[5]. Jim Cosgrove, US Youth Soccer Executive Director What is Recreational Soccer? It's the Player's Game. US Youth Soccer Director of Coach and Player Development Manual –Recreational soccer. Feb. 2002
[6]. Gomes AR, Simães C, Morais C, Cunha R. Adaptation to stress in football athletes: The importance of cognitive appraisal. Frontiers in Psychology. 2022 Aug 24;13: 939840.
[7]. Vestberg T, Gustafson R, Maurex L, Ingvar M, Petrovic P. Executive functions predict the success of top-soccer players. PloS one. 2012 Apr 4;7(4): e34731.
[8]. Lucia S, Aydin M, Di Russo F. Sex Differences in

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun397

Cognitive-Motor Dual-Task Training Effects and in Brain Processing of Semi-Elite Basketball Players. Brain Sciences. 2023 Mar 4;13(3):443.
[9]. Verburgh L, Scherder EJ, van Lange PA, Oosterlaan J. Executive functioning in highly talented soccer players. PloS one. 2014 Mar 14;9(3): e91254.
[10]. Diamond A. Executive functions. Annual review of psychology. 2013 Jan 3;64(1):135-68.
[11]. Casella A, Ventura E, Di Russo F. The influence of a specific cognitive-motor training protocol on planning abilities and visual search in young soccer players. Brain Sci [Internet]. 2022;12(12):1624.
[12]. Xiao Y, Yang T, Shang H. The impact of motor-cognitive dual-task training on physical and cognitive functions in Parkinson's disease. Brain Sci [Internet]. 2023;13(3
[13]. Ren Y, Wang C, Lu A. Effects of perceptual-cognitive tasks on inter-joint coordination of soccer players and ordinary college students. Front Psychol [Internet]. 2022;13.
[14]. Sakamoto S, Takeuchi H, Ihara N, Ligao B, Suzukawa K. Correction: Possible requirement of executive functions for high performance in soccer. PLoS One [Internet]. 2021;16(4): e0251168
[15]. Koch P, Krenn B. Executive functions in elite athletes–Comparing open-skill and closed-skill sports and considering the role of athletes past involvement in both sport categories. Psychology of Sport and Exercise. 2021 Jul 1; 55:101925.
[16]. Vestberg T, Gustafson R, Maurex L, Ingvar M, Petrovic P. Executive functions predict the success of top-soccer players. PloS one. 2012 Apr 4;7(4): e34731.
[17]. Takahashi S, Grove PM. Use of Stroop Test for Sports Psychology Study: Cross-Over Design Research. Frontiers in Psychology. 2020 Dec 7; 11:614038.
[18]. De Almeida RF, da Costa IT, Machado G, Rinaldi NM, Aquino R, Tallis J, Clarke ND, Guimaraes-Ferreira L. The Effect of Acute Caffeine Ingestion on Tactical Performance of Professional Soccer Players. Nutrients. 2022 Mar 31;14(7):1466.
[19]. EMEK SAVAŞ DD, Yerlikaya D, Yener GG, ÖKTEM TANÖR Ö. Validity, Reliability and Normative Data of the Stroop Test Çapa Version. Turk Psikiyatri Dergisi. 2020 Mar 1;31(1).
[20]. Steinke A, Kopp B, Lange F. The Wisconsin card sorting test: Split-half reliability estimates for a self-administered computerized variant. Brain Sciences. 2021 Apr 21;11(5):529.
[21]. Miranda AR, Franchetto Sierra J, Martínez Roulet A, Rivadero L, Serra SV, Soria EA. Age, education and gender effects on Wisconsin card sorting test: standardization, reliability and validity in healthy Argentinian adults. Aging, Neuropsychology, and Cognition. 2020 Nov 1;27(6):807-25.
[22]. Wen D, Robertson S, Hu G, Song B, Chen H. Measurement properties and feasibility of the Loughborough soccer passing test: A systematic review. Journal of sports sciences. 2018 Aug 3;36(15):1682-94.
[23]. Le Moal E, Rue O, Ajmol A, Abderrahman AB, Hammami MA, Ounis OB, Kebsi W, Zouhal H. Validation of the Loughborough Soccer Passing Test in young soccer players. The Journal of Strength & Conditioning Research. 2014 May 1;28(5):1418-26.
[24]. Luo H, Newton RU, Ma'ayah F, Galvão DA, Taaffe DR. Recreational soccer as sport medicine for middle-aged and older adults: a systematic review. BMJ open sport & exercise medicine. 2018 Aug 1;4(1): e000336.
[25]. Friedman NP, Robbins TW. The role of prefrontal cortex in cognitive control and executive function. Neuropsychopharmacology. 2022 Jan;47(1):72-89.
[26]. Wu J, Qiu P, Lv S, Chen M, Li Y. The effects of cognitive-motor dual-task training on athletes' cognition and motor performance. Frontiers in Psychology. 2024 Feb 8; 15:1284787.
[27]. Horváth K, Nemeth D, Janacsek K. Inhibitory control hinders habit change. Scientific Reports. 2022 May 18;12(1):8338.
[28]. Uddin LQ. Cognitive and behavioural flexibility: neural mechanisms and clinical considerations. Nature Reviews Neuroscience. 2021 Mar;22(3):167-79.
[29]. Zheng Y, Meng Z, Zhi X, Liang Z. Dual-task training to improve cognitive impairment and walking function in Parkinson's disease patients: A brief review. Sports Medicine and Health Science. 2021 Dec 1;3(4):202-6.

