

## **Breathing Techniques: Its relationship to the Generation of Power in Martial Arts**

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## **ABSTRACT**

Title of Thesis: THE EFFECT OF REVERSE ABDOMINAL BREATHING POWER  
ENHANCEMENT IN MARTIAL ARTS

The traditional martial arts breathing method, Mu Do Ki Kong, has long been used to develop health and power. The purpose of this study is to determine whether there is an increase in power using reverse abdominal breathing, which is Mu Do Ki Kong's main breathing method, versus natural breathing.

Data were collected by testing 19 subjects, all of who were black belts, who have studied Tae Kwon Do for a minimum of 3 and a maximum of 17 years. Subjects used natural and reverse abdominal breathing methods as they struck two different types of targets. Punching force, kicking force and knife-hand breaking force were all measured using either an Impax target or a set of re-breakable plastic boards. Lower abdominal pressure was measured using an abdominal pressure device worn by each subject. Results from a series of paired sample t-tests indicate significant increases in power in conjunction with the use of reverse abdominal breathing. Test results for punching were  $t= 9.581$ ,  $p < 0.000$ . Test results for kicking were  $t= 3.784$ ,  $p < 0.001$ . Test results for breaking were  $t= 6.095$ ,  $p < 0.000$ . The mean percentage increase in punching power was 15%. The mean percentage increase in kicking power was 10%. The mean percentage increase in breaking power was 25%.

Care should be taken during the training of Mu Do Ki Kong. Improper practice can result in serious injury – an increase in cranial pressure due to incorrect breathing could lead to a stroke or worse. All martial artists, as well as practitioners of other types of sports, can benefit by developing the reverse abdominal breathing method through Mu Do Ki Kong. One of the practical aspects of controlling breathing is that it could be beneficial for assisting women during labor and childbirth.

# CHAPTER I

## INTRODUCTION

In the practice of Tae Kwon Do, the martial arts instructor must teach control of the body, the mind and breathing. When these three aspects harmonize together in training, this is the proper practice of martial arts. If we look closely at the martial arts, we must understand that the Ki (air or life-force energy) will internally unite the body and mind. We cannot properly advance the mental aspect of control without mental training, but if we only focus on mental training, our physical progress will be slow. Therefore, we need to maintain the balance of these areas to be true to the martial arts. Proper breathing practice, “Ki Kong,” is a connection between body and mind. Ki Kong is divided into health Ki Kong and martial arts Ki Kong. Modern day health Ki Kong is very popular and is often studied and researched. In contrast, martial arts Ki Kong is traditionally passed on to a select few, and therefore, it is not completely understood because it has never been studied scientifically.

In the martial arts, Ki Kong has always focused on developing life-force energy and the proper circulation of this energy in the human body. This is the main goal for all martial arts Ki Kong. Each martial arts style uses its martial arts experience and combines practice, breathing, mental power and body strength to develop Ki Kong. One method of martial arts Ki Kong breathing is reverse abdominal breathing. In order to understand how this breathing technique affects power, we

need to better understand reverse abdominal breathing and how it is related to lower abdominal pressure and its effect on power.

By using Ki Kong practice, and harmonizing the mind and body, we are able to benefit completely from the martial arts. Nevertheless, many martial arts trainers will only occasionally focus on breathing, just to uphold tradition. Some practitioners do not study the Um Yang principle, five different styles of power (soft, heavy, return, strong, and pierce), or the 12 meridians in the human body. Some do not even want to understand these theories. Physical training and competition, which is often over-emphasized in sports, without recognizing the values of tradition, virtue and harmony, will in fact keep one from realizing the Do (the way) (Park, Young Gin, 2001).

The traditional martial arts were medicinal as well as combative, and were developed to promote a better life. In this combination, breathing played an integral role. Can reverse abdominal breathing in martial arts Ki Kong really be shown to improve the power of a practitioner? If power is improved, how is it related to abdominal pressure?

It is necessary to emphasize that the incorrect practice of reverse abdominal breathing can be dangerous. When we use this type of breathing without proper guidance, we must be careful, for its improper practice can result in elevated cranial pressure, possibly leading to stroke or mental incapacity. Therefore,

martial arts Ki Kong requires scientific study in order to make it easily understood and safe for martial artists.

### **Significance of the Study**

The significance of this study is that it attempts to prove that reverse abdominal breathing will enhance the power of the martial artist. A study of this type has never been done before. Traditionally, people have always pictured the *Dan Jun*, or lower abdominal, area of the body as a ball or a balloon. The lower abdomen is the center of gravity or low section focus of the body. When expanding the lower abdomen, a martial artist's power should be increased. Some people explain this as a "balloon" principal. As you train more in lower abdominal breathing, the "balloon" (energy ball) should get stronger, thicker and have more power. As a martial artist strikes an object, this power in the balloon should translate to increased striking power. This has long been a concept in the martial arts, passed on from teacher to student, but no one has ever been able to measure it or to scientifically demonstrate that this type of breathing enhances power.

Previously, there was no equipment in existence that could measure lower abdominal pressure externally. This study required creation of a device to measure abdominal pressure, along with a power measurement device from Century and re-breakable boards, in order to record results that are statistically sound. It is hypothesized that statistical analysis will show a definite increase in

the power of the subjects using reverse abdominal breathing. Thus, this study is significant because it is the first time that the power of reverse abdominal breathing in the martial arts will be scientifically measured and analyzed.

### **Purpose of the Study**

This study of traditional martial arts Ki Kong breathing will seek to determine if the impact of breathing techniques varies with the length of time one has studied martial arts, and whether body position also affects power and abdominal pressure. In addition, the study will examine the potential increase in power that can be attributed to reverse abdominal breathing and the scientific benefits of such breathing for martial artists.

### **Research Questions**

In order to examine the relationship between Ki Kong and the practice of the martial arts, the following questions will be considered in this study:

Q1. Does reverse abdominal breathing result in greater power than natural breathing?

Q2. Does reverse abdominal breathing result in greater abdominal pressure than natural breathing?

Q3. Does resulting power during reverse abdominal breathing relate to length of training?

Q4. Does resulting abdominal pressure relate to length of training?

Q5. Does kneeling or standing during natural breathing modify resulting abdominal pressure?

Q6. Does kneeling or standing during reverse abdominal breathing modify resulting abdominal pressure?

### **Limitations of the Study**

In this study the 19 subjects were all adult Black Belt volunteers chosen from students at Dong's Martial Arts School. Younger subjects were avoided because of the risk of injury. This study had the following limitations.

1. Different types of targets (soft and hard) may affect the intensity of the subjects' power. In this test only an Impax target and re-breakable plastic boards were used.

2. Subjects who are continually toughening their bare hands and feet might find it easier to hit the target and strike the boards. However, if subjects did not toughen their hands or feet, they might experience greater anxiety or fear in

addition to greater discomfort when striking the targets, thereby diminishing the intensity of their punch, kick, or strike over the course of the test.

