The use of Ki to "pysch-up" and increase strength

by

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ABSTRACT

In many modern sports where an explosion of power/strength is necessary, such as weight lifting, shot put, and tennis, athletes often yell or grunt to “psych-up” and improve performance. Martial artists have been using a similar technique for centuries called a “kiap”. Unfortunately, there is little scientific evidence that yelling or kiaping improves performance. Therefore, this study examined the effect of kiaping on strength during a handgrip exercise in novices and experts. Fifty participants (25 novice and 25 expert martial artists) completed a handgrip strength test under three conditions, a baseline test, a no kiap control condition, and a kiap condition. Strength increased by a mean of 8% ($p < 0.001$) for the combined expertise levels in the kiap condition compared to the baseline and no kiap conditions. There was also a significant interaction ($p < 0.05$) between expertise level and condition, with a medium effect size of 0.48 for novices and a small effect size of 0.25 for experts. The results of this study indicate that the kiap may increase hand grip strength in participants with as little as two months of training, benefiting novices slightly more than experts, and additional training may not result in further increases in strength.

CHAPTER 1: INTRODUCTION

A key factor in sports performance is the performer's level of arousal. In particular, lower levels of arousal have been theorized to be optimal for sports that require more fine motor control, like golf, and higher levels of arousal appear to be optimal for explosive sports like weightlifting and boxing (Oxendine, 1970). Athletes often use some form of 'psyching-up' technique in order to increase arousal in an attempt to facilitate performance (Perkins, Wilson & Kerr, 2001). The term 'psyching-up' can be defined as the use of cognitive and/or somatic techniques, designed to enhance performance, before or during competition (Tod, Iredale & Gill, 2003). These techniques include but are not limited to focusing attention, imagery, positive self-talk, and arousal regulation (Tod et al., 2003). One psyching-up technique, used for centuries by martial artists, appears to have been completely overlooked by sport psychology researchers. This technique is known as "Ki" or "inner energy" (Tedeschi, 2000).

Ki is a psychophysical energy that is believed to be located approximately two inches below the navel in an area called the tanden (Nagatomo, 2002; Seitz, Olsen, Locke & Quam, 1990). Ki is released and flows throughout the body through the use of simple breathing techniques, the most basic being the sharp exhalation of air in the form of a yell or grunt (Tedeschi, 2000). This yell is called a "kiap" in Korean martial arts, a term that will be used in this study to refer to the use of Ki as a psyching-up technique. According to tradition, both novices and experts can increase force during dynamic physical movements through the coordination of the mind and body through the kiap (Tedeschi, 2000). Use of the kiap is evident at the elite level in many modern sports where an explosion of energy is necessary, such as power lifting, track and field during a shot put

or javelin throw, as well as the martial arts. In fact, the use of a similar technique amongst professional tennis players has sparked recent debates and calls to place a restriction on its use because of the distraction it can cause other players (Jha, 2005).

Unfortunately, scientific research on the use of psyching-up techniques to increase power is very limited. In the case of the kiap, experimental research appears to be non-existent. A few studies have experimentally examined both prescribed and self-selected psyching-up techniques to determine if they improve performance, but have found mixed results (Tod et al., 2003). The exception appears to be the positive use of psyching-up techniques to enhance performance of dynamic physical tasks such as the bench press exercise. There is also disagreement as to whether these positive results were the function of psychological, physiological, or mechanical changes produced by the psych-up technique. In a review of the literature, Tod et al. (2003) also noted that there are conflicting results in the level of benefit obtained by psyching-up between experts and novices.

Based on conclusions by Tod et al. (2003), it can be argued that there are many unanswered questions when it comes to the effectiveness of psyching-up techniques at increasing strength due to lack of research and the wide range of psyching-up techniques. This lack of research and the wide use of the kiap (or comparable technique) as a psyching-up strategy for many athletes and coaches make it clearly important to systematically identify whether a kiap can enhance performance and whether it affects the expert and novice differently.

CHAPTER 2: LITERATURE REVIEW

Research on the effectiveness of psyching-up techniques to increase performance has been largely inconclusive (Tod et al., 2003). The aim of this literature review is therefore to explore this research in more detail in order to identify some potential reasons for the inconsistent results and highlight where further research is needed before conclusions can be drawn. The effectiveness of prescribed psyching-up techniques versus "free choice" techniques will be explored first, followed by the effect of psyching-up on expert and novice performance. Next, a review of the research on kiap-like strategies will be explored and presented as it appears in the literature. Finally, research on the potential mechanisms that may explain the relationship between psyching-up and performance improvements will be examined.

"Free-choice" versus prescribed psych-up techniques

Tod, Iredale, McGuigan, Strange & Gill (2005) asked 20 adult participants with at least one year of weight lifting experience to perform five repetitions of a maximal isokinetic bench press under three different conditions. The psych-up condition was a "free-choice" psych-up in which the participants were told to do whatever they thought might psych themselves up. That "free-choice" psych-up was randomly performed with two different control conditions, a distraction condition in which participants counted backwards from 1,000 in groups of seven, and an attention-placebo condition where participants were told their current heart rates were optimal for a higher level of performance on the task. Tod et al. (2005) found that the "free-choice" psych-up technique produced significantly greater torque (11%) than the distraction control

condition and significantly greater torque (8%) then the attention-placebo condition. No difference was found between the two control conditions.

