

**The 5th International Symposium for
Taekwondo Studies**

Leading Toward Taekwondo Excellence

May 9-10, 2015

South Ural State University, Russia



Opening Address



Dr. Chungwon Choue
President, World Taekwondo Federation

Together with the global Taekwondo family, I welcome you to the 5th International Symposium for Taekwondo Studies here in Chelyabinsk, Russia.

I wish to thank the International Association for Taekwondo Research (IATR) and Ural State University of Physical Culture for jointly organizing this symposium.

My special thanks also go to the keynote speakers, presenters, and contributors of this meaningful platform of discussion for the further development of Taekwondo as an academic discipline.

With a view to promoting the science of Taekwondo, the World Taekwondo Federation has promoted this International Symposium for Taekwondo Studies since 2007, on the occasion of the biennial WTF World Taekwondo Championships, to a great success.

The first International Symposium for Taekwondo Studies took place in 2007 in Beijing, China. The WTF hosted the 2nd symposium in 2009 in Copenhagen, Denmark; with the third and fourth ones in 2011 in Gyeongju, Korea and in 2013 in Puebla, Mexico, respectfully.

The main theme of this 5th International Symposium is “Leading Toward Taekwondo Excellence.” The main theme well reflects Taekwondo as it rapidly develops worldwide.

In a few days, you may have opportunity to watch the dynamic and action-packed

Taekwondo competition at the 2015 World Taekwondo Championships, in which the world's best Taekwondo athletes will test their skills. You will also have a chance to watch Taekwondo demonstrations by both the WTF and the International Taekwondo Federation (ITF) teams during the opening ceremony of the World Taekwondo Championships on May 12.

We are here today to expand the world's academic knowledge of Taekwondo. Though the science of Taekwondo is still new, much progress has been made with your dedication and research. Especially the establishment of the International Association of Taekwondo Research (IATR) will greatly help promote the academic discipline of Taekwondo.

I strongly believe the research and ideas presented at this symposium will serve as an important foundation for the future of Taekwondo in the academic field. In this regard, I ask for your continued research and contributions.

Once again, I appreciate the organizers of this symposium for their dedicated efforts for a successful event. I wish each of you the best luck.

Congratulatory Address



Evgeniv Orekhov, Ed.D
Rector, Ural State University of Physical Culture
President, Russian Organizing Committee for the 5th International
Symposium for Taekwondo Studies

I would like to gladly welcome all the attendees to the 5th International Symposium for Taekwondo Studies, and express gratitude to the World Taekwondo Federation executives responsible for the decision of holding it together with the Ural State University of Physical Culture in the year of our 45th anniversary.

Nowadays, much attention is paid to the development of physical culture and sport in Russia. The greatest sport forums, like the Worldwide Universiade in Kazan (2013), Winter Olympic and Paralympic Games in Sochi (2014), and Deaf Olympic Games in Khanty-Mansiisk and Magnitogorsk (2015) have been carried out in our country can serve as evidence of it. The WTF World Championships is a remarkable continuance of this tradition.

It is impossible to reach high results in modern sport without using the latest results of scientific research, which is why the significance of our symposium is undoubted.

Being the leading research education centre of the Ural Federal District, our university carries out innovative research programmes in the field of Taekwondo. One of our aims is the establishment of contacts with colleagues not only from Russia, but also from abroad. Holding this symposium will become one more obvious mark of the university's development. We also hope this symposium will further develop Taekwondo training systems and coaches, as well as help advance this kind of sport in Russia and all over the world.

Let me express my gratitude to Rector of the South Ural State University for providing the opportunity to hold the symposium within the walls of one of the leading

higher educational establishments of Russia while our university is being reconstructed.

With all my heart I wish the attendees of “The path to success in Taekwondo” symposium thirst for creative search, reaching new heights in their professional activities and successful implementation of all projects!

Congratulatory Address



Jong-Deok Kim, Ph.D.
Ministry of Culture, Sports and Tourism
Republic of Korea

President Chungwon Choue, IOC Members, World Taekwondo Federation Executive Members, and distinguished guests: On behalf of the Minister of Culture, Sport, and Tourism, it is a great honor for me to be here at the 5th International Symposium for Taekwondo Studies.

Taekwondo was born a traditional Korean martial art. However, it no longer belongs to just one country. At this moment of celebration, I would like to express my gratitude to everyone whose dedication and efforts have contributed to make Taekwondo one of the most popular Olympic sports in the world. I believe this event will contribute to the globalization and scientific development of Taekwondo. I, as a representative of the South Korean government, sincerely thank you for your efforts.

Through this symposium, many researchers have acquired important scientific and systematic results, and by doing so have provided valuable information to the global community of Taekwondo scholars. All the more, please accept my congratulations on the success of the founding of the International Association for Taekwondo Research in 2013, and the first publications of the Journal of International Association for Taekwondo Research last year.

In the last few years, the culture, traditions, and spirit of Korea have made the Korean Wave, called Hallyu in Korean, which is loved by all age groups over the world. Now, Korea is dedicated to the development of the nation through its unique arts, sports, and tourism opportunities. I would like to ask each of you to continue expanding Taekwondo globally while upholding its special Korean values and characteristics to ensure its worldwide development. I am confident this symposium will

contribute toward this goal.

For instance, demonstration teams from the World Taekwondo Federation and the International Taekwon-Do Federation demonstrations will perform at the World Taekwondo Championships in the next few days. It is a great opportunity to harmonize not only all Taekwondo practitioners but also both Korean nations.

This symposium promotes a more scientific approach to the sport and art of Taekwondo. It is a cornerstone of Taekwondo's advancement. As such, I am proud to announce that the Ministry of Culture, Sports and Tourism will from now on support the International Association for Taekwondo Research. With the support of the Korean government, the IATR will continue promoting scientific investigation and scholarship of Taekwondo. In this way, the Korean government will thus be supporting Taekwondo holistically.

Once again, I want to express my deep gratitude to the hosts of this event. And please continue giving your love to Taekwondo.

Thank you.

Symposium Schedule

Date	Time	Duration	Program	Note
May 9 (Sat)	09:00 – 11:00	120'	Attend 70th Anniversary of Russia's Victory in World War II Parade	Teatral'naya Square
	11:00 – 11:30	30'	Move to South Ural State University	
	11:30 – 12:30	60'	Lunch	Ural'skiye Pel'meni Restaurant
	12:30 – 13:00	30'	Symposium Registration	Sigma Hall, 2F; Institute of International Education (IIE); South Ural State University
	13:00 – 13:30	30'	Opening Ceremony	
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	15:50 – 18:10	140'	Academic Session I (Natural Sci./Social Sci.)	
	20:00 – 22:00	120'	Reception & Banquet	Malakhit Hotel

May 10 (Sun)	09:00 – 09:10	10'	Opening Remarks Dr. John A. Johnson	Sigma Hall, 2F; Institute of International Education (IIE); South Ural State University
	09:10 – 09:40	30'	Special Lecture Dr. George Vitale	
	09:40 – 09:45	5'	Break	
	09:45 – 11:45	120'	Academic Session II (Natural Sci./Social Sci.)	
	11:45 – 13:00	75'	Lunch	Ural'skiye Pel'meni Restaurant
	13:00 – 15:00	120'	Annual Meeting Editorial Board Meeting Round Table	Sigma Hall, 2F; Institute of International Education (IIE); South Ural State University
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The 5th International Symposium for Taekwondo Studies



Leading Toward Taekwondo Excellence

Keynote Speeches



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Development of a Consistent International Educational Context by Training Taekwondo Specialists

Evgeniv Orekhov*

Rector, Ural State University of Physical Culture

Professor, Pedagogical Sciences, Ural State University of Physical Culture

President, Russian Organizing Committee for the 5th International Symposium for Taekwondo Studies, Russia

Abstract

Purpose: This study provides a systematic approach for the international education context development by training WTF Taekwondo athletes.

Methods: We examined the use of modern education and research technologies and management strategy principles of the Taekwondo training process.

Contents: Accepting the fact of increasing popularity of Taekwondo as an Olympic sport, it is necessary to point out the importance of systematic approach use towards Taekwondo management strategy development in Russia. In connection with the use of this approach, some requirements were applied to solve a wide range of new problems, some of them are as follows:

1. International experience studying and implementation into the present Russian research base in the field of Taekwondo.
2. Cooperation between Russian and foreign specialists improvement.
3. Common Taekwondo specialists' educational path formation.
4. Economic, material, and technical base development for grant support for the most promising researches and education projects.
5. For Taekwondo sportsmen training process research and methodology support, it is necessary to create an international complex scientific group (ICSG).
6. Attracting modern technologies for training process monitoring.
7. Joint research in the field of Taekwondo coordination.

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8. Russian academics involvement and membership in the international Taekwondo federations' development.
9. New education technologies and methods (e.g., summer school) development for involvement of the best Taekwondo experts.

Results: We defined ways to further develop Taekwondo in the Russian Federation, pointed out the cooperation trends between Russian and foreign specialists, came to the decision on summer school organization advisability, and demonstrated the significance of common Taekwondo specialists' educational path. These results allow us to make methodological recommendations for athletes at different levels of training while taking into account general model characteristics as well as improving Taekwondo training in Russia.

Conclusion: With a systematic approach toward training WTF Taekwondo specialists, we may form an educational context at Ural State University of Physical Culture (UralSUPC). This permits us develop Russian sport, expand sharing experiences, and implement new technologies into the education and training processes.

Keywords: Taekwondo, educational path, systematic approach, intercultural exchange, new education technologies, summer school, training process control

Taekwondo as a System of Spiritual and Moral Upbringing of Youth

Maksim Karpov*

Ural State University of Physical Culture, Russia

Abstract

Purpose: We suggest viewing Taekwondo not only as an Olympic sport and combat sport, but also as a system of spiritual and moral upbringing of youth.

Methods: This study's specific significance is to reconsider the historic nurturing experience from the viewpoint of the modern theory of upbringing. It is important to formulate and justify the pedagogical basis of sporting entities' activity, whose implementation in practice would help them take a decent place in the system of moral and patriotic upbringing of the younger generation under new socio-economic conditions. According to our statistics collected by surveying athletes' parents and athletes themselves, about 10% of the total number of practitioners practice to achieve high sporting results, while for the remaining 90% the key motivation to practice Taekwondo is to develop their own personality, strengthen the body, and improve spiritually. Taekwondo in the world is more than a sport—it is a certain culture embracing the opportunity for physical improvement and a powerful system of spiritual and moral upbringing of youth.

Results: Thus, successful organization of nurturing work with children and youth in the process of Taekwondo training requires: creation of a nurturing environment in the sporting entity on the basis of humane-oriented and individual approaches, contributing to self-determination, self-orientation, and self-fulfillment of athletes; involvement of teenagers in the processes of creating structural design and organization of a sporting entity (school) activity; availability of programs and methodol-

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ogy for nurturing in the process of sporting activity under conditions of a sporting entity; study of the closest social environment in order to single out values and ideals that form the basis of family upbringing; inclusion in the system of creative team work which is socially valuable; organization of a nurturing environment in extra-curricular (extra-training) activity of practitioners and actualization of a healthy lifestyle; use of various forms and methods of upbringing corresponding to objective aims and tasks of fitness and sporting activity, and reflection of the teenagers' personal positive striving to improve the environment and to understand the meaning of life in line with universal cultural traditions.

Conclusions: By way of developing Taekwondo throughout the country and bringing more and more children and youth to practice, it is possible to achieve a significant decrease in crime and drug addiction figures, and bring up a healthy generation of patriots of their country able to solve the most complicated issues.

Keywords: Taekwondo, system of spiritual and moral upbringing

Maximizing Physiological Performance of Taekwondo Athletes: Insights from Animal Athletes

James H. Jones*

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University of California Davis, USA

Abstract

We can learn many things about human athletic performance by studying and understanding animal athletic performance; after all, humans ARE animals! I will use examples of extreme differences in two variables that we study in comparative physiology to demonstrate how they can determine a Taekwondo athlete's maximal performance: body temperature and body size. Body temperature is a fundamental determinant of physiological function, because the rates at which all physiological processes occur are, ultimately, determined thermodynamically by the temperature at which the function is carried out. For vertebrate animals (including humans), the thermodynamics that govern chemical reaction rates dictate that for every increase in temperature of 10 °C, there is a corresponding average increase in chemical reaction rate of approximately 2.3-fold, a relationship called the Q_{10} effect. This relationship dictates the rate of actin-myosin cross-bridge cycling that determines the rate at which skeletal muscle shortens and, therefore, the speeds of punches, kicks, and blocks. Recognition of temperature effects emphasizes the importance for Taekwondo competitors to warm up sufficiently, so that these thermodynamic effects will enable them to punch, kick, and block at the maximal speeds of which their muscles are capable. Body size affects structure and function of animals more than any other single factor. It determines the relative strength of animals of different size based on differences in body size, or scaling, of factors such as the cross-sectional area of muscles (determines the total force they can generate) vs. the body weight of the animal. In a similar fashion, the time required for any physiological process to occur changes regularly and predictably with body size such that any function takes longer

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to occur in a larger animal than a smaller one. This relationship has ramifications for dictating that smaller competitors will nearly always be faster than larger ones.

Keywords: Q_{10} effect, temperature, allometry, body size

Using Taekwondo History to Secure Its Olympic Status

George Vitale*

The National Committee on North Korea, USA
Korea Society, USA
Vice President, Tae Kwon Do Times, USA

Abstract

The history of Taekwondo has been a highly controversial topic for a myriad of reasons. Some factors that have contributed to the controversy stem from attempts to reinvigorate Korean nationalism after the Japanese occupation. Taekwondo's actual developmental path has roots in this period, but eventually split due into two major directions: one becoming a national sport and the other a method of self-cultivation through self-defense. This division has resulted in two major styles of Taekwondo, commonly referred to by their respective organizations' names; i.e., the International Taekwon-Do Federation (ITF) and the World Taekwondo Federation (WTF). The ITF and WTF are now supported respectfully the by southern and northern halves of Korea and are symbolic of the overall greater divide of the Korean people. This research uses a linear historical approach to examine events in Taekwondo history to further dispel the 2,000 year-old myth about Taekwondo's history to explain the history of Taekwondo as a sport and martial art. This information may be useful for several reasons. It elucidates the two styles' common roots, which may contribute to closer relationships between the ITF and WTF. This type of analysis can additionally serve as a mechanism in crediting the many influential personnel that helped develop Taekwondo and disseminate it around the world. In light of the recent historical agreement between the WTF and ITF, this information may help the current leaders of the groups move from the animosity of the past caused in part by a political situation that no longer exists and the rivalries of those past leaders who are no longer on the scene. Most importantly, learning from the past helps chart a more positive way forward together which can also ensure Taekwondo retains its status as an Olympic sport.

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Keywords: Tae-Hi Nam, Cha-Kyo Han, Chong-Woo Lee, Korean 29th Infantry Division, Military Taekwon-Do, Civilian Taekwondo, Tae Soo Do, General Hong-Hi Choi

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Effect of Hopping Frequency on the Performance of Roundhouse Kick

Young-Kwan Kim*, Hwi-Jung Jung, Ji-Yong Joo

Department of Physical Education, College of Education, Chonnam National University, Korea

Abstract

Purpose: The purpose of the study was to investigate the effect of hopping frequency in preparatory movements in the performance of the roundhouse kick in Taekwondo.

Methods: Eleven Taekwondo athletes consisting of five male athletes and six female athletes (age: 14.4 ± 1.4 years; mass: 43.5 ± 7.8 kg; height: 1.55 ± 0.07 m) voluntarily participated in this study. They performed preparatory hopping prior to the roundhouse kick. Four different hopping conditions (normal hopping, 15% faster and 15% slower than normal hopping, and no hop) were defined. When an external stimulus (a blink of an LED located next to a target) was turned on, athletes performed the roundhouse as fast as accurately to a target at the level of abdomen. The response time of kicking and the kicking speeds were calculated and compared by one-way repeated measures ANOVA with a significance of .05.

Results: There was no main effect of hopping frequency, but the 15% faster hopping frequency than normal hopping frequency (i.e., preferred frequency) reduced the response time of kicking significantly than the 15% slower hopping frequency did ($p < .05$). The 15% faster hopping frequency than normal frequency would be beneficial to maximum kicking speed.

Conclusions: Coaches should be mindful of the hopping frequency of athletes in sparring. In order to enhance athlete's kicking speed, an athlete should increase his/her hopping frequency than preferred normal frequency. Also, coaches must carefully watch an athlete's rhythm of hopping and should not let his/her hopping fre-

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quency fall under his/her normal hopping frequency because of the slower response to an external stimulus.

Keywords: roundhouse kick, response time, kicking speed, hopping rhythm



Figure 1. Experimental set-up for kicking task

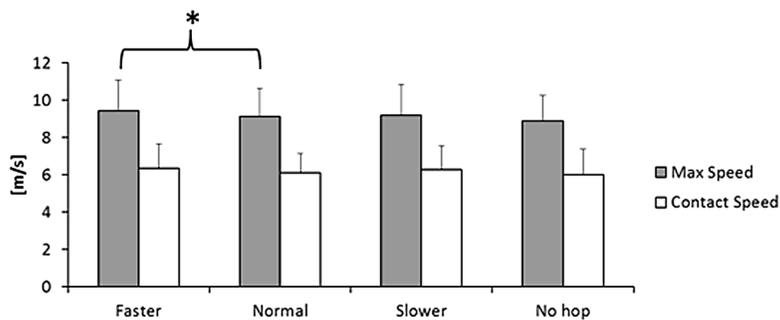


Figure 2. Comparison of maximum kicking speed and contact speed according to hopping frequency. *significant difference between two groups ($p < .05$).

Table 1. Response time, ground time, and kicking time according to change in hopping frequency (unit: second)

Frequency	Response Time		Ground Time		Kicking Time	
	M	SD	M	SD	M	SD
15% Faster	0.762*	0.056	0.222	0.075	0.542	0.111
Normal	0.800	0.099	0.200	0.040	0.605	0.130
15% Slower	0.808*	0.079	0.222	0.020	0.588	0.067
No Hop	0.768	0.050	0.227	0.023	0.545	0.038

*significant difference between two groups ($p < .05$)

Preparatory Motions of Roundhouse Kicks according to Different Target Distance Conditions

Madoka Kinoshita^{1*}, Norihisa Fujii²

¹Doctoral Program in Physical Education, Health and Sport Science, University of Tsukuba, Japan

²Faculty of Health and Sport Science, University of Tsukuba, Japan

Abstract

Purpose: The purpose of this study was to clarify preparatory motions in a Taekwondo roundhouse kick according to the different target distance conditions.

Methods: Thirteen male Japanese Taekwondo athletes participated in this study. The participants had diverse skill levels. They performed roundhouse kicks to a target with three distance conditions (short, normal, and long). The 3D coordinates of the reflective markers on body segments and the target were captured by a motion capture system (Vicon MX+, 250 Hz). The ground reaction forces (GRFs) were obtained with both kicking and support legs by two force platforms (Kistler, 1000 Hz). The impulse of GRFs and the angular impulse of GRFs were calculated. A roundhouse kick was divided into three phases with four events as shown in Figure 1. The READY phase was main subject of this study.

Results: There was no significant difference in the time during the READY phase and kicking speed at impact according to three distance conditions (Figure 2). Significant difference was obtained for impulse of kicking direction (Y axis) in both the kicking and support legs during distance conditions (Figure 3) and angular impulse around the vertical axis (Z axis) in the support leg between short and long distance conditions and between normal and long distance conditions (Figure 4).

Conclusions: Taekwondo athletes should adjust the translational motion of their roundhouse kicking directions by adjusting not only their kicking but also their supporting legs. They should additionally adjust the rotational motion around the

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vertical axis in relationship to the kicking speed generation by the supporting leg. In a short distance condition, they should control more rotational motion in the READY phase to generate kicking speed, because there is not enough distance to get the speed of translation. In the long distance condition, they should control more translational motion in the READY phase to generate kicking speed. These results provided new insight into the specific roles of the both legs in the READY phase according to different target distance conditions.

Keywords: ground reaction forces, READY phase, kicking time, kicking speed

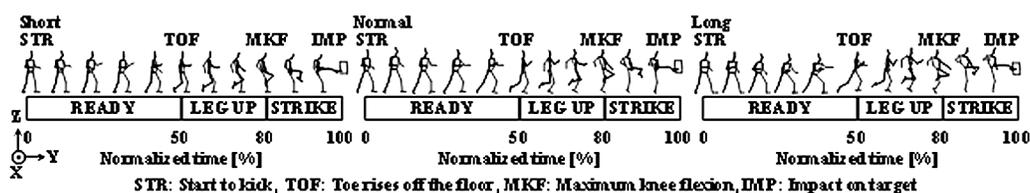


Figure 1. Motion of roundhouse kick in three different target distance conditions. The Y axis was the direction of the kicking mitt, the Z axis was the vertical axis, and the X axis was crossing these two axes at a right angle.

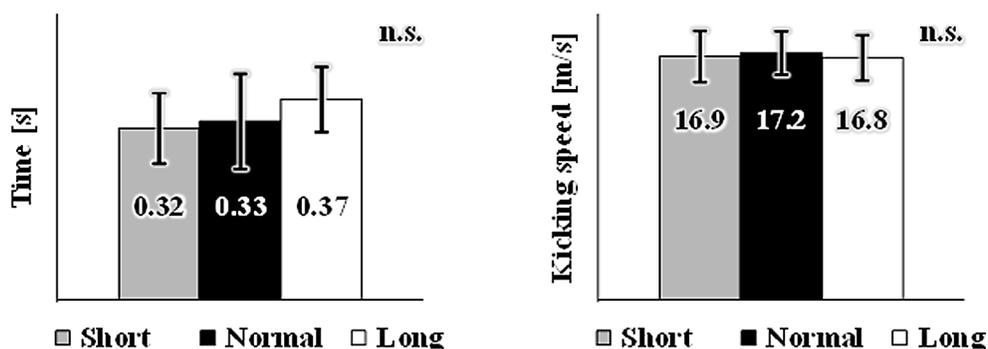


Figure 2. The mean kicking time during the READY phase and kicking speed at impact according to three different target distance conditions.