3. In this test the subjects performed a straight punch, front snap kick, and knife-hand strike. If the test had used other types of martial arts techniques, the results may have been different.

4. This test used only external measurements for abdominal pressure instead of inserting a balloon into the subjects' intestines, because an internal measurement procedure was determined to be infeasible.

### **Definitions Used in the Study**

The following terms are presented and defined in the manner in which they are used throughout the study:

**Mu Do**: Mu Do is divided into the Nae Kong (internal practice) and Wae Kong (external practice) for training mind and body, resulting from a human being's desire to protect his own body. Mu Do is a method for learning self-defense movements for preparation of fighting skills and for promoting order and peace. Mind and body unification and harmony are joined in a militant and scholastic atmosphere to create the Do (the Way) (Park, Young Gin, 2001).

**Nae Kong**: "Nae Kong is internal training of the body in the martial arts. Fang Le Ju delineated the difference between Nae Kong and Wae Kong during the Song

Dynasty. Fang Le Ju stated that the foundation of the form is Wae Kong (external). Chi is based on Nae Kong, which is internal. Over time, martial artists decided to lean on the strength of one or the other, and people began to refer to Nae Kong as internal power” (Lim, Pung Jang, 1997).

Ki Kong: “Ki Kong” is an expression derived from the time of the Gin Dynasty and was first used by Her Son in his book Ki Kong Chun Ging. Ki is “breathing;” Kong means “practice” or “training.” The Ki is an internally developing awareness and a harmony for control of breathing and internal circulation. Externally, it develops musculature and muscle tone; both tension and strength are emphasized. Ki Kong is the essential requirement for development of human success in the Do, through the harmony of mind, breathing, and physical training (Fang, Mu Hyun, 1991).

Tae Kwon Do: “Without any weapons, only confidence and techniques with the most advanced moral culture is Tae Kwon Do” (Choi, Hong Hee, 1973). “Tae means a system of foot techniques; Kwon means a system of hand techniques; and Do means the art of experiencing the ultimate being through physical and metaphysical enlightenment” (Kim, Sang H., 1999). Tae Kwon Do is one of the Korean style martial arts that focus on controlling the mind and the body for self-defense and health. In modern days it has become recognized as an Olympic sport. It especially emphasizes the use of kicking techniques. For speed

purposes, it uses more linear movements rather than circular movements, which are more common among other forms of martial arts.

Breathing: Breathing is defined as inhaling outside air into the lungs. From the lungs, used air is expelled, or exhaled, from the body. Inhalation uses muscular contraction; therefore, exhalation uses muscular relaxation. The muscles that tense during inhalation relax during exhalation. Generally, the movement of inhalation involves contraction of the diaphragm along with relaxation of the stomach muscle. An average person's breathing rate is 13 – 22 breaths per minute (Lee, Sang Myung, 1994).

Lower abdominal pressure: Lower abdominal pressure is defined as abdominal pressure measured without breathing. In this case, when we hold our breath, adding up the pressure is called Incomplete Abdominal Pressure because there is no exhalation, or relaxation of the stomach muscles. If the pressure is in the chest, this will increase the cranial pressure, which can be very dangerous. Continuous lower abdominal pressure, whether breathing in or out, is the expertise of the highly trained martial arts expert, who should maintain a continuous pressure through mastery of this lower abdominal pressure (Hiromasa, Muraki, 1993).

Reverse abdominal breathing: Reverse abdominal breathing occurs when the air comes all the way into the diaphragm when inhaling. Therefore, when inhaling the chest should be out above the diaphragm while the area below the diaphragm

is contracted. When exhaling, the reverse of that movement should apply; i.e., the lower abdomen is extended and the upper chest is drawn in (Kim, Kwang Suk, 1992).

## CHAPTER II

### THEORY AND BACKGROUND

#### Understanding Ki Kong

Ki is a natural force that fills the universe, generally divided into three types of Ki: Heaven Ki, Earth Ki and Human Ki. Heaven Ki is made up of the forces affecting the Earth, such as sunshine, moonlight, and the moon's effect on the tides. Earth Ki absorbs Heavenly Ki and is influenced by it. The Human Ki exists between these two. Jing (the essence), Ki (internal energy) and Shen (spirit) are the roots of our life (Yang, Jwing-Ming, 1997). We try to control Ki through breathing, so we call this Nae Kong. Nae Kong controls the body through breathing practice, which in turn controls the internal development while at the same time externally making the body strong. To experience Ki Kong, we must go into a meditative state, using less energy to improve our physical condition and to increase Ki circulation.

In the martial arts, hardness and softness, strength and Ki, are separate. Most martial arts training combines hard and soft techniques. In 1957, Kijin Ryu officially used the name "Ki Kong" in his modern book Ki Kong Yo Puk Sil Chun (Lee, Dong Hyun, 1990).

Generally, Ki Kong practice is divided into three categories: body control, breathing control and mind control. Breathing control is the most important of these three due to its complex nature. Breathing occurs automatically without effort or thought, but breathing is not merely the exchange of oxygen and carbon dioxide. On the contrary, it is much more complex. The length of time one takes to inhale and exhale, how smoothly, softly, steadily, silently and slowly this action is performed, and the holding of one's breath affect the involuntary nervous system. As a result, internal bodily functions - heartbeat and digestion, among others - are influenced. Breathing control thus helps to boost our immune system and prevent illness. Improved breathing methods are effective in improving blood circulation as well. Proper breathing promotes blood flow through the veins and the circulation of blood through the body by changing abdominal pressure (Yayama, Toshihiko, 1999).

Generally, people breathe very shallowly because of habit. But if one emphasizes long and smooth exhalation, it is possible to maintain a constant lower abdominal pressure. This is very important because constant lower abdominal pressure is the pump for the veins as opposed to the heart, which is the pump for the arteries. If these two pumps support each other, the complicated blood circulation system of the human body will function more effectively. Lower abdominal pressure can be controlled consciously by anyone, through the practice of deep abdominal or reverse abdominal breathing. Therefore, we can improve our blood circulation by focusing on the manner in which we breathe (Hiromasa, Muraki, 1993).

However, there are several different methods of breathing. In Mu Do Ki Kong, the martial artist uses two types of lower abdominal breathing, regular and reverse, which are essential to our body and conditioning. Both types of abdominal breathing will bring more air to the lungs. Practicing these breathing techniques develops the chest muscles and the contraction and relaxation of the diaphragm muscle.

Generally, our natural breathing takes in a volume of 300cc to 500cc of air. If we want to breathe in more, we have the capacity to increase our air intake up to 1000-1500cc without conscious effort (natural breathing). We call this extra breathing “preparation inhalation.” Natural breathing capacity combined with conscious air intake is called “total lung capacity.” When we are unconsciously breathing, we use only 10-16% of our lung capacity (Hiromasa, Muraki, 1993).

