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EFFECTS OF TWELVE-WEEK KETTLEBELL TRAINING PROGRAM UPON HEART RATE RECOVERY IN AMATEUR PLAYERS: A RANDOMIZED CONTROLLED TRIAL

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KEYWORDS

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ABSTRACT

The resistance training demonstrated numerous benefits including increased strength, power, and endurance. The resistance training has been used since ancient times to increase functional abilities, strength, power, and endurance. This study aimed to evaluate the impact of kettlebell training upon heart rate recovery (HRR) in the amateur male athletes aged 18–30 years. A randomized controlled trial was conducted with 40 participants from various sports. The participants were divided into an experimental group (kettlebell training) and the control group, each with 20 athletes. The training program lasted 12 weeks, and HRR was measured pre- and post-intervention using Harvard Step Test. The experimental group showed significant improvement in HRR post-training (MD = 9.10, p = 0.014, Cohen's d = 0.62), whereas control group showed no significant change (p = 0.213). The experimental group confirmed a 10.82% improvement in HRR, compared to only 0.42% in the control group. The results provide significant information in reaching the conclusion as the structured kettlebell training program significantly improves the heart rate recovery in the amateur athletes, suggesting its efficacy as the cardiovascular conditioning modality.

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INTRODUCTION

Resistance training demonstrated numerous benefits including increased strength, power, and endurance. Resistance training has been used since ancient times to boost functional abilities, strength, power, and endurance (Stojiljkovic., Ignjatovic, Savic, Markovic & Milanovic, 2013; Cao, Liu, Wang & Geok, 2024). Due to its ability to improve athletes' performance by growing

muscle hypertrophy, speed, power, and endurance, along with motor function, balance, and mind body coordination, resistance training has gained popularity as an exercise in the past 20 years (Kraemer & Ratamess, 2004). Strategies used by effective competitions or promoted by other performance-driven organizations are often swiftly adopted by elite fitness groups and athletes (Thompson, 2013). In athletics, the sports medicine, rehabilitation, and health, building strength, power, and endurance I always a key priority. Novel training methods with varying degrees of result evaluation are continuously being tried and used (Girard & Hussain, 2015). There is a wide range of training methods and equipment available to athletes. One such tool is kettlebell.

Over the past ten years, kettlebell training has gained popularity and is now seen as legitimate option for strength and conditioning training. It is an effective technique that has its roots in Russia and can be used to reduce body fat and increase aerobic capacity, muscle strength, and muscle endurance (Farrar, Mayhew & Koch, 2010). The kettlebell is likened to the cannonball with a handle (Seethalakshi & Suresh, 2019). Kettlebells are excellent for full-body, explosive movements that build strength, and they can also help boost heart and lunge function (Wesley, & Kivi, 2017). Enhancing training stress can be achieved through three different approaches, an athlete can make workout more challenging by doing more sets or reps, exercising more often during the week, and lifting heavier weights. By gradually increasing both the intensity and overall training load, an athlete introduces more variety into workouts, which can help the body adapt and rally effectively (Junior, Salles, Dias, Simão, & Willardson, 2022). Developing strength, power and endurance with kettlebell training is helpful for pre-season conditioning regimens.

LITERATURE REVIEW

Studies shown that during multiple 5- 7-minute rounds of self-paced kettlebell workouts, heart rate and oxygen consumption were meaningly higher compared to outdated aerobic exercises like incline walking, cycling, and running (Falatic, Plato, Holder, Finch, Han, & Cisar, 2015). Additionally, high-intensity interval training with kettlebells has been linked to improvements in grip strength (Quednow, Sedlak, Meier, Janot, & Braun, 2015). In this context, the literature primarily focuses upon acute responses that examine cardiovascular metrics (HR, V2 Max) to assess the intensity of training sessions (Fusi, 2017; Williams and Kraemer, 2015; Fortner, 2014; Thomas, 2014). The recovery plays a crucial role in the effectiveness of workout programs, as muscle fatigue is frequently the key factor in determining success (Allen & Westerblad, 2004). Kettlebell exercises that are specifically designed to target weaknesses and imbalances help to prevent injuries and promote healing. Nevertheless, the existing research upon how kettlebell exercises protocols affect the autonomic nervous structure in terms of the cardiac autonomic recovery is limited (Wong, Nordvall, Walters, Lastova, Francavillo, Summerfield, & Sanchez, 2017).

