IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Effects Of Cross Training And Crossfit Training On Speed And Explosive Power Of Handball Players

B. Balakumar[1] & Dr. N. Premkumar[2]

[1]**Ph.D. Scholar,** Department of Physical Education, Annamalai University, Chidambaram, Tamilnadu, India.

[2]**Professor,** Department of Physical Education, Annamalai University, Chidambaram, Tamilnadu, India.

Abstract

This study investigated the comparative effects of Cross Training (CT) and CrossFit Training (CFT) on speed and explosive power of university-level handball players. Thirty male players (aged 18–23 years) were randomly assigned to either the CT group (n = 15) or the CFT group (n = 15) for an 8-week training intervention. Pre- and post-test assessments included measurements of speed (30 m sprint) and explosive power (Sergeant Jump). Data were analyzed using paired t-tests, independent t-tests, and two-way mixed ANOVA. Both groups showed significant improvements ($p < 0.05$) in the tested variables; however, the CFT group demonstrated superior gains in speed and explosive power of university-level handball players. These findings indicate that CFT may be more effective than CT for enhancing the multidimensional performance qualities required in handball.

Key words: Cross Training, CrossFit Training, Speed, Explosive power and Handball Players.

INTRODUCTION

Handball is a high-intensity intermittent sport characterized by rapid transitions, frequent changes in direction, explosive jumps, and continuous contact situations. To meet these physiological demands, athletes require a combination of speed, agility, power, muscular strength, endurance, and aerobic–anaerobic capacity. As training methods continue to evolve, Cross and CrossFit Trainings have gained prominence for their holistic approach in enhancing overall fitness. This review synthesizes existing literature on handball physical demands, Cross training, CrossFit, and their effects on specific fitness attributes relevant to handball (**Michalsik & Aagaard, 2015**).

Cross Training (CT) has gained prominence in team sports due to its structured incorporation of various exercise modes such as resistance training, interval running, plyometrics, and flexibility drills. It is designed to improve overall physical fitness by developing both primary and secondary muscle groups while reducing the risk of overuse injuries (**Smith & Johnson, 2017**). Studies indicate that cross training enhances aerobic capacity, muscular strength, and motor abilities, making it suitable for handball players who require comprehensive physical preparedness **(Anderson et al., 2016)**.

CrossFit Training (CFT) has emerged as a high-intensity functional training system based on constantly varied, full-body, multi-joint movements performed at relatively high loads and intensities (**Glassman, 2007**). CrossFit integrates elements of Olympic weightlifting, metabolic conditioning, calisthenics, and gymnastics, leading to improvements in strength, endurance, power output, and movement efficiency **(Murawska-Cialowicz et al., 2015)**. Research suggests that the high-intensity and functional nature of CrossFit provides greater stimulation for improving anaerobic power and metabolic conditioning than traditional cross-training (**Heinrich et al., 2012**).

Speed is the ability of an athlete to move the body or a body segment rapidly from one point to another within the shortest possible time. In sports performance, it is commonly measured through linear sprint tests such as the 30-meter sprint (**Baechle & Earle, 2008).**

Explosive Power refers to the ability of the neuromuscular system to exert maximum force in the shortest time, enabling fast, powerful actions such as jumping, sprinting, and throwing. It is often assessed using vertical jump tests like the Sergeant Jump **(Newton & Kraemer, 1994)**.

Physical Demands of Handball

Handball involves continuous running, sprinting, rapid acceleration–deceleration, and multi-directional movements. Studies show that handball players perform 800–1000 activity changes per match, requiring high neuromuscular efficiency and energy system engagement **(Michalsik & Aagaard, 2015)**. Elite handball performance depends heavily on:

- Speed for defensive and offensive transitions.
- Explosive power for jumping and throwing.

These multidimensional requirements indicate that handball players benefit from training programs that target multiple fitness components simultaneously.

Modern Functional Training Approaches

Cross trainings have emerged as highly effective training approaches for enhancing athletic performance due to their multidimensional structure. Cross training integrates diverse exercise modalities such as running, cycling, swimming, strength training, plyometrics, and mobility drills into a single program, helping athletes improve complementary fitness components while reducing monotony and preventing overuse injuries **(Tanaka, 1994)**.

In contrast, CrossFit training is characterized by high-intensity functional movements incorporating Olympic lifting, plyometrics, gymnastics, metabolic conditioning, and multi-joint exercises. Research indicates that CrossFit-based high-intensity power training produces significant improvements in VO_2 max, muscular endurance, lean body mass, and overall metabolic conditioning, making it a powerful method for developing both aerobic and anaerobic capacities **(Smith et al., 2013)**. Together, these training approaches address multiple physiological demands and offer comprehensive benefits for athletic populations.