Whelan, Epkins & Meyers (1990) also explored the effect of different psyching-up techniques on handgrip strength in 86 adult participants separated into low, medium, or high competitive experience groups. They found that the use of prescribed and "free-choice" psyching-up techniques led to a significant increase in handgrip strength in the medium and high competitive experienced participants respectively when compared to attention-placebo and distraction control conditions. No significant change in strength among the low competitive experience group was found when compared to the control conditions. Similarly, Eiko & Ostrow (1992) examined the effect of "free-choice" and imagery psyching-up techniques on handgrip strength among 30 older adults with a mean age of 60.13 years and 30 younger adults with a mean age of 21.55 years. Both groups had little to no competitive experience. They found that imagery significantly increased strength ($p < .05$) in both groups of adults while "free-choice" psyching-up only increased strength amongst the younger adults.

In general, the majority of studies that empirically support the use of psyching-up to improve performance have shown an average increase of 12% in force/strength produced due to psyching-up (Tod et al., 2003). Most of those increases in performance were obtained by using a "free-choice" psych-up technique. Unfortunately these studies did not identify the psych-up technique "chosen" by the participants, so it is unclear if one technique works better than another.

Not all studies empirically support the use of psyching-up techniques to increase performance however, be it "free-choice" or a prescribed technique. The inconsistency

of these findings with other research may be attributable to some methodological problems. For example, in one study that investigated the effect of "free-choice" psyching-up on force during an isometric elbow flexion task, Brody, Hatfield, Spalding, Frazer & Caherty (2000) found no benefit from psyching-up amongst 15 experienced strength trained men when their performance was compared to two distraction control conditions, where the men either read out loud before the task or counted backwards from 1,000 in groups of seven. Brody et al. (2000) submitted that the lack of effect was due to the isometric nature of the task. Because the participants were not allowed to adjust their arm position in any way, they could not produce a mechanical advantage from varying the arm position, which in turn could have increased motor unit recruitment and improved performance. This experiment also lacked external validity, as most dynamic sports require movements/tasks that are almost never limited to the isometric level.

Another area where psyching-up appears to fail to improve performance is in full body or complex movements. McGuigan, Ghiagiarelli & Tod (2005) studied the effect of "free-choice" psyching-up on a one repetition maximum squat test with 20 experienced weight lifters. They found no difference in weight lifted between the counting distraction control condition and a "free-choice" psych-up. McGuigan et al. (2005) speculated that this finding was linked to the complexity of the task and its interference with the psyching-up technique. However, the participants were experienced weight lifters and should not have found the squat task to be complex. Another possible explanation was the experience level of the participants. Because they were well trained, the participants' movement patterns and neural pathways were already efficient and not adjustable by psyching-up (McGuigan et al., 2005). These two explanations are somewhat

contradictory and highlight the importance of psych-up technique selection and level of experience when designing an experiment on psyching-up.

The effect of experience on psyching-up

The majority of the literature on psyching-up has focused on the effect of psyching-up with novices or experts, but rarely with both (Tod et al., 2003). In fact only two studies have made a direct comparison between the two experience levels and the effect of psyching-up. Whelan et al. (1990) has done the most comprehensive study to date on the effects of psyching-up and experience level. Whelan and colleagues found that athletes with little to no experience could not increase performance during a handgrip strength task using either prescribed or "free-choice" psyching-up techniques. Moderately experienced athletes could significantly increase strength using a prescribed psyching-up technique but not the "free-choice" psych-up. Conversely, highly experienced athletes could significantly increase strength using the "free-choice" psyching-up technique but not the prescribed psych-up. These results could explain the findings by Morales, Owen & O'Connell (1999) that novices increased peak force by 5% using the prescribed psych-up technique of grunting, while experts increased peak force by only 2%. These two studies suggest that experience level and the type of psyching-up technique used can significantly affect whether or not performance is increased. However, additional research is needed before any real conclusions can be made due to contradictory results.

Kiap-like strategies

Direct research on the use of the kiap as a psyching-up technique appears to have been completely overlooked by the scientific community. However there are two experiments that have investigated techniques similar to the kiap. One of the very first studies to measure if shouting increased force was conducted in 1961 by Ikai & Steinhaus. They found that the 25 participants could significantly increase the force applied to a cable tensiometer by 12%, during an isometric forearm flexor task, by shouting versus without shouting (Ikai & Steinhaus, 1961). In contrast, a more recent study on the use of grunting to increase force during a maximal dead lift exercise found no significant difference between grunting and not grunting (Morales et al., 1999). Again, it is important to note that while their results were not statistically significant, Morales et al. (1999) did see a 2% increase in force for athletes and a 5% increase in force for non-athletes when they grunted during the exercise.