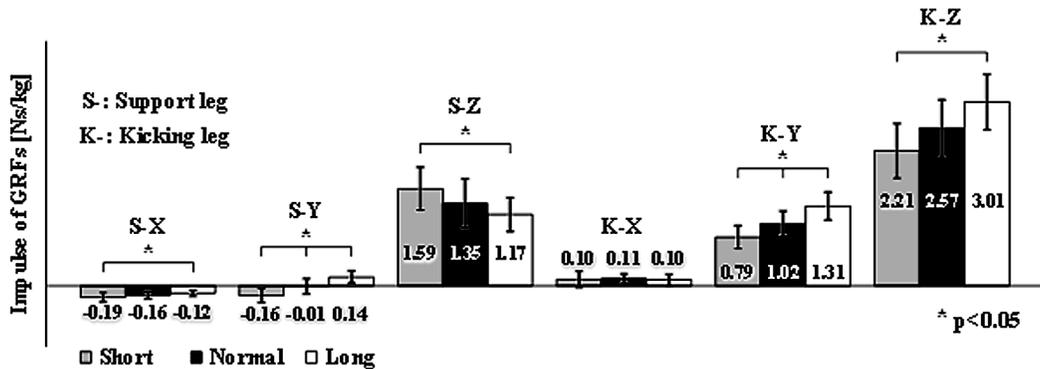


Figure 3. The mean impulse of ground reaction forces during the READY phase divided by the body mass. S-X was the impulse of the X axis direction in the supporting leg. S-Y was the impulse of the Y axis direction in the supporting leg. S-Z was the impulse of the Z axis direction in the supporting leg. K-X was the impulse of the X axis direction in the kicking leg. K-Y was the impulse of the Y axis direction in the kicking leg. K-Z was the impulse of the Z axis direction in the kicking leg. Impulse of the Z axis in both legs included the impulse opposing gravity.

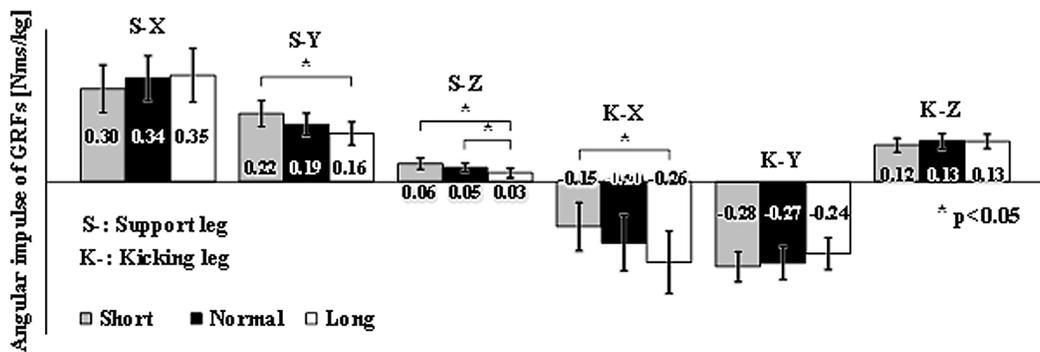


Figure 4. The mean angular impulse of ground reaction forces during the READY phase divided by body mass. S-X was the angular impulse around the X axis in the supporting leg. S-Y was the angular impulse around the Y axis in the supporting leg. S-Z was the angular impulse around the Z axis in the supporting leg. K-X was the angular impulse around the X axis in the kicking leg. K-Y was the angular impulse around the Y axis in the kicking leg. K-Z was the angular impulse around the Z axis in the kicking leg. Angular impulse around Z axis in both legs included angular impulse generated by the moment around the center pressures in both legs.

Analysis of Kinematic Variables for the Consistency of Taekwondo Pyeongwon Poomsae

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Abstract

Purpose: The aim of this study was to investigate the consistency of the kinematic variables such as time and distance at Taekwondo pyeongwon poomsae.

Methods: The movements of six Taekwondo Poomsae athletes (age: 21.2 ± 1.2 years; weight: 67.7 ± 7.7 kg; height: 173.4 ± 4.0 cm; career: 7.7 ± 3.9 years) who are enrolled at K university in South Korea were analyzed. The multi-capture imaging system with six video-cameras (60 frames/s, Visol kwon3D 3.1) was employed to record full-body movement of 6 subjects. The two LEDs (light-emitting diode) were used to synchronize six video-cameras (motion master 60). The changes, ranges, and executed time of the vertex's moving distance were analyzed in order to find the accuracy of pyeongwon poomsae. The characteristics of pyeongwon poomsae performance was categorized with simple and couple motions. Each motion was divided into fourteen phases. The entire phases of the vertex movement data were normalized with time.

Results: The executed time of phase 4, phase 10, phase 5 and phase 11 showed different duration of 2.14 ± 0.16 sec, 0.96 ± 0.15 sec, 1.43 ± 0.11 sec and 2.61 ± 0.19 sec respectively. The change and range of vertex moving distance at frontal plane were shown on an average of -0.38 ± 0.19 m and 0.83 ± 0.13 m, respectively. The change and range of vertex moving distance at sagittal plane demonstrated an average of -0.22 ± 0.19 m and 2.77 ± 0.14 m, respectively. The change and range of vertex vertical movement were showed on the average of -0.20 ± 0.02 m and 0.67 ± 0.13 m respectively

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Conclusions: The taekwondo pyeongwon poomsae movement of the change, range of vertex moving distance and executed time has to be symmetrical at the frontal and sagittal plane but it shows no symmetrical movement pattern. These results suggest that the additional evaluation criteria should be added in the accuracy category for the objective judgment.

Keywords: consistency, symmetrical movement pattern, vertex, executed

Table 1. The executed time of individual phases and the whole phase during Taekwondo pyeongwon poomsae (unit: sec)

Phase	Subject A		Subject B		Subject C		Subject D		Subject E		Subject F		M±SD
	Time	%											
1PH	9.73	29	9.98	29	10.32	29	10.22	28	9.35	28	9.88	29	9.91±0.35
2PH	0.70	2	0.60	2	0.52	1	0.55	2	0.52	2	0.60	2	0.58±0.07
3PH	2.80	8	2.73	8	2.90	8	2.88	8	2.80	8	2.97	9	2.85±0.08
4PH	2.23	7	2.10	6	2.13	6	2.35	7	2.13	6	1.88	5	2.14±0.16
5PH	1.28	4	1.33	4	1.37	4	1.50	4	1.55	5	1.53	4	1.43±0.11
6PH	2.18	6	2.05	6	2.23	6	2.13	6	2.00	6	2.03	6	2.11±0.09
7PH	2.00	6	2.15	6	2.02	6	2.17	6	1.98	6	2.25	7	2.09±0.11
8PH	1.27	4	1.05	3	1.30	4	1.55	4	1.20	4	1.38	4	1.29±0.17
9PH	2.80	8	2.95	9	3.02	9	2.90	8	2.85	9	3.00	9	2.92±0.09
10PH	1.07	3	0.93	3	1.00	3	1.08	3	1.00	3	0.68	2	0.96±0.15
11PH	2.37	7	2.60	8	2.60	7	2.95	8	2.53	8	2.63	8	2.61±0.19
12PH	2.20	6	2.17	6	2.27	6	2.32	6	2.05	6	1.83	5	2.14±0.19
13PH	2.13	6	2.17	6	2.12	6	2.12	6	2.15	6	2.33	7	2.17±0.08
14PH	1.28	4	1.27	4	1.33	4	1.43	4	1.15	3	1.32	4	1.30±0.09
WP	34.05		34.08		35.12		36.15		33.27		34.33		34.50±1.00

PH: phase, WP: whole phase

Table 2. The change and range of vertex moving distance at frontal plane, sagittal plane, and of vertex vertical movement (unit: m)

Subject	Whole Phases					
	Change			Range		
	X	Y	Z	X	Y	Z
Subject A (3.26)	-0.59	-0.17	-0.20	1.01	2.59	0.72
Subject B (3.16)	-0.03	-0.33	-0.23	0.93	2.70	0.83
Subject C (3.48)	-0.46	-0.08	-0.20	0.74	2.95	0.68
Subject D (3.36)	-0.46	-0.55	-0.23	0.73	2.78	0.72
Subject E (3.22)	-0.34	-0.05	-0.23	0.69	2.71	0.58
Subject F (3.40)	-0.42	-0.16	-0.19	0.90	2.91	0.47
M±SD	-0.38±0.19	-0.22±0.19	-0.21±0.02	0.83±0.13	2.77±0.14	0.67±0.13

(): the accuracy score

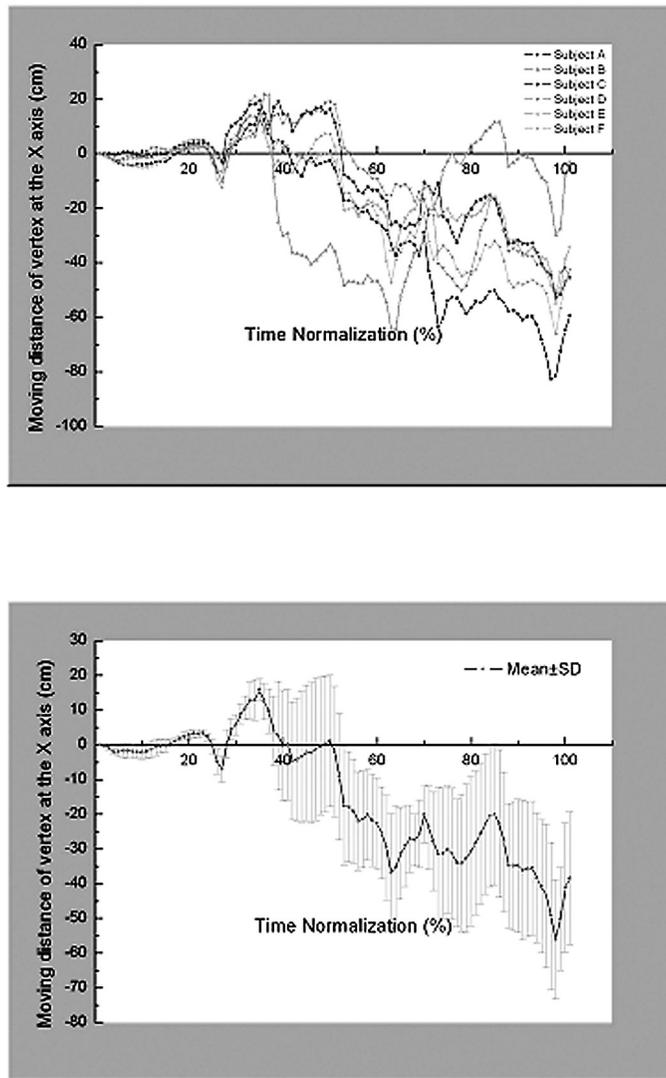


Figure 1. Normalized vertex moving distance on the frontal plane

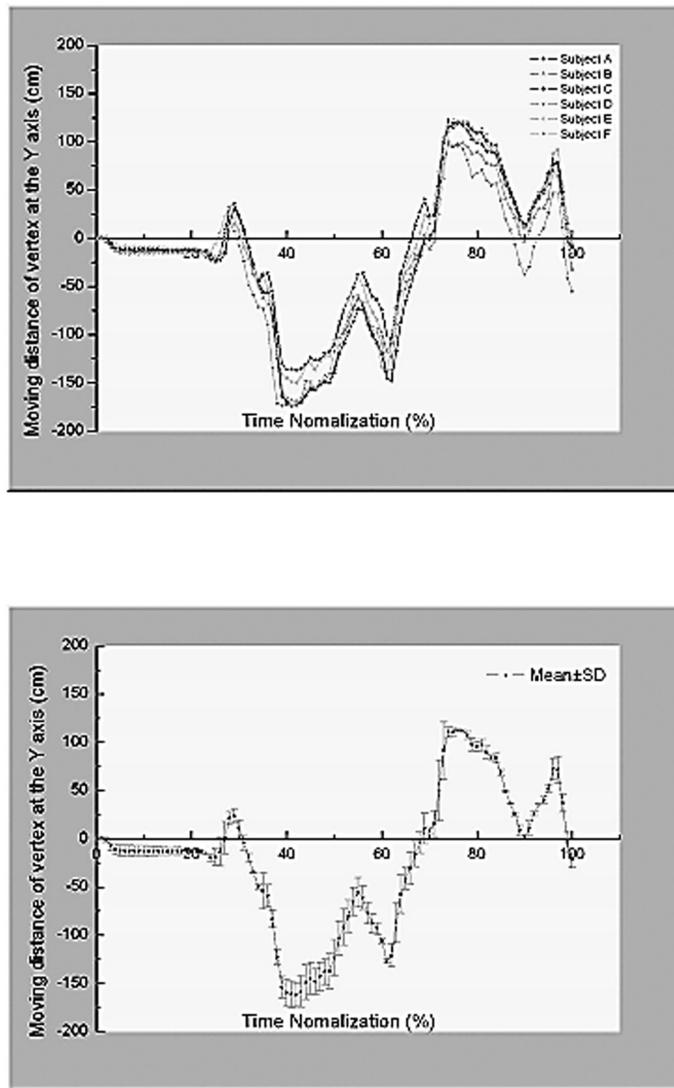


Figure 2. Normalized vertex moving distance on the sagittal plane

Effects of Chronic Dietary Nitrate Supplementation on the Hemodynamic Response to Exercise

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Abstract

Purpose: The purpose of this study was to test the hypotheses that: 1) chronic dietary supplementation with beetroot juice (BRJ) (which contains high levels of nitrates [NO_3^-] and nitrites [NO_2^-]) attenuates mean arterial blood pressure (MAP) and rate x pressure product (RPP, an index of myocardial O_2 consumption) and enhances stroke volume (SV) and cardiac output (CO) at rest and during progressive elevations in exercise intensity, and 2) these effects are partly due to reductions in peripheral vasoconstriction.

Methods: In 14 healthy male subjects, we compared effects of 15 days of dietary supplementation with BRJ (4.2 mmol/day in 70 ml) and nitrate depleted beetroot juice (NDBRJ) (70 ml/day) on plasma concentrations of NOx ($\text{NO}_3^-/\text{NO}_2^-$), MAP, RPP, SV, CO, and total vascular resistance (TPR) at rest in response to progressive cycling at 30%, 60%, and 80% of peak O_2 uptake.

Results: BRJ supplementation increased plasma NOx, while NDBRJ had no effect (Figure 1). Compared to NDBRJ, which had no effect (Figure 2), BRJ (Figure 3) reduced MAP at rest and during exercise. In addition, RPP was decreased during exercise, while CO was increased, but only at rest and the during the 30% workload.

Conclusions: Chronic dietary supplementation with BRJ increases NOx in plasma, lowers blood pressure and vascular resistance at rest and during exercise,

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and reduces RPP during exercise. Cardiac function during exercise is also enhanced via augmentations in SV and CO at lower workloads. Cardiovascular effects seen during exercise were most likely due to reductions in afterload on the heart and to diminished peripheral vasoconstriction. These findings suggest that BRJ can act as a dietary ergogenic supplement capable of enhancing O₂ delivery and reducing work of the heart, allowing exercise to be performed at a given workload for a longer period of time before the onset of fatigue.

Keywords: beetroot juice, mean arterial blood pressure, stroke volume, cardiac output, exercise intensity

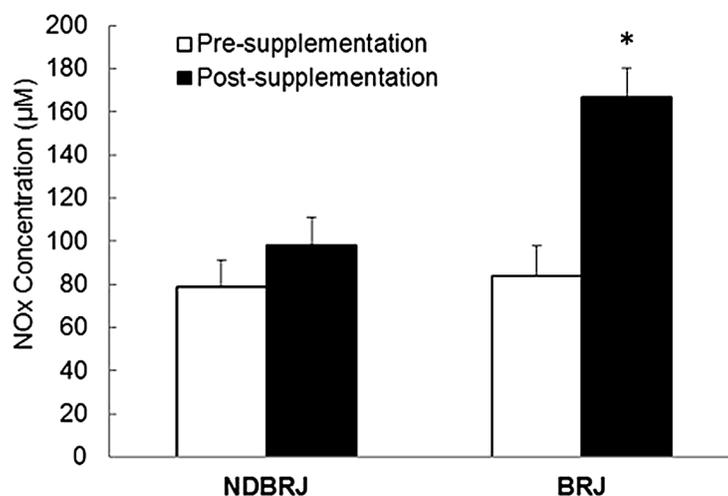


Figure 1. Plasma NOx (NO₃⁻/NO₂⁻) concentrations at rest before and after 14 days of supplementation of nitrate-depleted beetroot juice (NDBRJ) (70 ml/day) and nitrate-containing beetroot juice (BRJ) (4.2 mmol/day in 70 ml); *P<0.05 vs. pre-supplementation

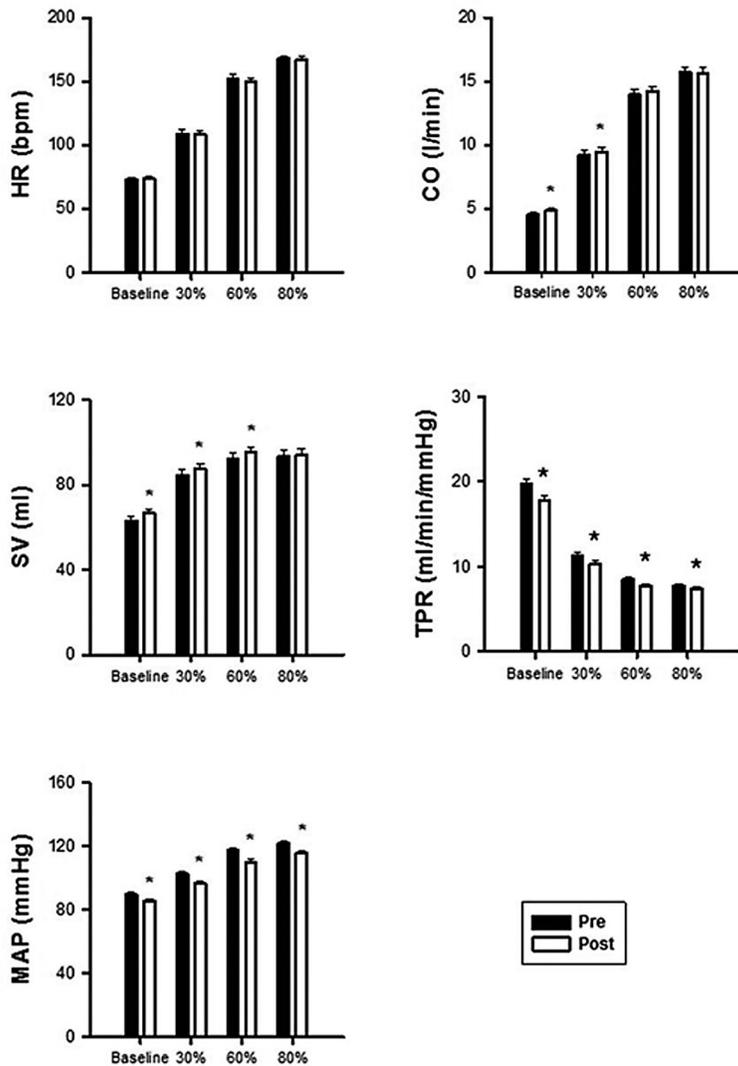


Figure 2. Effects of 14 days of nitrate-depleted beetroot juice supplementation on mean arterial pressure (MAP), heart rate (HR), cardiac output (CO), stroke volume (SV), and total peripheral resistance (TPR) at rest and during dynamic exercise; *P < 0.05, vs. control

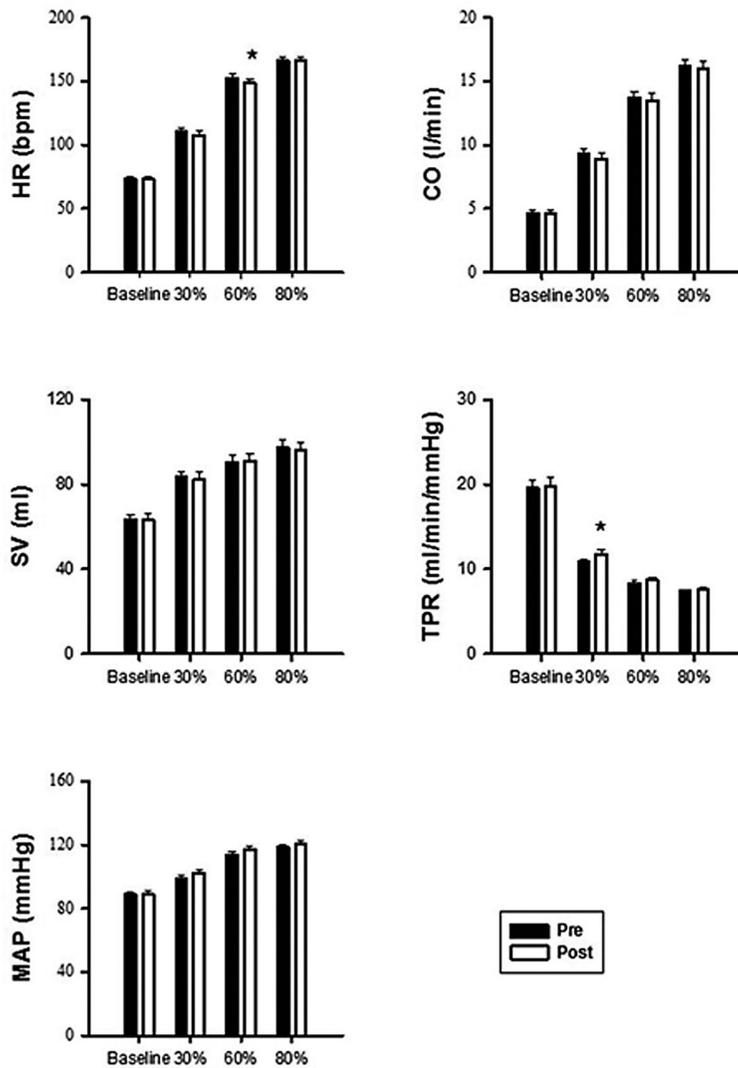


Figure 3. Effects of 14 days of dietary nitrate-containing beetroot juice supplementation on mean arterial pressure (MAP), heart rate (HR), cardiac output (CO), stroke volume (SV), and total peripheral resistance (TPR) at rest and during dynamic exercise; *P<0.05, vs. control

Injuries in Elite Taekwondo Poomsae Athletes

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Abstract

Purpose: Poomsae is the only non-contact and no opponent form of Taekwondo. With age classification for competition, Poomsae athletes can compete at world level almost at any age. As such there has been astronomical increase in competitors worldwide and hence the need for clear understanding of risks involved. The purpose of this study is to determine type and rate of injuries (location, severity, age of the athlete, mechanism, and occurrence during training vs. competition) in elite Canadian Poomsae athletes.

Methods: This longitudinal retrospective study consisted of 34 male and female elite Poomsae athletes competed in three consecutive World Poomsae Championships. Injuries were recorded by the team doctor on an injury form. Means are used to describe number of athletes, number of reported injuries, injury rates, body location, injury type and mechanism, and descriptive statistics are used to describe the sample population in terms of anthropomorphic factors (population number, number of males and females, age range and mean age, and experience level expressed as a belt level).

Results: Strain, sprain and joint dysfunctions are the most common type of injuries in Poomsae. Lower limb and back were the most common area of injury in females and males respectively. Males with a 3rd degree black belt or lower are most likely to have an acute injury. Females who incurred chronic overuse injuries were less experienced (DAN) compared to their male counterparts and were more likely to suffer from chronic overuse injuries. Athletes 40 year old and under were more prone to acute injuries compared to athletes over 40.