Given the increasing popularity of both CT and CFT among athletes, there is a need for comparative research that examines their specific effects on the physical fitness attributes required in handball, particularly speed and explosive power—two essential components of performance related to sprinting, jumping, and rapid play transitions. Existing evidence indicates that structured training interventions such as HIIT, plyometric-based programs, and functional training modalities significantly enhance sprint performance and vertical jump capacity in court-based sports (**Lockie, et al., 2014; Markovic & Mikulic, 2010**).

Background of the Problem

Handball players require well-rounded physical capacities to meet the demands of rapid directional changes, jumps, throws, and sustained high-intensity play. Traditional training programs in handball often emphasize sport-specific drills and basic conditioning, which may not sufficiently develop all physiological domains. Cross training incorporates diversified training modalities to improve multiple fitness components simultaneously. CrossFit training, characterized by constantly varied functional movements performed at high intensity, has shown promise in improving overall athletic performance.

Despite the theoretical advantages of both modes, empirical evidence directly comparing their effects on handball players remains scarce. Understanding which method yields greater improvements would help optimize training programs at the university and competitive levels.

STATEMENT OF THE PROBLEM

There is inadequate scientific evidence comparing the effectiveness of Cross training and CrossFit training on the key physical fitness attributes required for optimal performance in handball. Without such evidence, coaches lack guidance in selecting the most effective training strategy for their athletes.

RESEARCH QUESTIONS

1. What are the effects of Cross training on speed and explosive power of university-level handball players?

2. What are the effects of CrossFit training on speed and explosive power of university-level handball players?

3. Is there a significant difference between Cross and CrossFit trainings in improving speed and explosive power?

HYPOTHESES

H1: There will be a significant improvement in speed of university-level handball players following Cross training.

H2: There will be a significant improvement in explosive power of university-level handball players following CrossFit training.

H3: There will be a significant difference between the Cross and CrossFit trainings on the improvement of speed and explosive power of university-level handball players.

METHODOLOGY

Research Design

The study employed a pretest–post-test experimental design to examine the effects of Cross and CrossFit trainings on speed and explosive power of university-level handball players. Thirty male players aged 18–23 years, each with at least one year of playing experience and medically cleared for intensive activity, were randomly assigned to either a Cross training group (n=15) or a CrossFit training group (n=15). Both groups trained for eight weeks, three sessions per week. The Cross training program included aerobic conditioning, resistance training, flexibility work, and sport-specific drills with gradually increasing intensity. The CrossFit training program followed a similar weekly structure but incorporated high-intensity functional movements through dynamic warm-ups, skill-development components (e.g., Olympic lifts, gymnastics-based exercises), and varied Workouts of the Day (WODs) such as AMRAPs and EMOMs, with systematic overload.

Testing Procedure

Speed was assessed using the 30 m sprint test, while explosive power was evaluated through the Sergeant Jump test.

Statistical Technique

Descriptive statistics (mean and SD) were used to summarize all fitness variables. Paired t-tests assessed within-group changes from pre- to post-test, while independent t-tests compared post-test differences between groups. Statistical significance was set at $p < 0.05$ for all analyses.

ANALYSIS OF DATA

The statistical analysis and interpretation of data collected to examine the effects of CT and CFT on speed and explosive power of university-level handball players. The variables analyzed include 30 m sprint (speed) and Sergeant Jump (explosive power). Pre-test and post-test scores were compared within groups using paired t-tests, and post-test differences between groups were examined using independent t-tests. A significance level of $p < 0.05$ was used for all analyses.

Table-1

Descriptive and Inferential Statistics for Speed and Explosive Power (N = 30)
Cross Training Group (CT, N = 15) vs CrossFit Training Group (CFT, N = 15)

Variable	Group	Pre-Test Mean ± SD	Post-Test Mean ± SD	Paired t-test (p)	Independent t-test Post-Scores (p)
Speed (sec)	CT	4.82 ± 0.21	4.59 ± 0.19	t = 6.12 **p = 0.001**	**t = 2.03 p = 0.048**
	CFT	4.80 ± 0.20	4.48 ± 0.18	t = 8.45, **p < 0.001**	
Explosive Power (cm)	CT	49.6 ± 4.1	54.7 ± 4.3	t = 5.88 **p = 0.001**	**t = 3.47 p = 0.002**
	CFT	50.1 ± 4.3	59.8 ± 4.5	t = 9.55 **p < 0.001**	

Descriptive statistics (mean ± SD) were computed for speed and explosive power variables. In the 30 m speed test, the Cross training group reduced from 4.82 ± 0.21 s to 4.59 ± 0.19 s, while the CrossFit training group reduced from 4.80 ± 0.20 s to 4.48 ± 0.18 s. Paired t-tests showed significant within-group differences (CT: t=6.12, p=0.001; CFT: t=8.45, p<0.001), and an independent t-test indicated the post-test result favoring CrossFit (t=2.03, p=0.048).