These two studies highlight the inconsistency in results with the use of psyching-up techniques and again these inconsistencies can largely be explained by methodological problems. Ikai & Steinhaus (1961) used 10 participants to establish their baseline data on the isometric forearm flexor task without the shout. The authors then used a within-subjects design, when a between–subjects design should have been used, to compare the performance of 25 participants (the 10 original participants plus an additional 15) from the shouting task to the baseline data of the original 10 participants in order to find a significant result. Morales et al. (1999) failed to control for the possible participant biases that grunting would or would not increase strength by not using a deception or distraction technique to mask the true purpose of their experiment. The methodological

errors found in the Ikai & Steinhaus (1961) and Morales et al. (1999) studies weaken the conclusions that can be drawn about kiap-like psyching-up strategies and encourage further experimentation in the area.

Possible mechanisms underlying positive psych-up/performance relationships

A number of hypotheses have been proposed to explain why psyching-up techniques may have a positive impact on performance. Tod et al. (2003), in their review of psych-up literature, outlined the possible physiological process that takes place when psyching-up does improve performance. Tod and colleagues believe that psyching-up affects the entire movement process from the higher motor functions to the manipulation of the interaction between the actin and myosin of the muscle fibers. This includes changes in the central nervous system, which increase motor unit recruitment, synchronization, and firing rate. This results in increased excitation of the muscle membrane (action potential), release of acetylcholine and calcium, sarcomere length, and the binding of actin and myosin. This combined chemical and electrical activity increases agonist muscle and decreases antagonist muscle contractions, which affects mechanical factors like optimal lengthening of muscle fibers and rate of contraction (Tod et al., 2003).

In order to determine if there were physiological and psychological changes during psyching-up, Brody et al. (2000) measured bicep and triceps EMG activity as well as attentional focus and arousal during their study on the isometric elbow flexion task. They found no difference in EMG readings between the psych-up and control conditions. Brody et al. (2000) did find a significant positive increase in attentional focus and

perceived arousal between the psych-up and control conditions, but this psychological advantage failed to produce an increase in force during the psych-up condition because of the isometric nature of the task. Hypothetically, if the participants had had a greater range of motion with their arms, a mechanical/physiological advantage could have been combined with the psychological advantage measured to improve performance during the psych-up.

Perkins et al. (2001) attempted to identify if there was an underlying relationship between the physiological and psychological aspects of psyching-up and increased handgrip strength performance. In order to explain the improved performance associated with psyching-up, Perkins and colleagues measured heart rate, respiratory sinus arrhythmia, skin conductance level, and finger pulse amplitude to assess physiological arousal via the sympathetic nervous system and parasympathetic nervous system. There was no correlation between the increased handgrip strength and all the physiological variables measured. However, Perkins et al. (2001) found a strong correlation between increased handgrip strength and a high level of felt arousal ($p < 0.001$) and positive hedonic tone ($p < 0.001$), leading them to conclude that the increased performance was caused primarily by psychological not physiological factors. Perkins and colleagues hypothesized that the combination of high level of felt arousal and positive hedonic tone induced feelings of excitement verses anxiety towards performance, which cognitively reduced stress allowing for improved performance. However, the current literature has found no real evidence that physiological, psychological or mechanical factors account for improved performance with psyching-up. Rather it indicates that some unknown

combination of physiological, psychological and mechanical elements account for the performance increases (Tod et al., 2003).

Summary

The literature on the effectiveness of psyching-up techniques is limited and has inconclusive results, and it appears that only two studies to date have investigated the effectiveness of kiap-like techniques. However, psyching-up has been shown to improve performance during simple dynamic strength tasks using a "free-choice" psych-up technique (Eiko & Ostrow, 1992; Tod et al., 2005; Whelan et al., 1990). Unfortunately these studies did not identify the psych-up technique used by the participants. Furthermore, evidence that prescribed psych-up techniques can improve performance is inconsistent and not as widely studied. The kiap has not been included in any of the studies reviewed as one of the prescribed techniques, nor was there any documentation as to whether it was one of the techniques used by participants in the "free-choice" conditions. The only research that has investigated kiap-like techniques has been methodologically flawed because of possible participant bias and questionable conclusions drawn from comparing one group's baseline data to another group's performance data. Since there is anecdotal evidence that the kiap is a technique used by professional athletes (who have "free choice" over their preferred technique) it is clearly essential that effectiveness of the kiap be assessed systematically, controlling for some of the methodological limitations of previous research.

The literature is also unclear about the level of benefit athletes with different levels of experience can expect from psyching-up. There has been some suggestion that

novices may not benefit at all because of lack of experience, while experts may not benefit from the prescription of specific techniques due to experience (Brody et al., 2000; Morales et al., 1999; Whelan et al., 1990). The kiap, due to its simplicity, is easily learned and could therefore be used by both novice and experts to improve performance. Further more, experts trained in the technique of kiaping should be able to gain maximum performance increases because of the synergistic effects the kiap has on both the mental and physical aspects of any given dynamic task (Tedeschi, 2000). Ultimately, it is still unclear what affect experience level and the type of psych-up technique used has on performance. The examination of kiaping could answer whether a prescribed psych-up technique can improve performance and whether it will affect the performance of experts and novices differently.

Finally, the majority of psyching-up literature has concluded that some combination of physiological and psychological factors contribute to improved performance after psyching-up (Brody et al., 2000; Perkins et al., 2001; Tod et al., 2003). This is the very definition of Ki, a psychophysical energy that coordinates the mental and physical aspects of a dynamic task through the use of a kiap. Hypothetically, the kiap improves attentional focus and reduces anxiety, which leads to reduced tension, more synchronous muscle firing and in some cases adrenaline release (Tedeschi, 2000).

