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To Compare Effects of High Intensity Interval Training and Plyometric Training on Agility in Intermediate Kumite Karate Players by the End of 6 Weeks: A Comparative Study.

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Abstract

Background: Karate kumite is a fast-paced sports requiring agility, speed, co ordination and balance, literature has proven that plyometric training and high intensity interval training is proved to improve the athletics performance. But limited evidence is available on comparing agility in intermediate kumite players.

Aim: to compare the effect of plyometric training and HIIT on agility in intermediate kumite players a comparative study.

Methodology: a comparative study was conducted on 40 individuals with kumite karate players aged between 10 to 15 years of age. The individuals were selected using convenient sampling. The participants were allocated into two groups (n=20 each). Group A received plyometric training, while Group B received underwent HIIT protocol both the groups trained twice weekly for two weeks with duration of each session lasting for 60 mins. Baseline assessment was performed and post treatment assessment was done using paired and unpaired t test.

Results: Group A and Group B showed significant improvement in agility following the intervention. Group A participants showed slightly better results as compared to Group B. from 14.76 ± 0.63 seconds to 12.89 ± 0.57 and 14.75 ± 0.40 seconds to 14.61 ± 0.41 respectively ($t = 11.79$, $p < 0.001$).

Conclusion: both group showed significant results, however group A that is plyometric training showed significant improvement in intermediate kumite karate players.

Keywords*: Karate, Kumite, Agility, Plyometric Training, High-Intensity Interval Training, Illinois Agility Test.*

1. Introduction:

Karate is a martial art that originated in Japan, and is widely practiced across the world including India. The practice of karate promotes discipline, respect, self-control and personal development. The further division of the karate is into two types Kata and Kumite. Kata involves performing a sequenced movement pattern and techniques with precision position and posture showing traditional aspect of

martial arts. Whereas kumite is a fighting technique under karate, where two opponents engage in controlled sparring with the scoring point. Due to dynamic and competitive nature kumite, the athlete devotes in skill development, speed agility and tactical movements this is to be done to enhance performance during competition.

Agility it is the ability of an individual to swiftly change the direction of the body while maintaining speed, coordination, balance. Which is the key component requiring for the kumite performance and changing situation during competition [1].

Plyometrics it is defined as a training form done to improve muscular power by enabling muscle to generate maximum explosive performance which is needed for effective kicking, punching and rapid directional changes in Kumite [4]

High-Intensity Interval Training (HIIT) this involves alternating short period of vigorous exercises with brief recovery intervals. This type of training improves cardiovascular fitness, speed, and overall athletic performance making it beneficial for Kumite [5].

Operational Definitions:

Intermediate Kumite Karate Player:

An intermediate karate kumite player is someone who has progressed beyond the beginner level and possesses a solid understanding of basic techniques and principles of sparring (kumite). This player typically has experience in applying techniques in a controlled setting, understands timing, distance, and strategy, and can execute various offensive and defensive moves with improved skill and confidence. They are also likely to have participated in competitions and are continuing to refine their abilities through practice and training.

2. Methodology:

After obtaining approval from the Institutional Ethical Committee of PES Modern College of Physiotherapy, the study was conducted in karate coaching institutes in and around the city. The participants were screened according to the inclusion and exclusion criteria and were recruited for the study after obtaining written assent from the participants and consent from their parents or guardians. The target population for this comparative study consisted of intermediate Kumite karate players between the age group of 10 to 15 years. The total duration of the study was 6 months.

A total sample size of 40 participants was selected using convenient sampling method. The study included both male and female intermediate Kumite karate players with belt levels ranging from Orange to Brown belt. Participants practicing karate for a minimum duration of 1 year and maximum duration of 3 years, having Illinois Agility Test values between 13.0 seconds and 16.0 seconds, and Body Mass Index (BMI) within normal range (14.5–23.5 kg/m²) were included in the study.

The exclusion criteria for the study included participants with any upper limb or lower limb soft tissue injuries such as sprains, strains, or bursitis in the past one month, history of surgery or fractures in the past six months, and cardiorespiratory pathologies such as asthma or chronic obstructive pulmonary disease (COPD). Participants who were irregular for training sessions, beginner or professional karate players, and those involved in any other training sessions or exercise programs apart from HIIT or plyometric training were also excluded from the study.