“Low abdominal breathing will always allow more air into the lungs. Breathing always uses chest muscles and the diaphragm moves on a regular basis through contraction and expansion. By using only the chest to breathe it is the chest muscles that are working, compared to lower abdominal breathing, which focuses on the diaphragm. The size of the diaphragm is  $270 \text{ cm}^2$ . When it moves 1 cm up or down, the extra air movement will be 300cc. During lower abdominal breathing, the average person’s diaphragm will move more than 2 to 3 cm. For an expert of this breathing technique, the movement of the diaphragm will be up to 5

cm. The air movement will be greatly increased in the body due to advanced breathing techniques” (Lee, Dong Hyun, 1990).

If we are able to gather more air (oxygen) with one breath, the breathing cycle will slow down, so less energy will be spent using the breathing system. Thus, lower abdominal breathing will relax the body and help the body’s biorhythms. While using regular abdominal breathing or reverse abdominal breathing, the diaphragm’s movement expands inside the torso, massaging the intestines and digestive system. This internal massage will improve digestion and strengthen the muscles. Therefore, in Ki Kong development, internal strength is the focus (Lee, Dong Hyun, 1990).

Traditionally, training in the martial arts focuses on lower abdominal breathing in order to increase both energy and power. Through lower abdominal breathing training, we can increase our lung capacity along with our health and fulfill the original purpose of the martial arts, which is to increase energy and power in addition to developing self-defense skills.

### **Difference in Breathing Methods**

In Ki Kong, controlled breathing is one of the most important aspects of training. Traditionally this type of controlled breathing has been known by many different names: Dan Jun breathing, Bok Ki Bup, Hang Ki Bup, and To Nap Bup among

others. Any type of Ki Kong performance follows three fundamental principles. The first of these is the control of the body and movement. This principle is called Jo Shin. The second principle is the control of the breathing, which is called Jo Sik. The third is the control of the mind, called Jo Shim. The sum of these techniques is called Ki Kong Sam Jo. In practicing the Ki Kong, these parts cannot be divided. First, the correct posture must be combined with proper movement to allow easier breathing. Easier breathing allows for mental and conscious control of breathing. Applying these three principles together will finally make the three parts into one. These principles are also called Hyung (Posture) Ki (Energy) Ui (Thought), which become one. A martial arts style can emphasize one more than the others, with the result that there can be a specialized Ki Kong.

However, if a practitioner neglects one of the three, the proper result and benefit is lost. Illness, listlessness, and other physical or mental problems can be caused by the Ki being blocked in the body and an imbalance in Ki flow (Shaw, Scott, 1997). In this study about lower abdominal reverse breathing, the focus is on breathing control. The Jo Sik, or control of breathing, has two purposes. The first is to find the most efficient breathing method to gather the universe's Ki and to help change it to life force energy for living. The second is to help control the mind, so we can have the most effective result of Ki Kong practice.

There are more than 50 different methods to control breathing, but we cannot say if one is more practical than another. Most modern martial arts use natural breathing, which is a novice level of breathing suited for beginners. If we look at this method closely, we observe three different methods of natural breathing. The first method, which is average breathing, mainly moves the chest. The second moves the stomach area. The third type of natural breathing moves the chest and stomach together. We call these chest-natural, stomach-natural and chest-stomach-natural breathing. In all three cases the breathing must be smooth and steady. In contrast to natural breathing, lower abdominal breathing (up and down), which is the basis of the Ki Kong, develops the lower abdominal musculature.

There are two different kinds of lower abdominal breathing. Inhalation with the lower abdomen extended, which we call regular abdominal breathing. The reverse of this style is inhalation with the abdomen contracted, which we call reverse abdominal breathing. For health purposes, the former is used because it is safer. In general, martial arts Ki Kong utilizes reverse abdominal breathing. People also inhale and hold their breath or exhale and hold their breath to improve power or control energy. All of these breathing methods, and others such as the Sounds breathing method, or Pung method, will increase internal relaxation, not only improving digestion but also energy concentration. In addition, the so called Tae Sik Bup, which is breathing like a child inside the womb, is an expression of the concept of breathing biologically by still using the nose but breathing only one or two times per minute because the skin breathes through the pores. This could also

be called pore breathing. If this method of respiration is maintained, practitioners do not realize that they are breathing and should only feel a little movement of the navel. Other breathing methods include natural deep breathing, cleansing breathing, tonic breathing (inhaling extra air for more energy), alternative breathing, and long breathing (Jou, Tsung Hwa, 2001).

“In Tae Kwon Do training, breathing supports the speed. During movements we must hold our breath for maximum power when striking, attacking or blocking. When we contact the opponent, breathe out quickly. After contact, inhale slowly. If we inhale during the block, a light attack can do a lot of damage. Even with a strong attack to you, holding your breath will reduce the damage. The conclusion is that during action, it is best to hold our breath when attacked” (Choi, Hong Hee, 1973).

Because breathing techniques have been emphasized in martial arts training, it is important to examine them scientifically. This study will attempt to demonstrate that reverse abdominal breathing will increase the lower abdominal pressure as well as increase the striking power more than natural breathing during the execution of several basic martial arts techniques.

## **CHAPTER III**

### **METHOD**

#### **Subjects**

Seventeen male and two female black belt subjects volunteered to participate in this study. The subjects' ages ranged from 16 to 52 years with an average of 32.6 years. The subjects' heights ranged from 64 inches to 75 inches with an average height of 69.3 inches. The subjects' weights ranged from 116 pounds to 210 pounds with an average weight of 163 pounds. All of the subjects were students who trained with Dong's Tae Kwon Do School in Richmond, Virginia. They have studied for a minimum of 3 and a maximum of 17 years with an average of 7.8 years of martial arts training.

#### **Instruments**

The Impax target (see Figure 1 below) is an electronic device that measures the subjects' power upon impact from the subjects' punch and kick. This device, created by Century Martial Arts Supply Company, uses a sensor inside the target rectangle.



*Figure 1: Impax Target for Punching and Kicking Measurement*

In a hospital scenario abdominal pressure is normally tested using a rubber balloon in the intestines. Due to the impracticality of such a technique in the martial arts school, we measured abdominal pressure by using an external method developed by a Japanese medical doctor who is an expert on abdominal breathing and studies abdominal pressure for health, Muraki Hiromasa. This method uses a belt placed around the lower abdomen with the pressure gauge set at a 20 mm Hg standard (with a maximum of 300 mm Hg) to determine the change in pressure according to the breathing method. This starting point was maintained during natural breathing. The device was created by Seung Gyoo Dong using a Marshall Tru-Gauge Cuff and Sphygmomanometer (see Figure 2 below), which is a reliable tool used in the medical industry.



*Figure 2: Abdominal Pressure Device*

Ten plastic re-breakable boards (see Figure 3 below) were used to measure the power of the subjects' knife-hand strikes. Masters of the World Martial Arts Supply Company created the plastic re-breakable boards for martial arts training purposes. The plastic re-breakable boards were used rather than wooden boards for several reasons. Wooden boards can splinter and perhaps injure the subjects. In addition, the tension in differing blocks of wood can vary and could produce inaccurate data. Finally, subjects can become excited or nervous when they are asked to break a stack of wood and might be unable to control their emotions and reactions, which could affect the results.



