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Impact Of High-Intensity Interval Training On Grip Strength Of Judokas

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ABSTRACT

This study explores the impact of a six-week High-Intensity Interval Training (HIIT) program on grip strength among male judokas aged 18 to 25. Twelve state-level athletes were selected from the Lakshmibai National Institute of Physical Education (LNIPE), Guwahati, and randomly divided into experimental (n = 6) and control (n = 6) groups. The experimental group underwent HIIT combined with regular judo training, while the control group followed only the standard routine. Grip strength was measured using a handheld dynamometer before and after the intervention. The results revealed a statistically significant increase in grip strength in the experimental group ($p < 0.001$), while the control group did not demonstrate notable changes ($p = 0.076$). These findings suggest that integrating HIIT into judo training programs can effectively enhance grip strength, which is a crucial component of judo performance. The study highlights the practical value of HIIT as a focused and time-efficient method for developing grappling strength in combat sports.

KEYWORDS: High-Intensity Interval Training, Grip Strength, Judokas, Judo Conditioning, Strength Development, Combat Sports

INTRODUCTION

Grip strength plays a pivotal role in judo performance, serving as the foundation for successful execution of throws, counters, and grip control (kumi-kata). The ability to maintain a strong and enduring grip on the opponent's judogi is essential not only for offensive techniques but also for defending against attacks and controlling the pace of the match. Enhancing grip strength is therefore a key priority in the physical conditioning of judokas. High-Intensity Interval Training (HIIT) is a form of exercise characterized by repeated bursts of high-effort work followed by brief periods of rest or low-intensity activity. It has gained popularity for its efficiency in improving cardiovascular endurance, muscular strength, and metabolic function. In combat sports like judo, HIIT can be designed using sport-specific drills, making it both physiologically effective and technically relevant. This study focuses specifically on the effect of a six-week HIIT program on grip strength development in male judokas. The HIIT protocol included exercises such as towel squeezing, rope holds, and high-intensity uchi-komi, all targeting the muscular endurance and static strength of the forearms and fingers. These exercises simulate the physical demands experienced during real judo combat, thereby offering a functional training approach. Despite the widespread use of traditional strength training methods in judo, there is limited empirical evidence on the use of HIIT for improving grip strength specifically. This study aims to fill that gap by evaluating whether a structured HIIT program can produce statistically significant improvements in grip strength in a short training cycle. The results have practical implications for coaches and athletes seeking to optimize training outcomes within limited timeframes.

METHODOLOGY

This study employed a **pre-test–post-test control group design** to investigate the impact of a six-week High-Intensity Interval Training (HIIT) program on the grip strength of male judokas. Participants were randomly assigned to either an experimental group, which engaged in HIIT alongside their regular judo training, or a control group, which continued with their standard judo training routine. Grip strength measurements were taken before the intervention (Week 0) and after its completion (Week 6) to assess the training effect. The sample consisted of twelve male judokas, aged between 18 and 25 years, who were purposively selected from the Lakshmibai National Institute of Physical Education (LNIPE), North-East Regional Centre, Guwahati. All participants had prior competitive experience at the state level and were actively involved in structured judo training. The experimental group (n = 6) participated in a six-week HIIT program integrated with their existing training, while the control group (n = 6) followed only their regular training regimen. Informed consent was obtained from all participants, and the study was conducted in accordance with institutional ethical standards for human research.

The primary variable under investigation was grip strength, assessed as the **dependent variable**, while the **independent variable** was the structured HIIT intervention. Grip strength was measured using a handheld grip dynamometer, a widely recognized and reliable tool for evaluating isometric hand strength. Each participant was seated with their elbow flexed at a 90-degree angle, and the dynamometer was adjusted to match individual hand sizes. Participants performed three maximal-effort grip trials with short rest intervals, and the highest value recorded from the dominant hand (in kilograms) was used for analysis. The HIIT protocol administered to the experimental group was specifically designed to target grip and forearm strength. Conducted three times per week over a six-week period, each session lasted approximately 30 to 45 minutes and was performed at an intensity level of 75 to 80 percent of the participants' maximum heart rate (MHR). The protocol included exercises such as towel squeezing (2–3 sets of 40 seconds), static rope holds using thick climbing ropes (2–3 sets of 40 seconds), high-intensity uchi-komi drills with short rest intervals, and bodyweight pull-ups performed to failure (AMRAP). Work-to-rest ratios were gradually increased from 20:10 seconds in the first two weeks to 30:10 seconds in the final weeks. Each session began with a 10-minute dynamic warm-up and concluded with 5 to 10 minutes of light aerobic activity and static stretching. The control group continued their regular technical and tactical judo training without any additional HIIT elements.