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Conclusions: Taekwondo Poomsae Athletes have far less complicated injuries compared with sparring or any other martial arts. Poomsae athletes suffer more from chronic overuse injuries compared to the sparring athletes. Joint dysfunction was the second most common type of injury among Poomsae athletes.

Keywords: Poomsae, Taekwondo, overuse injury, acute injury, joint dysfunction

Table 1. Characteristics of all injured participants (n=19)

Variables	Female	Male	Total
Age (Year)	40.1 (SD 14.0)	27 (SD 10.4)	34.7 (SD 13.4)
TKD level/rank (Dan)	3.3 (SD 1.5)	4.2 (SD 2.1)	3.6 (SD 1.7)

Table 2. Characteristics of participants with COI (n=11)

Variables	Female	Male	Total
Age (Year)	45.3 (SD 13.5)	30.3 (SD 11.7)	39.8 (SD 14.5)
TKD level/rank (Dan)	3.4 (SD 1.5)	4.8 (SD 2.5)	3.9 (SD 1.9)

Table 3. Characteristics of participants with acute injuries (n=8)

Variables	Female	Male	Total
Age (Year)	34 (SD 13.1)	20.5 (SD 0.7)	30.6 (SD 12.7)
TKD level/rank (Dan)	3.2 (SD 1.7)	3 (SD 0.0)	3.1 (SD 1.5)

Table 4. Prevalence of athletes injured (% , n=19), chronic overuse injury (% , n=11) and acute injury (% , n=8)

Contents	Female	Male	Total
Total participants (athletes)	16	18	34
Total participants (athletes) injured	13	6	19
Total prevalence rate of athletes rate injured (%)	81.25	33.33	55.88
	(CI: 62.13-100.37)	(CI: 11.55-55.11)	(CI: 39.19-72.57)
Prevalence rate of athletes injured ≤ 40 years old	6 (46.2)	5 (83.3)	11 (57.9)
Prevalence rate of athletes injured > 40 years old	7 (53.8)	1 (16.7)	8 (42.1)
Prevalence rate of athletes injured TKD ≤ 3	5 (38.5)	3 (50.0)	8 (42.1)
Prevalence rate of athletes injured TKD > 3	8 (61.5)	3 (50.0)	11 (57.9)
Total COI (athletes)	7	4	11
Total prevalence rate of COI (%)	43.75	22.22	32.35
	(CI: 19.44-68.06)	(CI: 3.01-41.43)	(CI: 16.63-48.07)
Prevalence rate of COI ≤ 40 years old	2 (28.6)	3 (75.0)	5 (45.5)
Prevalence rate of COI > 40 years old	5 (71.4)	1 (25.0)	6 (54.5)
Prevalence rate of COI TKD ≤ 3	3 (42.9)	1 (25.0)	4 (36.4)
Prevalence rate of COI TKD > 3	4 (57.1)	3 (75.0)	7 (63.6)
Total acute injuries (athletes)	6	2	8
Total prevalence rate of acute injuries (%)	37.5	7.14	23.53
	(CI: 13.78-61.22)	(CI: -4.76-19.04)	(CI: 9.27-37.79)
Prevalence rate of acute injuries ≤ 40 years old	4 (66.7)	2 (100.0)	6 (0.75)
Prevalence rate of acute injuries > 40 years old	2 (33.3)	0 (0.0)	2 (0.25)
Prevalence rate of acute injuries TKD ≤ 3	2 (33.3)	2 (100.0)	4 (50.0)
Prevalence rate of acute injuries TKD > 3	4 (66.7)	0 (0.0)	4 (50.0)

CI: Confidence interval at 95%, COI: Chronic overuse injury.

Table 5. Occurrence of multiple COIs in athletes (n=29)

Contents	Female	Male	Total
Athletes with single COI (# of body regions)	0	1	1
Athletes with 2 COIs (# of body regions)	2	0	2
Athletes with 3 COIs (# of body regions)	3	3	6
Athletes with 3+ COIs (# of body regions)	2	0	2
Total case of COIs (# of all injuries)	19	10	29

Table 6. Injured body regions in all injured athletes, COI, acute and both

Body region	Female (%)	Male (%)	Total (%)
Total of all injured athletes (% , n=19)			
Upper body part	6 (0.32)	1 (0.05)	7 (0.37)
Lower body part	4 (0.21)	3 (0.16)	7 (0.37)
Upper and Lower body part	3 (0.16)	2 (0.11)	5 (0.26)
Total	13 (0.68)	6 (0.32)	19 (1)
Total COI athletes (% , n=9)			
Upper body part	3 (0.33)	1 (0.11)	4 (0.44)
Lower body part	2 (0.22)	2 (0.22)	4 (0.44)
Upper and Lower body part	0 (0)	1 (0.11)	1 (0.11)
Total	5 (0.56)	4 (0.44)	9 (1)
Total Acute athletes (% , n=2)			
Upper body part	3 (0.38)	0 (0)	3 (0.38)
Lower body part	2 (0.25)	1 (0.13)	3 (0.38)
Upper and Lower body part	1 (0.13)	1 (0.13)	2 (0.25)
Total	6 (0.75)	2 (0.25)	8 (1)
Total of acute & COI			
Upper body part	0 (0)	0 (0)	0 (0)
Lower body part	0 (0)	0 (0)	0 (0)
Upper and Lower body part	2 (1)	0 (0)	2 (1)
Total	2 (1)	0 (0)	2 (1)

Table 7. Injured body regions in female athletes

Body region	≤ 40 years old (%)	> 40 years old (%)	TKD ≤ 3 (%)	TKD > 3 (%)
Total of all injured athletes				
Upper body part	3(0.23)	3(0.23)	3(0.23)	3(0.23)
Lower body part	1(0.07)	3(0.23)	1(0.07)	3(0.23)
Upper and Lower body part	2(0.15)	1(0.07)	1(0.07)	2(0.15)
Total	6(0.46)	7(0.54)	5(0.38)	8(0.62)
Injured body Regions of COI in females				
Upper body part	1(0.2)	2(0.4)	1(0.2)	2(0.4)
Lower body part	0(0)	2(0.4)	1(0.2)	1(0.2)
Upper and Lower body part	0(0)	0(0)	0(0)	0(0)
Total	1(0.2)	4(0.8)	2(0.4)	3(0.6)
Injured body Regions of acute injuries (% , n = 8) in females				
Upper body part	0(0)	0(0)	0(0)	0(0)
Lower body part	0(0)	0(0)	0(0)	0(0)
Upper and Lower body part	1(0.5)	1(0.5)	1(0.5)	1(0.5)
Total	1(0.5)	1(0.5)	1(0.5)	1(0.5)

Table 8. Injured body regions in male athletes

Body region	≤ 40 years old (%)	> 40 years old (%)	TKD ≤ 3 (%)	TKD > 3 (%)
Total of all injured athletes				
Upper body part	1(0.17)	0 (0)	0 (0)	1 (0.17)
Lower body part	2(0.33)	1 (0.17)	2 (0.33)	1 (0.17)
Upper and Lower body part	2(0.33)	0 (0)	1 (0.17)	1 (0.17)
Total	5(0.83)	1 (0.17)	3(0.5)	3(0.5)
Injured body Regions of COI in males				
Upper body part	1(0.25)	0(0)	0(0)	1 (0.25)
Lower body part	1(0.25)	1(0.25)	1(0.25)	1(0.25)
Upper and Lower body part	1(0.25)	0(0)	0(0)	1(0.25)
Total	3(0.75)	1(0.25)	1(0.25)	3(0.75)
Injured body Regions of acute injuries (% , n = 8) in males				
Upper body part	0(0)	0(0)	0(0)	0(0)
Lower body part	1(0.5)	0(0)	1(0.5)	0(0)
Upper and Lower body part	1(0.5)	0(0)	1(0.5)	0(0)
Total	2(1)	0(0)	2(1)	0(0)
Injured body regions of both COI and Acute injuries (n=2) in males				
Upper body part	0(0)	0(0)	0(0)	0(0)
Lower body part	0(0)	0(0)	0(0)	0(0)
Upper and Lower body part	0(0)	0(0)	0(0)	0(0)
Total	0(0)	0(0)	0(0)	0(0)

Table 9. Total COIs by anatomical body regions (% , n=5), a total of 50 injuries

Body parts	Female (%)	Male (%)	Total injuries (%)
Neck (cervical)	5 (15)	1(6)	6 (12)
Back (cervicothoracic, thoracic & lumbar)	7 (21)	10 (59)	17 (34)
Upper limb (shoulder, arm, etc.)	0 (0)	0 (0)	0 (0)
Pelvis (SI & hip)	2 (6)	1 (6)	3 (6)
Lower limb (leg, thigh, knee, calf, toe)	19 (58)	5 (29)	26 (52)

Table 10. Types of past injury (n= 10, number of total injuries=50)

Injury Type	Female (%)	Male (%)	Age ≤ 40 years old (%)	Age > 40 (%)	TKD ≤ 3 (%)	TKD > 3 (%)	Total (%)
Sprain (Grade I and II)	1 (2)	0	0 (0)	1 (2)	0 (0)	1 (2)	1
Strain	10 (30)	9 (30)	11 (22)	8 (14)	12	7 (14)	19
Joint Dysfunction	10 (20)	7 (14)	11 (22)	6 (12)	6 (12)	11 (22)	17
Myofasciopathy	3 (4)	0 (0)	3 (6)	0 (0)	0 (0)	3 (6)	3
Chain Dysfunction	2 (4)	0 (0)	2 (4)	0 (0)	0 (0)	2 (4)	2
OA	1 (2)	0 (0)	1 (2)	0 (0)	1 (2)	0 (0)	1
SICK scapula	1 (2)	0 (0)	1 (2)	0 (0)	0 (0)	1 (2)	1
Tissue irritation/dysfunction	1(2)	1 (2)	2 (4)	0 (0)	1 (2)	1 (2)	2
Osgood-Schlatter Syndrome	0(0)	2 (4)	2 (4)	0 (0)	2 (4)	0 (0)	2
ACL deficiency	2 (2)	0 (0)	0 (0)	2 (4)	2 (4)	0 (0)	2
Total	31 (60)	19(40)	33 (66)	17 (34)	24 (48)	26 (52)	50(100)

Table 11. Techniques that cause injury during training
(n=5, number of unique injuries=11)

Technique	Female	%	Male	%	Total	%
Forearm block	2	18.18%	0	0.00%	2	18.18%
Side Kick	3	27.27%	3	27.27%	6	54.55%
Rotation and jumping	0	0.00%	3	27.27%	3	27.27%
Total	5	45.45%	6	54.55%	11	100.00%

Prevalence of Chronic Overuse Pain in Taekwondo Athletes: A Systematic Review of the Evidence

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Abstract

Purpose: The purpose of this study was to estimate the prevalence of chronic overuse pain in Taekwondo athletes.

Methods: PubMed, KISS, and RISS articles were searched from 1990-2015. In addition, some articles included in this research were not captured in the database searches, but were found after searching keywords such as Taekwondo, injury, chronic overuse injury, and overuse pain. All search terms were limited to the English and Korean languages, studies of humans, and the year 1990-2015. A three-step screening strategy (i.e., title, abstract, and article screening) was used to identify articles to be reviewed. Articles meeting the inclusion/exclusion criteria were critically appraised for methodologic quality. The prevalence rate and confidence intervals were recalculated in some cases.

Results: Six out of 34 identified articles were accepted to estimate the prevalence of chronic overuse pain. Overall, the sport-poomsae athletes have the highest prevalence rate of chronic overuse pain followed by sparring-Taekwondo athletes and object-breaking maneuver athletes. Female athletes of the sport-poomsae and sparring-Taekwondo showed higher prevalence rate than the male athletes. No studies of chronic overuse pain in adolescent male athletes were found. In addition, there were limited studies on the prevalence of chronic overuse pain in the English language.

Conclusions: There are limited studies on the prevalence of chronic overuse pain in Taekwondo in English language and limited information on the prevalence rate of chronic overuse pain for middle and high school males in sparring-Taekwondo.

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Some methodological problems were also identified in this literature with the hope of improving future studies.

Keywords: chronic overuse pain, overuse injury, Taekwondo, poomsae, systematic review, injury

Table 1. Summary of study characteristics risk of chronic overuse pain in Taekwondo

Study period	Source of population/ type of Taekwondo	Denominator/ total participants	Definition of chronic overuse pain	Method for injury report	Number of cases	Recalculated prevalence rate (%) and 95% confidence intervals (CI)
2006-2007	Sparring-Taekwondo; Elementary, middle & high school competitors; Koreans	210 athletes	An athlete who is suffering constant pain for one month or three times or over for recurrent pain for two weeks or over during three consecutive months.	Interview and physical examination (including X-ray, MRI).	162 athletes	77.1 (71.5-82.8)
2011 Aug	Sport-Poomsae; Competitors; Middle school or over; Koreans	236 athletes M=156 F=80	An athlete who is suffering constant pain for three consecutive months or longer during after training session or at rest. The case must have had persistent pain at the time of investigation.	Self report	167 athletes M=99 F= 68	70.8 (64.6-76.9) M=85.0 F=63.5
2011 Dec	Object-Breaking Maneuver; Competitors; Aged 18 years or over males; Koreans	205 athletes Males only	An athlete who is suffering constant pain for three consecutive months or longer during after training session or at rest. The case must have had persistent pain at the time of investigation.	Self report and telephone interview	94 athletes	45.9 (39.1-52.9)

2013 May	Sport-Poomsae; Competitors; Aged 18 years or over; Black belt levels; Canadians	26 athletes M=13 F=13	An athlete who is suffering constant pain for two consecutive months or longer during after training session or at rest. The case must have had persistent pain at the time of investigation.	Self report	19 athletes M=9 F=10	73.1 (56.0-90.1)
2014 July	Sparring- Taekwondo; Middle & high school competitors; Koreans	225 Middle=90 High=135 Females only	An athlete who is suffering constant pain for two consecutive months or longer during after training session or at rest. The case must have had persistent pain at the time of investigation.	Self report	114 athletes Mid- dle=35 High=79	50.7 (43.9-57.4)
2014 Aug.	Sparring- Taekwondo; College com- petitors; Koreans	197 athletes M=107 F=90	An athlete who is suffering constant pain for two consecutive months or longer during after training session or at rest. The case must have had persistent pain at the time of investigation.	Self report	123 athletes M=64 F=59	62.4 (55.7-69.1)

Bite Balance by Occlusal Appliance Improves Athletic Performance

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Abstract

Purpose: The aim of this study was to evaluate the effect of bite balance on physical fitness and motor capacity to determine the importance of the occlusal stability as a possible action mechanism of occlusal appliance including mouthguards on physical performances. Many prominent athletes are in the news wearing mouthguards to improve their athletic performance. An investigation the determinants of athletic performance in sports revealed most studies over-interpreted the results and lack of evidence to support the information. However, great expectations for new possibility in this field exist, and a more academic approach to this subject is intriguing. The following are some examples of the subject:

1. Archers who wore occlusal appliances to increase the vertical dimension of occlusion by 2-3mm increased their ability to focus and to maintain a good sense of balance improved their accuracy rates. The appliance was made of acrylic resin (a type of plastic).
2. Canoe players who wore occlusal appliances to increase the vertical dimension of occlusion by 5mm surpassed longtime competitors and won their races with 10-second gaps.
3. A cycle rider who wore an occlusal appliance to treat his malocclusion surpassed his old record from 10.8 seconds to 10.3 seconds. His muscle reflexes (anaerobic exercise) and endurance (aerobic exercise) were enhanced.
4. Occlusal appliances had a good effect on athletic performance in most sports such as swimming, diving, and weightlifting.

Methods: For this study, ten male athletes with a mean age of 23 who joined a former study were selected. Upper and lower casts were mounted on a semi-adjust-

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able articulator in the intercuspal position, and a point was marked on the attached gingival area between the right canine and the right first premolar in each upper and lower cast. From the mark, the occlusal vertical dimension was increased by 2mm, 3.5mm, and 5mm. Then, ten maxillary type occlusal splints for each of the dimension were fabricated with heat curing clear acrylic resin (Table 1).

Results: The above examples were reported on the news, but most of them lacked scientific evidence and mechanism. When balanced occlusion was induced artificially with the appliance, an increase in muscle strength was observed (Table 2). On the other hand, decreases in athletic performance were rarely reported except for verbal and respiratory disorders. When attention is paid to the people who bench-press in fitness gyms (weight rooms), the lifting action is repeated rhythmically while performing less repetitions. When the weight is beyond their strength, the lifting motion gets slower, a frown is formed on their faces, and finally their jaw positions changes. We can analyze the displacement of their jaw in dentistry: opening of the jaw, protrusion of mandible (the lower jaw is projected forward), lip biting (the lower lip beneath the upper front teeth), and clenching (the teeth are closed tightly).

Conclusion: As for the clenching on dentition, people clench their teeth when they push their physical and mental limits during sports. Clenching can be induced by physical exertion when maximum muscle strength is retained, and this is similarly found in different types of exercises. In addition, restraint of respiratory function is observed. Therefore, creating an occlusal balance with occlusal appliance or mouthguard promoted a favorable influence when an athlete clenches.

Keywords: sports dentistry, sports activity, clenching, occlusal appliance, mouthguard, increase of occlusal vertical dimension (VD), muscle strength

Table 1. Examination Schedule

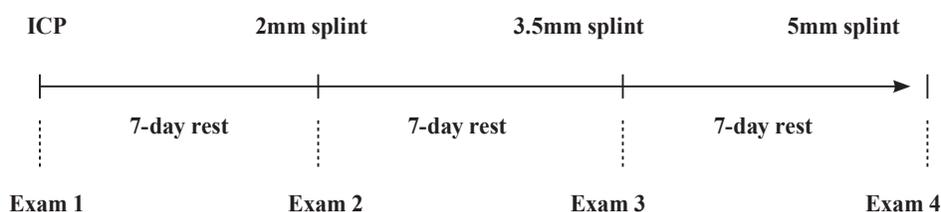


Table 2. Mean values and increase rate of muscle strength at each VD

position	2mm Increase of VD				3.5mm Increase of VD				5mm Increase of VD			
	mean (ft-lb)	S.D.	increase rate(%)	p value	mean (ft-lb)	S.D.	increase rate(%)	p value	mean (ft-lb)	S.D.	increase rate(%)	p value
shoulder external rotation	28.3	±5.03	11.4	.0186*	28.8	±6.30	13.7	.0283*	26.4	±4.74	7.4	.2457
shoulder internal rotation	44.2	±5.07	10.2	.0007*	43.0	±5.12	7.2	.0492*	40.7	±5.10	1.4	.3841
knee internal rotation	28.6	±4.83	12.2	.0163*	28.2	±6.22	10.9	.0134*	25.0	±5.24	-1.7	.2970
knee external rotation	27.1	±4.62	2.1	.2223	26.7	±3.57	0.4	.4571	25.9	±4.31	-2.5	.2821
ankle dorsiflexion	22.9	±3.95	11.4	.0869	21.9	±2.26	6.5	.1484	20.8	±2.68	1.1	.4118
ankle plantarflexion	68.4	±12.58	29.7	.0033*	66.3	±11.52	25.7	.0039*	61.7	±8.63	16.8	.0144*
forearm supination	8.4	±1.74	13.4	.0921	7.3	±1.41	-1.5	.4267	7.6	±1.59	1.5	.4403
forearm pronation	9.9	±0.97	12.8	.0207*	7.8	±1.20	-10.3	.0183*	8.6	±1.50	-1.3	.3641
wrist ulnar deviation	14.8	±2.99	-12.5	.0010*	14.3	±3.08	-15.1	.0027*	12.2	±1.98	-27.6	.0014*
wrist radial deviation	10.9	±2.32	-2.0	.3688	11.0	±1.94	-1.0	.4000	9.6	±1.33	-14.0	.0381*
elbow flexion	44.6	±4.00	11.1	.0001*	44.1	±2.71	10.0	.0148*	39.3	±3.04	-1.9	.2692
elbow extension	46.6	±3.72	2.2	.2843	47.4	±4.18	4.1	.1112	46.6	±5.66	2.2	.2764
hip flexion	162.6	±15.99	17.2	.0062*	156.9	±20.87	13.1	.0032*	157.9	±15.94	13.9	.0129*
hip extension	234.7	±52.47	11.8	.0233*	224.1	±43.55	6.8	.0975	210.9	±38.28	0.5	.4642

VD : Vertical Dimension

ft-lb : foot-pound

* : significantly different ($p < 0.05$)

The 5th International Symposium for Taekwondo Studies



Leading Toward Taekwondo Excellence

Academic Session I : Social Science

Chairperson : Jeung-Hak Lee

May 9

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Paradoxical Pacifist Teachings of East Asian Martial Arts

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Abstract

The five major East Asian philosophies are Taoism, Buddhism, Confucianism, Mohism, and Legalism, (as well as some animistic traditions). With the exception of Legalism, East Asian martial arts—including the Korean martial art Taekwondo—claim to be based in whole or in part on these philosophies. Interestingly, Taoism, Buddhism, Confucianism, and Mohism all propose some form of pacifism. The only Chinese philosophy that did not view war negatively was Legalism; ironically, East Asian martial arts do not claim to be related to Legalism—which with its pro-war stance is possibly the best suited for martial arts (i.e. “war arts”). Instead, East Asian martial arts tend to allude to the other pacifistic philosophies of the Far East. There seems to be a paradox between the generally pacifistic, anti-war position of traditional East Asian philosophies, in particular Taoism, Buddhism, Confucianism and Mohism, and the practice of offensive, potentially lethal techniques that are part of the East Asian martial arts, such as Taekwondo. The purpose of this paper is to engage in Moral Philosophy in order to solve this paradox. Through methodological reasoning based on Normative Ethics (Prescriptive Ethics), the three branches of Moral Philosophy (Consequentialism, Deontology, and Virtue Ethics) are applied to show that East Asian martial arts such as Taekwondo can practice offensive “martial” techniques while still adhering to the core ethics of East Asia’s pacifist philosophies.

