# Tight Trip vs. Loose Grip on Russian Kettlebell Swing Work Capacity

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Abstract

The purpose of this study was to examine the effects of a tight grip(TG) and a loose grip(LG) on work capacity while performing Russian kettlebell swings(KBS). It was hypothesized that LG would result in an ability to perform more work. Thirty fit adults (16 male; 14 female) were tested. Two (TG and LG) separate counterbalanced trials for each subject were collected, counting the number of repetitions completed until volitional exhaustion. RPE for forearms and overall exhaustion were collected post-trial. SPSS was used to run a paired samples t-test. There was a significant difference between the two grips ($p = 0.013$)(TG reps = 160.47±96.943; LG reps = 190.73±125.824). RPE forearms ($p = 0.001$)(TG = 7.10±1.698; LG = 5.79±2.177). RPE overall was not statistically significant ($p = 0.475$)(TG= 7.59±1.211; LG = 7.45±1.152). These results suggest grip firmness impacts performance, and using a LG while performing KBS increases work capacity. Strength coaches and athletes may use LG while performing KBS to increase work capacity.

Key words: kettlebell swing, grip firmness, work capacity, muscular endurance, RPE, physiology

INTRODUCTION

Handgrip firmness and technique are a part of sport and exercise that can determine a task's success (31). Depending on the object and the intentions, the firmness and technique of the grip will vary. Performing a kettlebell swing (KBS) requires holding onto a kettlebell (KB) with one's hands using a pronated grip. How one grips the KB can potentially lead to different results. Kettlebells are among the most widely used pieces of equipment for exercise, training, and sport worldwide (30). Kettlebells are a cast iron/steel ball with a handle attached to the top. They have been used for centuries to build strength, power, and endurance (35). A KBS begins when the KB passes back and between the legs, followed by a rapid extension of the hips and knees projecting the KB upward. An American-style swing ends with the KB overhead and the bottom up, and a Russian style swing ends with the KB at chin height. A double-handed pronated grip is used when swinging a KB, entailing an isometric contraction of the forearm muscles. Whether it is a barbell, baseball bat, tennis racquet, or golf club, how one grabs or grips the implement used to complete a task can determine a task's outcome (12,31).

In weightlifting, hook grip (HG) is common practice. It is a more secure grip when performing weightlifting movements and reduces the necessary effort for the muscles of the hands, wrist, and forearms to maintain control during explosive movements (29). A successful power clean (PC) results with the barbell racked across the shoulders and thighs above parallel. A study by Oranchuk DJ Et al. (2019) compared hook grip and closed grip (CG) on sub-maximal (75%–95%) and 1-rep max (1RM) power clean. Eleven subjects able to PC weight equal to their body mass had no injuries and had at least 3 months of experience using HG were recruited. A 1RM was established, followed by 3 sessions in a lab separated by 5-7 days performed at the same time of day. Kinetic and kinematic data were measured quantitatively. Qualitative data was gathered using a 5-point Likert scale. Hook grip led to the greatest amount of weight lifted for all subjects. A 1RM PC was 6.8kg greater using HG compared to CG. Qualitative data resulted in a nonsignificant ($P \geq .13$) outcome using HG and had a small to moderate magnitude of effect (ES = 0.31 to 0.70) regarding all perceived variables at 1RM. Completing a 1RM PC using HG resulted in similar perceptions of a 1RM using a CG. If the same sub-maximal weight is being lifted using HG and CG, perceived intensity is less with a hook grip.

It is known that grip strength is strongly correlated with an increased ability to control and manipulate objects (8,12,22,37). Grip position on the golf club significantly influenced absolute accuracy ($p < .001$) and distance a ball travels ($P < .001$), demonstrating that grip technique impacts performance outcomes according to D'Arcy M. et al. (2021) (13). Grip technique, wrist action, club head mass, and shaft length profoundly affect outcomes and are well studied but lack research focusing on grip firmness (6,7,10,24). A golf study investigating 3 grip conditions (weak, neutral, and strong grip) with wrist and club kinematics revealed multiple significant ($P$= .001, $P = 0.002$, $P = 0.029$, etc.) relationships between the weak, strong, and neutral grips, further demonstrating the importance of grip technique (6). Fat grips (FG) are used to strengthen the forearms (8). A study using Division I Male Golfers implemented an 8 week resistance training program using FG to examine effects on golf performance. Training with FG had a significant increase ($P \leq 0.05$) in ball speed, carry, and driving distance when compared to a control (12). Interestingly the FG group's results indicate a significant (p = 0.022) increase in left-hand grip strength but not the right hand. Although there is no explicit mention of grip firmness, it can be assumed that grip strength increases one's range and ability to manipulate grip firmness and technique, resulting in altered performance (6,12,23,32,38).