The material required for the study are as follows pen, assessment form, measuring tape, stopwatch, and cones for agility testing the individuals were voluntarily enrolled the detailed information regarding demographic data will be recorded. The individuals can withdraw anytime from the study and the confidentiality of the study is maintained throughout the study.

3. Outcome Measures:

Illinois Agility Test (ICC = 0.96)

This test is reliable on field for testing and measuring speed, agility i.e rapid change of the direction. The test has ICC value of 0.96 the test is conducted on a 10 m by 5 m course marked by 8 cones. The total time taken to complete the course was recorded in seconds using stopwatch lesser time indicates better agility. The Illinois Agility Test performance values were interpreted as follows: excellent for scores below 13.0 seconds, above average for scores between 13.0 and 14.0 seconds, average for scores between 14.0 and 15.0 seconds, below average for scores between 15.0 and 16.0 seconds, and poor for scores above 16.0 seconds. As shown in figure 1.

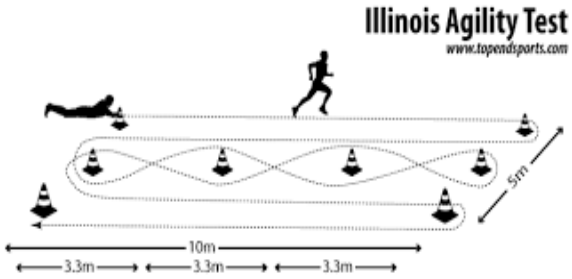


Figure 1: Procedure of the test.

4. Procedure:

• The study was initiated after presenting the synopsis before the Institutional Ethical Committee of PES Modern College of Physiotherapy.
• Ethical clearance was obtained from the committee prior to commencement of the study.
• Participants were screened and selected according to the inclusion and exclusion criteria.
• The study procedure was explained to the participants in groups, and written assent forms were obtained from the participants along with consent from their parents or guardians.
• A total of 40 participants were recruited and divided into two groups consisting of 20 participants each. Group A received Plyometric Training and Group B received High-Intensity Interval Training (HIIT).
• Materials used for the study included assent forms, pens, evaluation sheets, measuring tape, stopwatch, and eight cones.
• For the Illinois Agility Test setup, a rectangular area measuring 10 meters in length and 5 meters in width was marked using cones.
• Four cones were placed at the corners to outline the testing area, and four additional cones were positioned at the centre in a straight line with a spacing of 3.3 meters between each cone.
• Prior to the intervention, pre-test agility assessment was performed for both groups using the Illinois Agility Test.
• During the test, the participant started in a prone position at the starting line with hands placed near the shoulders.
• On the command of the timer, the participant stood up and sprinted 10 meters toward the opposite end and returned back to the starting line.
• The participant then weaved through the center cones in a zigzag pattern toward the far end, turned around, and weaved back through the cones before completing the final 10-meter sprint to the finish line.
• The total time taken to complete the test was recorded in seconds using a stopwatch.
• Group A underwent Plyometric Training for a duration of 6 weeks, while Group B underwent HIIT training for 6 weeks.
• The training sessions were conducted twice weekly for 60 minutes, including proper warm-up and cool-down exercises, with a minimum interval of 48 hours between sessions.

• After completion of the 6-week intervention program, post-test assessment using the Illinois Agility Test was carried out for both groups.
• The obtained data were recorded, documented, and analysed using appropriate statistical methods.

5. Protocol:

A. Plyometric Training Protocol [3]

Training weeks	Plyometric drills	Sets	Repetitions
Week 1	• Side to side ankle hops • Standing jump and reach • Front cone hops	• 2 • 2 • 5	• 15 • 15 • 6
Week 2	• Side to side ankle hops • Standing jump and reach • Lateral jump over barrier • Double Leg hops	• 2 • 5 • 2 • 5	• 15 • 6 • 15 • 6
Week 3	• Side to side ankle hops • Standing jump and reach • Lateral jump over barrier • Double Leg hops • Lateral cone hops	• 2 • 4 • 2 • 3 • 2	• 12 • 6 • 12 • 8 • 12
Week 4	• Diagonal cone hops • Standing long jumps with lateral sprint • Lateral cone hops • Single leg bounding • Lateral jump single leg	• 4 • 4 • 2 • 4 • 4	• 8 • 8 • 12 • 7 • 6
Week 5	• Diagonal cone hops • Standing long jumps with lateral sprint • Lateral cone hops • Cone hops with 180-degree turn • Single leg bounding • Lateral jump single leg	• 2 • 4 • 4 • 4 • 4 • 2	• 7 • 7 • 7 • 7 • 7 • 7
Week 6	• Diagonal cone hops • Hexagon drill • Cone hops with change of direction sprint • Double leg hops • Lateral jump single leg	• 2 • 2 • 4 • 3 • 4	• 12 • 12 • 6 • 8 • 6