*Figure 3: Re-Breakable Boards for Knife-Hand Striking Measurement*

## **Measurement Procedures**

At the beginning of the test, the subjects removed their belt and attached the abdominal pressure belt. The beginning pressure was elevated to 20 mm Hg, which was the pressure maintained when the subjects were at rest. The subjects stood comfortably in fighting stance in front of the Impax target. A punch, during natural breathing, was thrown at the center of the target, which was clearly defined. After a short respite, the subjects used the same fist to punch the target during reverse lower abdominal breathing. The subjects alternated between regular and reverse abdominal breathing. This alternation maintains the breathing and consistency of the punches. In total, 20 punches were thrown. Upon completion, the subjects rested for several minutes before beginning the kicking portion of the test.

For the kicking portion of the test, the subjects stood comfortably in fighting stance in front of the Impax target. The subjects began with a front snap kick at the clearly defined center of the target using natural breathing. Another kick was performed with the same leg using reverse abdominal breathing. The subjects' breathing was alternated until the subjects reached 20 kicks.

Following the kicking test, the subjects knelt on one knee to break a maximum of ten plastic re-breakable boards stacked on the ground. The subjects performed a knife-hand strike using natural breathing. The subjects followed this technique

with the same type of strike using reverse abdominal breathing for a total of 10 strikes. Only 10 strikes were performed to prevent substantial bruising to the subjects' hand.

The subjects repeated the test the following week and also the subsequent week for a total of three trials.

### **Data Analyses**

Five assistants aided in the collection of the data. Two held the target against a concrete wall to prevent the target's movement as much as possible. One assistant read the pressure gauge and another read the power gauge. One other assistant recorded the results (See Appendix A). Statistical data (descriptive statistics, paired sample t-test and correlational analysis) were generated using SPSS for Windows Release 10.1.

## CHAPTER IV

### RESULTS AND ANALYSIS

#### **Punching**

Table 1 shows the results obtained for the 19 subjects executing the punching techniques as described in the Methods section. They struck the target twenty times, alternating between using the natural breathing method and the reverse abdominal breathing method. Each was measured using the Impax target while wearing the abdominal pressure device. The table shows the average pressure and power, using both the natural and reverse abdominal breathing methods, and the difference between the two results. The table then shows the percent increase in both pressure and power.

**Table 1. Punching Data Table**

	Years	Natural Breathing Pressure	Reverse Abdominal Breathing Pressure	Pressure Difference Score	% Increase Pressure	Natural Breathing Power	Reverse Abdominal Breathing Power	Power Difference Score	% Increase Power
1	14	24.00	66.67	42.67	177.78	65.87	69.33	3.47	5.26
2	8	29.70	83.87	54.17	182.38	84.33	91.37	7.03	8.34
3	6	28.23	67.23	39.00	138.13	51.90	57.90	6.00	11.56
4	4	30.57	68.30	37.73	123.45	35.87	42.70	6.83	19.05
5	4	29.93	72.30	42.37	141.54	53.03	57.13	4.10	7.73
6	5	27.73	89.73	62.00	223.56	42.67	53.33	10.67	25.00
7	7	24.60	67.13	42.53	172.90	50.77	59.50	8.73	17.20
8	10	22.67	39.43	16.77	73.97	50.60	66.87	16.27	32.15
9	6	28.50	68.87	40.37	141.64	51.57	57.80	6.23	12.09
10	10	38.20	78.00	39.80	104.19	70.77	76.27	5.50	7.77
11	6	24.96	54.96	30.00	120.18	27.59	34.70	7.11	25.77
12	12	25.60	37.15	11.55	45.12	55.45	60.85	5.40	9.74
13	5	39.40	52.15	12.75	32.36	47.10	54.25	7.15	15.18
14	17	41.00	50.15	9.15	22.32	49.75	53.80	4.05	8.14
15	8	26.50	42.10	15.60	58.87	45.95	50.10	4.15	9.03
16	7	23.20	57.70	34.50	148.71	53.70	60.05	6.35	11.82
17	3	38.70	86.50	47.80	123.51	51.80	65.35	13.55	26.16
18	10	25.85	58.05	32.20	124.56	45.45	51.60	6.15	13.53
19	7	37.40	89.85	52.45	140.24	56.30	63.30	7.00	12.43
Total	19	19	19	19	19	19	19	19	19
Mean	7.84	29.8288	64.7445	34.9158	120.8103	52.1294	59.2739	7.1444	14.6299
Std. Deviation	3.610	6.04060	16.41195	15.39258	53.85950	12.20055	12.14354	3.25023	7.62676
Minimum	3	22.67	37.15	9.15	22.32	27.59	34.70	3.47	5.26
Maximum	17	41.00	89.85	62.00	223.56	84.33	91.37	16.27	32.15

Q1. Does reverse abdominal breathing result in greater power than natural breathing?

The mean power for natural breathing is 52.13 and the mean power for reverse abdominal breathing is 59.27. The appropriate test of statistical significance for the difference in the two means is a paired sample *t*-test. As shown in Table 2, the difference in the means between the two breathing conditions is 7.14, which is highly significant ( $t = 9.581, p < .000$ ).

**Table 2. Mean Power Difference, Punching**

Mean Power Difference	S.D. <sup>1</sup>	S.E.M. <sup>2</sup>	95% Confidence Interval of the Difference		<i>t</i> <sup>3</sup>	df <sup>4</sup>	<i>p</i> <sup>5</sup>
			Lower	Upper			
7.14	3.25	0.746	5.58	8.71	9.581	18	0.000

1: Standard deviation  
 2: Standard error of mean  
 3: Paired sample *t*-test  
 4: Degrees of freedom  
 5: *p* value. Significance criterion set at  $p \leq 0.05$ .

Since the difference in the means is statistically significant, this supports the conclusion that the observed increase in power is an effect of the reverse abdominal breathing used while executing the punching technique.

Q2. Does reverse abdominal breathing result in greater abdominal pressure than natural breathing?

The mean pressure for natural breathing is 29.83 and the mean pressure for reverse abdominal breathing is 64.74. The appropriate test of statistical significance for the difference in the two means is a paired sample *t*-test. As shown in Table 3, the difference in the means between the two breathing conditions is 34.92 which is highly significant ( $t = 9.888, p < .000$ ).

**Table 3. Mean Abdominal Pressure Difference, Punching**

Mean Abd. Pressure Difference	S.D.	S.E.M.	95% Confidence Interval of the Difference		<i>t</i>	df	<i>p</i>
			Lower	Upper			
34.92	15.39	3.53	27.50	42.33	9.888	18	0.000

These results and their statistical significance are consistent with the results obtained with the analysis of the power data. Both the significant increase in power and the significant increase in abdominal pressure appear to be related to the use of reverse abdominal breathing during the execution of the punching technique.