Grip firmness impacts direction, rebound velocity, and reaction impulse on post-impact balls along with the type of golf club, baseball bat, or tennis racquet used (6,14,19,37,38). When handling a tennis racquet, the grip's intensity has meaningful effects on the ball's rebound velocity, consequential of increased dampening factors and frequency shifts within the racquet (7). Two studies concluded that grip firmness had no significant effects on post-impact ball velocity (21,40). Grabiner M. D. (1983) found no significant effects on post-impact ball velocity when using various grip firmness; however, post-impact implement control was significantly affected by the firmness of the grip. Ball velocity results were affirmed in a study by T Watanabe (20,38). However, the studies simulated a closed-loop system (14,219,34,37). Grabiner M. D. secured the racquets handle in a vice-like contraption and dropped balls from a pre-determined height (20). Elliot et al. (1982) fired tennis balls out of a ball machine at a horizontally secured racquet (14). Real world applicability of these studies may be questioned as tennis is an open-loop sport (33). There is a complex relationship between grip firmness, mass of implement, grip diameter, and material of the implement being used (7,31,37,38). An investigation examining the effects of bat composition (wooden and aluminum) and grip and firmness (TG and no-tension grip) was conducted, finding a significant ($p < 0.01$) relationship between the type of grip and bat used (38).

Work capacity is the ability to complete or continue physical work before failure and could be considered synonymous with muscular endurance (3,26). There is an upregulation in metabolic reactions when muscles contract resulting in elevated heart rate (HR) and blood pressure (BP). This is the case in rock climbers using an isometric contraction in the forearms when climbing (34). Performing KBS requires the same isometric contraction of the forearms to maintain a secure grip; thus, similar metabolic reactions and elevated HR and BP could be expected (18,34). When energy diminishes, and cellular respiration can no longer keep up with energy demands, fatigue sets in, resulting in the inability to produce more work. A study by Fung, B. J. and Shore, S. L. found that grip fatigue was the limiting factor during a maximal kettlebell stress test (17).

Gripping is the result of muscles contracting, especially the flexor digitorum profundis and flexor pollicis longus (2). Gripping a KB tightly causes muscles to contract harder and longer, increasing metabolic costs. In contrast, a looser grip may use less energy (34). Optimal technique may reduce the intensity and metabolic cost of griping a KB during KBS, potentially leading to greater work capacity. The effects of tight grip (TG) and loose grip (LG) technique on work capacity while performing KBS have yet to be examined. The purpose of this study was to see if using a tight grip or a loose grip technique while performing Russian KBS allows for an increase in work capacity. It is hypothesized that a loose grip will increase work capacity.

# METHODS

**Experimental Approach to the Problem**

The style of KBS used for this study is the Russian style swing. All participants completed 2 separate trials of Russian KBS to volitional exhaustion. The dependent variable was the Russian KB swing, and the independent variables are the two different grips (TG and LG). According to Tsatsouline, P., a 20kg KB is for a “stronger-than- average gentleman” and 12kg for a “Strong lady.” For this study, subjects were considered fit; thus, 20kg was used for males and 12kg for females (1,35). The circumference of the 12kg KB was 10cm, and the 20kg KB was 10.2cm. These were the only KB available to the researchers in kg.

A standardized warm up was used to increase the temperature of muscles, elevate HR, increase blood flow providing oxygen to tissues, facilitate neuromuscular conditioning, and enhance movement efficiency (16,27). Furthermore, to increase performance and reduce injury risk, hip-specific movements were incorporated (11,32).

**Subjects:**

A total of 33 fit males (n=17) and females (n=16) participated in this study. Two subjects did not complete the second trial, and one subject's trials did not meet the standards for a Russian KBS. The 3 subjects were removed from data analysis resulting in the final subject count used for analysis was 30 participants (males=16; females= 14).