Keywords: Pacifism, ethics, Oriental philosophy

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From Technique to Way: Taekwondo's Educational Process

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Abstract

Previous attempts to understand Taekwondo's three-step educational process have lacked a succinct and lucid explanation in English. The process is delineated by the three steps Taekwondo-in (Taekwondo practitioners) undergo over time: *musul* ("martial technique"), *muyae* ("martial art"), *mudo* ("martial way"). To date, no academic research has attempted to articulate Taekwondo's learning process etymologically and pedagogically in English, which deprives Taekwondo-in worldwide of a better understanding of what their martial art affords them. Thus, this paper defines these three terms and compares those definitions to the literature of other martial arts to validate these understandings. By doing so, we can elucidate the stratified development of Taekwondo education. The three stages of Taekwondo education begin with learning the physical techniques of the art, or *musul* in Korean. The next level is *muyae*, which is when practitioners learn to adapt the physical skills in a personal manner. The final level of Taekwondo education, called *mudo*, typically occurs after decades of study and when a student actively tries to incorporate their Taekwondo training into everyday life; however, we show it is possible to begin learning *mudo* from the outset of one's Taekwondo study. This research will allow all Taekwondo students to comprehend what they are learning more fully and how they are developing personally through Taekwondo. We offer a demystified explanation of Taekwondo education and philosophy so practitioners can recognize their non-physical achievements in the martial art. Most importantly, we explain for the first time how *Do* can be a means for social or spiritual improvement.

Keywords: *musul*, *muyae*, *mudo*, *-do* suffix

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Origin and Function of Poomsae in Taekwondo in Relation to *Daoyin* Exercise

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Abstract

The objective of this paper is to establish a new paradigm for the understanding of poomsae in Taekwondo training. Until now the training of poomsae has been taken as offensive and defensive drills for combat. Hence, it is understood as a means and preparatory stage for attaining fighting (sparring) skills, and it is consequently treated as a secondary activity in comparison with sparring. Contrary to this understanding of poomsae, we want to argue that the training of poomsae has its own end, independent from the training of sparring. To demonstrate this point, we will focus on the relation between the poomsae and Chinese gymnastic exercises of *Daoyin*, or “guiding and pulling,” which are concerned with breathing techniques and the stretching of body.

Our paper consists of two parts. The first part deals with how the meaning of poomsae in the present time was formed in connection with Japanese conception of martial arts in terms of Bushido, which signifies the philosophical system of the training of the samurai. In this part, we seek to clarify the reason why early Taekwondo masters put a great emphasis on the sparring training and treat the training of poomsae as a means to attaining combat skills. This is due to the influence of Japanese conception of martial arts on Taekwondo. For the Japanese, who admire *MooDo JungShin* (Korean: the spirit of martial arts) derived from the Bushido, any type of martial arts—regardless if they incorporate weapons training—are taken to be a combative activity. In this understanding of martial arts, it is quite natural to stress the importance of fighting and to accept the dominance of fight (sparring) over a combat drill, namely poomsae.

In the second part, we discuss the meaning of poomsae training in respect to Chinese gymnastics called “the arts of guiding and pulling” (*Daoyin* exercise). *Daoyin*

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exercise was a religious ritual in Taoism, and it aimed at cultivating qi, which Chinese regarded as the ultimate source of life. *Daoyin* exercises consist of the stretching of body and breathing techniques without kinetic movement of body. Moreover, there are many different types of *Daoyin* exercise postures; the most famous exercises are the Five Animal Frolics, which are the basic forms for Shaolin Temple martial arts. However, the primary purpose of *Daoyin* exercises was not concerned with the combative activity for martial artists. Exercises such as the Five Animal Frolics were later transformed into combat drills for fighting. Primarily *Daoyin* exercises have religious purpose and were practiced by Taoist monks whose ultimate goal is to change the mortal body into an immortal body. With this analysis of *Daoyin* exercise, which we believe to be the proto-type of martial arts forms, we want to argue that the poomsae training was not primarily designed for combat drills, but rather it has its own function, which is the harmonization of oneself with nature by cultivating qi.

Keywords: poomsae, qi, *Daoyin*, *Mudo JungShin*

Taekwondo as One's Life Philosophy

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Abstract

Taekwondo has been posited as a life philosophy for decades, but to date no proper examination of how this is possible has been conducted. Our question is therefore whether the practice of Taekwondo gives us a "philosophy of life" so universal that it can be exercised in all areas of our daily lives. From a philosophical perspective, Taekwondo-in (Taekwondo practitioners) find it compulsory to ask themselves why they practice Taekwondo. Then, how Taekwondo-in in particular can be considered as philosophers, albeit not in an academic sense, without purposefully engaging in a philosophical study should be examined. We find that with the practice of Taekwondo comes experiences that allow practitioners to develop holistic, autonomous, philosophical, spiritual, and experiential knowledge. We conclude that Taekwondo-in recognize that they as Human Beings are capable of having a unique orientation of life formed from Taekwondo practice, and that constant practice is a reminder that knowledge acquired from training is useful to their daily lives. It also allows Taekwondo-in to integrate a sense of belonging into a society and create a connection with their surroundings and nature.

Keywords: Taekwondo-in, maieutics, poomsae, Heidegger

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Gene Doping between Fact and Fiction

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Abstract

In modern society scientific and technological progress leads to a type of decision making called *tragic choices*. The tragedy is situated in the fact that decisions for and against something can be treated as a risk. Nuclear accidents, for example, call in remembrance that besides the desired effects of nuclear energy, the unintended, unanticipated and non-expected repercussions have to be taken into consideration as well. In response, uncertainty and insecurity have become typical values of modern societies technology assessment (TA). By the means of prospective analysis, TA aims to deliver a theoretically and empirically viable basis for orientation, management, and control.

Moderne elite sports like Taekwondo deliver an environment of pushing the boundaries. As such, performance enhancement is a well-known phenomenon and not at least a question of risky technology. In the area of emerging doping technologies the most promising form of illegitimate performance enhancement is the so-called gene doping. Indeed, the World Anti-Doping Agency listed gene doping 10 years ago as a prohibited method in the World Anti-Doping Code.

In sense of a reflexive and modest claim of an "order with foresight" the contribution argues that gene doping in elite sports will be highly functional and as such structurally expectable. After giving a brief description of main structural features of present global elite sports, gene-doping will be outlined as "functional illegality." By addressing molecular target points, gene doping is especially associated with serious consequences for modern sports and society.

Keywords: gene doping, elite sports, Taekwondo, performance enhancement

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The 5th International Symposium for Taekwondo Studies



Leading Toward Taekwondo Excellence

Academic Session II : Natural Science

Chairperson : Young-Kwan Kim

May 10

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Effects of 6-week Pre-season Training on Body Composition, Physical Fitness and Isokinetic Muscle Strength in Weight Categories of Female Taekwondo Athletes

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Abstract

Purpose: The aim of this study was to examine the effects of a 6-week pre-season training program on body composition and isokinetic muscular strength in weight categories of female Taekwondo athletes.

Methods: Twenty-two female athletes participated. They were divided into four groups according to their weight categories: G1 (n=8, <49kg), G2 (n=6, <49kg-57kg), G3 (n=4, 57-67kg), and G4 (n=4, >67kg). The pre-season training program was conducted 3 sessions a day, 3 days a week for 6 weeks. Body composition parameters were measured by DXA. Physical fitness was assessed with sit-and-reach, grip strength, standing long jump, 50m shuttle run, and 20m multistage endurance run tests. Isokinetic muscular strength was measured for the extensors and flexors of the knee at three fixed angular velocities ($60^{\circ}\cdot\text{s}^{-1}$, $120^{\circ}\cdot\text{s}^{-1}$ and $240^{\circ}\cdot\text{s}^{-1}$).

Results: Significant time and group interaction effect was found for fat tissue ($p < 0.05$). G4 demonstrated significant decreases in percent body fat ($p < 0.05$) and fat tissue ($p < 0.01$) after 6 weeks of pre-season training. G1 demonstrated significant improvements on 50m shuttle run ($p < 0.001$) and multistage endurance run ($p < 0.001$), and G2 showed significant changes for grip strength ($p < 0.01$), 50m shuttle run ($p < 0.01$), and multistage endurance run ($p < 0.05$). G1 demonstrated significant improvement in left extension ($p < 0.0001$) and left flexion ($p < 0.05$) at $60^{\circ}/\text{sec}$, left extension ($p < 0.001$) at $120^{\circ}/\text{sec}$, and all variables at $240^{\circ}/\text{sec}$. Significant changes

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were also found in G2 (left and right extension at 60 %/sec at 120 %/sec, right flexion at 240 %/sec), and in G3 (left extension at 60 %/sec, 120 %/sec, and 240 %/sec), and in G4 (right flexion and left flexion at 120 %/sec and 240 %/sec).

Conclusions: The findings of the study suggest that a 6-week pre-season training program affects body fat, agility, endurance running, and knee muscle strength in female Taekwondo athletes. The impact was different depending on the weight categories. Pre-season training program should be established by considering an athlete's weight category in female Taekwondo athletes.

Keywords: pre-season, weight category, body composition, extension, flexion

Table 1. Pre-season training program for 6 weeks

		Training	
1wk	Morning	· long distance running (60~80% > HRmax) · stepping 140 reps*5set (60~80% > HRmax)	3 sessions / wk
	Afternoon	· interval training 400m* 10set, rest = 1:3 (60~80% > HRmax)	3 sessions / wk
	Evening	· weight training 12 reps*3set (75~85%>1RM)	3 sessions / wk
2-5wk	Morning	· high-intensive continuous running (85~95% > HRmax) · stepping 140 reps*3set (85~95% > HRmax)	3 sessions / wk
	Afternoon	· interval training 400m* 10set (80~90% > HRmax) · Taekwondo step kick	3 sessions / wk
	Evening	· weight training 6 reps*3set (75 ~ 85% < 1RM) · individual exercise	3 sessions / wk
6wk	Morning	· high-intensive continuous running 4km (85~95% > HRmax) · stepping 140 reps*5set (85~95% > HRmax)	3 sessions / wk
	Afternoon	· interval training 400m* 10set rest = 1:1.5 (60~80% > HRmax) · Taekwondo step kick	3 sessions / wk
	Evening	· weight training 20 reps*3set (40 ~ 60% < 1RM)	3 sessions / wk

Table 2. Body composition between pre- and post-tests by weight categories of female Taekwondo athletes

	G1		G2		G3		G4		F-value
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
Body mass (kg)	52.1± 3.41	51.7± 2.63	57.2± 3.08	57.3± 3.27	65.8± 4.89	65.7± 5.86	73.8± 4.4	72.3± 5.73	T*G 1.19 T 1.92 G 30.39***
Fat tissue (kg)	11.6± 1.87	11.2± 1.97	11.4± 2.8	11.1± 2.78	16.5± 1.29	15.5± 1.53	20.3± 2.34 ^a	18.2± 2.83 ^b	T*G 4.31* T 25.44*** G 15.32***
Percent body fat (%)	22.4± 3.05	21.8± 3.37	20.0± 4.28	19.4± 4.31	25.4± 2.25	24.1± 2.84	27.8± 2.28 ^a	25.5± 2.67 ^b	T*G 2.02 T 17.06*** G 4.16*
Lean tissue (kg)	38.0± 2.53	37.7± 2.30	42.6± 1.86	42.9± 1.56	46.0± 4.50	46.4± 5.17	49.9± 2.66	50.2± 3.33	T*G 0.87 T 1.35 G 17.92***
Bone mineral content (g)	21.8± 1.49	21.4± 1.29	26.7± 1.68	26.6± 1.56	26.8± 2.89	26.3± 3.03	29.1± 1.38	28.8± 1.28	T*G 1.30 T 15.19*** G 18.95***
Bone mineral density (g/cm²)	1.15± 0.04	1.15± 0.03	1.28± 0.04	1.26± 0.03	1.22± 0.06	1.22± 0.06	1.27± 0.06	1.26± 0.06	T*G 0.04 T 3.56 G 10.01***

Values are mean±SD

*Different letters indicate significant difference between pre- and post-tests

*p<.05, **p<.01, ***p<.001; G: group, T: time

Table 3. Physical fitness between pre- and post-tests by weight categories of female Taekwondo athletes

	G1		G2		G3		G4		F-value
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
Sit and reach (cm)	18.6± 9.20	19.5± 5.98	21.7± 6.27	22.1± 6.93	25.0± 4.29	26.5± 2.47	22.9± 2.75	22.7± 1.72	T*G 1.07 T 4.26 G 1.41
Grip strength (kg)	27.6± 2.08	29.0± 2.10	29.3± 4.16 ^a	31.8± 3.78 ^b	31.1± 3.84	31.0± 1.41	30.0± 1.73	31.1± 4.03	T*G 0.85 T 4.70* G 1.31
Sit-ups (n)	57.6± 8.98	57.6± 13.34	58.7± 3.56	60.5± 5.32	55.3± 4.03	60.8± 9.29	57.3± 9.25	58.5± 9.15	T*G 0.46 T 1.46 G 0.08
Standing long jump (cm)	193.6± 12.91	199.6± 8.23	193.2± 17.39	199.7± 14.79	195.3± 10.08	192.0± 10.49	186.3± 14.36	192.8± 12.89	T*G 1.02 T 3.20 G 0.38
50m shuttle run (sec)	19.6± 1.13 ^a	18.2± 0.78 ^b	19.6± 0.76 ^a	18.7± 0.74 ^b	19.3± 0.94	18.4± 0.52	19.3± 1.47	18.3± 0.85	T*G 0.96 T 44.37*** G 0.14
Multistage endurance run (n)	83.1± 11.96 ^a	95.3± 7.85 ^b	87.7± 13.26 ^a	94.0± 11.64 ^b	70.0± 9.49	79.8± 9.22	83.3± 13.05	93.3± 16.46	T*G 0.83 T 39.95*** G 1.95

Values are mean±SD

*Different alphabet indicates significant difference between pre- and post-tests

*p<.05, **p<.01, ***p<.001; G: group, T: time

Table 4. Knee isokinetic strength at 60°/sec, 120°/sec, and 240°/sec between pre- and post-tests by weight categories of female Taekwondo athletes

		G1		G2		G3		G4		F-value
		Pre	Post	Pre	Post	Pre	Post	Pre	Post	
Peak torque (N·m) 60°/sec	Right extension	130.9±8.08	135.6±24.38	145.8±25.34 ^a	163.5±11.22 ^b	160.5±18.48	175.3±20.73	200.5±28.9	209.8±36.12	T*G 0.37 T 4.72* G 14.24***
	Left extension	128.9±13.54 ^a	154.1±10.48 ^b	148.5±26.29 ^a	164.3±16.82 ^b	166.5±28.62 ^a	193.3±26.66 ^b	196.8±22.82	208.3±28.49	T*G 2.48 T 74.84*** G 9.34***
	Right flexion	72.5±9.29	79.4±17.39	82.5±11.47	89.5±11.1	86.8±19.69	99.5±17.02	104.3±9.22	122.5±3.31	T*G 0.16 T 6.98* G 8.18**
	Left flexion	72.0±9.09 ^a	81.9±11.95 ^b	78.5±10.11	83.0±12.98	98.0±15.23 ^a	111.0±15.25 ^b	105.5±13.40	110.8±6.13	T*G 0.62 T 10.83*** G 12.42***
Peak torque (N·m) 120°/sec	Right extension	108.3±6.76	117.5±12.68	120.8±18.65 ^a	134.5±15.40 ^b	132.8±19.22	142.0±16.43	157.8±21.23	170.5±26.40	T*G 0.14 T 11.77*** G 11.17***
	Left extension	108.3±9.69 ^a	124.5±9.46 ^b	122.5±18.49 ^a	135.3±17.05 ^b	136.0±23.89 ^a	151.5±21.17 ^b	155.8±16.50	165.3±17.91	T*G 0.64 T 51.46*** G 8.06**
	Right flexion	65.1±7.75	70.5±12.17	75.0±8.69	79.8±7.52	80.0±12.36	89.0±14.94	82.3±7.09 ^a	95.3±3.40 ^b	T*G 0.61 T 11.59** G 7.22**
	Left flexion	66.3±4.83	69.5±11.03	71.0±8.00	76.0±8.15	88.0±9.20	94.3±15.50	89.8±3.77 ^a	97.5±4.43 ^b	T*G 0.27 T 8.47** G 15.03***
Peak torque (N·m) 240°/sec	Right extension	79.4±5.90 ^a	92.4±12.07 ^b	88.0±14.90	99.3±8.94	91.5±13.18	106.3±18.45	115.8±11.73	122.8±16.58	T*G 0.24 T 14.05** G 9.53**
	Left extension	79.0±6.48 ^a	95.6±6.61 ^b	89.5±13.62	99.2±13.72	96.0±19.65 ^a	115.0±15.51 ^b	111.8±12.74	123.8±12.53	T*G 1.71 T 75.75*** G 6.93**
	Right flexion	47.8±4.80 ^a	57.4±7.69 ^b	56.0±7.07 ^a	64.3±7.81 ^b	66.3±4.57	74.3±12.58	64.3±8.02 ^a	79.0±2.83 ^b	T*G 0.79 T 40.00*** G 11.59***
	Left flexion	51.9±5.06 ^a	59.0±7.54 ^b	54.0±6.69 ^a	62.8±3.82	68.5±10.50	78.5±11.09	67.5±9.11 ^a	81.0±6.68 ^b	T*G 0.74 T 39.13*** G 12.21***

Values are mean±SD

*Different letters indicate significant difference between pre- and post-tests

*p<.05, **p<.01, ***p<.001; G: group, T: time

Warming Up: Are Taekwondo Athletes Getting Enough?

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Abstract

Purpose: The purpose of this study was to evaluate the effects that the physical demands of match and training sessions have on stiffness and power output of the lower limbs of Taekwondo athletes.

Methods: A sample of convenience of 46 elite and sub-elite male Taekwondo athletes aged 21 (7) were evaluated over a six-month period during training and a competition session. Participants executed a seven repetition set of continuous maximal jumps prior and post training over two training macrocycles and pre- and post-match in the competition session. Ground reaction forces data from both feet were collected using a portable AMTI (1000Hz) force plate.

Results: There was significant different response to match and training demands from elite and sub-elite athletes. Stiffness levels decreased in the sub-elite group post training while these increased in the elite group. Similarly, power output increased only in the elite group after training. During the match day, athletes participated in four matches of competition standards. It was observed elite athletes showed a decline in power output and leg stiffness only after the third match, while these declines were evident post the first match for the sub-elite group.

Conclusions: Elite athletes may need a more effective warm up period than they allow themselves pre training and competition.

Keywords: performance, power, stiffness

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Table 1. Mean (SD) peak power (watts) and leg stiffness (KNm-1) data for the elite and sub-elite groups at pre- and post-exertion

	Training				Match Day			
	Stiffness		Power		Stiffness		Power	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Elite	18.34	24.51	4399	4934	18.45	24.56	4401	4998
Sub-Elite	17.43	15.83	4385	4060	18.54	16.95	4684	4544

Table 2. Mean (SD) peak power (watts) and leg stiffness (KNm-1) data for the elite and sub-elite groups at pre- and post-exertion

	Training				Match Day			
	Stiffness		Power		Stiffness		Power	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Elite	17.34	23.51	4399	4934	28.45	29.56	4401	4998
Sub-Elite	23.43	22.83	4785	4560	24.54	22.95	4484	4044

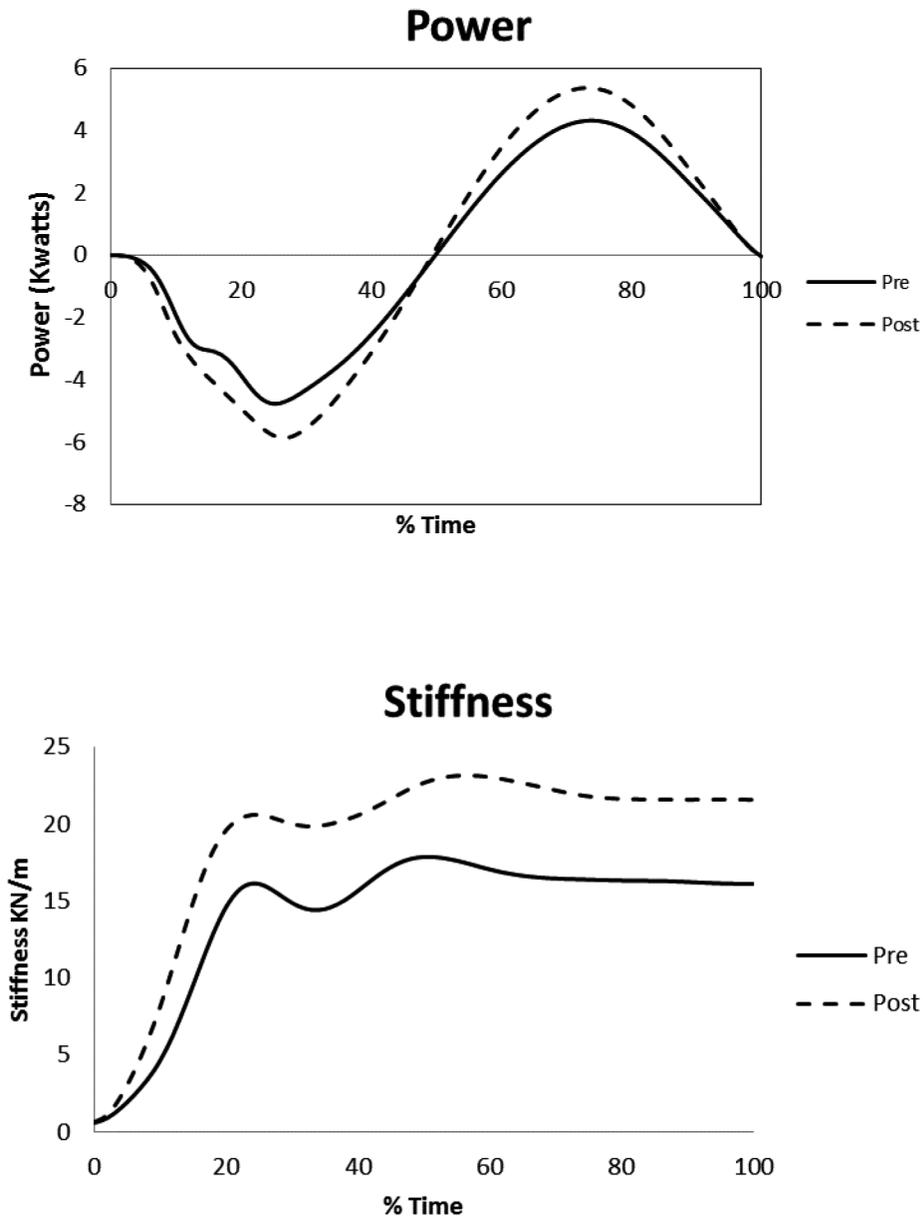


Figure 1. Representative figure of pre- and post-training (a) stiffness and (b) power of an elite athlete.

Para-Taekwondo: The Paradigm Shift in Taekwondo towards Therapy for Individuals with Various Special Abilities

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Abstract

Purpose: This research aims to bring global awareness to the Taekwondo community of the impact of Para-Taekwondo when used as a form of physical, mental, and emotional therapy at the micro and macro levels.

Methods: Incorporating life skills and character development in Taekwondo training was conducted over the past sixteen years of working with over 2,000 individuals from ages three to fifty plus with multitude disabilities at various stages in Taekwondo rank and performance. Integration of individuals with the full spectrum of disabilities occurred within Taekwondo clubs and Taekwondo associations.