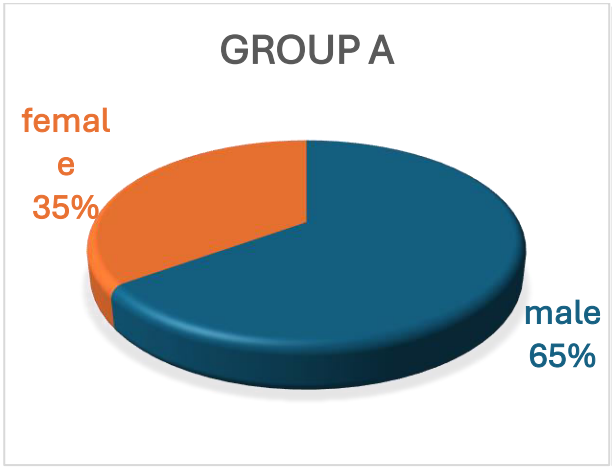
B. High Intensity Interval Training Protocol [5]

Week	Exercise material	Exercise dosage
1-2	Post 1: Explosive push up Post 2: Long jump Post 3: V sit up Post 4: Punch technique Post 5: Superman twist Post 6: Diamond push up Post 7: Box Cross-over jump Post 8: Crunch Post 9: Kick technique Post 10: Burpee	Set: 2 Work time: 15seconds Interval: 30 seconds Recovery: 5 minutes
3-4	Post 1: Push up Clapping Post 2: Lateral hurdle jump Post 3: Supine Medicine Ball Core Pass Post 4: Kick technique Post 5: Backup Post 6: Triceps Dip on Chair Post 7: Split jump Post 8: Leg raises Post 9: Punch technique	Set: 2 Work time: 20 seconds Interval: 40 seconds Recovery: 5 minutes
5-6	Post 1: Medicine Ball Chest Pass in Wall Post 2: Hurdle Jump Post 3: Punch and kick techniques Post 4: Medicine Ball sit ups chest pass Post 5: Box-off and long Post 6: Punch and kick techniques Post 7: Resistance Band Row (Yellow) Post 8: Resistance Band Squat Jump (Yellow) Post 9: Punch and kick techniques	Set: 2 set Work time: 20seconds Interval: 40 seconds Recovery: 5 minutes

6. Data Analysis and Statistical Analysis:

In this study 40 individuals were trained for 6 weeks with Plyometric training and HIIT respectively and assessed with Illinois agility test (pre and post protocol). Data was collected and entered in excel spread sheet, tabulated and subjected to statistical analysis.
Results for group A and B were analysed and then post values of both were compared for the results.