CHAPTER 3: PURPOSE

The purpose of this study was to examine the effect of kiaping as a psyching-up technique on strength during a handgrip exercise and to determine whether the level of expertise of the participants influenced its effectiveness. The handgrip strength test was selected due to the simplicity of the test and the extensive use of grip in martial arts. For example, grappling martial arts, like Judo and Hapkido, use grip extensively for throwing and joint locking. Striking martial arts like Taekwondo and Karate constantly grip and release their fists when striking or blocking. This makes the handgrip strength test highly applicable in measuring practical strength in martial artists. It was hypothesized that the kiap would significantly increase the strength output of both novice and experts, and that experts would have a significantly greater increase in strength output than novices in the kiap condition.

CHAPTER 4: METHODS

Participants

This study had 50 participants (mean age = 22.2 ± 3.3 years; mean body mass = 77.0 ± 15.4 kg; mean height = 174.2 ± 10.0 cm). Half of the sample (18 men, 7 women) was classified as "novices" with at least 1 month but not more than 12 months of martial arts experience (mean experience = 4.9 ± 1.9 months). The other half of the sample (17 men, 8 women) formed the "expert" group with at least 24 months of martial arts experience (mean experience = 89.0 ± 49.9 months) and the rank of black belt. Novice participants were recruited locally at Iowa State University and the surrounding area via email, flyers, undergraduate class visitation, and phone calls. Expert participant recruitment used the same recruitment efforts, but focused on local martial arts schools, tournaments, and the State of Iowa Black Belt Association (SIBBA) membership email list.

Instruments

A Jamar hand dynamometer (Model # 2A) with a range of 0-90 kilograms was used to measure handgrip strength with precision to the nearest kilogram. The Jamar hand dynamometer has a reliability of r = 0.99 and a validity of r = 0.99 for the right hand and r = 0.99 for the left hand (Shechtman, Gestewitz & Kimble, 2005).

Procedures

Ethical approval for this study was obtained from the Iowa State University Institutional Review Board along with signed consent from each participant prior to completing the study. After giving consent, all participants completed three sessions, performed three to four days apart at the same time of day, in the Exercise Psychology Laboratory at Iowa State University. The three sessions consisted of a baseline session, no kiap (control) session, and kiap session performed in that order. The baseline and no kiap sessions followed identical procedures in order to measure any possible learning effect, while the kiap session included the kiap for comparison between sessions. The kiap session was completed last because the true purpose of the experiment was not divulged to participants in order to protect against participant bias and to ensure maximal effort during the first two sessions.

Each session consisted of three maximal pulls with the participant's dominant hand using the Jamar hand dynamometer. Harkonen, Harju & Alaranta (1993) found that there is no statistical difference between 1 pull, 3 pulls, and the mean of 3 pulls performed on a handgrip dynamometer by participants, therefore the current study used the mean of three pulls for analysis. A 30 second break was given between each pull to allow participants to rest and the researcher to record individual trial data based upon the results of Trossman and Li (1989) where no statistical difference was found between pulls when participants were given a 15, 30, and 60 second break. All pulls from all three sessions were completed from a seated position with the dominant hand held at 90 degrees in accordance with recommendations from the American Society of Hand Therapists (Richards & Palmiter-Thomas, 1996).

Baseline Condition

The baseline session was a familiarization session in which the experiment was described (with deception) and participants' descriptive characteristics (age, body mass, height, and martial arts experience) were collected. Familiarization with the handgrip dynamometer was also conducted. After familiarization was complete, the participants completed three maximal pulls on the handgrip dynamometer without kiaping. No feedback or encouragement was given between pulls. The following instructions were given to each participant before completing the pulls:

> **The purpose of this study is to measure whether martial arts participation increases handgrip strength as compared to national averages. We have to complete three sessions to make sure the data we collect are reliable. I need you to squeeze the handgrip dynamometer as hard as you can for 3 to 5 seconds. You are going to do this three times with a 30 second rest in-between pulls. After you complete the pull, refrain from looking at the dial and hand me the dynamometer. I will tell you when to start.**

No-Kiap (Control) Condition

The second session consisted of the same handgrip strength testing procedure outlined in the baseline session. Participants completed three maximal pulls on the handgrip dynamometer without kiaping. Again, no feedback or encouragement was given between pulls. The following instructions were given to each participant before completing the pulls:

We are going to conduct the same handgrip strength test you completed in the first session. I need you to squeeze the handgrip dynamometer as hard as you can for 3 to 5 seconds. You are going to do this three times with a 30 second rest in-between pulls. After you complete the pull, refrain from looking at the dial and hand me the dynamometer. I will tell you when to start.