Q3. Does resulting power during reverse abdominal breathing relate to length of training?

Correlational analysis was applied to data collected for length of training and power observed using reverse abdominal breathing in order to determine whether there is a correlation between those two variables.

**Table 4. Correlation of Power with Experience, Punching**

		Reverse Abdominal Breathing Power
Years	Pearson Correlation	.226
	Sig. (2-tailed)	.352
	N	19

As Table 4 shows, the correlation is in a positive direction ( $r = .226, p < .352$ ) but does not reach the  $p \leq .05$  level of statistical significance. Thus one would conclude that the length of training is not related to the power generated using reverse abdominal breathing. More research is needed to determine if proper training with this breathing method over a longer period of time would result in a greater effect, i.e. greater power.

Q4. Does resulting abdominal pressure relate to length of training?

Correlational analysis was applied to the data collected to examine the correlations between years of training and natural breathing pressure, reverse abdominal breathing pressure, and the percentage increase in pressure observed when reverse abdominal breathing was compared to natural breathing.

**Table 5. Correlation of Abdominal Pressure with Experience, Punching**

		Natural Breathing Pressure	Reverse Abdominal Breathing Pressure	% Increase Pressure
Years	Pearson Correlation	-.018	-.443	-.369
	Sig. (2-tailed)	.941	.058	.120
	N	19	19	19

Table 5 shows negative correlations between years of experience and natural breathing pressure ( $r = -.018$ ), reverse abdominal breathing pressure ( $r = -.443$ ), and percent increase in pressure ( $r = -.369$ ). However, none of the correlations are statistically significant at the .05 level of significance. Thus, one would conclude that the number of years of training is not related to natural breathing pressure and reverse abdominal breathing pressure. In addition, the number of years of training is not related to the percent increase in abdominal pressure observed for reverse abdominal breathing as compared to natural breathing. In fact, the observed negative correlation may support the conclusion that the effective use of reverse abdominal breathing may only be obtained through proper training and practice in the reverse abdominal breathing method rather than through general training in

the martial arts. This hypothesis is further supported by the previous correlation analysis which failed to find a significant correlation between length of martial arts training and power using the reverse abdominal breathing method.

## **Kicking**

Table 6 shows the results obtained for the 19 subjects executing the kicking techniques as described in the Methods section. They struck the target twenty times, alternating between using the natural breathing method and the reverse abdominal breathing method. Each kick was measured using the Impax target while the subjects were wearing the abdominal pressure device. The table shows the average pressure and power, using both the natural and reverse abdominal breathing methods, and the difference between the two results. The table then shows the percent increase in both pressure and power.

**Table 6. Kicking Data Table**

	Years	Natural Breathing Pressure	Reverse Abdominal Breathing Pressure	Pressure Difference Score	% Increase Pressure	Natural Breathing Power	Reverse Abdominal Breathing Power	Power Difference Score	% Increase Power
1	14	23.53	79.73	56.20	238.81	105.77	118.43	12.67	11.98
2	8	38.20	82.13	43.93	115.01	125.80	126.53	.73	.58
3	6	45.10	73.73	28.63	63.49	72.27	80.23	7.97	11.02
4	4	36.37	77.10	40.73	112.01	63.60	76.27	12.67	19.92
5	4	40.73	69.27	28.53	70.05	73.70	84.90	11.20	15.20
6	5	37.67	68.87	31.20	82.83	54.77	63.30	8.53	15.58
7	7	30.30	63.33	33.03	109.02	86.90	86.90	.00	.00
8	10	26.27	40.57	14.30	54.44	68.50	78.97	10.47	15.28
9	6	50.10	73.00	22.90	45.71	78.03	80.37	2.33	2.99
10	10	54.23	88.23	34.00	62.69	91.47	93.27	1.80	1.97
11	6	34.74	48.67	13.93	40.09	42.22	48.93	6.70	15.88
12	12	39.10	42.90	3.80	9.72	92.90	83.20	-9.70	-10.44
13	5	44.05	54.45	10.40	23.61	50.75	55.45	4.70	9.26
14	17	45.60	61.30	15.70	34.43	91.10	111.45	20.35	22.34
15	8	39.10	52.15	13.05	33.38	60.45	76.90	16.45	27.21
16	7	35.20	58.85	23.65	67.19	90.15	112.35	22.20	24.63
17	3	51.55	95.00	43.45	84.29	84.05	88.80	4.75	5.65
18	10	38.50	55.60	17.10	44.42	58.85	56.70	-2.15	-3.65
19	7	45.70	89.00	43.30	94.75	79.85	80.10	.25	.31
Total	19	19	19	19	19	19	19	19	19
Mean	7.84	39.7916	67.0465	27.2549	72.9430	77.4275	84.3707	6.9432	9.7737
Std. Deviation	3.610	8.07698	15.87787	14.07412	50.27944	20.38181	21.16778	7.99782	10.28802
Minimum	3	23.53	40.57	3.80	9.72	42.22	48.93	-9.70	-10.44
Maximum	17	54.23	95.00	56.20	238.81	125.80	126.53	22.20	27.21

Q1. Does reverse abdominal breathing result in greater power than natural breathing?

The mean power for natural breathing is 77.43 and the mean power for reverse abdominal breathing is 84.37. The appropriate test of statistical significance for the difference in the two means is a paired sample *t*-test. As Table 7 shows, the difference in the means between the two breathing conditions is 6.94, which is highly significant ( $t = 3.784, p < .001$ ).

**Table 7. Mean Power Difference, Kicking**

Mean Power Difference	S.D. <sup>1</sup>	S.E.M. <sup>2</sup>	95% Confidence Interval of the Difference		<i>t</i> <sup>3</sup>	df <sup>4</sup>	<i>p</i> <sup>5</sup>
			Lower	Upper			
6.94	8.00	1.83	3.08	10.80	3.784	18	0.001

1: Standard deviation  
 2: Standard error of mean  
 3: Paired sample *t*-test  
 4: Degrees of freedom  
 5: *p* value. Significance criterion set at  $p \leq 0.05$ .

Since the difference in the means is statistically significant, this supports the conclusion that the observed increase in power is an effect of using reverse abdominal breathing while executing the kicking techniques.

Q2. Does reverse abdominal breathing result in greater abdominal pressure than natural breathing?

The mean pressure for natural breathing is 39.79 and the mean pressure for reverse abdominal breathing is 67.05. The appropriate test of statistical significance for the difference in the two means is a paired sample *t*-test. The difference in the means between the two breathing conditions is 27.25 which is highly significant ( $t = 8.441, p < .000$ ).

**Table 8. Mean Abdominal Pressure Difference, Kicking**

Mean Abd. Pressure Difference	S.D.	S.E.M.	95% Confidence Interval of the Difference		<i>t</i>	df	<i>p</i>
			Lower	Upper			
27.25	14.07	3.23	20.47	34.04	8.441	18	0.000

These results and their statistical significance are consistent with the results and conclusions obtained with the analysis of the power data. Both the significant increase in power and the significant increase in abdominal pressure appear to be related to the use of reverse abdominal breathing.