Graph 1: Gender wise distribution



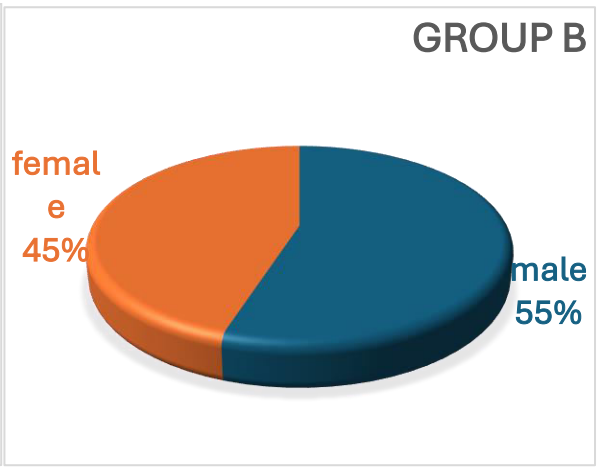


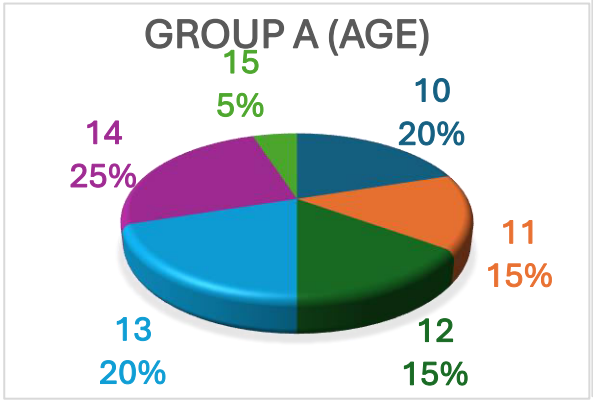
Table 1: Gender wise distribution

Group A	Male	Female
Percentage %	65%	35%

Group B	Male	Female
Percentage %	55%	45%

Interpretation: Group A had more males (65%) than females (35%), while Group B showed a relatively balanced distribution with (55%) males and (45%) females.

Graph 2: Age wise distribution



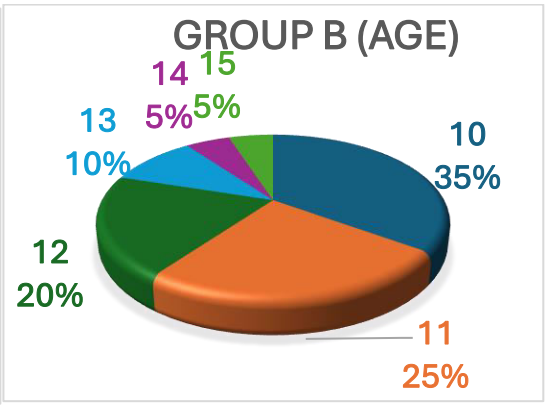


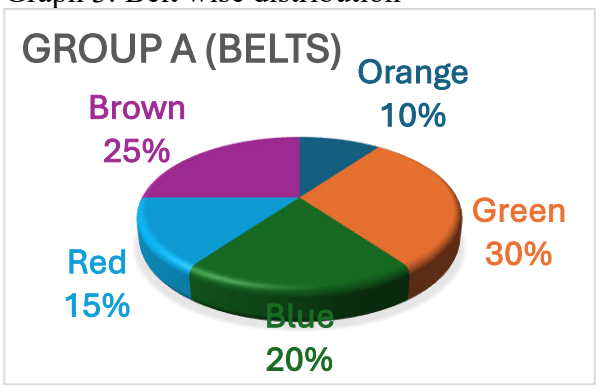
Table 2: Age wise distribution

Age category (A)	Percentage %
10	20%
11	15%
12	15%
13	20%
14	25%
15	5%

Age category (B)	Percentage %
10	35%
11	25%
12	20%
13	10%
14	5%
15	5%

Interpretation: Both groups show similar age distribution, with Group A having more 14-year-olds and Group B having more 10-year-olds.