Results: Promotion of acceptance and inclusiveness of individuals with special abilities works. Participants have demonstrated an enhancement in their physical development, emotional self-control, and mental focus via adapted Para-Taekwondo training; thus, Para-Taekwondo training brings balance and harmony to each individual's well-being. Personal transformation occurs in all who trained in Para-Taekwondo regardless of their state of ability.

Conclusions: With over 2,000 study cases, it has been proven that Para-Taekwondo has a significant therapeutic component for individuals with various special abilities, since it transforms them on the physical, mental, and emotional planes. This results in benefiting the individual, their family, and community. Furthermore, Para-Taekwondo has the potential to transform our society in becoming more accepting of all individuals.

Keywords: Para-Taekwondo, therapeutic, adaptive, inclusiveness, empowerment

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Short Term Supplementation of Cordyceps Militaris Mycelium Powder May Be Beneficial to Physical and Anti-oxidative Capacity of Taekwondo Players

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Abstract

Purpose: Cordyceps militaris, an entomopathogenic fungus, which is traditionally called as ‘summer-plant winter-worm,’ is one of the most popular traditional medicines. It has a long history of use as a crude drug for tonic enhancement in China and Korea. It has multiple physiological activities, such as anti-oxidation and anti-inflammation effects which are considered to be applied as an ergogenic in sports. If the efficacies are guaranteed, a short term use of ergogenic supplements rather than chronic uptake may allow several benefits such as convenience, low-cost, and safety to athletes. Effects of cordyceps powder with maximum safety assurance dose within short duration were observed.

Methods: Three cordyceps capsules (1g total/time) uptake with 12hr intervals were applied to college Taekwondo poomsae players (n=8), and the subjects did treadmill running to exhaustion with a modified Bruce protocol. Double-blind cross over design was applied with seven days of wash-out period between trials. Aerobic capacity, muscle function, blood lactate, and anti-oxidative capacity were measured.

Results: Cordyceps group showed a 27% lower lactate level at post-5 min than the placebo group. A 15% lower level of hyperoxide level and a 10% higher level of biological antioxidant potential were demonstrated in cordyceps than the placebo group. There was no significant difference in HRmax, VO₂max, and isokinetic muscle function between the two groups.

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Conclusions: Acute application of cordyceps with the max dose may allow several beneficial effects, especially oxidative stress and related metabolic burden, to athletes.

Keywords: cordyceps, supplementation, physical capacity, anti-oxidation

Table 1. Changes of blood lactate level after exercise to exhaustion with acute uptake of cordycepin powder

	Pre	Post-5min	Post-15min
Placebo	0.93±0.12	6.01±0.82a	3.90±1.05
Cordycepin	0.91±0.38	4.41±1.12b	2.84±0.83

Same letters indicate no significant difference; (p=0.048)

Table 2. Changes of d-ROMs and BAP after exercise to exhaustion with acute uptake of cordycepin powder

d-ROMs

	Pre	Post-5min	Post-15min
Placebo	243.20±16.84	291.80±35.94	297.20±34.28a
Cordycepin	275.40±34.49	295.50±32.42	253.00±16.52b

Units d-ROMs; Carratelli Units: 1 CARR U = 0.08mg/100ml H₂O₂, BAP; μMol/L

Same letters indicate no significant difference; (p=0.032)

BAP

	Pre	Post-5min	Post-15min
Placebo	2037.20±85.56	2126.50±171.83a	2178.20±100.34
Cordycepin	2065.00±167.98	2348.40±112.71b	2258.80±89.09

Same letters indicate no significant difference; (p=0.030)

Table 3. Comparison of HRmax and $\dot{V}O_2$ max with exercise to exhaustion with acute uptake of cordycepin powder

	HRmax	$\dot{V}O_2$ max
Placebo	194.40±6.67	55.44±6.49
Cordycepin	194.33±8.14	57.67±4.83

Same letter indicate no significant difference

Taekwondo in a Prism of Sports Genetics

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Abstract

Purpose: Taekwondo has evolved into a modern-day Olympic combat sport. The physical activity and physiological requirements of Taekwondo competition require athletes to be competent in several aspects of fitness, including aerobic and anaerobic power, muscular strength and endurance, flexibility, speed, and agility. Sports genetics is only about a quarter of a century old. Its birth seems to coincide with the publication of an article by Montgomery HE et al. (1998) in *Nature*, which showed higher ACE I allele frequency in a group of high-altitude climbers compared with controls. Achievements of sports genetics are noticeable and aimed mainly at “pure” sprint/power or endurance athletes (swimmers, runners, speed skaters, etc.). It seems that nowadays researches in the field of sports genetics directed on Taekwondo are absent. Searching for the candidate genes related to successful traits is important for the success in Taekwondo.

Methods: A literature search of PubMed, ISI Web of Knowledge, and Scopus was performed for English-language peer-reviewed articles from inception to March 2015 and dedicated to associative studies between physical and physiological traits and candidate genes.

Results: The most prominent physical and physiological traits of Taekwondo were chosen on the basis of the comprehensive review of Bridge CA et al. (2014). 17 candidate genes (*ACE*, *ACVR1B*, *ACTN3*, *ADRB2*, *AMPD1*, *BDKRB2*, *CKM*, *COL1A1*, *COL5A1*, *COL12A1*, *EPAS1*, *HIF1A*, *IGF2BP2*, *LPL*, *NOS3*, *PPARA*, *PPARGC1A*), which in our opinion are the most relevant to these traits, are presented in Table 1.

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Conclusions: We hope that the information presented here will be useful for future studies to identify genetic attributes that are favorable for competitive success in Taekwondo. We invite all interested to collaboration.

Keywords: Taekwondo, physical and physiological traits, candidate genes

Table 1. The most prominent physical and physiological traits of Taekwondo and related candidate genes

	Trait, examination method	Candidate genes	References
1	Body composition: Low level body fat. Somatotype: Ectomorphic Mesomorph	ADRB2, LPL, IGF2BP2	Banting LK et al., 2015; Zhang H et al., 2014
2	Anaerobic profile. High anaerobic power ability. High peak anaerobic power values (30 s Wingate test)	AMPD1, CKM	Fedotovskaya ON et al., 2013; Zhou DQ et al., 2006
3	Aerobic profile. Moderate to high levels of cardiorespiratory fitness (VO ₂ max).	ACE, BDKRB2, HIF1A, EPAS1	Gabbasov RT et al., 2013; Popadic Gacesa JZ et al., 2011; Puthuchery Z et al., 2011; Saunders CJ et al., 2006; Voisin S et al., 2014
4	Muscular strength. High relative 1RM bench press values.	ACE, ACTN3, ACVR1B, PPARA	Eynon N et al., 2012; Eynon N et al., 2013; Maciejewska A et al., 2011; Puthuchery Z et al., 2011; Wang G et al., 2013; Windelinckx A et al., 2011
5	Muscular endurance. High values of 60s push-up and sit-up test.	ACE, ACTN3, NOS3, PPARGC1A	Eynon N et al., 2012; Eynon N et al., 2013; Maciejewska A et al., 2012; Puthuchery Z et al., 2011; Saunders CJ et al., 2006; Wang G et al., 2013
6	Speed and agility. Short time in 20m, 30m sprint, turning kick.	ACTN3, AMPD1, ACVR1B	Eynon N et al., 2012; Eynon N et al., 2013; Wang G et al., 2013; Windelinckx A et al., 2011
7	Flexibility, range of motions. High values of sit-and-reach test.	COL1A1, COL5A1, COL12A1	Abrahams S et al., 2014; Bell RD et al., 2012; Brown JC et al., 2011

Estimation Model for Anaerobic Power of Taekwondo Athletes Based on Field Test

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Abstract

Purpose: This study analyzes the correlation among different variables in field and laboratory tests in order to establish a base to measure anaerobic motor ability, which is essential in a Taekwondo match.

Methods: The research subjects were selected among elite athletes from K University who have five years or more experience as professional athletes. Anaerobic power was measured by using Wingate in the laboratory, and the isokinetic muscular function was measured by using Biodex. In a field test, a physical strength examination and 3 sets of 30-second roundhouse kicks at maximum speed were performed. To determine if differences exist among the various weight classes in anaerobic power, isokinetic muscular function, physical strength, and ANOVA tests were performed, and a correlation analysis was performed to determine the correlation among variables. To build a model to estimate anaerobic exercise ability in the field, Wingate anaerobic power variables were inserted as dependent variables and physical strength and kick performance were used as independent variables in order to perform a stepwise multiple regression.

Results: In terms of Wingate anaerobic power by weight division, the average power and total activity was significantly higher ($p < .05$) in the +80 kg weight class than in the -80 kg and +68 kg classes. The average power of isokinetic muscular function of 180°/sec flexor muscle and total work of 300°/sec flexor muscle were significantly higher in the +80 kg weight class. The 30-second kick and 3 set entire kick performance was significantly higher in the +80 kg weight class. The correlation between kick performance and Wingate anaerobic power according to weight class

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was negative, and there was a significant ($p < .05$) positive correlation between the 30-second kick and Wingate anaerobic power variables. In terms of the correlation between weight class and isokinetic muscular function, the total work performed at $300^\circ/\text{sec}$ was significantly higher ($p < .05$) in the lower weight classes, and there was positive correlation among 30-second kick performance with the average power performed at $180^\circ/\text{sec}$ and total work performed at $300^\circ/\text{sec}$. Based on the anaerobic power calculated by Wingate evaluation, the 5-second kick, 50 m run, 10-to-15-second kick, and standing board jump were used as field test items to estimate anaerobic power, and the designed estimation model was $Y = 5.537 + 0.337X_1 - 1.042X_2 + 0.235X_3 + 0.014X_4$ $R^2 = .770$ to explain 77% of the anaerobic power.

Conclusions: The 30-second kick was correlated to Wingate power and isokinetic muscular function, and the field test items were correlated to estimate anaerobic power; specifically, the 5-second kick, 50 m run, 10-to-15-second kick, and standing board jump had a significant effect on Wingate anaerobic power. Therefore, the model for estimating anaerobic exercise ability can be useful in the field and further implemented for evaluating Taekwondo athletes and training effects.

Keywords: isokinetic muscular function, Wingate anaerobic power, roundhouse kicks

Table 1. Wingate anaerobic power by weight categories of taekwondo athletes

Variables	Wingate test (30 sec)				Wingate test (90 sec)			
	Groups			Total	Groups			Total
	A (n=7)	B (n=7)	C (n=6)		A (n=7)	B (n=7)	C (n=6)	
PP/kg	10.0	10.5	10.1	10.2	7.9	7.3	7.2	7.5
	±5	±6	±7	±6	±8	±7	±4	±7
AP/kg	8.8	8.9	8.2	8.6	15.5	14.7	13.6	14.7
	±2	±6	±3	±5	±9	±5	±1.0	±1.1
TW/kg	27.4	27.7	25.6	26.9	48.3	45.9	42.6	45.8
	±7	±2.0	±9	±1.6	±2.9	±1.5	±3.0	±3.4
FI	31.1	34.4	39.6	34.8	61.3	55.7	65.2	60.5
	±9.2	±8.2	±8.1	±8.8	±11.5	±8.9	±7.3	±9.8
HR	161.1	165.4	162.0	162.9	167.1	167.7	166.5	167.2
	±8.2	±12.8	±11.6	±10.6	±7.5	±11.2	±10.0	±9.2
LA	9.0	7.9	7.9	8.3	10.2	9.3	8.4	9.4
	±1.5	±1.7	±1.4	±1.6	±9	±1.8	±1.8	±1.6
PP	620.4	782.9	866.7	751.2	491.0	547.2	618.3	548.9
	±30.5	±69.3	±91.0	±122.0	±45.2	±68.6	±52.7	±74.9
AP	543.1	664.8	703.1	633.7	959.0	1102.0	1170.6	1072.5
	±24.7	±66.5	±48.3	±84.3	±79.0	±71.6	±101.4	±120.0
TW	1694.0	2073.6	2193.0	1976.5	2991.4	3437.5	3651.4	3345.5
	±77.0	±207.6	±150.8	±263.0	±246.4	±223.3	±316.3	±374.3

PP: peak power, AP: average power, TW: total work, FI: fatigue index,

HR: heart rate, LA: lactic acid

A : -68 kg group, B: -80 kg group, C: +80 kg group

Table 2. Isokinetic muscular function by weight categories of taekwondo athletes

Variables			Absolute				%BW			
			Groups			Total	Groups			Total
			A (n=7)	B (n=7)	C (n=6)		A (n=7)	B (n=7)	C (n=6)	
60°/sec	PT (Nm)	Ext	199.7	250.9	261.1	236.1	332.9	352.3	311.9	333.4
			±13.8	±29.3	±27.3	±35.9	±36.5	±32.4	±22.0	±34.0
	Flex	108.6	133.1	140.6	126.8	181.2	185.8	172.8	180.3	
			±11.0	±27.7	±23.6	±25.0	±14.7	±31.7	±25.8	±24.3
180°/sec	AP (W)	Ext	234.5	298.1	298.6	276.0	380.1	399.2	347.7	377.1
			±16.1	±30.6	±26.8	±39.3	±39.4	±43.4	±17.1	±40.2
	Flex	162.4	217.9	192.2	190.8	262.5	291.1	223.9	260.9	
			±21.9	±40.3	±34.1	±39.2	±33.9	±49.9	±37.5	±47.8
300°/sec	TW (J)	Ext	2273.2	2669.9	2743.6	2553.2	3676.9	3566.6	3205.2	3496.8
			±124.2	±253.8	±189.7	±282.9	±239.1	±242.2	±283.8	±313.6
	Flex	1713.3	2324.2	2024.0	2020.3	2767.1	3102.5	2369.2	2765.1	
			±420.4	±523.9	±342.5	±492.0	±651.7	±652.6	±448.1	±642.6

PT: peak torque, Ext: extension, Flex: flexion

Table 3. High performance kicks by weight categories of taekwondo athletes

Variables	Groups			Total	
	A (n=7)	B (n=7)	C (n=6)		
TK1 (30s)	5s	12.0±0.6	11.4±1.0	10.7±0.8	61.3±3.4
	10s	10.9±0.7	10.6±1.0	10.3±0.5	
	15s	10.4±1.3	10.4±0.5	10.3±0.5	
	20s	10.6±0.8	10.0±1.2	9.7±1.2	
	25s	9.9±1.2	10.0±0.6	8.7±0.5	
	30s	9.6±1.4	9.6±0.8	8.5±1.9	
	Total	63.3±3.0	62.0±2.7	58.2±2.6	
TK2 (30s)	5s	10.6±1.0	10.3±0.5	9.8±0.8	55.8±3.9
	10s	10.7±0.8	10.0±1.0	9.7±0.5	
	15s	10.0±1.2	9.4±0.8	8.5±0.8	
	20s	9.1±0.9	9.4±1.0	9.0±0.6	
	25s	9.7±0.5	9.0±1.0	8.2±1.2	
	30s	8.0±2.2	7.3±1.1	8.2±1.3	
	Total	58.1±3.6	55.4±3.4	53.3±3.5	
TK3 (30s)	5s	10.3±0.5	9.7±0.8	9.5±1.0	54.2±3.5
	10s	10.3±1.0	10.3±1.4	8.7±1.6	
	15s	9.6±0.5	9.1±0.9	9.0±0.6	
	20s	9.0±1.0	8.7±1.0	8.0±0.9	
	25s	8.7±0.8	8.3±0.8	8.5±0.5	
	30s	8.6±1.1	7.7±1.0	8.3±0.8	
	Total	56.4±2.7	53.9±3.5	52.0±3.4	
TK Total (90s)	177.9±8.8	171.3±8.1	163.5±8.5	171.3±10.0	
HR (beats/min)	174.7±7.2	178.6±7.2	172.5±8.7	175.4±7.7	
LA (mmol)	12.8±2.0	11.8±1.7	11.2±1.1	12.0±1.7	

TK1: Taekwondo kick 0-30 sec, TK2: Taekwondo kick 30-60 sec,

TK3: Taekwondo kick 60-90 sec, HR: heart rate, LA: lactic acid

Table 4. Correlation analysis between wingate anaerobic power and high performance kicks test

	WD	TK1	TK2	TK3
AP30S	-.453*	.514*	.184	.084
TW30S	-.454*	.515*	.185	.086
AP90S	-.702**	.711**	.481*	.471*
TW90S	-.701**	.711**	.481*	.471*

AP30S: Wingate test 30 sec average power, TW30S: Wingate test 30 sec total work, AP90S:

Wingate test 90 sec average power, TW90S: Wingate test 90 sec total work

p* $<$.05, **p $<$.01

Table 5. Correlation analysis between isokinetic muscular function and high performance kicks

	WD	TK1	TK2	TK3
E60° PT	-.235	.400	.051	.128
F60° PT	-.133	.213	-.202	-.172
E180° AP	-.313	.469*	.219	.158
F180° AP	-.311	.366	-.018	-.069
E300° TW	-.612**	.529*	.327	.257
F300° TW	-.237	.320	.118	.000

E60° PT; 60 degrees/sec extension peak torque,

F60° PT; 60 degrees/sec flexion peak torque,

E180° AP; 180 degrees/sec extension average power,

F180° AP; 180 degrees/sec flexion average power,

E300° TW; 300 degrees/sec extension total work,

F300° TW; 300 degrees/sec flexion total work

p* $<$.05, **p $<$.015

The 5th International Symposium for Taekwondo Studies



Leading Toward Taekwondo Excellence

Academic Session II : Social Science

Chairperson : Peter Ha

May 10

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Psychosocial Factors and Injury Risk in Taekwondo: A Prospective Cohort Study

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Abstract

Purpose: The objectives of this study were to examine the psychological profile of Taekwondo athletes competing at the Australian National Championships and to explore the potential relationship between psychosocial variables and injury risk.

Methods: Forty-five athletes aged 16 years and older consented to complete an online pre-tournament survey comprising demographic information and a battery of questionnaires designed to quantify four separate psychosocial factors (i.e., life-changing events, competition anxiety, coping skills, and social support).

Results: Multivariate linear regression analyses revealed that younger athletes have significantly greater competition anxiety ($P = 0.035$) and lower level of satisfaction with social support ($P = 0.019$) relative to older athletes. Female athletes reported significantly fewer positive life events ($P = 0.039$) compared to their male counterparts. In addition, older age might also be associated weakly with greater coping skills ($P = 0.062$) and lower level of competition anxiety ($P = 0.057$); however, the lack of power in this pilot study precluded these latter trends from reaching statistical significance.

Conclusions: Younger and inexperienced Taekwondo athletes may be at greater risk from psychosocial stressors, and targeted programs designed to alleviate competition anxiety and enhance coping skills in these athletes may therefore be worthwhile. While research elsewhere has indicated a relationship between psychosocial

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stressors and injury risk, further research is needed to elucidate the potential relationships between injury risk and psychosocial factors in Taekwondo athletes.

Keywords: risk factors, athletic injuries, psychosocial factors, stress, anxiety

Effects of Han's Psychological Skills Training on Taekwondo Athletes Participating in the Korean National Children's Sports Meet: A Case Study

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Abstract

Purpose: The purpose of the study was to examine the effects of psychological skills training on Taekwondo (TKD) athletes taking part in the Korean National Children's Sports Meet.

Methods: Four (three female/one male) TKD children athletes participated in the study. Han's psychological skills training program (HPSTP) adapted to meet each athlete's need was conducted for a month. HPSTP consisted of progressive relaxation, cognitive re-structuring based upon REBT, thought stopping, substitute negative thinking, and sport counseling.

Results: All members' psychological profiles changed positively. Their thinking patterns dramatically changed to positive ways resulting in the enhancement of self-confidence. In addition, their trait/state anxiety reduced. Two athletes won the silver and bronze medal in their category, while two failed to get a medal.

Conclusions: This result indicates HPSTP was effective for the youth athletes, especially for those who took part in the National Children's Sport Meet. This also suggests that children's psychological well-being and their performance will be better if the psychological skills training is adapted earlier than current.

Keywords: case study, effects, psychological skills training, Taekwondo, Korean National Children's Sports Meet,

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Physical and Cognitive Attributes Have a Minimal Association with Fundamental Movement Skills of Elite Junior Taekwondo Athletes

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Abstract

Purpose: Fundamental movement skill (FMS) tests are increasing in popularity amongst talent identification scientists due to their accuracy, reliability, and relationship with sporting success. The aim of this study is to describe the relationship that physical and cognitive attributes have with the FMS of elite Australian junior Taekwondo athletes.

Methods: Thirty-nine elite Australian junior Taekwondo athletes were tested for physical, cognitive, and skill attributes at a national representative camp. The physical qualities collected were countermovement jump height (CMJH), countermovement jump peak power (CMJPP), countermovement jump relative peak power (CMJRPP), height (H), and mass (M). Cognitive qualities collected consisted of simple reaction time (RTS), choice reaction time (RTC), and a pursuit tracking task (PTT). Fundamental movement skills were assessed using the körperkoordinationstest für kinder (KTK), a reliable non-sports specific motor testing battery which includes 4 tests: hopping for height (HH), backward balancing (BB), sideways jumping (SJ), and moving platforms (MP), which were used to accumulate a motor quotient or total score (MQ).

Results: Countermovement jump peak power correlated significantly with MQ ($r = .521, p < .001$) and MP ($r = .506, p < .001$). Non-significant correlations were found between all other physical attributes and fundamental movement skill qualities and all cognitive parameters and FMS.

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Conclusion: Findings reveal that physical and cognitive attributes are minimally associated with FMS. Talent identification scientists should therefore consider the use of FMS tests as they may provide insight that cannot be gained through physical and cognitive testing. Future research should focus on establishing a relationship between FMS and Taekwondo performance.

Keywords: talent identification, fundamental movement skills

Modern Methods of Control and Correction of the Training Process in Taekwondo

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Abstract

Purpose: This research establishes efficiency of Taekwondo training process management improvement based on modern methods of control and correction.

Methods: The athletes' functional state evaluation was carried out with the help of "Firstbeat" technology: round the clock monitoring of heart rhythm was carried out online. The parameters of stress and recovery were estimated on the basis of computerized spectral analysis of heart rate variability using the Fourier transform, as well as metabolic activity and respiratory functions evaluation. Eight elite athletes took part in the study. To make a correction of the athletes' functional state a licensed information microwave therapy apparatus was used. Electroencephalography was used as an additional research method.

Results: 65% of the athletes showed poor exercise capacity and slowing recovery processes when being examined with the help of "Firstbeat." After the training loading correction and information microwave impact usage, the total power spectrum of heart rhythm and the proportion of high-frequency waves increased. The electroencephalogram basic rhythms normalization and emergence of zonal differences were achieved. These results show the sportsmen's neuro-humoral regulation recovery.