Q3. Does resulting power during reverse abdominal breathing relate to length of training?

Correlational analysis was used to determine the correlation between length of training and resulting power using reverse abdominal breathing. The correlation analysis is shown in Table 9.

**Table 9. Correlation of Power with Experience, Kicking**

		Reverse Abdominal Breathing Power
Years	Pearson Correlation	.447
	Sig. (2-tailed)	.055
	N	19

The positive correlation with the  $p$  value only slightly greater than 0.05 ( $r = .447$ ,  $p < .055$ ) is consistent with the results obtained for the punching data. Thus one would conclude that length of training and power under reverse abdominal breathing could be related, but future research is needed to determine more precisely the interaction between length of training and the use of reverse abdominal breathing in the generation of greater kicking power.

Q4. Does resulting abdominal pressure relate to length of training?

Correlational analysis was applied to the data collected to examine the correlation of years of training with natural breathing pressure, reverse abdominal breathing

pressure, and the percent increase in pressure observed when the natural breathing condition was compared to the reverse abdominal breathing condition.

**Table 10. Correlation of Abdominal Pressure with Experience, Kicking**

		Natural Breathing Pressure	Reverse Abdominal Breathing Pressure	% Increase Pressure
Years	Pearson Correlation	-.223	-.253	.087
	Sig. (2-tailed)	.359	.296	.722
	N	19	19	19

The correlation between years of experience and natural breathing pressure is -.223. The correlation between years of experience and reverse abdominal breathing pressure is -.253. The correlation between percent increase in pressure and years of training is slightly positive ( $r = .087$ ). However, none of the correlations are statistically significant at the .05 level of significance. The slight positive correlation between the number of years of training and the percent increase in pressure can only be considered to be a very weak indicator of any positive correlation between number of years of experience in martial arts and percent increase in pressure. More research would be needed in order to determine the precise nature of the interaction between martial arts experience and the increase in abdominal pressure using the reverse abdominal breathing method.

## **Breaking**

Table 11 shows the results obtained for the 19 subjects executing breaking techniques. They struck a stack of ten re-breakable boards ten times; with nine boards being the maximum any subject broke. The subjects executed the breaking technique alternating between using the natural breathing method and the reverse abdominal breathing method. This test also shows the effect of the subjects' posture on abdominal pressure as they kneeled. The table shows the average pressure and power, using both the natural and reverse abdominal breathing methods, and the difference between the two results. The table then shows the percent increase in both pressure and power.

**Table 11. Breaking Data Table**

	Years	Natural Breathing Pressure	Reverse Abdominal Breathing Pressure	Pressure Difference Score	% Increase Pressure	Natural Breathing Power	Reverse Abdominal Breathing Power	Power Difference Score	% Increase Power
1	14	51.20	119.80	68.60	133.98	6.93	7.47	.53	7.69
2	8	37.00	129.73	92.73	250.63	4.73	6.20	1.47	30.99
3	6	67.20	113.00	45.80	68.15	5.93	7.20	1.27	21.35
4	4	43.13	130.27	87.13	202.01	3.07	5.87	2.80	91.30
5	4	55.13	87.40	32.27	58.52	4.60	5.07	.47	10.14
6	5	38.33	112.60	74.27	193.74	3.67	5.47	1.80	49.09
7	7	36.33	103.20	66.87	184.04	4.87	6.53	1.67	34.25
8	10	29.33	76.93	47.60	162.27	4.13	6.67	2.53	61.29
9	6	65.07	106.80	41.73	64.14	2.47	2.93	.47	18.92
10	10	65.07	121.87	56.80	87.30	6.40	7.33	.93	14.58
11	6	32.53	95.33	62.80	193.03	2.67	3.07	.40	15.00
12	12	74.70	99.10	24.40	32.66	7.90	8.80	.90	11.39
13	5	63.10	78.10	15.00	23.77	6.70	7.20	.50	7.46
14	17	124.00	165.40	41.40	33.39	8.30	8.30	.00	.00
15	8	41.60	61.00	19.40	46.63	4.50	6.30	1.80	40.00
16	7	40.40	84.00	43.60	107.92	5.30	6.30	1.00	18.87
17	3	92.70	139.00	46.30	49.95	5.20	6.00	.80	15.38
18	10	48.80	89.20	40.40	82.79	4.40	4.70	.30	6.82
19	7	34.30	153.90	119.60	348.69	3.20	3.90	.70	21.87
Total	19	19	19	19	19	19	19	19	19
Mean	7.84	54.7333	108.7702	54.0368	122.2957	4.9982	6.0684	1.0702	25.0740
Std. Deviation	3.610	23.70517	27.26741	26.47079	88.10020	1.68517	1.60002	.76529	22.36941
Minimum	3	29.33	61.00	15.00	23.77	2.47	2.93	.00	.00
Maximum	17	124.00	165.40	119.60	348.69	8.30	8.80	2.80	91.30

Q1. Does reverse abdominal breathing result in greater power than natural breathing?

The mean power for natural breathing is 5.00 and the mean power for reverse abdominal breathing is 6.07. The appropriate test of statistical significance for the difference in the two means is a paired sample *t*-test. As shown in Table 12, the difference in the means between the two breathing conditions is 1.07, which is highly significant ( $t = 6.095, p < .000$ ).

**Table 12. Mean Power Difference, Breking**

Mean Power Difference	S.D. <sup>1</sup>	S.E.M. <sup>2</sup>	95% Confidence Interval of the Difference		<i>t</i> <sup>3</sup>	df <sup>4</sup>	<i>p</i> <sup>5</sup>
			Lower	Upper			
1.0702	.76529	.17557	.7013	1.4390	6.095	18	.000
1: Standard deviation 2: Standard error of mean 3: Paired sample t-test 4: Degrees of freedom 5: <i>p</i> value. Significance criterion set at $p \leq 0.05$ .							

Since the difference in the means is statistically significant, this supports the conclusion that the observed increase in power is an effect of using reverse abdominal breathing while executing the breaking technique.

Q2. Does reverse abdominal breathing result in greater abdominal pressure than natural breathing?

The mean pressure for natural breathing is 54.73 and the mean pressure for reverse abdominal breathing is 108.77. The appropriate test of statistical significance for the difference in the two means is a paired sample *t*-test. As shown in Table 13, the difference in the means between the two breathing conditions is 54.04, which is highly significant ( $t = 8.898, p < .000$ ).

**Table 13. Mean Pressure Difference, Breathing**

Mean Abd. Pressure Difference	S.D. <sup>1</sup>	S.E.M. <sup>2</sup>	95% Confidence Interval of the Difference		<i>t</i> <sup>3</sup>	df <sup>4</sup>	<i>p</i> <sup>5</sup>
			Lower	Upper			
54.04	24.471	6.073	41.28	66.80	8.898	18	.000

1: Standard deviation  
 2: Standard error of mean  
 3: Paired sample *t*-test  
 4: Degrees of freedom  
 5: *p* value. Significance criterion set at  $p \leq 0.05$ .