Graph 3: Belt wise distribution



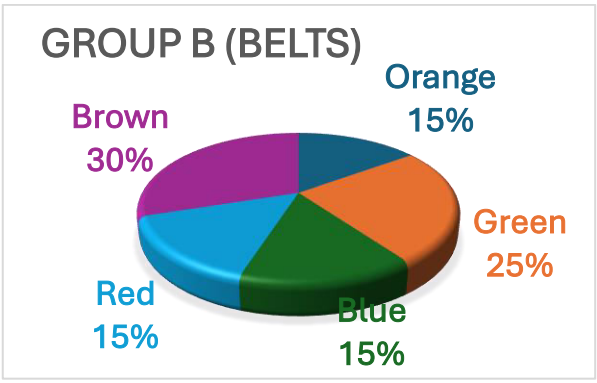


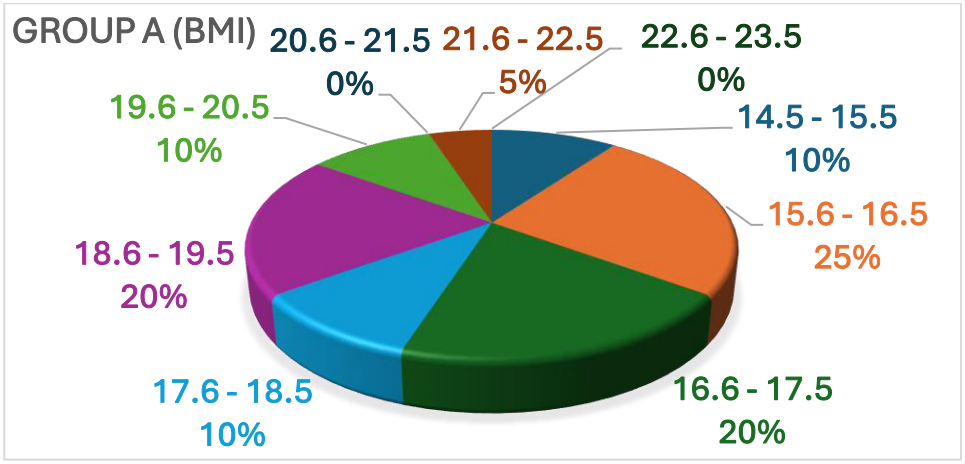
Table 3: Belt wise distribution

Group A	
Belt	Percentage %
Orange	10%
Green	30%
Blue	20%
Red	15%
Brown	25%

Group B	
Belt	Percentage %
Orange	15%
Green	25%
Blue	15%
Red	15%
Brown	30%

Interpretation: Group A shows a higher proportion of green belts, while Group B is dominated by brown belts, indicating a relatively higher skill level in Group B.

Graph 4: BMI wise distribution



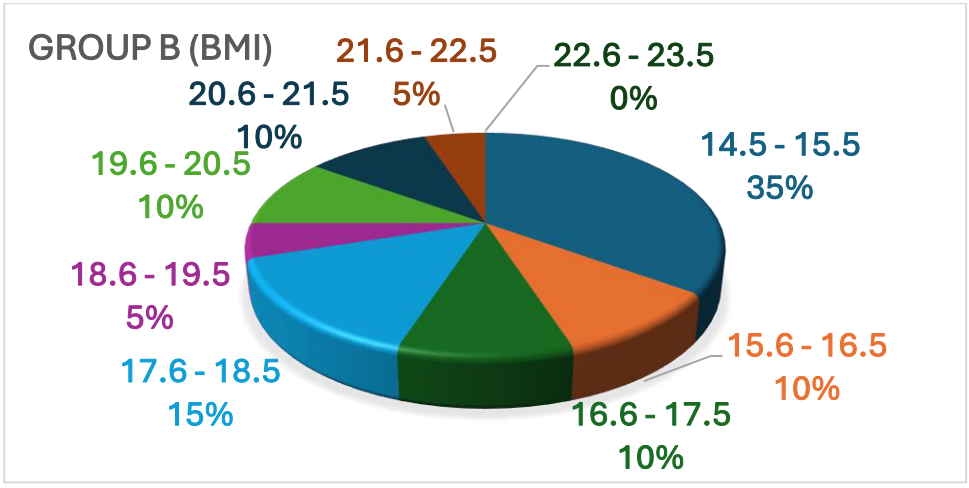


Table 4: BMI wise distribution

Group A (BMI)	
BMI	Percentage%
14.5 - 15.5	10%
15.6 - 16.5	25%
16.6 - 17.5	20%
17.6 - 18.5	10%
18.6 - 19.5	20%
19.6 - 20.5	10%
20.6 - 21.5	0%
21.6 - 22.5	5%
22.6 - 23.5	0%

Group B	
BMI	Percentage %
14.5 - 15.5	35%
15.6 - 16.5	10%
16.6 - 17.5	10%
17.6 - 18.5	15%
18.6 - 19.5	5%
19.6 - 20.5	10%
20.6 - 21.5	10%
21.6 - 22.5	5%
22.6 - 23.5	0%

Interpretation: Group A mainly falls in the mid BMI range (15.6 – 19.5), while Group B shows a higher proportion of lower BMI values (14.5 – 15.5).

7. Results:

Graph 5: Pre and post results of Group A – Plyometric Training.

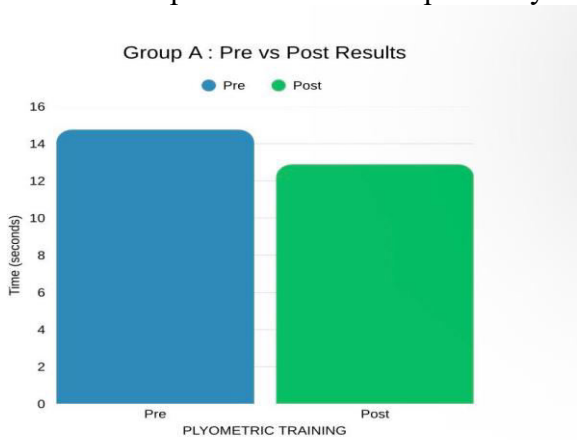


Table 5: Pre & post results of Group A & Group B.