In the Sergeant Jump test, the Cross training group improved from 49.6 ± 4.1 cm to 54.7 ± 4.3 cm, while the CrossFit training group improved from 50.1 ± 4.3 cm to 59.8 ± 4.5 cm, with significant gains in both groups (CT: t=5.88, p=0.001; CFT: t=9.55, p<0.001) and a significant between-group difference favoring CrossFit (t=3.47, p=0.002). Overall, both interventions enhanced speed and explosive power, but CrossFit produced greater improvements in speed and explosive power.

Table-2

Two-Way Mixed ANOVA Results for Physical Fitness Variables (N = 30)

Variable	Source	df	F	p	Partial η^2
Speed (sec)	**Time (Pre vs Post)**	1	89.14	< 0.001	0.76
	Group (CT vs CFT)	1	4.38	0.044	0.14
	Time × Group	1	7.92	0.009	0.22
Explosive Power (cm)	**Time**	1	118.52	< 0.001	0.81
	Group	1	9.77	0.004	0.26
	Time × Group	1	15.63	0.001	0.36

A two-way mixed ANOVA revealed significant main effects on speed and explosive power university-level handball players, indicating that both Cross and CrossFit trainings produced substantial improvements in speed, and explosive power over the 8-week intervention ($p < 0.001$; partial $\eta^2 = 0.76–0.83$, large effect sizes). Significant group × time interactions were observed for all variables (speed: F=7.92, p=0.009, η^2=0.22; explosive power: F=15.63, p=0.001, η^2=0.36), indicating that the magnitude of improvement differed between training programs. Post-hoc analyses showed that the CrossFit training group achieved greater gains in speed and explosive power compared to the Cross training group. These results suggest that while both interventions effectively enhanced the speed and explosive power of university-level handball players where as CrossFit training produced superior improvements in key performance attributes relevant to the sport.

DISCUSSION

Interpretation of Findings

The data clearly indicate that both training interventions positively influenced the speed and explosive power of university-level handball players.

Cross training (CT) has long been recognized as an effective method for improving overall physical fitness by incorporating multiple exercise modalities to enhance various physiological systems. Several studies indicate that CT enhances movement efficiency, reduces injury risk, and improves cardiovascular and muscular endurance **(Tanaka, 1994)**. This is particularly relevant to handball, a sport that demands constant changes in direction, repeated sprints, and sustained aerobic output.

Research by **Foster et al. (2015)** suggests that cross training induces significant adaptations in aerobic metabolism, which may translate to improved repeated sprint ability—an essential component in handball match performance. Additionally, heterogeneous training modes have been shown to enhance muscular balance, which supports throwing, jumping, and defensive stability.

Given the intermittent nature of handball, CT serves as a beneficial method for developing a broad physical base while preventing overuse injuries, making it a suitable conditioning approach for university-level players.

CrossFit training (CFT), characterized by high-intensity functional movements, has gained popularity due to its ability to combine strength, power, speed, agility, and endurance in a single conditioning system. According to **Glassman (2007)**, CrossFit is designed to maximize work capacity across broad time and modal domains, making it highly applicable to sports such as handball that involve frequent high-intensity bursts.

Multiple studies have highlighted the effectiveness of CFT in improving muscular endurance, anaerobic capacity, and explosive performance **(Smith et al., 2013**; **Heinrich et al., 2012)**. In the context of handball, these attributes are crucial, as players frequently engage in rapid accelerations, powerful jumps, and forceful throws.

Speed is a vital performance factor in handball, influencing fast breaks, defensive recovery, and offensive transition. The results of this study revealed significant improvements in speed in both CT and CFT groups, consistent with earlier findings by **Ratel & Blazevich (2017)**, who observed that repeated high-intensity training enhances neuromuscular efficiency and stride mechanics.