Kiap Condition

The third and final session incorporated the kiap into the handgrip strength testing procedure. Participants were briefed on the change in testing procedure before completing three maximal pulls, kiaping during each pull on the handgrip dynamometer. As in the previous two sessions, no feedback or encouragement was given between pulls. The following instructions were given to each participant before completing the pulls:

We are going to conduct the same handgrip strength test you completed in the first two sessions with one minor change. For this session, I want you to kiap and squeeze at the same time. Kiaping is a form of yelling used by martial artists during the performance of their particular style of martial arts. This kiap or yell starts low in the abdomen and rises through the chest and out of the mouth. It is more of a loud guttural yell verses a scream or shout that is produced from just the vocal cords or throat. Think of it as a yell from deep within your body. Again, for this session I want you to start squeezing the handgrip dynamometer and simultaneously kiap as loud and as good as you can while squeezing the handgrip as hard as possible for 3 to

5 seconds. You are going to do this three times with a 30 second rest in-between pulls. After you complete the pull, refrain from looking at the dial and hand me the dynamometer. I will tell you when to start.

After completing the third pull, participants were debriefed on the deception used and informed of the true purpose of the study, to measure the effect of kiaping on handgrip strength. Participants were also instructed to refrain from discussing the study with anyone until given approval to do so by the researcher.

During the kiap condition each participant was also video taped using a JVC compact VHS camcorder model # GR-AXM20. The video was transferred to DVD and independently judged by four black belts with an average of 15.9 ± 5.5 years of martial arts experience. The four judges were asked to evaluate each kiap on a "go", "no-go" basis by paying specific attention to the sound of the kiap and whether the participant used their abdomen to produce the kiap. If all four judges assessed the same kiap as "no go", the data from that particular trial was removed from the average of the kiap condition for that particular participant. All four judges were required to agree that a kiap was a "no go" for it to be dropped from analysis due to the subjective nature of the judging, the reduced quality of the audio and visual representation of each kiap due to video taping, and a poor inter-observer agreement.

Analysis

A 3 (Condition) x 2 (Expertise Level) mixed model ANOVA with repeated measures was used to compute the statistical significance of within-subjects and between-subjects effects on handgrip strength with the alpha coefficient set at 0.05. Inter-observer

agreement (represented as a percentage) on whether an individual kiap was judged as a "go" or "no go" was calculated using the following equation: [agreements/(agreement + disagreements)] x 100 (Thomas, Nelson & Silverman, 2005).

CHAPTER 5: RESULTS

The mixed model ANOVA revealed a significant effect for condition, $F(2, 96) = 48.4$, $p < 0.001$, $\eta^2 = 0.50$ and condition x expertise, $F(2,96) = 4.2$, $p < 0.05$, $\eta^2 = 0.08$ on handgrip strength (Figure 1). A test of sphericity was violated for all three conditions; therefore Greenhouse-Geisser corrections ($\varepsilon = 0.86$) are presented. An evaluation of the means and SD for the three conditions clearly reveals that the significant main effect for condition lies with the kiap condition when compared to the baseline and no kiap conditions (Table 1). Furthermore, there is almost no difference between the means and SD of the baseline and no kiap conditions suggesting that there was no learning effect. The differences in mean scores between the three conditions equated to a mean increase in strength of 10% for novices, 6% for experts, and 8% for the combined experts and novices in the kiap condition.

To further investigate the condition x expertise level interaction, Cohen's *d* effects sizes (ES) were calculated and compared. The novice group had a medium ES for the kiap condition compared to both the baseline (Cohen's $d = 0.48$) and no kiap (Cohen's $d = 0.46$) conditions. Notably smaller than the novice group ES, the expert group had a kiap Cohen's *d* ES = 0.25 compared to the baseline condition and a Cohen's *d* ES = 0.21 compared to the no-kiap condition. The Cohen's *d* ES for the kiap with experts and novices combined were 0.36 and 0.33 compared to the baseline and no kiap conditions, respectively.

Finally, inter-observer agreement among the four judges (i.e. whether a kiap was judged as "go" or "no go") was 36%. A total of 16 individual kiap trials were removed from data analysis due to receiving a "no go" from all four judges (four novices and one

expert had 2 of 3 kiap trials removed, five novices and one expert had 1 of 3 kiap trials removed). The removal of the 16 individual kiap trials had no effect on the ANOVA results.