Group	Data	N	Mean	Median	SD	SE	T test	P value	Result
Group A	Pre	20	14.76 s	14.64 s	0.63	0.14 s	21.32	$p < 0.001$	Significant
	Post		12.89 s	12.93 s	0.57	0.13 s			

Interpretation: Group A showed a significant improvement in agility after the intervention, with reduced mean time.

Graph 6: Pre and post results of Group B – HIIT

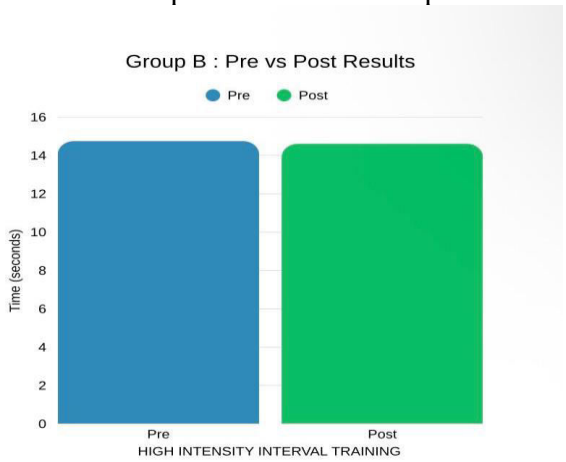


Table 6: Pre & post results of Group B.

Group	Data	N	Mean	Median	SD	SE	T test	P value	Result
	Pre		14.75 s	14.69 s	0.40	0.08		p < 0.001	Significant
Group B	Post	20	14.61 s	14.56 s	0.41	0.09	18.79		

Interpretation: Group B showed minimal change despite statistical significance in agility after the intervention.

Graph 7: Mean post results of Group A and Group B.

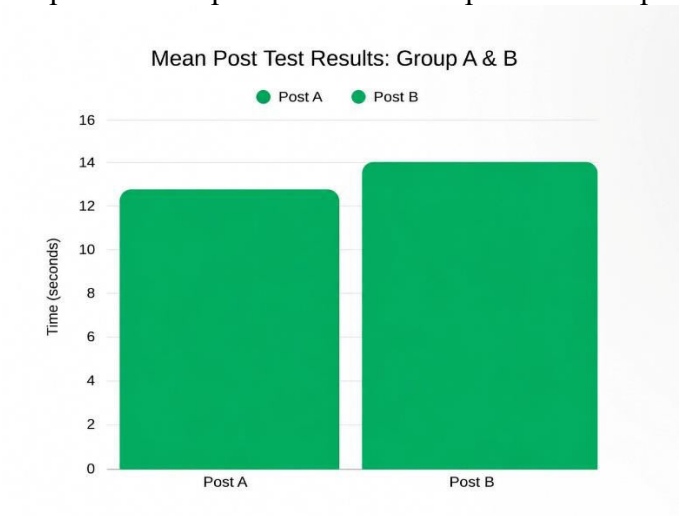


Table 6: Mean post results of Group A & Group B

Group	N	Mean (Post)	SD	T test	P value
Group A	20	12.89 s	0.57	11.79	p < 0.001
Group B	20	14.61 s	0.41		

Interpretation: The comparison of post-test mean agility scores between the two groups show that Group A achieved a significantly lower mean time (12.89 seconds) than Group B (14.61 seconds), with a T-test value of 11.79 and a p-value less than 0.001. This significant difference indicates that the intervention used for Group A was much more effective in improving agility compared to the intervention for Group B.

- This present study was conducted to find out which approach i.e. HIIT or Plyometric training is more significant than other as both have showed significant improvement in perspective protocol training for agility in kumite players.
- A total number of 40 participants were included in the study between the age of 10 to 15.
- The pre and post intervention scores of both groups were analysed using SPSS Software with help of paired t-test.
- The p values for both groups were <0.05, hence significant.
- Then both post values were compared with unpaired t-test and results showed the difference that is statistically significant ($t(38) = -11.79$, $p < 0.001$), indicating a real difference between groups.
- Although the improvement was statistically significant ($p < 0.001$). It suggests that HIIT contributed to agility enhancement, but its impact was not as pronounced as plyometric training.