Conclusions: The modern control technology training loading using ("Firstbeat") and timely correction improves the efficiency of the training process management in Taekwondo.

Keywords: training process, "Firstbeat," heart rate variability

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Leading Toward Taekwondo Excellence

Poster Session

May 10

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Effects of Credibility of the Taekwondo Relay Broadcasting during the 2012 London Olympics on Participation Continue and Recommendation Intention of Trainee

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Abstract

Purpose: In today's society, the impact of sports is growing through the relationship between a sport and television. Taekwondo planted itself as sport for all and an elite sport when it was adopted as an official sport at the 2000 Sydney Olympics. Consequently, there has been growing interest in Taekwondo. Currently, 70 million people in 206 countries train in Taekwondo. Taekwondo relay broadcasting in the Olympic affects elementary school trainees' of Taekwondo on participation continue and recommendation intention. Thus, the purpose of this study is to provide basic data to continue popularizing Taekwondo by examining the effect of credible relay broadcasting on participation and recommendation intention of trainees.

Methods: The subjects of this research were 340 elementary school trainees in Korea's Gyeonggi region who watched the Taekwondo relay broadcasting during the 2012 London Olympics. Questionnaires were used as the survey tool to examine the credibility of Taekwondo relay broadcasting. There was a total of 25 questionnaires, and a 5-point Likert scale was used. The PASW 18.0 statistical program was used to determine frequency analysis, exploratory factor analysis, reliability analysis, correlation relative analysis, and multiple regression analysis.

Results: The results of the analysis are as follows. First, the dynamics, expertise, and reliability factors in the credibility of Taekwondo relay broadcasting in the London Olympics effect on participation were found to be significant ($p < .001$). Second, the reliability, dynamics, and expertise factors in the credibility of Taekwondo relay broadcasting in the London Olympics effect on recommendation intention were

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found to be significant ($p < .001$). Third, continued participation was found to have significant effects on recommendation intention ($p < .001$).

Conclusions: The result of these studies indicate the credibility of Taekwondo relay broadcasting causes trainees to train consistently, and it is recommended to future consumers and trainers. However, Taekwondo relay broadcasting is not common even though numerous Taekwondo Championships are held in Korea. In order popularize and revitalize Taekwondo relay broadcasting, we found that announcers should describe the rules of the Taekwondo competition during television broadcasts. Moreover, if star players appear on television, participation would continue and recommendation intention of trainees would increase.

Keywords: 2012 London Olympics, Taekwondo relay broadcasting

Taekwondo Performance Viewing Experience and How to Improve such Experiences Using CIT

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Abstract

Purpose: The goal of this research is to point out problematic issues and measurements with Taekwondo performance to improve those issues so that Taekwondo can be recognized as an international product and as a method that can publicize South Korea not only in foreign conditions but also domestically as well. By analyzing the audiences key experience factors, we hope to also achieve methods that can help discover the value of Taekwondo and increase the number of Taekwondo performance the audience is willing to attend.

Methods: In order to discover the hidden values of Taekwondo performance as an international product we conducted a survey on 197 participants who had just watched a Taekwondo performance on April 7th, 2014 located in NamSan Hanokmaeul, Junggu, Seoul. We used Critical Incident Technique (CIT) and analyzed the data in order to find areas of improvement.

Results: The results of the research are as follows. First, the participants of the Taekwondo performance found the following five factors as positive: satisfaction of the show, admission fees, the image (or perception) of Taekwondo, promotion (marketing), and the sense of pride. Second, the participants of the Taekwondo performance found the following four factors as negative: dissatisfaction in the design of the stage, sound effects, subsidiary facilities, and the scale of the performance. Third, five factors that might help improve discrepancies regarding Taekwondo performance: provision of information, a guide on the scene, transportation, conditions regarding the stage, and the content of the performance.

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Conclusions: This research provides basic information that may change the Taekwondo industry, so that Taekwondo is recognized as a tourist product that represents Korea. We believe the conclusions will help attract more tourist. Also, we exposed key characteristics of Taekwondo performance culture and help resolved some issues regarding the sports tourism industry such as the weakness of our industry being heavily concentrated on only a small amount of specific areas.

Keywords: CIT, Taekwondo performance, viewing experience

Effects of Emotional Factors on Audiences of Taekwondo Performance

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Abstract

Purpose: Today, all countries are not only interested in culture and the art industries but the relevant reinforcement of support policies. Nations are now investing in these industries. Currently, many Taekwondo performance demonstrate fighting techniques, acrobatic skills, and Taekwondo mentality alongside performance highlight competition styles. Further, continuous efforts are being made to make Taekwondo a cultural good. Recently, narrative Taekwondo performance with cultural themes have been produced. However, such activities have not been profitable; therefore, Taekwondo has not been stabilized as a cultural art form. In this light, this study has been carried out to determine the effects of emotional factors on audience members of Taekwondo performance for marketing promotion. Further, this research examines the current status and problems of Taekwondo performance to provide measurement for the commercialization of Taekwondo performance.

Methods: The subjects of this study are the audience members of Taekwondo performance. 205 questionnaires among 250 samples in total were used for analysis. Based on these, SPSS 21.0 and AMOS 18.0 have been employed for frequency, exploratory factor, reliability, confirmatory factor, correlation, and structural equation analyses.

Results: In regard to emotional desire, emotionally sensitive audience members have been found to experience present sense, but significant relation with hedonic responses has not been found. Secondly, there was a positive relation between hedonic responses, which was included as an intervening variable, and recognition of present sense. The hedonic responses were found to affect both preferences in play-type and musical Taekwondo performance. Thirdly, present sense was found to

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positively affect preference in performance only.

Conclusions: Accordingly, image differentiation strategy by utilizing props, which can affect emotional judgement of audiences of Taekwondo performance, can be utilized effectively based on the results of this study. Further, marketing on play-type and musical factors of Taekwondo performance need to be strategically classified. In case of musical-type Taekwondo performance, understanding on the presence sense of audience is very critical.

Keywords: Taekwondo performance, performance culture contents, emotion, emotional

Comprehensive Sporting Education in Taekwondo vs. the Problem of Sports Precocious Specialization

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Abstract

Purpose: The purpose of this study is to analyze the general and specific bibliography on sports and Taekwondo in the comprehensive teaching of children who practice Taekwondo and the problem of precocious specialization.

Method: A descriptive documental analysis based on specific sport pedagogy works, children training, high performance, and Taekwondo was performed. The analysis also focused to collect, select, and analyze data in the form of "documents" to study the phenomenon of sports training in Taekwondo.

Result: A thorough bibliography search, both printed and online, was carried out resulting in the discovery of material about child and youth training as well as about contemporary initiation sports training. Moreover, the study indicated that literature on educational sports training in Taekwondo is limited either in printed form (books) as in online papers and articles. All the references used in this study agreed that early specialized training in children is risky and entails various problems. The few articles and bibliography about Taekwondo describe the lack of specific rules for children's competitions that were derived from copying the senior's competition rules.

Conclusions: We must warn about the risks of bringing children to a "precocious sports specialization." We also need to establish rules and regulations for sporting events aimed at children and highlight the Taekwondo coach/teacher's responsibility to develop sports initiation in respect to the growing phases in children. The high performance is the smallest and highest part of a pyramid that must be built

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by different "architects" and "engineers." Like any other pyramid, it cannot be built overnight, knowing that to achieve the best finish at the top it should have a solid and proper construction in its base. This is not new in the world of sport, which is why we invite all people involved with children in sports initiation to reflect on this important issue.

Keywords: sports precocious specialization, sports pedagogy, sports teaching, coach, teacher, children, comprehensive education

Exploring Pre-service Taekwondo Masters' Occupational Socialization Process and Professional Development through International Internship Program

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Abstract

Purpose: During the past decade, college students have communicated their desire to have additional hands-on experiences provided through short /long term internship components to help increase their socialization and professional development in their discipline of study. Recently, colleges and universities have begun implementing service-learning (synonymous with short internship) experiences with their students. Internships are required for the majority of professional degrees such as education, nursing, counseling and other health related professions. Students report that internships, between 400 and 1,200 hours per course, help organize information they have studied in their prerequisite courses prior to the real-life practical experience that takes place during full-time internships of longer durations. The internship program is a crucial stage where core competencies of pre-service Taekwondo masters' future instruction are developed. Frequently, pre-service Taekwondo masters' request more hands-on experience and request internships, which promote active learning. However, a few research studies have been written about the significance of internships or international internship on pre-service Taekwondo masters' socialization process, experiences, and professional development through internship program. There is a need to improve the quality of internship programs so that they will be developmentally and instructionally appropriate in order to provide quality Taekwondo instruction to students. The process of socialization into the role of teacher may influence the way in which pre-service Taekwondo masters perceive the characteristics important for successful instruction or professional development. The purpose of this study was to exploring the 11 pre-service Taekwondo

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masters' socialization process, empirically experiences and professional development and how they changed the beliefs of instruction through international internship program.

Method: Through an 8-month international internship program, 11 pre-service Taekwondo Masters (6 females and 5 males) participated in a socialization process and professional development that focused on experiential learning and implementing practical instructions through international internship program. Qualitative data were collected through field observations, journals, and interviews to assess pre-service Taekwondo masters' receptivity and perceptions of the internship as well as pre-service Taekwondo master's socialization process and professional development toward practical instruction. Inductive analysis and trustworthiness was supported through member checks and triangulation of various data sources.

Results: Both female and male pre-service Taekwondo masters stated that they were open to change, excited about the international Internship program, and expected it to improve their instruction and professional development. Most pre-service Taekwondo masters were confident that they would fully implement the international internship program. However, female pre-service Taekwondo masters followed through and made several advances in implementing the internship program while the male pre-service Taekwondo masters made few advances. Even though all of the pre-service Taekwondo masters confirmed that they improved instructional skills, leadership, decision making, and confidence of the instructions through the internship program, they reported that the program did not provide specifically how they can improve their socializations (i.e., language, culture, and interventions).

Conclusions: Overall, the internship program seems to be a practicable and motivating curriculum option for pre-service Taekwondo masters (i.e., the increased levels of confidence, improved social behavior and leadership, and enjoyment of the international internship program). Male pre-service Taekwondo masters recognized a lack of their preparation of the internship program. This led them to spend the implementation time at the beginning of the international internship program, because the university curriculum did not guide and inform about the program. Nonetheless, all of the pre-service Taekwondo masters did see the greater experiences of the

international internship program for leadership improvement and decision making opportunities. There was a shift from passive attitude to active/positive attitude of instruction as pre-service Taekwondo masters took on various stages of the socialization during the international internship program.

Keyword: pre-service TKD masters, socialization process, professional development, international internship

Reclassification of Management Quality Factors of Korean Private Taekwondo Gyms

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Abstract

Purpose: This study aims to reclassify the factors affecting the management of Taekwondo gyms by their properties through specific investigations. The field of Korean private Taekwondo gyms has played a leading role in globalization and dissemination of Taekwondo. These gyms have a cultural duty to do this due since Taekwondo originated in Korea. In addition, South Korea has provided over 2,000 college graduates majoring in Taekwondo as field leaders every year. Since these leaders establish private Taekwondo gyms, the competition to profit from operating Taekwondo gyms is cutthroat. Furthermore, the field of Korean private Taekwondo gyms that has become only about physical activity of the youth is facing a very difficult business environment along with the social phenomenon in Korea, which shows a world-class low birth rate. This study recognizes the need for a different approach to the factors affecting the management of private Taekwondo gyms in Korea and consequently researched management factors to constitute and support the effective management of Korean private Taekwondo gyms.

Methods: This study is based on a qualitative research method. Recent studies conducted in Korea on private Taekwondo gyms have been carried on a quantitative research with main variables of service quality, marketing mix, and purchasing behavior. The research was based on a pre-generalized measurement tool (questionnaire), which does not specifically represent the management phenomenon of current Korean private Taekwondo gym. Therefore, the study established a standard on Taekwondo gyms of managerial excellence through advanced research and in-depth interviews with leaders of Taekwondo gyms. The field survey for this study was

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conducted from July to September 2014.

Results: According to the basic principles of the study, participants were well aware of the management environment of Taekwondo gyms. Thus, 10 managers from Taekwondo gyms with more than one year experience and over 300 Taekwondo practitioners in the Seoul Metropolitan Area were selected as participants in the study. Survey tools were in-depth interviewing and open questionnaires. Data processing used the inductive analysis method in order to consider internal and external validity of the qualitative data collected effectively. The classified properties of management quality factors of Korean private Taekwondo gyms through the above research methods are as follows:

1. The first factor is the location and environment. This means whether the location of Taekwondo gym can safely secure a certain number of local practitioners.
2. The second factor is the internal facilities. This means the main space for Taekwondo training, hygienic interior facilities, and additional facilities in a Taekwondo gym.
3. The third factor is the equipment and tools. This means the supplies needed to run Taekwondo training and others programs than training.
4. The fourth factor is the Taekwondo program. This means all technical training programs to acquire techniques of Taekwondo in a Taekwondo gym.
5. The fifth factor is the school athletic programs. This means that the program is carried out in order to supplement physical education in the regular curriculum of a youth in a Taekwondo gym.
6. The sixth factor is the general activity program. This program is to raise interest for youth practitioners in a Taekwondo gym and includes a weight control program, an outdoor activities program, and individual sports programs like swimming and soccer.
7. The seventh factor is the leader. This means individual and organizational capabilities of Taekwondo instructors who teach techniques and guide personality development in a Taekwondo gym.
8. The eighth factor is cost. This means multiplicative forms of expenses for Taekwondo programs and programs other than training in a Taekwondo gym.
9. The ninth factor is promotion. This means all offline activities to effectively promote Taekwondo gym to areas and potential trainees such as residents in

areas.

10. The tenth factor is the online service. This means activities to increase the accessibility of a Taekwondo gym through social networking available through PCs and smart phones in order to ensure effective communication with the guardians of Taekwondo practitioners and practitioners as well as a means to attract new trainees.
11. The eleventh factor is communication between managers of cooperating Taekwondo gyms. As the competition between Taekwondo gyms continue to escalate, the business cooperation activity with non-competitive Taekwondo gyms in other regions has been increasing, and the leaders have recognized its importance of using this cooperation effectively.

Conclusion: The study is limited on the business market of Korean private Taekwondo gyms, and the properties of management quality factors were reclassified considering the environmental characteristics of Korean private Taekwondo gyms with managers of excellent Taekwondo gyms. Therefore, further studies based on the quantitative research are needed to make a measurement tool for the specific field study and to practically suggest management strategies for each private Taekwondo gym.

Keywords: Taekwondo gym, management, service quality, management quality factors

Taekwondo Personal Teaching Philosophies

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Abstract

Instructors should write a personal teaching philosophy (PTP) for Taekwondo in order to help raise education practices to the level of professional educators. We present herein a plan for writing a personal teaching philosophy (TPTP) for all Taekwondo instructors regardless of their knowledge of pedagogical practices or purpose for teaching the martial art. Writing a TPTP will enable instructors and school owners to guide their students toward clearly defined educational goals and objectives in the most efficient manners possible. TPTP enable instructors to identify what and how their students should learn within the unique educational setting of a school. By elucidating a teaching philosophy, instructors make more appropriate decisions to help students to their educational goals. A TPTP's chain of influence is clear: adapting education standards and practices in a setting produces better students and schools. The results of this study therefore indicate TPTP will not only strengthen instructors' abilities to teach but improve every level of from student to instructor or organization. TPTP can therefore provide positive improvements to the instruction, but only if Taekwondo organizations impose and enforce them as part of their instructor training.

Keywords: pedagogy, Taekwondo personal teaching philosophy (TPTP), martial arts instruction

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Martial Art Forms: Not Just Combative Drills

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Abstract

According to the standard view in hoplology (the study of human combative behavior and performance), real martial arts are foremost concerned with weapons, and unarmed combat tend to be derived from weapon arts. Obviously weapon drills are very risky to practice against an actual opponent and mistakes can be fatal, so it is believed that solo drills in the form of martial art forms were developed, which allowed warriors to train dangerous skills against imaginary opponents. Similarly, since modern sparring methods with safety equipment and safety rules were only a recent invention, it was difficult to practice martial art techniques against someone without the possibility of injury, so instead forms were devised to practice such techniques. There are several problems with this purely combative view of the martial art forms. If forms are merely drills for effective combative techniques in particular sequences, why do so many forms seem to practice impractical and sometimes overly complicated techniques—rather than only simple, effective techniques—or practice techniques at unrealistic speeds that are too slow for actual combat, or use stances that are unnecessarily low and not useful for quick combative movement, or engage in motions that appear to be non-combative, but rather seem to be ritualized or symbolic gestures? The purpose of this research is to propose that, particularly in the case of East Asian martial arts, there may be alternative influences that affected martial art forms; for example, traditional folk dances and traditional religious practices such as Taoist exercises.

Keywords: hoplology, forms, combat drills, folk dance, Taoist exercise

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Meaning and Value of Globalization of Traditional Korean Martial Arts

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Abstract

Introduction: Globalization is an important concept which has been dealt with in several academic domains in Korea since 1990's. In Sports and Martial Arts area, many studies on this topic have been published. In existing studies, globalization is understood as a process of Korean traditional martial arts that are only practiced in Korea or are introduced to only small number of countries to enter more countries or to be disseminated to the rest of the world. There are strong opinions to recommend the globalization of martial arts as it is good for national interests as well as martial arts organizations. Therefore, most of the studies describes the necessity of globalization, analyzes development process and propose several methods to artificially promote the process before closing a paper. This presentation is also not very far from such structure of the studies. The difference with the existing studies, this presentation deals with the topic objectively as possible as it can. There are two main contents in the presentation. The first is to identify the meaning of globalization of martial arts and the second content is to think about what value such globalization has.

Purpose: The purpose of this study was to identify the meaning and the value of globalization of traditional Korean martial arts.

Methods: To identify what is the meaning of globalization of traditional martial arts, I will show the meaning of tradition adopting the opinion of the Historian Go Byeong Ik and explain the meaning of traditional martial arts based on it. Next, I will find the meaning of globalization from Anthony Giddens, the British sociologist and explain in details what is the meaning of globalization of traditional martial arts have on the basis of the findings. Then, the value of globalization of traditional martial arts will be discussed. Value is a concept derived from the terms of econom-

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ics such as exchange value and use value. However, the concept of value is used in various areas beyond the economics such as psychological value, symbolic value and cultural value. The lecturer use this term for benefits gained from a certain point of view. Therefore, the value of globalization can be understood as "benefits when globalization is succeeded." The problem is to define "who has the benefits." There are three possible beneficiaries; traditional martial arts themselves, the birth country and the world society. Benefits to traditional martial arts will be revealed in the discussion of the meaning of globalization. Then, what are the benefits to the birth country? The lecturer reviews them from political and economic point of view. Finally, what are the benefits to the world society? Traditional martial arts can play educational roles to increase diversification of culture in the world and grow global civic consciousness and give catharsis, releasing personal demands suppressed during the process of modernization. These contents are dealt with in the last part of this presentation.

Conclusions: Tradition originates from ancestors heritages that require four principle factors: change, continuity, uniqueness, and ‘now-ness.’ In this context, the expression ‘traditional martial arts’ means martial arts which were, irrespective of their origination, actively modified and supplemented by Koreans. Moreover, these arts must incorporate a unique skill structure (change and uniqueness factor), they need to have been practiced continuously for at least 30 to 40 years (continuity factor), and must still be trained contemporarily (now-ness factor).

Globalization is the process that constructs and deepens global, social relationships. In other words, a certain event and phenomenon is spatially expanded, based on its uniqueness and interdependency, while it increases by mixing with cultures of other regions. Eventually, it gives up its uniqueness and acquires generality according to the demands of the external world. Globalization of traditional martial arts means the process by which a traditional martial art of a certain country is exported to other countries and trained by ever more people. During this course, the traditional martial art spreads to the world through its uniqueness; at the same time, its uniqueness is modified and given universal characteristics. In this way, globalization of traditional culture is a paradoxical process, containing expansion of uniqueness and acquisition of generality.

The process of globalization of traditional martial arts brings many benefits to the martial art itself, the country of origin, and the wider world. The process improves

substantiality and increases the martial arts influence through spatial expansion, and prepares opportunity for self-examination and innovation through adaptation to the wider world. The country of origin may have a variety of benefits in the political and economic sphere. It can enhance its soft power through cultural awareness in other societies, promote martial arts equipment industries, provide overseas job opportunities, and increase revenues from tourism. Moreover, it can be a chance to enhance national competitiveness by improving the national image through synergy effects.

Globalization of traditional martial arts also brings many benefits to the wider world in terms of cultural, educational, and psychological broadening. Currently, most societies in the world are westernized to a high degree. As a result, global culture tends to be uniform and standardized. Under these circumstances, traditional martial arts could contribute to a diversification of global culture. In addition, the traditional martial arts could be an educational mechanism to grow the consciousness of modern people. Strict and disciplined martial arts training could provide trainees with a chance of introspection, meditation, and promote growth of consciousness. Finally, traditional martial arts make psychological conditions of members of a society stable by helping people to relieve underlying emotions in a way that does not violate their self-image.

Keywords: globalization, traditional martial arts, taekwondo

Effects of Personality Traits on Leadership in Martial Arts Athletes

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Abstract

Purpose: The purpose of this study was to determine the effects of personality traits on leadership in martial arts (Taekwondo, Judo, and Wrestling) athletes.

Methods: Through a convenience sampling method, 342 survey questionnaires were used for final analysis from martial arts athletes in Gyeonggi Province, Korea. From the collected data, a descriptive statistics, exploratory factor analysis, frequency analysis, cross analysis, independent t-test, and multivariate analysis were performed by SPSS 18.0.

Results: The results of the study are summarized as follows. First, a higher rate of androgyny was found in both males and females, but no significant difference was found in gender. Second, significant differences were found on agreeableness, neuroticism, conscientiousness of personality traits, and transformational leadership master leadership by the sports type. Third, there are significant differences for agreeableness and conscientiousness between personality traits and leadership, and a positive correlation was found on transformational leadership and transactional leadership factors.

Conclusions: In conclusion, personality traits are significantly related to sex, sports type, and leadership in martial arts athletes.

Keywords: personality traits, leadership, martial arts athletes

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Effects of Gender Role Identity on Leadership in Martial Art Athletes

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Abstract

Purpose: The purpose of this study was to determine the effects of gender role identity on leadership in martial art (Taekwondo, Judo, and Wrestling) athletes.

Methods: Through a convenience sampling method, 342 survey questionnaires were used for final analysis from martial arts athletes in Gyeonggi Province, Korea. From the collected data, a descriptive statistics, exploratory factor analysis, frequency analysis, cross analysis, independent t-test, and multivariate analysis were performed by SPSS 18.0.