These results are consistent with those found previously for the punching and kicking techniques. The observed increase in abdominal pressure appears to be an effect of using reverse abdominal breathing.

Q3. Does resulting power during reverse abdominal breathing relate to length of training?

Correlational analysis was applied in order to determine the correlation between years of training and breaking power using reverse abdominal breathing. The results of the correlation are shown in Table 14 below.

**Table 14. Correlation of Power with Experience, Breaking**

		Reverse Abdominal Breathing Power
Years	Pearson Correlation	.533
	Sig. (2-tailed)	.019
	N	19

The correlation is positive ( $r = .533, p < .019$ ). The positive correlation would support the relationship between length of training and reverse abdominal breathing but in the case of breaking, the relationship between the subjects' breaking position and power may be affected by the length of martial arts training because of the stances (i.e., horseback riding stance or other low stances) that are learned and practiced repeatedly over years of training. In conjunction with the data obtained for punching and kicking, these data indicate the need for further investigation of this relationship.

Q4. Does resulting abdominal pressure relate to length of training?

Correlational analysis was applied to determine the correlation between years of training and natural breathing pressure, reverse abdominal breathing pressure, and the percent increase in pressure from the natural breathing condition to the reverse abdominal breathing condition.

**Table 15. Correlation of Abdominal Pressure with Experience, Breathing**

		Natural Breathing Pressure	Reverse Abdominal Breathing Pressure	% Increase Pressure
Years	Pearson Correlation	.371	.224	-.169
	Sig. (2-tailed)	.118	.356	.488
	N	19	19	19

The correlation between years of experience and natural breathing pressure is .371. The correlation between years of experience and reverse abdominal breathing pressure is .224. The correlation between percent increase in pressure and years of training is slightly negative ( $r = -.169$ ). None of the correlations are statistically significant, indicating that length of training does not explain the relationship between abdominal pressure and breathing technique. These results are also consistent with those obtained for punching and kicking techniques and indicate that more research is needed on the relationship between experience, breathing technique and abdominal pressure.

Q5. Does kneeling or standing during natural breathing modify resulting abdominal pressure?

Abdominal pressure data for kneeling (breaking) and standing (punching) were compared for natural breathing. The descriptive statistics are shown in Table 16.

**Table 16. Descriptive Statistics: Kneeling and Standing Abdominal Pressure, Natural Breathing**

	N	Minimum	Maximum	Mean	Std. Error	Std. Deviation
Kneeling Natural Breathing Pressure (Breaking)	19	29.3	124.0	54.73	5.43	23.706
Standing Natural Breathing Pressure (Punching)	19	23.0	41.0	29.83	1.39	6.041

The mean pressure for kneeling (breaking) was 54.73 and mean pressure for standing (punching) was 29.83. The appropriate test of statistical significance for the difference in the two means is a paired sample *t*-test. As shown in Table 17, the difference in the means between the two conditions is 24.90, which is highly significant ( $t = 5.294, p < .000$ ).

**Table 17. Paired Sample *t*-Test Mean Abdominal Pressure Difference, Natural Breathing**

Mean Abd. Pressure Difference	S.D. <sup>1</sup>	S.E.M. <sup>2</sup>	95% Confidence Interval of the Difference		<i>t</i> <sup>3</sup>	df <sup>4</sup>	<i>p</i> <sup>5</sup>
			Lower	Upper			
24.90	20.5062	4.7044	15.021	34.788	5.294	18	.000
1: Standard deviation 2: Standard error of mean 3: Paired sample <i>t</i> -test 4: Degrees of freedom 5: <i>p</i> value. Significance criterion set at $p \leq 0.05$ .							

The data support the conclusion that abdominal pressure is significantly greater in the kneeling position when compared to the standing position.

Q6. Does kneeling or standing during reverse abdominal breathing modify resulting abdominal pressure?

Abdominal pressure data for kneeling (breaking) and standing (punching) were compared for reverse abdominal breathing. The descriptive statistics are shown in Table 18.

**Table 18. Descriptive Statistics: Kneeling and Standing Abdominal Pressure, Reverse Abdominal Breathing**

	N	Minimum	Maximum	Mean	Std. Error	Std. Deviation
Kneeling Reverse Abdominal Breathing Pressure (Breaking)	19	61.00	165.40	108.770	6.256	27.2678
Standing Reverse Abdominal Breathing Pressure (Punching)						
	19	37.15	89.85	64.744	3.765	16.4122

The mean pressure for kneeling (breaking) was 108.77, and the mean pressure for standing (punching) was 64.74. The appropriate test of statistical significance for the difference in the two means is a paired sample *t*-test. As shown in Table 19, the difference in the means between the two conditions is 44.03, which is highly significant ( $t = 8.508, p < .000$ ).

**Table 19. Paired Sample *t*-Test Mean Abdominal Pressure Difference, Reverse Abdominal Breathing**

Mean Abd. Pressure Difference	S.D. <sup>1</sup>	S.E.M. <sup>2</sup>	95% Confidence Interval of the Difference		<i>t</i> <sup>3</sup>	df <sup>4</sup>	<i>p</i> <sup>5</sup>
			Lower	Upper			
44.0258	22.55482	5.17443	33.1547	54.8969	8.508	18	.000

1: Standard deviation  
2: Standard error of mean  
3: Paired sample *t*-test  
4: Degrees of freedom  
5: *p* value. Significance criterion set at  $p \leq 0.05$ .

The data support the conclusion that abdominal pressure is significantly higher in the kneeling position when compared to the standing position.

## CHAPTER V

### DISCUSSION AND CONCLUSION

#### **Summary of Data Collection and Findings**

Table 20 summarizes the statistical data obtained for the comparisons of the differences in the means for both power and abdominal pressure during the tests involving punching, kicking and breaking. The differences in all of the means are statistically significant, indicating that there are significant relationships between increased power and the use of reverse abdominal breathing and between increased abdominal pressure and the use of reverse abdominal breathing for all three martial arts techniques.

Table 20. Summary Statistics for Power and Abdominal Pressure

<b>Power</b>						<b>Abdominal Pressure</b>					
	<b>Natural (S.D.)<sup>1</sup></b>	<b>Rev. Abd. (S.D.)</b>	<b>Difference (S.D.)</b>	<b><math>t^2</math></b>	<b><math>p^3</math></b>	<b>Natural (S.D.)</b>	<b>Rev. Abd. (S.D.)</b>	<b>Difference (S.D.)</b>	<b><math>t</math></b>	<b><math>p</math></b>	
<b>Punching</b>	52.13 (12.20)	59.27 (12.14)	7.14 (3.25)	9.581	<0.000	29.83 (6.041)	64.74 (16.412)	34.92 (15.393)	9.888	<0.000	
<b>Kicking</b>	77.43 (20.38)	84.37 (21.17)	6.94 (8.00)	3.784	<0.001	39.79 (8.08)	67.04 (15.88)	27.25 (14.07)	8.441	<0.000	
<b>Breaking</b>	5.00 (1.69)	6.07 (1.60)	1.07 (0.77)	6.095	<0.000	54.73 (23.71)	108.77 (27.27)	54.04 (24.47)	8.898	<0.000	

1: Standard deviation  
2: Paired sample  $t$ -test  
3:  $p \leq 0.05$  set as criterion for statistical significance

## **Conclusion**

Q1. Does reverse abdominal breathing result in greater power than natural breathing?