Analyzing recovery phase following exercise permits observation of alterations in autonomic cardiac function as a response to the effects of physical activity, and it helps track the return to baseline levels, thereby indicating the extent of cardiac strain (elevated HR) induced exercises

(Schaun & Vecchio, 2018; Kliszczewicz, 2018). Consequently, the post-exercise phase is a vital aspect of research studies. A study of 10 weeks high intensity kettlebell training on untrained women found sustained reduction in heart rate variability throughout recovery in the early phases, but at the end of 10th week, most of the participants heart rate variability returned to baseline within 20 minutes (Alves, Zimerer, Leite, Neves, Moreira, & Carletti, 2024). Kettlebell exercises add variation to an athlete's main training schedule and help them avoid overuse injuries in diverse circumstaces. In this drive, adding dynamic kettlebell exercises to pre-game warm-ups can effectively activate key muscle groups and prepare the body for the high-level performance.

Research shows that such movements can create a significant metabolic demand reaching up to 87% of maximum heart rate and 65% of VO_2 max highlighting their potential to enhance readiness for competition during the 12-minute continuous kettlebell swings, which increased aerobic capacity with the greater gains than those observed with the traditional circuit weight training. Muscle fatigue has two primary causes: (1) a lack of mitochondrial substrates and (2) the accumulation of metabolic by-products that lead to muscle contractile failure (Davis & Bailey, 1997). Moreover, the accumulation of lactate and the consequent rise in muscle acidity are often linked with fatigue along with the metabolic by-products (Sahlin, 1986), although this assertion may not be entirely accurate. Another study by Farrar, Mayhew and Koch (2010) reveals that kettlebell swings have great impact on oxygen consumption (VO2 max) and heart rate variability in comparison to traditional resistance training. Thus, current study's primary aim was to examine the effects of kettlebell training program on heart rate recovery in amateur platers.

Objectives of Study

To evaluate the impact of Kettlebell Training on Heart Rate Recovery in the particular context.

RESEARCH METHODOLOGY

The research was conducted at the I.8 Active Lab in Islamabad, Pakistan. The lab provided the necessary facilities for conducting the research, including the equipment such as Kettlebells, stopwatches, whistles, and specific equipment for the tests. The research study followed the randomized control trial (RCT). In this connection, it is an experimental research strategy with a pre-post assessment. The participants were healthy amateur players from various sports, including the Football, Cricket, Field Hockey, Badminton, and Athletics. We carefully selected players from a range of sports, considering the sports where the upper body strength is more important, likewise badminton, and sports where lower body strength is more important, like football.

We were able to investigate effects of Kettlebell workouts on our objective was to gain a more thorough understanding of the impact of these workouts across different sports disciplines by incorporating individuals with varying backgrounds in sports to understand how they impact different physical components that are essential for athletic performance. Males between the ages of 18 and 30 who are physically fit and in good health meet the inclusion requirements.

engaging in physical exercise and being open to taking part in study. Participants physically not fit and or on medication or having less than 18 years and more than 30 years of age were excluded.

Sampling Procedures

A randomized controlled trial design was used. A total of 87 volunteer amateur players were selected for sampling procedure. 40 were involved recruiting 60 volunteer amateur players who met the inclusion criteria of being physically fit volunteer amateur players were selected for the study fulfilling the inclusion and exclusion criteria. males between 18 and 30 years of age. The players with any surviving injuries, with any type of medicine, beyond the prescribed age limit were excluded from the study. Various studies have explored the impact of training with a kettlebell on physical fitness, mostly following the consistent approach to sample size. Normally, around 15 participants per group were selected by the researchers when studying a kettlebell-related interventions. In approach with this trend, current study initially included 15 participants in each of the two groups. Keeping in mind the a potential dropout rate of up to 25%, as recommended by Smith et al. (2017) and Garcia et al. (2019), five extra participants were added to both groups, bringing the total to 40 participants, the total of 20 participants in each group. Finally, all participants completed the study, resulting in a complete and reliable data set.