Results: The results of the study are summarized as follows. First, no significant differences were found in gender, but a higher rate of androgyny was found in both males and females. Second, there were significant differences for transformational, transformational, laissez-faire, and trading factors by gender. Third, there were significant differences in gender roles by sports types, and in the case of Taekwondo athletes there was a different distribution of androgyny factors and undifferentiated factors in judo/wrestling athletes. Fourth, each sports type had significant differences in transformational leadership. Fifth, although there were no significant interaction effects of sex and gender roles on leadership, sub-factors on master leadership and gender roles were significantly different. Sixth, sports type and gender roles showed statistically significant differences on sub-factors of masters in gender roles.

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Conclusions: In conclusion, gender role identity and leadership are significantly related to sex, sports type, gender roles, and leadership factors.

Keywords: gender role identity, leadership, martial arts athletes

Effects of Achievement Goal on Psychological Skills in Korean High School Taekwondo Athletes

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Abstract

Purpose: The purpose of the study was to investigate whether psychological skills are different based upon achievement goal in Korean high school Taekwondo(TKD) athletes.

Methods: 268 high school TKD athletes enrolled in Korea Sport Council were divided into three ranking groups(high: those who advanced to semifinal in 2014 any domestic meets, middle: those who advanced to quarter final or round of 16, and low group: those who didn't elevated into 16 meets). Korean version of Task and Ego Orientation in Sports Questionnaire (Duda, 1992; Kim, 2001) and Sport Psychological Skills Questionnaire (Yu & Huh, 2002) were administered. ANOVA and step-wise regression analyses were conducted

Results: Significant group differences were found between high and low groups in task orientation. In addition, significant psychological differences were also found between high and low groups in imagery, between high and middle/low groups in self-confidence and goal setting. Task orientation is associated with will power, imagery, self-confidence, team harmony, goal setting, and concentration, while ego orientation is related to imagery and goal setting. These results contradict previous studies, which may imply that achievement goal orientations differ based upon sports event.

Conclusions: Although these findings support previous studies maintaining that better athletes show task orientation, if the subjects were adults, then the results could be changed. It implies that future research should examine this possibility.

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The fact that psychological differences were found in imagery, self-confidence, and goal setting factors suggests that these psychological skills should be recognized as important psychological skills for high school TKD athletes. As the possibility that achievement goal orientations affecting on psychological skills differ based up[on sports event, further examination on this theme should be guaranteed.

Keywords: achievement goal, psychological skills, Korean high school TKD athletes

Taekwondo Training Improves CVD Risk Factors and Health-related Fitness in Obese Adolescents

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Abstract

Purpose: Prevalence of obesity during growth periods has been increased remarkably worldwide. We placed special emphasis on after-school Taekwondo training programs to prevent obesity. The purpose of this study was therefore to analyze the effect of Taekwondo training on health-related fitness and cardiovascular disease risk factors in obese adolescents in after-school Taekwondo programs.

Methods: Twenty four obese male adolescents (over 85 percentile of BMI: $29.64 \pm 2.24 \text{ kg} \cdot \text{m}^{-2}$), aged 13.96 ± 0.91 years participated in the study. They were randomly divided into a Taekwondo training group (TG=12) and a control group (CON=12). TG participated in one session of Taekwondo training for 60 min, 3 times a week for 16 weeks. Body height and body weight were measured. Blood lipids with total cholesterols, triglyceride, HDL-C, LDL-C were analyzed. Blood pressure and brachial-ankle pulse wave velocity (BaPWV) and ankle brachial index (ABI) were assessed with an automated vascular screening device (VP-1000). The health-related fitness tests included sit and reach, grip strength, sit-up, and VO₂max. Two-way repeated measures ANOVAs and paired t-test were applied.

Results: Significant decreases could be obtained for body weight ($p < 0.01$) and BMI ($p < 0.001$) in the TG between pre- and posttests. There were significant improvements for sit and reach (+313%), grip strength (+7.6%), sit-up (+53.2%), and VO₂max (+11.4%) tests in TG during the 16 weeks of intervention periods. Reduction

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of blood lipids include total cholesterol (-5.8%), triglyceride (-4.2%), HDL-C (-6.4%), LDL-C (-8.3%) were shown in the TG, whereas CON significantly increased on total cholesterol (8.5%) and triglycerides (60.9%). Taekwondo training improved right BaPWV between pre- ($995.0 \pm 147.59 \text{ m}\cdot\text{s}^{-1}$) and posttests ($922.1 \pm 97.30 \text{ m}\cdot\text{s}^{-1}$) but not left BaPWV and ABI.

Conclusions: The results of the study indicate that a 16-week Taekwondo training program improved health-related fitness and reduced CVD risk factors including blood lipids and vascular compliance in obese adolescents. Therefore, our Taekwondo training program with training held three times a week may be recommended as a physical activity program after school for obese adolescents.

Keywords: Taekwondo, CVD risk factors, health-related fitness, obese adolescent

Table 1. Anthropometric characteristics of the subjects

		Pre	Post	F-value
Body height (cm)	TG	170.62 \pm 8.90	172.28 \pm 8.25 ⁺⁺⁺	Group \times Time 0.10
	CON	168.23 \pm 7.49	170.02 \pm 8.63 ⁺⁺⁺	Group 69.04 ^{***} Time 0.52
Body weight (kg)	TG	84.63 \pm 13.91	80.69 \pm 14.88 ⁺⁺	Group \times Time 10.40 ^{**}
	CON	86.26 \pm 9.64	87.01 \pm 8.52	Group 0.67 Time 4.83 [*]
BMI (kg \cdot m ⁻²)	TG	28.9 \pm 2.38	27.0 \pm 3.03 ⁺⁺⁺	Group \times Time 10.78 ^{**}
	CON	30.4 \pm 1.88 ^{\$}	30.1 \pm 1.66	Group 6.55 [*] Time 23.68 ^{***}

Values are mean \pm SD; BMI; body mass index

\$ Significant difference between the group; $\$p < .05$

+ Significant difference within each group; + $p < .05$, ++ $p < .01$, +++ $p < .001$

* Significant main effect or interaction effect; * $p < .05$, *** $p < .01$, **** $p < .001$

Table 2. Health-related fitness between pre- and posttests in obese adolescents

		Pre	Post	F-value
Sit and reach (cm)	TT	2.26±7.35	9.46±5.34 ⁺⁺⁺	Group × Time 11.31** Group 1.80 Time 26.09***
	CG	1.39±8.30	2.88±7.14	
Grip strength (N)	TT	30.13±7.31	32.42±7.91 ⁺	Group × Time 11.31** Group 1.80 Time 26.09***
	CG	27.96±7.32	29.63±6.51	
Sit-up (n)	TT	21.75±9.53	33.42±7.97 ⁺⁺⁺	Group × Time 8.53** Group 1.83 Time 38.02***
	CG	19.67±13.83	23.83±11.87	
VO ₂ max (ml·kg ⁻¹ ·min ⁻¹)	TT	41.97±5.32	46.82±6.64 ⁺	Group × Time 5.54* Group 7.23* Time 6.36*
	CG	39.04±4.42	39.20±4.91	

Values are mean±SD

+ Significant difference within each group; + p<.05, ++ p<.01, +++ p<.001

* Significant main effect or interaction effect; * p<.05, ** p<.01, *** p<.001

Table 3. Cardiovascular risk factors between pre- and posttests in obese adolescents

			Pre	Post	F-value
Blood pressure	Systolic (mmHg)	TG	128.91±11.07	124.17±8.07	Group × Time 4.26* Group 0.08 Time 0.00
		CON	123.25±9.51	128.00±9.79	
	Diastolic (mmHg)	TG	66.88±9.15	64.64±7.39	Group × Time 1.45 Group 0.16 Time 0.01
		CON	63.48±6.59	66.08±7.84	
Blood lipids	Total Cholesterol (mg·dL ⁻¹)	TG	163.08±33.57	153.58±32.32	Group × Time 7.81** Group 0.10 Time 0.20
		CON	155.33±28.16	168.50±25.60 ⁺	
	Triglyceride (mg·dL ⁻¹)	TG	105.83±75.56	101.42±57.95	Group × Time 7.00* Group 1.70 Time 5.35*
		CON	107.92±56.52	173.58±106.64 ⁺	
	Triglyceride (mg·dL ⁻¹)	TG	51.58±8.08	48.25±8.80 ⁺⁺	Group × Time 7.00* Group 1.70 Time 5.35*
		CON	46.58±9.08	47.08±8.26	
	LDL-C (mg·dL ⁻¹)	TG	102.33±28.04	93.75±25.43	Group × Time 5.28* Group 0.01 Time 0.67
		CON	97.08±22.86	101.17±21.31	
Vascular compliance	Right baPWV (cm·sec ⁻¹)	TT	995.00±147.59	922.08±97.30 ⁺	Group × Time 6.59* Group 0.46 Time 0.55
		CON	908.75±105.72	949.08±123.69	
	Left baPWV (cm·sec ⁻¹)	TG	993.00±144.66	930.50±97.89	Group × Time 3.75 Group 0.14 Time 0.37
		CON	930.00±108.48	962.67±111.00	
	Right ABI	TG	1.1±0.15	1.1±0.13	Group × Time 0.03 Group 0.60 Time 0.04
		CON	1.1±0.13	1.2±0.17	
Left ABI	TG	1.1±0.14	1.1±0.15	Group × Time 0.00 Group 0.45 Time 0.00	
	CON	1.1±0.12	1.1±0.15		

Values are mean±SD, baPWV; brachial-ankle pulse wave velocity, ABI; ankle brachial index

+ Significant difference within each group, + p<.05, ++ p<.01, +++ p<.001

* Significant main effect or interaction effect, * p<.05, **p<.01, *** p<.001

Effects of Type of Recovery and Glucose Supplementation on Heart Rate and Energy Metabolism-related Blood Variables in Male Collegiate Taekwondo Players

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Abstract

Purpose: This study was designed to investigate the effects of different types of recovery treatments (massage, cryotherapy, and no treatment) and glucose supplementation performed between games on heart rate after each game and energy metabolism-related blood variables (glucose, FFA, insulin, epinephrine, norepinephrin, and cortisol) before the first game, after the third game, and after the sixth game when six games were performed in one day.

Methods: Twelve male collegiate Taekwondo players participated in the control, massage, cryotherapy, glucose, glucose+massage, and glucose+cryotherapy trials consecutively. Six games of three 2-minute rounds were performed each day of trials, and an appropriate treatment was applied for 20 minutes between games in each trial.

Results: The main results were as follows: 1) Heart rate before each game remained significantly lower in glucose+cryotherapy trial than in other trials; 2) Glucose and insulin remained significantly higher, and FFA remained significantly lower in three trials with glucose intake than in the trials without glucose intake; 3) No significant trial effect was found in epinephrine, norepinephrine, and cortisol.

Conclusions: It was concluded that massage, cryotherapy, and glucose ingestion would be beneficial for energy metabolism-related blood variables and for reducing heart rate throughout the games.

Keywords: Taekwondo, massage, cryotherapy, heart rate, metabolism

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Table 1. Physical characteristics of subjects

Variables	Mean±SD
Age (yr)	20.58±0.79
Height (cm)	178.38±10.99
Body weight (kg)	72.42±9.96
Fat-free mass (kg)	58.99±8.64
Percent body fat (%)	16.03±2.67

Table 2. Changes in heart rate (bpm) before each game (Mean±SD)

Trial	1st game	2nd game	3rd game	4th game	5th game	6th game	1-2 △%	1-3 △%	1-4 △%	1-5 △%	1-6 △%	P
Control	64.58	69.58	69.58	73.16	74.25	74.25						Trial 0.064
	±3.91	±2.93	±2.93	±1.46	±1.35	±0.75	7.74	12.65	13.28	14.97	14.97	
	a	b	b	c	d	d						
Massage	63.83	66.50	66.50	72.25	72.83	73.00						Time 0.000 ***
	±4.87	±4.33	±4.33	±6.32	±4.34	±2.66	4.18	9.27	13.19	14.09	14.36	
	a	a	a	c	c	c						
Cryotherapy	65.25	68.08	68.08	71.08	72.08	72.16						Time 0.000 ***
	±5.64	±6.15	±6.15	±3.14	±5.31	±4.68	4.33	8.04	8.93	10.46	10.59	
	a	ab	ab	b	b	b						
Glucose	63.66	66.41	66.41	70.08	71.33	71.50						Trial* Time 0.646
	±4.61	±3.11	±3.11	±5.17	±1.62	±1.62	4.31	5.63	10.08	12.04	12.31	
	a	ac	ac	bcd	d	d						
Glucose+ Massage	63.83	67.33	67.33	71.66	71.91	71.08						Trial* Time 0.646
	±2.85	±4.71	±4.71	±3.42	±3.65	±1.92	5.48	12.06	12.26	12.65	11.35	
	a	ac	ac	b	b	b						
Glucose+ Cryotherapy	64.25	65.50	65.50	69.41	70.16	70.33						Trial* Time 0.646
	±3.16	±2.81	±2.81	±2.06	±1.58	±2.18	1.94	5.44	8.03	9.19	9.46	
	a	a	a	c	c	c						

***p<.001: Significant main effect and/or interaction

a, b, c, d: Different alphabet indicates significant difference between time within a trial

Table 3. Changes in heart rate (bpm) immediately after each game (Mean±SD)

Trial	1st game	2nd game	3rd game	4th game	5th game	6th game	1-2 △%	1-3 △%	1-4 △%	1-5 △%	1-6 △%	P
Control	182.91 ±14.40	183.50 ±13.66	184.41 ±13.03	184.91 ±16.03	185.00 ±12.01	185.58 ±14.22	0.32	0.82	1.09	1.14	1.45	Trial 0.908
Massage	182.83 ±11.95	184.16 ±14.59	184.33 ±14.07	184.58 ±13.83	184.83 ±13.38	185.33 ±14.31	0.72	0.82	0.95	1.09	1.36	
Cryotherapy	182.50 ±14.29	183.00 ±13.79	184.33 ±13.37	184.75 ±13.87	184.41 ±11.89	185.16 13.78	0.27	0.31	0.68	0.50	0.72	Time 0.090
Glucose	182.41 ±14.89	182.75 ±13.99	183.75 ±15.56	183.83 ±14.47	184.16 ±16.66	184.33 ±14.29	0.18	0.73	0.77	0.95	1.05	
Glucose+ Massage	183.33 ±13.77	183.50 14.71	184.25 ±14.70	184.41 ±13.01	184.75 ±12.29	184.66 ±14.24	0.09	0.50	0.58	0.77	0.72	Trial* Time 1.00
Glucose+ Cryotherapy	183.50 ±14.60	183.33 ±14.09	183.41 ±13.80	183.75 ±13.03	184.08 ±13.67	184.16 ±14.56	-0.09	-0.04	0.13	0.31	0.35	

Table 4. Changes in heart rate (bpm) 5 min after each game (Mean±SD)

Trial	1st game	2nd game	3rd game	4th game	5th game	6th game	1-2 △%	1-3 △%	1-4 △%	1-5 s△%	1-6 △%	P
Control	95.75 ±4.09	96.50 ±2.61	96.50 ±2.61	96.16 ±7.37	95.66 ±4.11	95.33 ±3.47	0.78	-0.09	0.42	-0.09	-0.43	Trial 0.000 ***
Massage	94.58 ±2.99	94.33 ±6.87	94.33 ±6.87	95.50 ±3.37	94.16 ±1.11	94.66 ±3.49	-0.26	0.08	0.97	-0.44	0.08	
Cryotherapy	93.08 ±5.19	94.00 ±14.44	94.00 ±14.44	91.66 ±5.82	92.75 ±4.80	92.91 ±5.38	0.98	0.53	-1.52	-0.35	-0.18	Time 0.552
Glucose	92.75 ±2.73	91.91 ±4.58	91.91 ±4.58	90.00 ±5.84	90.91 ±4.73	90.66 ±5.54	-0.90	-1.17	-2.96	-1.98	-2.25	
Glucose+ Massage	93.16 ±3.06	92.83 ±1.85	92.83 ±1.85	92.50 ±4.90	92.33 ±3.36	92.25 ±5.87	-0.35	0.53	-0.70	-0.89	-0.97	Trial* Time 1.00
Glucose+ Cryotherapy	91.66 ±4.53	90.75 ±4.30	90.75 ±4.30	88.75 ±4.35	89.91 ±5.55	88.66 ±4.31	-0.99	-2.08	-3.17	-1.90	-3.27	

*** p<.001: Significant main effect and/or interaction

I, II, III, IV: Different number indicates significant difference between trial within a time

Table 5. Changes in glucose

(Mean±SD)

Variable	PRE (before 1st game)	MID (before 4th game)	POST (after 6th game)	△%			P	
				PRE - MID	MID - POST	PRE - POST		
Glucose (mg·dL ⁻¹)	Control	95.00±11.31 a	86.17±4.15 b, I	82.08±3.78 c, I	-9.30	-4.74	-13.60	Trial 0.000
	Massage	91.42±10.35 a	87.25±5.93 ab, I	82.92±7.12 b, I	-4.56	-4.97	-9.30	***
	Cryotherapy	92.58±7.39 a	85.42±3.78 b, I	81.67±4.25 c, I	-7.74	-4.39	-11.79	Time 0.007**
	Glucose	91.42±3.48 a	107.83±12.93 b, II	111.75±14.07 b, II	17.96	3.63	22.24	
	Glucose+ Massage	95.25±6.06 a	111.08±14.43 b, II	112.50±5.16 b, II	16.62	1.28	18.11	Trial*Time 0.000***
	Glucose+ Cryotherapy	93.25±6.66 a	119.25±12.99 b, II	117.00±10.18 b, II	27.88	-1.89	25.47	

** p<.01, ***p<.001: Significant main effect and/or interaction

a, b, c: Different letter indicates significant difference between time within a trial

I, II: Different number indicates significant difference between trial within a time

Table 6. Changes in free fatty acid (FFA)

(Mean±SD)

Variable	PRE (before 1st game)	MID (before 4th game)	POST (after 6th game)	△%			P	
				PRE - MID	MID - POST	PRE - POST		
FFA (μEq·L ⁻¹)	Control	319.25±156.76 a, I,II	600.75±311.41 b, I	1052.00±498.38 c, I	88.18	75.11	229.52	Trial 0.000
	Massage	280.75±114.61 a, I,II	538.00±262.36 b, I	849.92±375.48 c, I	91.63	57.98	202.73	***
	Cryotherapy	379.42±284.38 a, I	610.17±367.49 b, I	969.33±425.39 c, I	60.82	58.86	155.48	Trial 0.000
	Glucose	327.33±243.68 I, II	212.75±186.07 II	249.58±200.94 II	-35.01	17.31	-23.75	***
	Glucose+ Massage	357.33±182.33 a, I	193.75±149.70 b, II	302.25±305.98 a, b, II	-45.78	56.00	-15.42	Trial* Time
	Glucose+ Cryotherapy	219.58±109.86 a, II	130.58±88.17 b, II	148.25±121.14 b, II	-40.53	13.53	-32.49	0.000 ***

*** p<.001: Significant main effect and/or interaction

a, b, c: Different alphabet indicates significant difference between time within a trial

I, II: Different number indicates significant difference between trial within a time

Table 7. Changes in insulin (Mean±SD)

Variable	PRE (before 1st game)	MID (before 4th game)	POST (after 6th game)	△%			P	
				PRE - MID	MID - POST	PRE - POST		
Insulin ($\mu\text{U}\cdot\text{mL}^{-1}$)	Control	4.61±5.16 a	2.46±1.53 a, b, I	1.87±1.98 b, I	-46.65	-24.07	-59.49	Trial 0.000
	Massage	4.43±1.63 a	3.03±1.24 b, I	1.94±1.01 b, I	-31.64	-35.81	-56.12	***
	Cryotherapy	4.32±2.85 a	2.41±1.59 b, I	1.79±1.14 b, I	-44.21	-25.61	-58.49	Time 0.007**
	Glucose	3.96±1.72 a	10.68±4.99 b, II	10.49±4.29 b, II	169.89	-1.79	165.05	
	Glucose+ Massage	4.65±3.92 a	13.19±9.45 b, II	9.16±3.26 b, II	183.69	-30.57	96.95	Trial* Time
	Glucose+ Cryotherapy	4.14±2.20 a	12.40±6.01 b, II	13.19±4.97 b, II	199.40	6.38	218.51	0.000 ***

*** p<.001: Significant main effect and/or interaction

a, b: Different alphabet indicates significant difference between time within a trial

I, II: Different number indicates significant difference between trial within a time

Table 8. Changes in epinephrine (EPI) (Mean±SD)

Variable	PRE (before 1st game)	MID (before 4th game)	POST (after 6th game)	△%			P	
				PRE - MID	MID - POST	PRE - POST		
EPI ($\text{pg}\cdot\text{mL}^{-1}$)	Control	38.60±26.24 a	54.00±35.90 b	81.37±41.57 c	39.89	50.68	110.80	Trial 0.418
	Massage	32.72±20.22 a	49.33±32.51 b	66.69±43.47 c	50.76	35.19	103.82	
	Cryotherapy	31.35±15.22 a	46.40±27.56 b	62.35±34.63 c	48.00	34.37	98.88	Time 0.000
	Glucose	36.65±20.99 a	41.98±19.53 b	64.15±39.70 c	14.54	52.81	75.03	***
	Glucose+ Massage	43.40±31.15 a	55.68±43.96 b	73.88±48.68 c	28.29	32.68	70.23	Trial* Time
	Glucose+ Cryotherapy	39.40±25.80 a	53.62±29.81 b	65.25±32.45 c	36.09	21.68	65.60	0.362

*** p<.001: Significant main effect and/or interaction

a, b, c: Different alphabet indicates significant difference between time within a trial

Table 9. Changes in norepinephrine (NOR) (Mean±SD)

Variable	PRE (before 1st game)	MID (before 4th game)	POST (after 6th game)	△%			P	
				PRE - MID	MID - POST	PRE - POST		
NOR (pg·mL ⁻¹)	Control	173.88±102.79 a	246.74±130.11 b	246.74±130.11 b	41.90	59.80	126.76	Trial 0.748
	Massage	180.48±78.32 a	237.92±122.53 b	237.92±122.53 b	31.8/2	47.06	93.87	
	Cryotherapy	164.11±95.59 a	211.83±146.63 b	211.83±146.63 b	29.07	29.80	67.54	Time 0.000 ***
	Glucose	177.29±88.62 a	226.34±111.44 b	226.34±111.44 b	27.66	27.41	62.66	
	Glucose+ Massage	183.91±139.62 a	225.16±142.07 b	225.16±142.07 b	22.42	21.54	48.80	Trial* Time 0.109
	Glucose+ Cryotherapy	198.44±128.94 a	231.73±122.53 b	231.73±122.53 b	16.77	26.14	47.30	

*** p<.001: Significant main effect and/or interaction

a, b, c: Different alphabet indicates significant difference between time within a trial

Table 10. Changes in cortisol (Mean±SD)

Variable	PRE (before 1st game)	MID (before 4th game)	POST (after 6th game)	△%			P	
				PRE - MID	MID - POST	PRE - POST		
Cortisol (µg·dL ⁻¹)	Control	14.67±4.04 a	19.35±3.52 b	22.70±3.46 c	31.81	17.31	54.63	Trial 0.143
	Massage	13.35±3.06 a	17.18±4.24 b	22.41±8.46 c	28.68	30.44	67.86	
	Cryotherapy	15.31±3.13 a	16.81±3.25 b	21.86±5.45 c	9.79	35.99	41.78	Time 0.000 ***
	Glucose	12.88±2.69 a	15.44±2.40 b	20.07±3.39 c	19.87	29.98	55.82	
	Glucose+ Massage	13.73±3.49 a	15.85±3.56 b	22.10±3.62 c	15.44	39.43	60.96	Trial* Time 0.265
	Glucose+ Cryotherapy	13.91±2.41 a	15.55±2.61 b	19.23±2.80 c	11.79	23.66	38.24	

*** p<.001: Significant main effect and/or interaction

a, b, c: Different alphabet indicates significant difference between time within a trial

Effects of Type of Recovery and Glucose Supplementation on Physical Fitness in Male Collegiate Taekwondo Athletes

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Abstract

Purpose: The purpose of this study was to examine the effects of different types of recovery treatments (massage, cryotherapy, and no treatment) and glucose supplementation performed between games on physical fitness (anaerobic power, muscular power, and agility) before the first game, after the third game, and after the sixth game when six games were performed in one day.