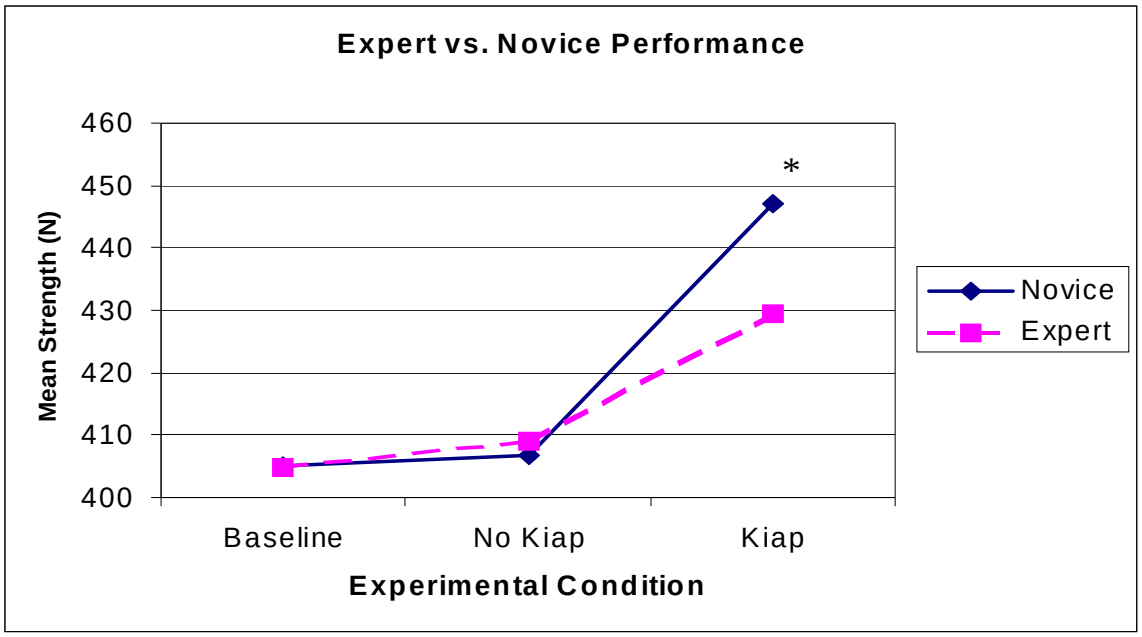

Figure 1. Novice and expert mean handgrip strength in the baseline, no kiap, and kiap conditions.
* Denotes a significant interaction ($p < 0.05$) between expertise level and condition.

Table 1. Mean handgrip strength (Newtons) of novice, expert and combined (novice and expert) martial artists in the baseline, no kiap, and kiap conditions.

	Novice Mean (N) ± SD	**Expert** Mean (N) ± SD	**Combined** Mean (N) ± SD
Baseline	405.1 ± 85.4	404.7 ± 94.9	404.9 ± 89.3
No Kiap	406.7 ± 87.6	409.0 ± 95.3	407.9 ± 90.6
Kiap	447.1 ± 88.8*****	429.3 ± 99.8*****	438.3 ± 93.9*****

***** Denotes a significant main effect for condition ($p < 0.001$).

CHAPTER 6: DISCUSSION

The purpose of this study was to examine the effect of kiaping as a psyching-up technique on strength during a handgrip exercise and to determine whether the level of expertise of the participants (i.e. novice or expert) influenced its effectiveness. The first hypothesis was that the kiap, because of its simplicity and ease of use, would significantly improve handgrip strength in both experts and novices. The results of the current study provide support for that hypothesis. The kiap increased handgrip strength by a mean of 8% with an ES of 0.36 and 0.33 when compared to the baseline and no kiap conditions, respectively.

These results add support to the literature that found psych-up techniques improve performance (Eiko & Ostrow, 1992; Tod et al., 2003; Tod et al., 2005; Whelan et al., 1990) and refutes the literature that found no improvement (Brody et al., 2000; McGuigan et al., 2005; Morales et al., 1999). The present results are novel, however, because of the prescribed nature of the kiap. The majority of supporting psych-up literature found strength increases only with the free-choice psych-up, but not prescribed techniques (Tod et al., 2003; Tod et al., 2005). The few studies that did use prescribed psych-ups found insignificant results. For example, Morales et al. (1999) found no statistically significant increase in novice and expert dead lift force with grunting. Similarly, Tenenbaum et al. (1995) found no significant difference in participant performance between two prescribed psych-up techniques (positive statement verbalization and relaxation) and a control condition during an isokinetic leg strength task. The current study adds unique support to psych-up literature by finding significance with a prescribed psych-up.

Additionally, the prescribed kiap psych-up increased strength for both experts and novices in this study. In contrast, in the only other comprehensive comparison of expert and novice use of psyching-up, Whelan et al. (1990) found that only athletes with moderate levels of experience benefited from a prescribed psych-up, while experts required a free-choice psych-up to improve performance. Brody et al. (2000) hypothesized that experts do not benefit from prescribed psych-up techniques because their movement patterns and neural pathways are not capable of adapting to the prescribed psych-up. The current study contests this hypothesis with the results that experts significantly improved performance with a prescribed psych-up. It is important to note, however, that the experts in this study were well trained in kiaping, which may have positively affected their ability to use it as a prescribed psych-up to increase handgrip strength. These results suggest that prescribed psych-up techniques can improve expert performance in individuals that are well trained in that specific technique.

The second hypothesis of this study was that experts, due to greater experience with the kiap, would have a significantly higher increase in handgrip strength during the kiap condition than the novices. No support for this hypothesis was found. In fact, the opposite was found. The novices benefited more in terms of handgrip strength when using the kiap for psyching-up than the experts. Novices increased handgrip strength by a mean of 10% during the kiap condition versus only a 6 % increase by the experts during the same kiap condition. This difference was also seen in the effect sizes. The novices had a medium ES of 0.48 while the experts only had a small ES of 0.25 when using the kiap. Interestingly, this trend of novices benefiting more from the kiap is similar to the results from Morales et al (1999). Morales and colleagues found that novice weight

lifters increased dead lift force by 5% with grunting versus a 2% increase by experts. It may be that experts benefit slightly less using a prescribed psych-up, similar to what Brody et al. (2000) suggested. The expert martial artists in the current study may have developed their own unique method of kiaping, due to years of training, that was restricted because of the execution requirements of the researcher, thus reducing the kiap's effectiveness. However, further empirical testing is required before that question can be answered. One question that has been clearly answered by the current study is that both novice and expert martial artists can significantly increase strength with the kiap technique.