Research Layout Plan

The participants were alienated into two groups: Kettlebell experimental group, and control group. Each group consisted of 20 players. The study followed a pre-post assessment design, where measurements were taken before and after the 12-weeks training period. The study measured the effects of training on heart rate recovery. The term "heart rate recovery" describes how after rapidly, following physical activity or exercise, heart rate returns to its resting level. The first experimental group underwent Kettle Bell training, and the second group served as the control group. Before and after 12 weeks, subjects were evaluated. At the same time of day one week before and after the training, all measures were obtained. In this linking, the general warm-up, which included stretching, calisthenics, and jogging, was followed by the tests. 25 seconds of training time and 50 seconds of rest time were employed in a 1:2 work-to-rest ratio training regime for same activity. There was 2-minute break while changing exercises between sets.

Table 1

Kettlebel Exercises Protocol

EXERCISES	SET	ET/PS (SEC)	RT/PS (SEC)
Kettlebel ideadlift	5	25	50
Two ihanded ikettle ibell iswing	5	25	50
Kettlebel iclean	5	25	50
One iarm iKettlebel isnatch	5	25	50
The front isquart iwith ijump	5	25	50

Parameters/variables Investigated

The study measured the effects of training on heart rate recovery. Thus, the term "heart rate recovery" describes how after rapidly, following physical activity or exercise, heart rate returns to its resting level. Data collection involved conducting specific tests to measure heart rate recovery. The Harvard Step test was used in the study. Data was collected before and after the 12-weeks training period. To perform the Harvard test, participants will engage in stepping on and off on a platform for a set period. (30 steps per minute, equivalent to every two seconds) for the duration of 5 minutes or until reaching exhaustion. Exhaustion is indicated when the participant cannot maintain the stepping rhythm for 15 seconds. Immediately after completing the test, the athlete sits down, and the total count of the heartbeats is taken between 1 to 1.5 minutes. Additionally, heart rate measurements are taken between 2 to 2.5 minutes and 3 to 3.5 minutes.

Required Scoring

The continued Fitness Index score would be (100 x 300) / (240 x 2) = 62.5 if the test lasted 300 seconds (five minutes), and heartbeats were 90 amid 1-1.5 minutes, 80 between 2-2.5 minutes, and 70 between 3-3.5 minutes. It's crucial to remember that 30-second period's total heartbeats rather than heart rate (beats p/m) are used. (100 x test duration in seconds) divided by (2 x sum of heartbeats during recovery periods) is the fitness index. To measure the heart rate recovery Harward Step Test was used. The validity, reliability is shown by previous studies (El-Badri et al., 2019; El-Metwally et al., 2020). The data was analyzed statistically by using SPSS (statistical Package for Social Sciences) version 22. The results were reported using descriptive statistics, effect sizes. To compare heart rate recovery times in groups, independent samples t-test was used when data followed a normal and Wilcoxon rank-sum test was applied when data was not normally distributed. This two-method approach confirmed that statistical analysis aligned with nature of data and objectives of study. Following best practices in research methodology, using these well-established statistical tools helped strengthen validity and reliability of results (Pallant, 2020).

RESULTS OF STUDY

This experimental study was based on pre-post assessment, and it involved participation of healthy amateur players from many sports, like Football, Cricket, Field Hockey, Badminton, and Athletics. Forty players took part in two groups (20 in each group). Shapiro-Wilk test was used for normality of data for recovery time Looking at results, p-values for recovery time was less than .05, indicates that data for variable was not normally distributed at 95% confidence level.

Table 2

Tests of Normality

	Shapiro-Wilk		
Variables	Statistic	Df	Sig.
Recovery Time	0.938	60	0.005

Note: Significance Level: p < 0.05*, p < 0.001***, df= degrees of freedom, Sig= Significance" or "p-value

Table 3

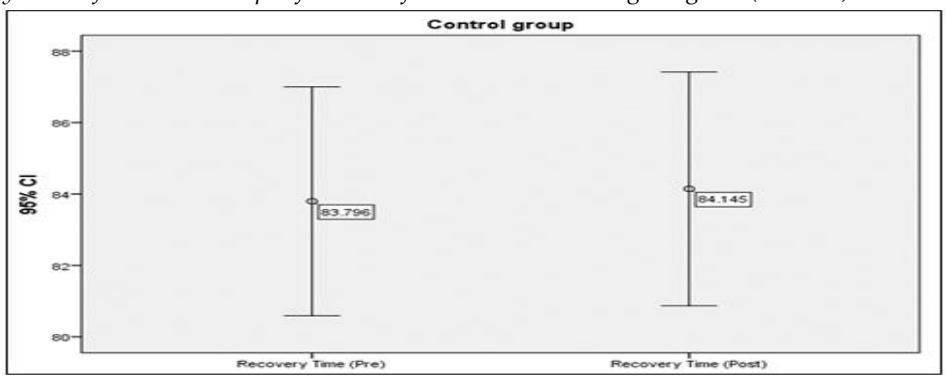
Comparison of Statistics of Recovery Time of Control Group