Methods: Twelve male elite Taekwondo athletes at K University in Korea participated in the study as subjects. They went through the control, massage, cryotherapy, glucose, glucose+massage, and glucose+cryotherapy trials consecutively. Six games of three 2-minute rounds were performed in a day of trials, and the appropriate treatment was applied for 20 minutes between games in each trial. Massage was performed utilizing a massage stick, and cryotherapy was performed by applying ice on the thighs of each subject. Two hundred ml of glucose (15 % glucose solution; 120 kcal) was provided six times, within 5 minutes after each game for glucose supplementation treatment. Two-way ANOVA with repeated measures was performed to detect the difference among trials and among times.

Results: All variables related to physical fitness remained significantly higher in the five trials than in the control trial. In particular, anaerobic power remained higher in the three trials with glucose intake than in other trials without glucose intake. Muscular power and agility were higher in massage trial and massage+glucose trial than in the other four trials.

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Conclusions: It was concluded that cryotherapy and glucose ingestion would be beneficial for remaining anaerobic power throughout the Taekwondo games.

Keywords: Taekwondo, massage, cryotherapy, glucose, physical fitness

Table 1. Physical characteristics of subjects (n=12)

Variables	Mean±SD
Age (yr)	20.58±0.79
Height (cm)	178.38±10.99
Body weight (kg)	72.42±9.96
Fat-free mass (kg)	58.99±8.64
Percent body fat (%)	16.03±2.67

Table 2. Changes in anaerodash - anaerobic power of lower extremity (Mean±SD)

Variable	PRE (before 1st game)	MID (before 4th game)	POST (after 6th game)	△%			P	
				PRE - MID	MID - POST	PRE - POST		
FFA ($\mu\text{Eq}\cdot\text{L}^{-1}$)	Control	1256.16 ±205.40a	1214.58 ±159.12a	1166.00 ±148.61b	-3.31	-3.99	-7.17	Trial 0.840
	Massage	1273.58 ±208.18a	1266.00 ±178.07ab	1212.58 ±180.20b	-0.59	-4.21	-4.78	
	Cryotherapy	1237.58 ±202.85a	1282.50 ±175.43b	1230.58 ±178.24a	3.62	-4.04	-0.56	Time 0.000
	Glucose	1269.92 ±165.93	1303.33 ±162.57	1277.58 ±130.06	2.63	-1.97	0.60	
	Glucose+ Massage	1253.25 ±169.72	1318.50 ±198.66	1292.16 ±146.47	5.20	-1.99	3.10	Trial* Time 0.067
	Glucose+ Cryotherapy	1245.75 ±217.10a	1332.25 ±209.72ab	1299.08 ±206.09ab	6.94	-2.48	4.28	

*** p<.001: Significant main effect and/or interaction

a, b: Different letters indicate significant difference between time within a trial

Table 3. Changes in standing long jump - muscle power (Mean±SD)

Variable	PRE (before 1st game)	MID (before 4th game)	POST (after 6th game)	△%			P	
				PRE - MID	MID - POST	PRE - POST		
Standing long jump (cm)	Control	226.75 ±18.56a	229.10 ±14.49b	226.70 ±11.57a	1.03	-1.04	-0.02	Trial 1.00
	Massage	226.00 ±17.15a	229.76 ±16.32b	228.43 ±17.39a	1.66	-0.75	1.07	
	Cryotherapy	226.57 ±14.15a	229.96 ±14.96b	228.75 ±15.65ab	1.49	-0.52	0.96	Time .013*
	Glucose	226.40 ±19.45a	229.59 ±17.06b	229.08 ±15.90ab	1.40	-0.22	1.18	
	Glucose+ Massage	226.96 ±18.91a	230.10 ±15.84b	230.20 ±15.01b	1.38	0.04	1.42	Trial* Time .947
	Glucose+ Cryotherapy	226.82 ±21.33a	230.07 ±18.82b	229.67 ±19.33b	1.43	-0.17	1.25	

* p<.05: Significant main effect and/or interaction.

a, b: Different alphabet indicates significant difference between time within a trial.

Table 4. Changes in shuttle run (5 m ×10) - agility (Mean±SD)

Variable	PRE (before 1st game)	MID (before 4th game)	POST (after 6th game)	P	
5m shuttle run (sec)	Control	16.55±0.48	16.51±0.51	16.54±0.73	Trial .999
	Massage	16.59±0.66	16.43±0.71	16.45±0.72	
	Cryotherapy	16.56±0.57	16.45±0.53	16.47±0.87	Time .135
	Glucose	16.61±0.55	16.44±0.49	16.50±0.62	
	Glucose+ Massage	16.58±0.68	16.41±0.55	16.39±0.53	Trial*Time 1.00
	Glucose+ Cryotherapy	16.57±0.68	16.42±0.70	16.42±0.74	

* p<.05: Significant main effect and/or interaction.

a, b: Different alphabet indicates significant difference between time within a trial.

Concussion Knowledge among Chiropractic Fourth Year Interns and Residents as Compared to their Medical Counterparts

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Abstract

Purpose: The objective of this study was to investigate the degree of knowledge chiropractic fourth year interns and post graduate chiropractic residents have in regard to concussion management compared to fourth year medical students and post graduate residents.

Methods: A same survey, which was used from a study conducted by Boggild & Tator (2012) at the University of Toronto (permission obtained), was slightly modified and administered to fourth year chiropractic interns and post graduate chiropractic residents via SurveyMonkey.com.

Results: Thirty-six fourth year chiropractic interns and eight post-graduate chiropractic residents responded to the survey. Chiropractic fourth year interns answered correctly significantly more of the questions on the survey than the graduating fourth year medical students (mean = 5.2 vs. 4.1; $t=3.94$; $p<0.01$). Chiropractic residents showed no statistically significant difference in their scores on the survey when compared to medical residents (mean = 5.25 vs. 5.80; $t=0.87$; $p>0.01$) or to fourth year chiropractic interns (mean = 5.25 vs 5.2; $t= 0.0628$; $p>0.01$). Approximately half of the chiropractic interns and residents did not recognize chronic traumatic encephalopathy ($n=22$), nor second impact syndrome ($n= 25$) as possible consequences for individuals sustaining recurrent concussions. Forty two percent of fourth year chiropractic students ($n=15$) did not believe that every concussed individual should see a physician.

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Conclusions: The findings of this study show that fourth year chiropractic interns do exceed fourth year medical students in knowledge regarding the diagnosis and management of concussion. When comparing chiropractic residents to medical residents there was no statistical difference between the scores. Several knowledge gaps were identified in the sample population as a whole. This study supports chiropractors playing a significant role at the forefront of concussion management. However, we recommend additional hours of lecture on the matter be added to the chiropractic undergraduate curriculum to fill knowledge gaps identified.

Keywords: concussion, knowledge, chiropractic, medical

Table 1. Proportion of male and female interns and residents

	Study Population	Sample Population	Response Rate
Chiropractic Interns	186	36	19.4%
Female	97	19	19.6
Male	89	17	19.1
All Chiropractic Residents	33	8	24.2%
Female	14	2	14.3%
Male	19	6	31.6%
Sports Science Residents	26	6	23%
Female	9	0	0%
Male	17	6	35.3%
Clinical Science Residents	5	2	40%
Female	3	2	67%
Male	2	0	0%
Total Chiropractic Students and Residents	219	44	20.1%
Female	111	21	18.9%
Male	108	23	21.3%

Table 2. Challenges faced by medical doctors and chiropractors when diagnosing and managing a concussion reported by chiropractic interns and residents

Theme	Representative Quote
Appropriate plan of management	<p>“The uncertainty surrounding the management of concussions. Treatment is often subjective, also there are so many conflicting views of the best way the manage concussions.”</p> <p>“The variety of ways they can present is vast, and not all concussions resolve in the same way or time frame.”</p>
Continuous evolution of guidelines and protocol	<p>“There is an abundance of information currently out in the field and it is constantly evolving and difficult to keep up with. For example: one of your questions asked about long-term consequences (including Parkinsons, CTE and dementia). Some of the recent systematic reviews are showing there is no conclusive relation between concussion and those disorders however most studies should be done to confirm this and the media plays on the few cases. Having an abundance of information can be helpful but also very confusing. Guiding our education by utilizing the best level of evidence is recommended.”</p> <p>“Being aware of changes in the guidelines for diagnosing and managing concussion”</p>
Determining safe return to play	<p>“Not knowing the proper protocol/return to play.”</p>
Lack of knowledge about patient’s baseline testing results prior to concussion	<p>“Baseline testing is often not done for athletes so that the SCAT become invalid.”</p>
Lack of imaging findings	<p>“Lack of physical findings on CT or MRI”</p>
Subtleties of the clinical diagnosis	<p>“The complexity of individuality. No two cases are the same: the signs and symptoms are different, the pathology, ability to heal, response to treatment.”</p> <p>“The main one is diagnosing one and the degree of severity.”</p> <p>“The consequences of missing a more severe diagnosis (e.g. intracranial bleed).”</p> <p>“The variability of signs and symptoms from person to person”</p> <p>“Separating confounding variables from the underlying cause.”</p>

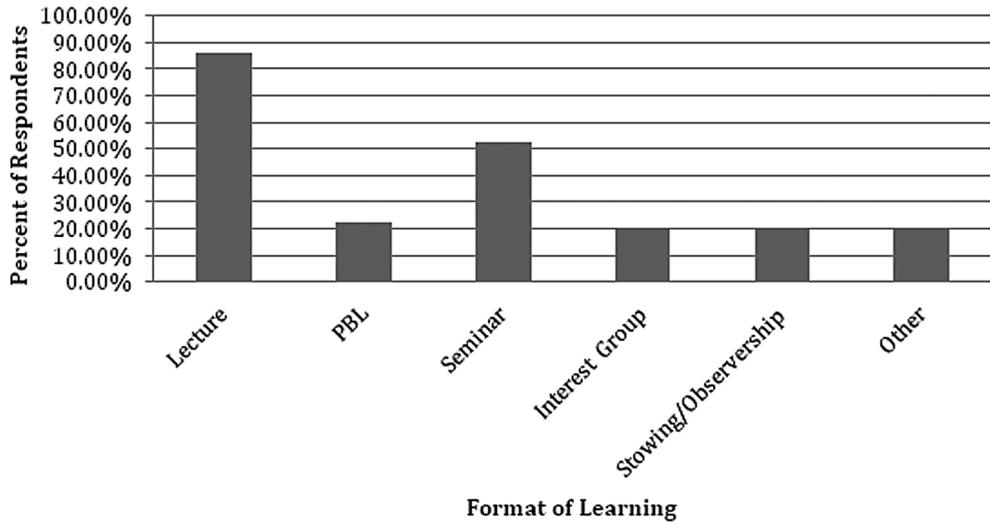


Figure 1. How chiropractic trainees learned about concussions during their undergraduate chiropractic education. PBL Problem Based Learning

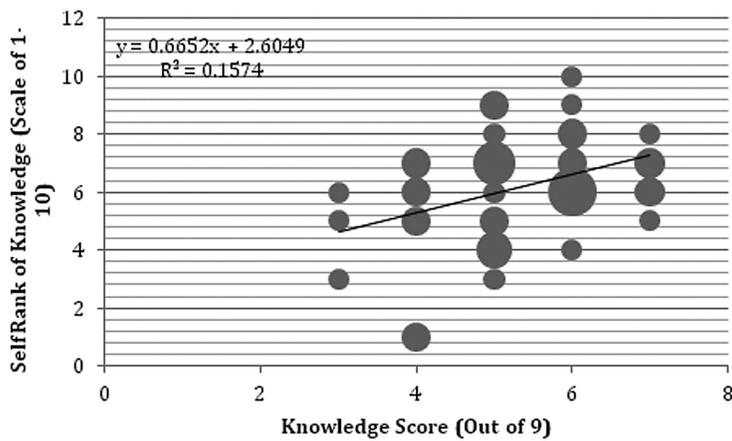


Figure 2. Relationship between chiropractic trainees' self rank of knowledge about concussions and knowledge assessment in the study survey. The area of points is proportional to the number of respondents when plotted to the same coordinate.

Profile of Olympic Taekwondo Athlete Medallists in Four Consecutive Olympic Games

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Abstract

Purpose: The purpose of this study is to identify and compare the characteristics (Body Mass Index (BMI), percentage of points from offensive or defensive type techniques, percentage of techniques used to score (kick/punch), and number of warnings or penalties received) of Olympic medal winners to non-winners who competed in the 2000, 2004, 2008, and 2012 Olympic Games.

Methods: The data for this study was obtained from the official Olympic public domain websites. The information obtained from this website includes the following: participants in each category, participants weight, height, date of birth, country, round report, points obtained, warnings, deduction points, defensive kicks, offensive kicks, offensive and defensive punches. Due to the change of the scoring system over the past Olympics, all scoring and point values were converted to percentages to ensure scoring was consistent. Variables were coded and labeled. A logistic regression was then performed to determine whether a statistical significance was found within our data.

Results: The athletes who received more penalties per match had a higher likelihood of winning and obtaining a medal. The odds ratio exemplify that if a participant obtained one more penalty than their opponent in a match, he/she would have a 1.34 times higher likelihood of winning and obtaining a medal than a participant who did not. The p-values from all the other categories (BMI, percentage of offensive or defensive techniques, percentage of kicks or punches used to score) when compared were of no significance.

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Conclusion: Determining ideal variables of champions serves to assist athletes and coaches regarding training protocols along with advancing the science of the sport. Winning a medal in Taekwondo during all last four Olympics Games was significantly associated with higher number of penalties received. This may indicate that the winners employed more aggressive strategy to win.

Keywords: Taekwondo, martial arts, profile, medalists, performance, Olympic Games

Table 1. Demographic profiles of athletes (n=482) (Mean±SD)

Characteristics	Males		Females	
	Winners (n=56)	Non-winners (n=190)	Winners (n=56)	Non-winners (n=180)
Age (years)	23.88 (5.25)	25.14 (4.020)	23.41 (3.27)	23.56 (4.32)
Height (m)	1.84 (0.09)	1.81 (0.08)	1.70 (0.07)	1.70 (0.07)
Weight (kg)	74.77 (14.06)	73.72 (13.20)	60.44 (9.16)	60.94 (9.64)
Body Mass Index	21.93 (2.57)	22.49 (2.70)	20.75 (2.36)	20.94 (2.24)

Table 2. Logistic Regression table

Logistic Regression

Outcome	Odds Ratio	[95% Conf. Interval]		Std. Err	P value
Age	0.97	0.92	1.02	0.03	0.24
Gender	0.99	0.63	1.56	0.23	0.97
BMI	0.96	0.89	1.04	0.04	0.38
Age	0.96	0.91	1.02	0.03	0.19
Gender	0.85	0.53	1.38	0.24	0.52
BMI	0.99	0.91	1.08	0.04	0.87
Ded. Per match	1	0.43	2.33	0.43	1
KG per match	1.4	0.91	2.14	0.22	0.12
Age	0.96	0.91	1.02	0.03	0.19
Gender	0.85	0.53	1.38	0.24	0.52
BMI	0.99	0.91	1.08	0.04	0.87
KG per match	1.4	1.14	1.71	0.10	0.001
Age	0.96	0.91	1.02	0.03	0.19
Gender	0.8	0.49	1.30	0.25	0.36
BMI	0.98	0.90	1.07	0.04	0.72
KG per match	1.34	1.08	1.65	0.11	0.01
% Off. Points	0.59	0.29	1.17	0.35	0.13
Age	0.98	0.92	1.03	0.03	0.41
Gender	0.87	0.53	1.44	0.25	0.59
BMI	0.97	0.87	1.07	0.05	0.50
KG per match	1.29	1.03	1.60	0.11	0.03
% Off. Kicks	0.53	0.001	331.01	3.29	0.85

Analysis of the Counterattack Reaction Time of Taekwondo Practitioners

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Abstract

Purpose: The aim of this research was the analysis of the counterattack reaction (response) time of Taekwondo based on their distance from their opponents.

Methods: Twenty boys and girls aged from 7 to 14 years were participated in this study. Subjects were subdivided into three groups according to the age, sex, and experience. The counterattack reaction (response) time was analyzed from each group depending on the distance between their opponents. Each subject executed a counterattack kick (*bandal chagi*) as a response to their opponent's attack kick (*bandal chagi*) in two modes. The first counterattack was performed in safety distance—a distance in which an offensive kick could not make contact. The second time the counterattack was performed at an unsafe distance—a distance in which an offensive kick could make contact. All data was registered and analyzed by the Dartfish 7 Connect and Statistica 10 software. Experimental data was analyzed by One-way ANOVA.

Results: Statistical difference was obtained only in "Distance variant" factor in all groups (F=13.35, P<0.001; F=30.38, P<0.001; and F=19.72, P<0.001, respectively). Post Hoc Fisher LSD tests showed no statistical differences in reaction (response) time between counterattack executions by each mode:

- In the first group (more experienced athletes): F=0.35 with P>0.05;
- In the second group (more experienced female athletes): F=2.04 with P>0.05;
- In the third group (beginner athletes): F=2.16 with P>0.05.

Conclusion: The findings of the study demonstrated that the working distance

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between the rivals does not exert influence on reaction time of beginners and of both boys and girls Taekwondo practitioners with little experience (i.e., children). This result may show that technical-tactical training for children will have equal effect in both safe and unsafe kicking distances, but safe-distance training will avoid traumas and facilitate self-reliance in future sportsmen.

Keywords: children, distance, kick, training, counterattack reaction, Taekwondo WTF.

Table 1. Results of ANOVA in "Distance variant" factor

		Multivariate Tests of Significance (Experience_players_data.sta)					
		Sigma-restricted parameterization		Effective hypothesis decomposition			
First group (more experienced athletes)	Effect	Test	Value	F	Effect df	Error df	p
	Intercept	Wilks	0,037914	164,9396	2	13	0,000000
	Distance variant	Wilks	0,327379	13,3547	2	13	0,000704
		Multivariate Tests of Significance (Experience_players_girls_data.sta)					
		Sigma-restricted parameterization		Effective hypothesis decomposition			
Second group (more experienced female athletes)	Effect	Test	Value	F	Effect df	Error df	p
	Intercept	Wilks	0,026770	163,6011	2	9	0,000000
	Distance variant	Wilks	0,129005	30,3822	2	9	0,000099
		Multivariate Tests of Significance (Beginner_players_data.sta)					
		Sigma-restricted parameterization		Effective hypothesis decomposition			
Third group (beginner athletes)	Effect	Test	Value	F	Effect df	Error df	p
	Intercept	Wilks	0,006928	645,0765	2	9	0,000000
	Distance variant	Wilks	0,185806	19,7188	2	9	0,000514

Table 2. Univariate results for each dependent variables

		Univariate Results for Each DV (Experience_players_data.sta) Sigma-restricted parameterization Effective hypothesis decomposition									
First group (more experienced athletes)	Effect	Degr. of Freedom	Reaction time (response), sec				Distance value, m				
			SS	MS	F	p	SS	MS	F	p	
	Intercept	1	2,678951	2,678951	121,7286	0,000000	9,030025	9,030025	282,5983	0,000000	
	Distance variant	1	0,007613	0,007613	0,3459	0,565807	0,855625	0,855625	26,7771	0,000141	
	Error	14	0,308106	0,022008			0,447350	0,031954			
	Total	15	0,315718				1,302975				
		Univariate Results for Each DV (Experience_players_girls_data.sta) Sigma-restricted parameterization Effective hypothesis decomposition									
Second group (more experienced female athletes)	Effect	Degr. of Freedom	Reaction time (response), sec				Distance value, m				
			SS	MS	F	p	SS	MS	F	p	
	Intercept	1	1,697264	1,697264	40,78032	0,000080	4,992300	4,992300	360,1948	0,000000	
	Distance variant	1	0,084840	0,084840	2,03846	0,183840	0,780300	0,780300	56,2987	0,000021	
	Error	10	0,416197	0,041620			0,138600	0,013860			
	Total	11	0,501037				0,918900				
		Univariate Results for Each DV (Beginner_players_data.sta) Sigma-restricted parameterization Effective hypothesis decomposition									
Third group (beginner athletes)	Effect	Degr. of Freedom	Reaction time (response), sec				Distance value, m				
			SS	MS	F	p	SS	MS	F	p	
	Intercept	1	2,448033	2,448033	126,9788	0,000001	4,575675	4,575675	942,4665	0,000000	
	Distance variant	1	0,041772	0,041772	2,1667	0,171787	0,210675	0,210675	43,3934	0,000062	
	Error	10	0,192791	0,019279			0,048550	0,004855			
	Total	11	0,234563				0,259225				

Table 3. Results of experimental data Post-hoc Fisher LSD tests

No	Distance variant	LSD test; variable Reaction time (response), sec (Experi- ence_players_data.sta) Probabilities for Post Hoc Tests Error: Between MS = ,02201, df = 14,000		LSD test; variable Reaction time (response), sec (Experi- ence_players_girls_data.sta) Probabilities for Post Hoc Tests Error: Between MS = ,04162, df = 10,000		LSD test; variable Reaction time (response), sec (Begin- ner_players_data.sta) Probabilities for Post Hoc Tests Error: Between MS = ,01928, df = 10,000	
		{1}	{2}	{1}	{2}	{1}	{2}
{1}	Without contact		0,565807		0,183840		0,171787
{2}	With contact	0,565807		0,183840		0,171787	

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