[Insert table 1]

Full inclusion in this study required subjects to be averagely fit according to ACSM standards. ACSM standards require at least two days per week of full-body resistance training along with 3 20 minute sessions of vigorous cardiovascular exercise or 5 30-minute moderately intense sessions. (1). Subjects could have no recent musculoskeletal injury and must have experience with kettlebells. The subjects physical activities included collegiate sports, CrossFit, and recreational exercise. All subjects had previous experience conducting the Russian KBS. Approval was obtained from the University's Institutional Review Board for Human Subjects. All participants were informed about the risks and benefits before signing the institutionally approved consent and filled out a PAR-Q. Subjects were asked to refrain from intense exercise for at least 24 hours before their trial. Upon arrival, subjects signed informed consent and a Par-Q. Subject's anthropometrics were measured, including weight and BF via an InBody 770 Bioelectrical Impedance Analyzer and height via a Seca medical scale with measurement rod attached.

**Procedures**

Trials were counterbalanced, one loose grip trial and one tight grip trial separated by at least 48 hours. A HR monitor (Polar V800, Finland) was used to measure HR during trials. The same standardized warm-up was used for both TG and LG trials.

The standardized warm-up consisted of a modified Wingate protocol on a Monark 894E leg cycle ergometer consisting of four minutes at an easy intensity of 0 Watts at 60 to 70 revolutions per minute, followed by three four-second sprints at a resistance level based upon the subject's specific weight (i.e., 0.075 X their body mass in kg). The subject had 90 seconds of passive recovery followed by two rounds of 10 double leg glute bridges and 8 quadruped hip abductions (4 each leg) followed by 2 minutes passive recovery (11,33).

During the 2 minutes of rest, the grip technique was prescribed and explained. Explanations for the grips are as follows: Tight grip — hold the KB firmly in hand, limiting any movement of the handle within the hands, and keep pads of fingers and palms in contact with the handle while performing swings. Loose grip — hook the handle with fingers as loose as possible while maintaining complete control of the KB (35). After 2 minutes of passive recovery, two sets of 20 seconds of KBS separated by 30 seconds rest were performed, functioning as familiarization and warm-up. All subjects used chalk on their hands for both TG and LG.

After the final familiarization set of KBS, there were 3 minutes of passive recovery. At the end of 3 minutes, the subject performed one set of Russian KBS to volitional exhaustion at a self-determined pace. Reps were counted, and HR was recorded every 20 seconds. Once the subject reached volitional exhaustion, RPE for overall exhaustion and forearm exhaustion were recorded using the Borg CR10 scale (6).One subject's RPE was not collected, leaving 29 subjects for RPE data analysis.

## STATISTICAL ANALYSES

Data were analyzed using IBM Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA). A paired-samples *t*-test was used to compare loose grip vs. tight grip, RPE for forearms, and RPE overall. Significance was set at $p \leq 0.05$.

## RESULTS

[Insert table 2]

Results were statistically significant ($p = 0.013$) between TG (160.47±96.943 reps) and LG (190.73±125.824 reps); forearm RPE were significant($p = 0.001$) between TG (7.10±1.698) and LG (5.79±2.177). RPE overall was not statistically significant ($p = 0.475$) between TG (7.59±1.211) and LG (7.45±1.152).

## DISCUSSION

The purpose of this study was to examine the effects of using two different grip techniques (TG vs. LG) while performing a Russian KBS to volitional exhaustion and its effects on work capacity. It was hypothesized that using a loose grip would increase one's ability to produce more work by completing more repetitions. It was demonstrated that using a LG led to ~17% increase in work capacity compared to using a TG when performing one set to volitional exhaustion. The current study's results suggest that a LG increases one's ability to perform more work when doing Russian KBS when compared to a TG.