Group		Mean	SD	MD	p-value	Cohen's d	Mean % Dif
Control	Pre	83.79	6.84	0.34	0.213	0.28	0.42%
	Post	84.14	6.99				
Kettlebel	Pre	84.22	4.98	9.1	0.014*	0.62	10.82%
	Post	93.33	15.53				

Note: Significance Level: p<0.05*, p<0.001***, S= Standard deviation, MD= Mean difference, (Heart Rate Recovery: Total Heart Beats (within specific time))

Figure 1

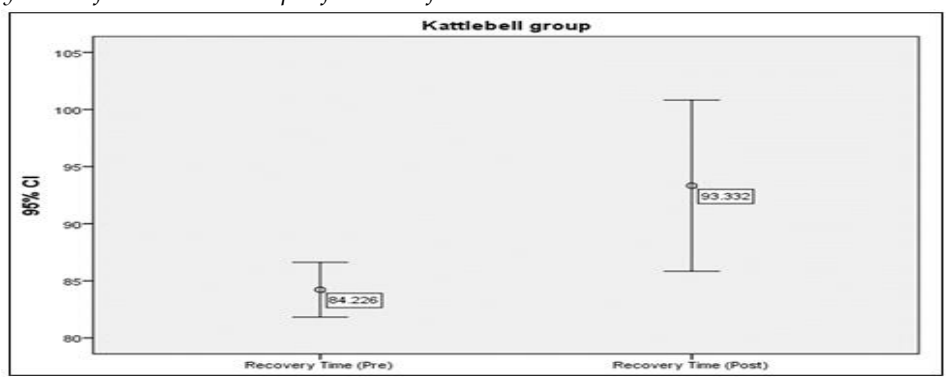
Recovery Time of Control Group before and after 12 Week Training Program (12WTP)



Note: Figure 17 displays the pre- and post-results of the control group for Recovery Time

Figure 2

Recovery Time of Kettle bell Group before and after 12 Week



Note: Figure 18 displays the pre- and post-results of the Kettle Bell group for Recovery Time

In the recovery time of pre-test Median ± SD was 84.22 ± 4.98 and post-test Median ± SD 93.330±15.530, MD =9.100, p=0.014, d=0.620) significant progress was marked with a medium effect size that revealed improvement in recovery time after 12 weeks of training. Recovery

time (86.26±5.17 ver. 105.28±4.22, MD=19.01, p<0.001, d=5.88) significantly improved with a large effect size which shows significant improvement was observed after 12 weeks of training. While observing changes in the control group, there was no significant improvement observed in recovery time (p=0.213). The Significant difference was also observed among the group regarding recovery time with a large effect size. Hence, pre-post intervention mean difference in recovery time scores indicated a 0.42% increase for control group, 10.82% for the kettlebell group.

DISCUSSION

The control group's mean recovery time showed no significant improvement (83.79 to 84.14) after the 12 weeks training program. Thus, Kettlebell group showed an increase in the mean recovery time from 84.22 to 93.33 after a 12-week training program. The comparison showed Kettlebell had higher mean recovery times after the 12WTP compared to control group, which shows that training programs involving Kettlebell exercises have vital impact upon recovery time. Several studies have explored the impact of Kettlebell training on heart rate recovery, shedding light on its positive effects on cardiovascular health. Martinez-Gomez et al. (2019) explored the acute effects of the Kettlebell training, showing significant improvements in heart rate recovery. Thus, for the study of the long-term effects, Williams et al. (2016) observed that a 12-week Kettlebell training program significantly heightened the heart rate recovery. When compared kettlebell training with conventional resistance training, they found that kettlebell training improved heart rate recovery more than conventional resistance training (Garcia et al., (2018).