- The post-test mean agility time for Group A (12.89s) was significantly faster than Group B (14.61 s), i.e. (1.72 s) difference.

The results were statistically significant with $p < 0.001$, confirming the acceptance of the null hypothesis (H1) that there is a significant difference between the two training methods. Proving plyometric group more significant than HIIT.

8. Discussion:

The present study was conducted to compare the effect of HIIT and Plyometric training on agility in intermediate kumite karate player by the end of 6 weeks. In this study, total 40 participants both male (24) and female (16) were included with the age group of 10 to 15 years old. The numbers of male subjects were more than female subjects in the study.

The Group A was given Plyometric training protocol for 6 weeks, twice a week for 60 minutes per session. The Group B was given HIIT protocol for 6 weeks, twice a week for 60 minutes per session.

According to the study conducted within group A and B, both HIIT and plyometric training improved agility; plyometrics produced slightly more gains in reactive change of direction while HIIT better preserved agility under repeated-effort fatigue [4],[7].

Relevant studies have found that the HIIT exercise method that includes plyometric exercise movement improves physical performance more than the HIIT method that does not include plyometric exercise movement (Racil, 2015). As a result, the HIIT approach has a substantial impact on boosting arm muscular strength, leg muscle power, agility, and anaerobic endurance in karate athletes in the periodized Kumite category. Relevant studies have shown that specific physical exercises combining plyometrics, medicine ball, and resistance band movements with high intensity and moderate and low volume settings performed three times per week for four weeks have a significant impact on aerobic endurance and anaerobic power (Kostikiadis et al., 2018).[3]

The mechanism of plyometrics training primarily improves agility by enhancing explosive power, muscle strength, and neuromuscular coordination through rapid stretch–shortening cycles of the muscles. It trains the body to generate maximum force in minimal time, which directly improves quick directional changes and reaction speed.

HIIT enhances agility more indirectly by improving cardiovascular endurance, anaerobic capacity, and recovery efficiency between high-intensity actions. [6]

High-intensity interval training (HIIT) is an exercise method with the complex goal of boosting the physical component of athletic accomplishment (Buchheit & Laursen, 2013). The HIIT training method involves performing high-intensity physical activities with short recovery periods before resuming high-intensity exercises (Sabag et al., 2021). This corresponds to the energy system utilized by Kumite athletes. When athletes attack with punches and kicks or defend, they use high-intensity motions. When the referee is dismissed or when doing static movements, the movements are performed with a low to moderate intensity. This suggests that the energy system is inherently compatible with kumite competition. As explained in the prior research, Kumite has the characteristics of forceful and fast motions, as well as movements that are performed sporadically, and then there are pauses (Yudhistira et al., 2021b). This is an anaerobic energy system. The anaerobic energy system plays a crucial role in Kumite attack and defense; therefore, aerobic, anaerobic combination training, and special methods are essential in building Kumite athletes' physical fitness, particularly in special periodization that concentrates on the dominant bio motor component (Yudhistira et al., 2021b). Anaerobic power, agility, and endurance are the dominant bio motor components that are used in Kumite competitions (Yudhistira et al., 2021b). Of course, the training program is tailored to the method to be utilized and the prominent bio motor component. According to the movement pattern, Kumite has a very fast movement with a brief pause and is adjusted to the actual match technique, however, it is not as comparable to the technique in the match, physical exercise must refer to muscle contraction and the essential needs in Kumite athletes (Beneke et al., 2004; Chaabène et al., 2015). Therefore, the HIIT method adapted to the movement pattern of the competition to improve anaerobic power, agility, and endurance in Kumite athletes in a special period is important to apply.[5]

While HIIT builds overall conditioning and speed endurance, plyometric exercises target the explosive movements that are more closely related to agility performance. This explains why plyometric training produced greater improvement in this study.
Hence comparison of both groups was done and showed a statistically significant difference between the effects of plyometric training and HIIT. From the results obtained it makes evident that players in group A had better results than in group B after training. Therefore, plyometric training is more effective in improving agility in kumite players.

9. Conclusion:

The present study concludes that Plyometric training shows more better results than High Intensity Interval Training in agility after 6 weeks of intervention training of karate athletes in kumite category.