Another important difference between this study and the current literature on psyching-up is that this is the first study to examine the long term effects of practicing a psych-up technique (i.e. kiap) that has been specifically taught and practiced as part of a normal curriculum from the very beginning of training through mastery of the sport. The results of the current study show that the full benefit of the kiap was utilized in novice participants with experience ranging from as little as two months to ten months of training. Years of additional training with the kiap (7.4 years on average for the experts) do not appear to result in significantly greater performance than those with limited training. This demonstrates the simplicity and possible ease with which the kiap could be taught and used effectively to increase strength.

Because of its effect on performance and ease of use, the kiap has numerous possible practical implications to many other sports where an explosion of force/strength is required. This study showed an overall increase of 8% in handgrip strength using the kiap to psych-up. This performance increase was gained with as little as two months of

training in the kiap technique. These results suggest that experts and novices in other sports that involve explosive movements, like tennis, weightlifting, and shot put, could see a significant increase in strength with very little training. This could be an incredible gain for the little amount of time and effort required and could significantly impact the individual results of the athletes during competition. Furthermore, there is almost no cost associated with the kiap strength increase, making it one of the most economical ways to increase strength without using specialized equipment or facilities. Finally, although not specifically measured by this study, it can be argued that the kiap has the possible cognitive benefits of increased self-efficacy due to improved performance (Schunk, 1995) and decreased opponent performance due to distraction (Janelle, Singer & Williams, 1999).

The current experiment did contain several limitations. First there was no non-martial artist participant control group. A third group of non-martial artists could have clearly demonstrated whether the kiap could or could not be used by non-martial artists, thus giving an indication of the generaliziblity of the kiap to other athletes and sports. The second limitation was that only the kiap condition was video taped. This could have lead to either social facilitation effects or increased performance anxiety among the participants. In fact, a majority of participants expressed anecdotally to the researcher a greater sense of anxiety with the video recording, which may have affected their performance negatively in the kiap condition. The video recording also made the judging of individual kiaps more difficult due to the reduced quality in the sound of the kiaps and video clarity of abdomen use to perform the kiaps. This resulted in the low inter-observer agreement of 36% between the judges. To adjust for this low inter-observer agreement,

all four judges were required to agree a kiap was a “no go” for it to be excluded from analysis. Interestingly, the removal of the “no go” kiaps had no effect on the overall results and conclusions. Regardless, in the future it is not recommended that kiaps be judged using video recording.

Another limitation of the study was the task itself. The handgrip strength test, while applicable to the martial arts, was simple to execute and may not have tasked the participants as much as performing a full kicking or punching technique or performing in a competitive environment. A more complex task may challenge cognitive and physical functions more (particularly in novices) and reduce the effectiveness of the kiap to psych-up a participant (Tenenbaum et al., 1995; McGuigan et al., 2005). A more complex task may also result in a greater difference between expertise level performances during the kiap condition due to the higher skill level of the experts.

The limitations of this study have specific implications for future research on the kiap technique. Future research needs to address the generaliziblity of the kiap to other athletes and sports. The current study could be replicated using all non-martial artists from a variety of different sports. Also, the effect of the kiap on more complex tasks, sport techniques, and competition needs to be examined. This would give a better measure of the cognitive complexity of the kiap and whether it still offered a performance increase under higher physiological and psychological demand. In addition, future research needs to identify how much training (i.e. number of trials, days, or months) is required before the maximum performance increase of the kiap is obtained from both novices and experts under various conditions. Given the simplicity of the kiap, it may be that it becomes an effective psych-up technique after only one or two training

sessions. Finally, the physiological, psychological, and mechanical reasons why the kiap psych-up worked needs to be examined. If these gaps in knowledge are addressed, the use of the kiap as a prescribed psych-up can be validated and its external validity increased.

CHAPTER 7: CONCLUSION

In summary, there is conflicting literature on whether psyching-up improves performance or not, whether prescribed psyching-up is better than free-choice, whether there is a difference between expert and novice psych-up capabilities, and what physiological, psychological, and mechanical factors are involved when psyching-up does improve performance. In an attempt to answers some of these questions, the current study examined the effect of psyching-up, using a kiap, on handgrip strength in both novice and expert martial artists. Analysis of the data found significantly higher handgrip strength with the kiap when compared to baseline and no kiap conditions for both novices and experts. Furthermore there was a significant interaction between expertise level and the kiap condition with a medium ES for novices and only a small ES for experts. These results suggest that the kiap can be learned easily and used to increase strength after only a short period of training, that novices benefit slightly more from the kiap than experts, and additional experience with the kiap does not result in further increases in strength. Further empirical research is needed to answer what extent kiaping can be generalized or trained to other athletes and sports, and what mechanisms work together for the kiap to improve performance.

APPENDIX A

INFORMED CONSENT DOCUMENT

Title of Study: The influence of martial arts training on strength.