Yes. Under reverse abdominal breathing, the mean percentage increase in punching power was 15%; the mean percentage increase in kicking power was 10%; and the mean percentage increase in breaking power was 25%. The subjects are experienced practitioners of Tae Kwon Do, however, they do not regularly practice reverse abdominal breathing. As suggested in the study, subjects can improve their power with regular practice of reverse abdominal breathing. This finding demonstrates that martial artists practicing reverse abdominal breathing can increase their power tremendously. Furthermore, “Mu Do Ki Kong experts can increase their power more than 12 times that of the average person” (Ko Dung, Choung Il Lang, 1996).

Q2. Does reverse abdominal breathing result in greater abdominal pressure than natural breathing?

Yes. Under reverse abdominal breathing, the mean percentage increase in abdominal pressure for punching was 121%; the mean percentage increase in abdominal pressure for kicking was 73%; and the mean percentage increase in abdominal pressure for breaking was 122%. This increased pressure is good for general physical health because of the emphasis on the stomach and intestines. It also helps to maintain proper blood circulation and to prevent illness and increases the capabilities of the immune system (Yayama, Toshihiko, 1999).

Q3. Does resulting power during reverse abdominal breathing relate to length of training?

No, but further research is needed. The correlations between power and length of training using reverse abdominal breathing were not significant for punching and kicking, although the results for kicking bordered on significance. The correlation between power and length of training for breaking was significant, however. It is possible that continued practice of low stances over the course of martial arts training has an effect on the level of power that occurs during the execution of certain types of techniques and stances, such as kneeling during breaking. These results suggest that length of martial arts training alone does not necessarily increase power when using reverse abdominal breathing. Therefore, the martial artist must train specifically in reverse abdominal breathing in order to increase power.

Q4. Does resulting abdominal pressure relate to length of training?

No. The length of training was not significantly related to changes in lower abdominal pressure for kicking and breaking, but the results were close to being statistically significant for punching. The data demonstrate the vital importance of combining proper breathing techniques with the physical training of martial arts.

Q5. Does kneeling or standing during natural breathing modify resulting abdominal pressure?

Yes. There was a significant relationship between the subjects' position and abdominal pressure. Abdominal pressure was significantly increased while the subjects were in the kneeling position

during the knife-hand breaking test. When the subjects knelt, mean abdominal pressure was increased by 83%. This means that when one lowers the body, abdominal pressure will increase along with power. As a result, during martial arts training, lower stances can increase abdominal pressure, which can result in greater power.

Q6. Does kneeling or standing during reverse abdominal breathing modify resulting abdominal pressure?

Yes. There was a statistically significant relationship in the knife-hand breaking test between subjects' position and abdominal pressure. Lower abdominal pressure was significantly increased during the kneeling position while using reverse abdominal breathing. When the subjects knelt, mean abdominal pressure was increased by 68%. It appears that during martial arts training, lower stances combined with using reverse abdominal breathing can increase abdominal pressure.

## **Discussion**

The results of this study demonstrate the impact of reverse abdominal breathing on both power and internal abdominal pressure while performing basic martial arts techniques, such as punching, kicking, and breaking. This study was successful in showing that reverse abdominal breathing can increase the abdominal pressure, which in turn increases power. In breaking, the mean percentage increase in power was 25%, and one of the subjects increased his power by 91%. This shows good potential for anyone who wants to increase his or her power using the

reverse abdominal breathing method consistently in practicing martial arts. The use of this method along with a lower stance can increase power as well. As an example, the traditional low horse-back riding stance is a required basic movement in training to increase power as well as focus on increasing lower abdominal pressure through breathing.

### **Recommendations for Future Research**

Further research in the following areas will be beneficial for the martial arts, as well as other types of physical activity, and could also provide a greater understanding of general health. It is also important to gather data on regular lower abdominal breathing to determine whether regular or reverse lower abdominal breathing is more beneficial and which one produces more power.

A new theory has recently emerged. Sam Kyuk theory (center of Kyuk (middle), between Um Kyuk and Yang Kyuk), focuses on a new concept of energy movement and development, called Tae Kyuk Ki Kong, which could also be examined through research (Park, Young Gin, 2001).

How this physical power influences individual mental confidence is also of interest, especially in terms of training individuals in these breathing techniques to facilitate physical activity and to focus power in specific body areas. There is also a need to establish the role of mental concentration, and the resulting brain waves, in producing power and pressure when lower, reverse or natural breathing is being used.

It will also be important to examine how stances affect abdominal pressure. This pressure, when practiced with the wrong method, can cause an increase in cranial pressure. A device that would

provide close monitoring of cranial pressure should be developed to prevent risks to health, such as stroke or brain damage. If practiced accurately and safely, this power or extra energy will be applicable to other sports.

In terms of methods of measurement, the use of the abdominal pressure device designed by the researcher was adequate for this study, but a more scientific advance in the future would further improve the instrument. The method for measurement of the power could also be improved by the development of a more sophisticated device.

Finally, the relationship between breathing and childbirth has long been recognized. By studying the impact of reverse abdominal breathing on abdominal pressure and power, we may be able to improve the breathing techniques that are currently used to assist women during labor and childbirth.

# APPENDIX A

## RECORD SHEET FOR EXPERIEMENT

Questionnaire for Martial Arts Breathing Practice Date: \_\_\_\_\_ Occupation: \_\_\_\_\_

Gender: \_\_\_\_\_ Age: \_\_\_\_\_ Years Training: \_\_\_\_\_ Height: \_\_\_\_\_ Weight: \_\_\_\_\_

<p>Punching Natural: 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____  7. _____ 8. _____ 9. _____ 10. _____ Avg. _____  Reverse Abdomen:  1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____  7. _____ 8. _____ 9. _____ 10. _____ Avg. _____</p>
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<p>Kicking Natural: 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____  7. _____ 8. _____ 9. _____ 10. _____ Avg. _____  Reverse Abdomen:  1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____  7. _____ 8. _____ 9. _____ 10. _____ Avg. _____</p>
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<p>Breaking Natural: 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ Avg. _____  Reverse Abdomen  1. _____ 2. _____ 3. _____ 4. _____ 5. _____ Avg. _____</p>
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\* I, as a Black Belt, realize this test is very important for martial arts future study, and voluntarily participate in this experiment.  
\_\_\_\_\_ (signature)

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