The current study investigated how kettlebell training affects heart rate recovery, and results were remarkable. After following suggested kettlebell training program, participants showed a positive enhancement in heart rate recovery, increasing from an average of Mean ± SD 84.22 ± 4.98 to 93.33 ± 15.33. Statistical analysis confirmed that significant change observed, accenting a faster recovery rate after exercise. These results of current study support outcomes of previous research, strengthening objective that kettlebell workouts positively affect the body's ability to recover after physical activity. The findings of the current study support the positive impact of kettlebell training on heart rate recovery and are in line with the previous research. The study observed significant improvements in participants' recovery rates, repeating results (Schlegel et al., 2020; Paisal, Ahmad, Ansari, Verma, & Singh, 2025; and Latorre Román, Villar Macias, & García Pinillos, 2018). Taking together, this developing body of evidence emphasizes kettlebell training as an effective method for enhancing cardiovascular recovery and supporting heart health.

Summary

The primary aim of the current research study was to compare the effects of Kettlebell training on the heart rate recovery time. The study involved 40 healthy amateur players from distinct sports, who were divided into two groups. The study followed a pre-post assessment design, with pre and post measurements after a 12-weeks kettlebell training program. The hypotheses were to examine the special effects of Kettlebell training on recovery time. The null hypothesis

(HO) stated that there would be no significant effects, while the alternative hypothesis (H1) proposed significant effects. The findings consistently supported alternative hypothesis (H1), demonstrating statistically significant ($p<0.05$) effects in heart rate recovery time. In this drive, the results of the study showed that Kettlebell training had significant effects on the heart rate recovery time period. On the other hand, in the control group, no significant effects were thus observed.

CONCLUSION

Heart rate recovery time is an important indicator of physical fitness. Kettlebell training can positively influence. The results from our study indicate that incorporating kettlebell exercises into training programs may accelerate quicker recovery in participants. However, to fully understand the long-term effects and broader benefits of kettlebell training, further research is needed across diverse populations and sports contexts. These results indicate that the kettlebell training not only improves the overall fitness but also enhances cardiovascular recovery. This would provide deeper understandings into its potential for enhancing cardiovascular recovery and fitness.

Recommendation

1. In today's competitive sports circumstances, athletes often face packed schedules with back-to-back competitions, allowing inadequate time for identifiable rest or focused skill development. To help athletes stay prepared and recover effectively, it is very critical to implement smart, targeted training methods. These methods can help manage physical and mental demands of frequent competition while supporting long-term performance and well-being.
2. In demanding sports landscape, where athletes move rapidly from one competition to the next, finding time for proper recovery and skill development is increasingly difficult. To sort out this matter, incorporating kettlebell training into regular athletic routine training exhibits effective and practical solution. Kettlebells are cost-effective, portable, and versatile, making them ideal for travel-heavy schedules. Their convenience allows athletes to maintain consistency in training regardless of location, which is crucial in managing limited preparation windows.
3. The uniqueness of key strengths of kettlebell training lies in its ability to target multiple components of fitness concurrently strength, endurance, balance, and coordination. This multidimensional approach offers solid foundation for enhanced athletic performance. In this drive, the research supports the use of functional resistance tools like kettlebells to improve general physical preparedness and reduce injury risk (Jay et al., 2013; Otto et al., 2012). Furthermore, kettlebell exercises do not require expensive or space-consuming tools, they offer an equitable option for athletes with limited access to advanced training facilities.
4. Kettlebell training is effective in boosting conditioning and metabolic performance. This method offer a dynamic training spur with the minimal equipment, making it ideal for improving cardiovascular endurance. Thus, studies have shown that such high-intensity functional training can yield significant improvements in aerobic and anaerobic capacity

(Falatic et al., 2015; Smith et al., 2017). This makes the kettlebell suitable alternatives to traditional gym-based workouts, particularly whenin the training time and resources are limited.

5. In conclusion, for athletes navigating tight competition calendars and limited training opportunities, kettlebell training offers strategic, research-backed approach to behind and enhancing performance. Its inclusion supports holistic fitness development while accommodating the logistical challenges faced by modern athletes. Combining kettlebell work with other portable tools like battle ropes represents practical and innovative way to adjust training. This approach underlines synergy amid performance enhancement, innovation in training design, accessibility, critical elements in today high-performance sport environment.

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