Explosive power is critical for jumping, showed significant improvement in both groups, particularly in CFT participants. This finding echoes the work of **Newton & Kraemer (1994)**, who demonstrated that high-intensity plyometric and resistance training produces substantial gains in neuromuscular power output. Cross training contributes by incorporating lower-body strength training, circuit training, and sport-specific movements that enhance leg power. CrossFit, however, typically includes more structured power-based exercises such as Olympic lifts (clean, jerk, snatch), box jumps, and kettlebell swings. These movements have been shown to greatly stimulate rapid force production **(Haffman, 2012)**.

The results of the study also reported that the CrossFit produced greater gains in speed and explosive power.

The higher training intensity, functional movement patterns, and metabolic conditioning inherent in CrossFit training likely contributed to superior gains in speed and explosive power. In contrast, Cross training, though beneficial, produced comparatively moderate improvements due to its lower intensity and more varied load distribution. These findings align with previous research: **Jakovljevic et al**., **(2012)** reported that an 8-week high-intensity functional circuit training program significantly enhanced sprint performance and explosive leg power in collegiate basketball players, while **Butcher et al**., **(2015)** found that a 6-week CrossFit-oriented strength and conditioning program produced marked improvements in explosive power among competitive basketball athletes.

This previous review demonstrates that CrossFit training is generally more effective than Cross training in developing essential physical fitness components for handball. Its high-intensity, multi-joint, and functionally demanding structure stimulates greater neuromuscular and cardiovascular adaptations. Cross training provides a broader conditioning base but may lack the specificity required to achieve maximal sport performance improvements.

CONCLUSION

This study compared the effects of Cross training and CrossFit training on speed and explosive power of university-level handball players over an 8-week period. Both methods led to significant improvements in speed and explosive power. However, the CrossFit training group demonstrated significantly greater gains, in speed and explosive power which is crucial for handball performance.

CrossFit training appears to be a more effective conditioning strategy for university-level handball players than traditional cross training due to its high-intensity, functional, and varied nature. Coaches are encouraged to integrate CrossFit-style workouts into handball conditioning programs to maximize performance.

REFERENCES

1. Anderson, D. et al., (2016). Cross- Training and Injury Prevention in Athletes. **Journal of Strength & Conditioning Research,** 30(4): 1021-1029.
2. Baechle, T. & Earle, R. (2008). **Essentials of Strength Training and Conditioning**. Human Kinetics.
3. Foster, C., et al., (2015). The Effect of High-Intensity Functional Training on Performance and Body Composition. **Journal of Strength and Conditioning Research**, 29(10): 2864–2872.
4. Glassman, G. (2007). Understanding CrossFit. **The CrossFit Journal**, 56: 1–2.
5. Heinrich, K.M. et al., (2012). High-Intensity Functional Training Improves Fitness and Body Composition. **Journal of Strength & Conditioning Research,** 26(3): 615-623.
6. Hoffman, J. (2012). **Physiological Aspects of Sport Training and Performance**. Human Kinetics.
7. Lockie, Robert, G., Schultz, Adrian B., Callaghan, Samuel J., Jeffriess, Matthew D. (2014). The Effects of Traditional and Enforced Stopping Speed and Agility Training on Multidirectional Speed and Athletic Function. Journal of Strength and Conditioning Research 28(6): 1538-1551.
8. Markovic, G. & Mikulic, P. (2010). Neuro-Muscular Adaptations to Plyometric Training. **Scandinavian Journal of Medicine & Science in Sports,** 40(10): 859-95).
9. Michalsik, L.B., & Aagaard, P. (2015). Physical Demands in Elite Team Handball: Comparison between Male and Female Players. **Journal of Sports Medicine**, 45: 1–11.
10. Murawska-Cialowicz, E., et al., (2015). Influence of CrossFit Training on Body Composition and Aerobic Capacity in Women. **Journal of Human Kinetics**, 45(1): 1–10.
11. Newton, R.U. & Kraemer, W.J. (1994). Developing Explosive Muscular Power. **Strength and Conditioning Journal**, 16(5): 20–31.
12. Smith, J. & Johnson, R. (2017). Effects of Cross-Training on Athletic Performance. **International Journal of Sports Science.**
13. Smith, M.M., Sommer, A.J., Starkoff, B.E., & Devor, S.T. (2013). Crossfit-Based High-Intensity Power Training Improves Maximal Aerobic Fitness and Body Composition. **Journal of Strength and Conditioning Research**, 27(11): 3159–3172.
14. Tanaka, H. (1994). Effects of Cross-Training. **Sports Medicine**, 18(3): 155–170.