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun397

ACKNOWLEDGEMENT

It is with profound sense of gratitude I compile and present this dissertation on '**THE IMPACT OF COGNITIVE-MOTOR DUAL-TASK TRAINING ON EXECUTIVE FUNCTION AND SOCCER-SPECIFIC SKILLS IN RECREATIONAL SOCCER PLAYERS: A SINGLE BLIND RANDOMIZED CONTROLLED TRIAL'** before the medical world and the esteemed public. First of all, I raise my love and gratitude to **God Almighty**, for the successful completion of this dissertation. I dedicate this study to **my family and teachers** for providing their love and support in each and every walk of my life.

I express my heartfelt gratitude to **Mr. Sebastain J Pengiparambil**, Principal, LIMSAR, Angamaly who had given me an opportunity to do my dissertation work. I am highly indebted to **Prof. Remya N.** (MPT Neurology), Head of the Department of Physiotherapy, LIMSAR, Angamaly, for her constant encouragement and valuable suggestions. My dissertation got initiated and fructified under the enlightened guidance of **Ms. Rejimol Jos Pulicken** (MPT-Musculoskeletal and Sports) Her constant motivation, guidance and valuable suggestions made me to finish this dissertation successfully. I also thank my co-guide **Ms. Reeba Roy** (MPT-Cardiorespiratory) for her valuable guidance and support.

It is my pleasure and privilege to record my deep sense of gratitude to **Prof. Dr Manju Unnikrishnan** Phd, (MPT-Neurology), **Ms Chinchu Alwin,** (MPT-Advanced physiotherapy in Orthopaedics), **Ms. Jisha Thampi** (MPT-Musculoskeletal and sports), **Ms. Anumol C** (MPT-Musculoskeletal and sports), **Ms. Rakhi Balagopal** (MPT-Cardiovascular and pulmonology), **Ms. Reethu Elsa Baby** (MPT-Adult Neurology with Paediatrics), **Mr. Praveen Baby** (MPT-Neurology and Psycho-Somatic Disorders), **Ms. Rani Sreenivas** (MPT-Cardiorespiratory) **, Ms. Arathy Km** (MPT-Musculoskeletal and sports), **Ms. Shyma Philip** (MPT-Cardiorespiratory), **Ms. Divyasree Chandran** (MSc Biostatistics) and **Mr. Vipin Xavier (** MSc, MCA**)** for their valuable guidance and support.

I also extend my sincere gratitude to **Mr. Jijo James** (HOD-Department of Physiotherapy, LF Hospital and Research Centre) and all other physiotherapists in LF Hospital, for their timely help in the clinical setting.

I am indebted to **Dr. Ashok Menon** (HOD, Department of Neurology) and **Dr. J.K Mukkadan** (Research director) for mentoring throughout the study.

I thank all the members of ethical committee of LF Hospital, for their kind suggestions, guidance, and approval to complete this dissertation. Last but not the least, I am thankful to my batchmates, juniors, faculties of LIMSAR and library staff who helped me to complete this dissertation.

Finally, I thank all the subjects for their kind co-operation. Without their involvement this dissertation would have not been a reality.

Date:
Place: **Jerin M Joy**

ISSN No: 2456-2165 https://doi.org/10.38124/ijisrt/25jun397

ETHICAL COMMITTEE
LITTLE FLOWER HOSPITAL & RESEARCH CENTRE
P.O. Box No. 23 Angamaly - 683572
E-mail : admin@lfhospital.org, enquiry@lfhospital.org,
Website : www.lfhospital.org,Tel: 0484-2675000, 2452546,2452547,2456146,
2456147, 24552548,2675300, Fax : +91 484 2452646,

EC/ 04/2023 29/07/2023

SUBJECT: THESIS TOPIC APPROVED BY THE ETHICAL COMMITTEE

The ethical committee held on 27/07/2023 discussed the thesis topic"**The Impact of Cognitive-Motor Dual-Task Training on Executive Function and Soccer Specific Skills in Recreational Soccer Players"** by **Jerin M Joy** of Physiotherapy Department and approved the thesis topic.

DIRECTOR
Fr. (Dr.) Joy Ainiyadan

LITTLE FLOWER HOSPITAL & RESEARCH CENTRE ETHICAL COMMITTEE ANGAMALY 683 572