All grip strength testing was conducted in the same indoor training facility under controlled environmental conditions and supervised by the researcher to ensure standardization. Data collected from the pre- and post-tests were analyzed using **paired sample t-tests** to examine within-group differences. Descriptive statistics, including mean and standard deviation, were computed for both groups. Statistical significance was set at $\mathbf{p < 0.05}$, and all data analysis was performed using **SPSS software (version 25.0)**.

RESULTS

The primary objective of this study was to assess the effect of a six-week High-Intensity Interval Training (HIIT) program on the grip strength of male judokas. Pre- and post-test measurements were recorded for both the experimental and control groups, and paired sample t-tests were conducted to analyze within-group differences. A significance level of $p < 0.05$ was used. The results showed a statistically significant improvement in grip strength in the experimental group, while the control group did not exhibit a significant change.

Table 1. Effect of HIIT on Grip Strength (Dominant Hand)

Group	Test	Mean ± SD (kg)	t-value	p-value	Significance
Experimental	Pre-test	46.50 ± 4.59			
	Post-test	49.50 ± 5.24	-8.216	0.000	**Significant** ($p < 0.001$)
Control	Pre-test	45.67 ± 5.89			
	Post-test	46.17 ± 5.56	-2.240	0.076	Not Significant

The experimental group, which underwent a structured six-week HIIT protocol in addition to regular judo training, demonstrated a statistically significant increase in grip strength ($p = 0.000$), indicating that the intervention effectively enhanced hand and forearm muscular strength. This improvement is attributed to the targeted exercises included in the HIIT program, such as towel squeezing, rope holds, and high-repetition pull-ups, all of which engage grip-related musculature under load and fatigue. In contrast, the control group, which continued with routine training that did not specifically emphasize grip strength, showed no statistically significant improvement ($p = 0.076$). This finding suggests that regular judo training alone may not be sufficient to elicit measurable gains in grip strength over a short-term period.

Discussion

The findings of this study confirm that High-Intensity Interval Training (HIIT) can significantly improve grip strength in judokas over a short training period. Participants in the experimental group, who engaged in HIIT sessions alongside routine judo training, exhibited a statistically significant increase in grip strength ($p = 0.000$), whereas the control group, which maintained standard training practices, showed no significant improvement ($p = 0.076$). These results suggest that the inclusion of HIIT, particularly with sport-specific exercises such as towel squeezing, rope holds, and high-repetition pull-ups, plays a crucial role in enhancing muscular strength and endurance in the forearms and hands—critical components for effective gripping in judo. Previous studies have emphasized the value of HIIT in enhancing both general and sport-specific strength parameters in combat athletes. For instance, Franchini et al. (2016) highlighted that judo-specific HIIT protocols could improve anaerobic capacity and upper-body endurance, both of which are closely linked to grip strength. Similarly, Slimani et al. (2017) reported that upper-body isometric training combined with high-intensity effort leads to significant improvements in neuromuscular coordination and muscle recruitment. The present findings support these conclusions and extend the literature by demonstrating grip-specific gains from a short, targeted HIIT intervention. It is worth noting that the control group's lack of improvement suggests that traditional judo training may not provide adequate overload or specificity to stimulate measurable gains in grip strength within a six-week period. This reinforces the need for deliberate strength and conditioning practices to complement technical training in judo. While the results are promising, the small sample size and short duration are limitations that may affect the generalizability of findings. Future research should consider long-term HIIT interventions with larger, more diverse participant groups and include assessments of other grip-related performance outcomes such as grip endurance and fatigue resistance.

CONCLUSION

This study concludes that a structured six-week High-Intensity Interval Training (HIIT) program significantly enhances grip strength in male judokas. The inclusion of specific exercises targeting forearm and hand musculature within the HIIT format proved effective in producing measurable performance gains. These findings suggest that HIIT can serve as a practical and time-efficient strategy for improving grip strength, which is essential for judo performance. Coaches and practitioners are encouraged to integrate HIIT protocols that emphasize grip-specific training into regular conditioning programs to optimize

physical preparedness. Further research is warranted to explore long-term adaptations and to expand applications across different age groups and competitive levels.

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