The ability to grip a KB and perform work is dependent on the body's ability to provide energy to the contracting muscles in the forearms (2,23,25,34). Stronger and more forceful contractions of muscles increase adenosine triphosphate (ATP) depletion resulting in decreased time to fatigue. In contrast, lesser contractions use less ATP, increasing the time to fatigue. Different gripping techniques may reduce or increase the amount of energy necessary to complete or continue a task (2,34). In this study, performing KBS with a LG was demonstrated to allow more work to be completed with lower RPE for forearms. RPE can estimate physiological responses such as blood lactate and the associated fatigue response when going to volitional exhaustion (20,29). Pritchett R. (2009) stated that an increased disruption of an individual's internal physiological environment when lifting weights to failure mat contributes to a higher RPE. This may be the case in forearm fatigue in the current study when using a TG.(30). The current study is unique in that there was only one set with no rest when attempting KBS repetitions to volitional exhaustion. Research examining physiological markers in conjunction with RPE during a single set of KBS to exhaustion does not exist. Regardless, there is potential that RPE in forearms using a LG indicates lower metabolic cost sense LG during KBS does have a lower RPE than TG (28,29,36). Efficiency is the ability to use minimal energy to complete a task (37). Although less efficient, using a TG may create muscular endurance adaptations in the forearm muscles based on the potential physiological responses associated with RPE (29). Research would need to be conducted to explore the potential use of TG for training adaptations. Maximizing KBS efficiency requires optimizing grip technique (28,37). The proper use of physiological and biomechanical principles may lead to greater efficiency, evidenced by lower RPE. The evidence suggests a LG technique is more efficient when aiming to maximize work capacity than a TG technique. Sports such as KB sport and CrossFit could greatly benefit from using a LG technique as they are both sports that mainly measure work capacity. As some sports and exercise activities involve gripping a KB, grip technique should be considered a pivotal point of interest in maximizing performance (28,30,31,36).

Previous research has demonstrated that HG increases many objective and subjective points of performance on submaximal (75%–95%) and1RM performance, demonstrating grip technique matters when weightlifting (29,39). However, when attempting a 1RM, HG and CG had no significant difference ($P \geq .13$) in RPE (30). This is similar to RPE overall in the current study comparing TG vs. LG KBS ($p = 0.475$). Oranchuk DJ. demonstrated that more weight can be lifted with a HG yet had no significant difference in RPE than a CG when completing a 1RM; likewise, in the current study, LG had significantly more reps and a lower RPE than TG, yet had no significant difference in RPE overall. Despite a significant difference in quantitative performance outcomes, qualitative data on all variables for HG and CG and RPE overall for TG and LG were not significant (28). This implies that grip techniques with lower efficacy result in weaker objective performance but may have the same perceived effort as better performance using more effective grip techniques. Inversely, an efficacious grip technique allows for better performance but may have a relatively equal perception of a less effective grip technique. This may have implications for overall psychophysiological strain. More energy is expended when using less efficient techniques, at least perceptually if not physiologically as well, negatively affecting desired performance and adaptations over time (20,25,26,29,34). Grip technique could impact psychological performance and physiological adaptations (20,25,26,29,34).

Quantified measures were not used to control for the firmness of grip. Instead, subjects were given verbal instructions, leaving room for interpretation. Having controls allows for greater predictability and repeatability. However, in the current study, personal interpretation of verbal instruction may be considered a strength as it is more applicable to real-world settings.

Quantifying grip firmness in competitive and training settings is not practical in many cases. In future studies, grip firmness could be quantified (12,13). A single set performed to volitional fatigue using KBS is not typically found in many sports, bringing into question the current protocol's meaningfulness. KB sport and CrossFit are two sports that often require high numbers of reps with minimal rest if any. Using LG is less fatiguing in the forearms, potentially having performance benefits (4,30,34). According to RPE, a single set performed to complete exhaustion could provide immediate time-efficient physiological insight into the potential of LG having a lower metabolic cost (20,29). Muscular endurance is vital in many sports as there are repeated bouts of effort with minimal rest. Most sports do not specifically require the use of KB; however, KB sport and CrossFit do. When using KB for training or competition, forearms can be the limiting factor (17). Data from the current study suggests that LG is less fatiguing to the forearms and allows for more work to be completed before exhaustion, potentially making the LG technique more advantageous in training and competition settings.

## PRACTICAL APPLICATIONS

KBS are one of the most beneficial exercises for increasing overall fitness that emulates many sport-specific movements. Sports like KB sport and CrossFit that focus on work capacity when using KB may benefit from using a LG when using a KB (4,15,35,36). LG increases the number of repetitions one can complete before exhaustion while preserving the forearms. This may prove beneficial when training to increase muscular endurance. KBS with a LG may provide greater adaptations for increasing overall work capacity and reduce strain on the forearms (20,29,31).

KBS using the LG technique may improve training and sport while reducing injury risk by increasing work capacity and limiting fatigue. LG may improve performance in sports incorporating KB. KBS with a LG may serve as a field test to measure athletes' work capacity/muscular endurance. This study provides further evidence to the current literature that grip technique can significantly impact performance outcomes (2,6,7,12,14,19,22,28,31,34,37,38).

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