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*Principal Investigator
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*** Research assistant who will conduct the study and obtain informed consent

This is a research study. Please take your time in deciding if you would like to participate. Please feel free to ask questions at any time.

INTRODUCTION

The purpose of this study is to examine whether participation in martial arts increases one's physical strength, particularly handgrip strength, as compared to national averages. You are being invited to participate in this study because we are investigating specific physiological and psychological responses in a representative sample from a young, healthy adult (ages 18 to 35 years old) population who participate in martial arts.

DESCRIPTION OF PROCEDURES

If you agree to participate in this study, your participation will last for the duration of three separate visits to the exercise psychology laboratory (0164M Forker Building on the ISU campus) spaced approximately three to four days apart. During the **first visit**, you will be familiarized with the instruments and equipment used in the data collection process while performing three baseline pulls on a handgrip dynamometer. You will be given a 30 second rest between each pull on the handgrip dynamometer. Combined, the first visit will take approximately 15 minutes to complete. During the **second** and **third visits** you will perform three pulls on a handgrip dynamometer to

measure the grip strength of your dominant hand. Again, you will be given a 30 second rest between each pull on the handgrip dynamometer. These two visits will take approximately 10 minutes each to complete and may be video recorded.

RISKS

While participating in this study you may experience minor muscle soreness in your hand and forearm following the handgrip strength testing. These effects should not last more than a day.

BENEFITS

If you decide to participate in this study there will be no direct benefit to you. However, it is hoped that the information gained in this study will benefit society by providing valuable information on the possible benefits of martial arts training in maintaining a healthy, physically active lifestyle.

COSTS AND COMPENSATION

You will not have any costs from participating in this study nor will you receive monetary compensation for your involvement in this study.

PARTICIPANT RIGHTS

Your participation in this study is completely voluntary and you may refuse to participate or leave the study at any time. If you decide to not participate in the study or leave the study early, it will not result in any penalty or loss of benefits to which you are otherwise entitled.

CONFIDENTIALITY

Records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available. To ensure confidentiality to the extent permitted by law, your name and other identifying information will be permanently erased once the collected data have been tabulated and entered in a computer for statistical analysis. Thus, there will be no traceable connection between your name and your data. Until the data are tabulated, your records will be kept in a room that will be locked at all times and only the researchers will have access to it. If the results are published, your identity will remain confidential.

QUESTIONS OR PROBLEMS

You are encouraged to ask questions at any time during this study. For further information about the study, contact Mark Tschampl (103C Forker Building, 515-450-7010, tschampl@iastate.edu) or Dr. Amy Welch (251 Forker Building, 515-294-8042, amywelch@iastate.edu). If you have any questions about the rights of research subjects or research-related injury, please contact the IRB Administrator, (515) 294-4566, IRB@iastate.edu, or Director, Office of Research Assurances, (515) 294-3115, 1138 Pearson Hall, Ames, IA 50011.

PARTICIPANT SIGNATURE

Your signature indicates that you voluntarily agree to participate in this study, that the study has been explained to you, that you have been given the time to read the document and that your questions have been satisfactorily answered. You will receive a copy of the written informed consent prior to your participation in the study.

Participant's Name (printed) _____

_____ _____

(Participant's Signature) (Date)

INVESTIGATOR STATEMENT

I certify that the participant has been given adequate time to read and learn about the study and all of their questions have been answered. It is my opinion that the participant understands the purpose, risks, benefits and the procedures that will be followed in this study and has voluntarily agreed to participate.

_____ _____

(Signature of Person Obtaining Informed Consent) (Date)

APPENDIX B

Demographic Information

Participant #: _____ Name: _____

Gender: Male ☐ Female ☐ Date of Birth: _____/_____/_____

Age: _____ Weight (kg): _____ Height (cm): _____

Phone: _____ E-mail: _____

Martial Art Experience

What martial art do you have the most experience in? _____

What belt rank do you hold in that martial art? _____

How long have you been practicing martial arts? _____(years) _____(months)

Data

Hand Grip Position: _____

Session #1 Hand Grip Pull (kg): 1) _____ 2) _____ 3) _____ Avg _____

Session #2 Hand Grip Pull (kg): 1) _____ 2) _____ 3) _____ Avg _____

Session #3 Hand Grip Pull (kg): 1) _____ 2) _____ 3) _____ Avg _____

Scheduling

Session #1: Date _____/_____/_____ Time _____

Session #2: Date _____/_____/_____ Time _____

Session #3: Date _____/_____/_____ Time _____

APPENDIX C

Kiap Judge's Form

	Kiap #1		Kiap #2		Kiap #3			Kiap #1		Kiap #2		Kiap #3	
Participant #	Go	No Go	Go	No Go	Go	No Go	Participant #	Go	No Go	Go	No Go	Go	No Go
1							26						
2							27						
3							28						
4							29						
5							30						
6							31						
7							32						
8							33						
9							34						
10							35						
11							36						
12							37						
13							38						
14							39						
15							40						
16							41						
17							42						
18							43						
19							44						
20							45						
21							46						
22							47						
23							48						
24							49						
25							50						

Date: _____

Judge's Name: _____

Years of Martial Arts Experience: _____

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