11. Figures:

1. Lateral cone hops

2. Standing jump and reach

3. Kick Technique

4. Burpees

12. References:

1) Reliability and validity of karate agility test, Monika Czaková, Jaroslav Broďáni ISSN: 2456-5067 Received: 21-03-2022, Accepted: 06-04-2022, Published: 22-04-2022 Volume 7, Issue 2, 2022, Page No. 72-77

2) The Effects of a 6-Week Plyometric Training Program on Agility. Micheal G Miller, Jeremy J. Herniman, Mark D. Richard. J Sports Sci Med. 2006 Sep; 5(3): 459–465. Published online 2006 Sep 1. PMCID: PMC3842147 PMID: 24353464

3) Effect of a 6-week plyometric training on power, muscle strength, and rate of force development in young competitive karate athletes. Published online: June 30, 2020. DOI:10.7752/jpes.2020.04236

4) The Effect of Plyometric Training on the Power and Reactive Agility of Karate Athletes. Danardono1, Agus Kristiyanto1, Sapta Kunta Purnama1, Tomoliyus2, *, Nevita Ariani. International Journal of Human Movement and Sports Sciences 11(2): 378-387, 2023 http://www.hrpub.org DOI: 10.13189/saj.2023.110215

5) High-intensity interval training method in karate athletes: Can it improve power, agility, and endurance in the Kumite category? Hadi, Dewangga Yudhistira. Vol. 8. No. 1. April, (2023) Received: 08October2022; Accepted 30January2023; Published 18February 2023Ed 2023; 8(1): 43-51

6) Effects of High Intensity Interval Training on Increasing Explosive Power, Speed, and Agility.: F Fajrin et al 2018 J. Phys.: Conf. Ser. 947 012045.

7) Effects of plyometric training on lower and upper extremity power in karate practitioners. Magdalena Nowakowska, Marek Zatoń, Iwona Wierzbicka-Damska. Department of Physiology and Biochemistry, Academy of Physical Education, Wrocław, Poland. Journal of Combat Sports and Martial Arts © MEDSPORTPRESS, 2017; 2(2); Vol. 8, 89-93 DOI: 10.5604/01.3001.0010.8674.

8) The effects of plyometric exercises on repeated strength and power performance in elite karate athletes. SPYROS MARGARITOPOULOS1; APOSTOLOS THEODOROU2; SPYROS METHENITIS3; NIKOS ZARAS4; OLYVIA DONTI5; CHARILAOS TSOLAKIS6 Journal of Physical Education and Sport (JPES), 15(2), Art 47, pp. 310 318, 2015 online ISSN: 2247 806X; pISSN: 2247 – 8051; ISSN L = 2247 8051 © JPES.

9) Age-Related Changes in Agility Time in Children and Adolescents Erika Zemková1, Dušan Hamar2 International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 Impact Factor (2012): 3.358

10) GENDER-SPECIFIC INFLUENCES OF BALANCE, SPEED, AND POWER ON AGILITY PERFORMANCE OF KARATE PLAYERS WMNS Wijethunga, LMD Perera Department of Sports Science, Faculty of Applied Sciences, University of Sri Jayewardenepura On 28th February 2021 http://www.research.lk
11) A Perspective on High-Intensity Interval Training for Performance and Health. Alexandra M. Coates1, Michael J. Joyner2, Jonathan P. Little3, Andrew M. Jones4, Martin J. Gibala1 Sports Medicine (2023) 53 (Suppl 1): S85–S96 https://doi.org/10.1007/s40279-023-01938-6

12) The Effects of Plyometric Training and Age on The Agility of Silat Fighters. Rodhi R. Hidayat. Copyright © 2018, the Authors. Published by Atlantis Press. The CC BY-NC license (http://creativecommons.org/licenses/by-nc/4.0/).

13) A cross-sectional study to assess agility skills of kumite karate players aged 15-20 years in Mumbai suburban area. Rigved Chindarkar, Suramya Sharma, Ajay Kumar. International Journal of Health Sciences and Research 11 (9), 252-258, 2021

14) Effects of High-Intensity Interval Training With Specific Techniques on Jumping Ability and Change of Direction Speed in Karate Athletes: An Inter-individual Analysis. Alex Ojeda-Aravena1,2*, Tomás Herrera-Valenzuela3, Pablo Valdés-Badilla. BRIEF RESEARCH REPORT published: 18 November 202. doi: 10.3389/fphys.2021.769267