

A profile of 2008 Olympic Taekwondo competitors

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The purpose of this study was to identify the characteristics of Olympic medal winners (gold, silver, bronze) who competed in the 2008 Beijing Olympic Games and compare these characteristics to those who competed but did not earn medals. We have also descriptively analysed the 2008 data in comparison to the 2004 data (Kazemi et al., 2009), and 2000 data (Kazemi et al., 2006) and summarized changes that were identified. This study as well as the last two studies did not find any statistically significant differences between winners and non-winners with regards to average age, weight, height and BMI. There are, however, some trends that were observed. Female winners were slightly younger, shorter, with greater BMI's versus non-winners. There was a significant decrease in frequency of warnings from 2004 to 2008. Unlike 2004, the 2008 Olympic Taekwondo competitors used more defensive kicks to score. These suggest a shift from aggressive tactics to score to a more conservative one. (JCCA 2010; 54(4):243-249)

KEY WORDS: Olympic, games, Taekwondo, profile, athlete

Cette étude avait pour objet de déterminer les caractéristiques des médaillés olympiques (or, argent, bronze) des Jeux de Pékin en 2008, et de les comparer à celles des athlètes qui ont compétitionné sans toutefois gagner de médailles. Nous avons analysé de façon descriptive les données de 2008 par rapport à celles de 2004 (Kazemi et autres, 2009) et de 2000 (Kazemi et autres, 2006), puis résumé les différences identifiées. Cette étude, ainsi que les deux dernières études, n'ont démontré aucune différence statistiquement significative entre les gagnants et les autres athlètes relativement à l'âge moyen, au poids, à la taille et à l'indice de masse corporelle. Certaines tendances furent cependant observées. Les gagnantes étaient un peu plus jeunes, moins grandes, et leur IMC était supérieure par rapport aux autres athlètes. La fréquence des avertissements a beaucoup diminué entre 2004 et 2008. Contrairement à 2004, les compétiteurs de taekwondo aux Jeux de 2008 ont eu recours à plus de coups de pied défensifs pour marquer des points. Ils seraient donc passés des tactiques agressives à des tactiques plus conservatrices pour l'emporter. (JCCA 2010; 54(4):243-249)

MOTS CLÉS : Olympiques, jeux, taekwondo, profil, athlète

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Introduction

Taekwondo, is one of many martial art forms originally developed over 120 centuries ago in Korea¹. The words 'Taekwondo' translate as *tae* to hit using the foot, *kwon* to hit using the fist, and *do* referring to the art. This term directly translates into the art of kicking and punching. Being one of many martial art forms, Taekwondo is unique by the predominant use of powerful kicking techniques. In more recent times, Taekwondo has transformed from a Korean self-defence skill set during warfare to a recognized international sport.

Recently, research has specifically focused on the physiological attributes necessary to be successful. Markovic and Vucetic examined heart rate and blood lactate concentration in elite women Taekwondo and karate athletes.² They concluded that the physiological demand in Taekwondo fighting is much greater than the demand during training exercises and therefore suggest that training should focus on high intensity anaerobic conditioning. A study by Butios and Tasika recorded and analyzed heart rate and blood lactate levels of elite male Taekwondo athletes and found that the anaerobic capacity of competitors is the same, regardless of weight class and aerobic capacity.³ This study further asserts the importance of anaerobic conditioning in elite Taekwondo competitors.

Studies evaluating body mass index in terms of speed, speed-endurance and flexibility show that successful Taekwondo competitors are leaner.⁴ Kazemi et al. (2006) was the first to compare winners versus non-winners in the 2000 Olympic games with respect to weight, height, age, points obtained, warnings, deduction points, and defensive and offensive kicks and punches.⁵ The results were not statistically significant but in a first attempt to analyze the profiles of winner's versus non-winners the study suggests that a trend can be seen with the winners. Specifically, winners tended to be younger in age, taller, with slightly lower body mass indexes than their respective weight category average.⁵

With the increase in popularity of Taekwondo as a sport, there has been a rise in interest in various areas of research, with injury rates being the most frequently investigated.^{5,6,7} Kicking generates the most powerful strikes while keeping the greatest distance from the opponent, therefore it is not surprising that the lower limb has been found to be the most commonly injured body segment.^{8, 9,10,11,12}

Variables such as height, weight, body-mass index (BMI), and VO2 max have been investigated in different sports. Defining physiological profiles have also been attempted in other sports such as freestyle wrestling,¹³ and karate.¹⁴ Heller et al. determined that the physiological profile of male and female taekwondo black belts consisted of very low body fat percentages, a high lean body mass, and above average results for muscle strength, flexibility, and anaerobic and aerobic capacities.¹⁵ Toskovic et al. found that experienced and trained males and females were more athletically fit in terms of greater lower-body strength, better aerobic capacity, and greater flexibility when compared to novice males and females, even though the experienced competitors were older in age.¹⁶

In Taekwondo, competitors must be able to move with high velocity, speed, and power. A surplus of body mass can hinder this ability especially if this excess mass is in the form of fat which is metabolically inactive when compared to muscle. A study by Pieter et al. found that female athletes in Filipino combat sports have a higher sum of skin fold measurements in comparison to males.⁷ Mengli assessed the differences in somatotype and body composition in female Taekwondo athletes at different competitive levels and concluded that elite female athletes are more mesomorphic and have less fat than collegiate female athletes in Taekwondo.¹⁷ Similar findings that elite athletes possessed low body fat percentages along with increased lean body mass and high VO2 max were also described by Tosovic et al.¹⁶ and Pieter et al.⁷ In contrast, Melhim found no significant differences in either resting heart rate or aerobic power after training, however, he did find differences in anaerobic power and capacity.¹⁸

In 2009, Kazemi et al. examined the profile of the 2004 Taekwondo Olympic medalists to their non-winner counterparts.¹⁹ They reported no statistically significant differences exist between winners and non-winners with respect to age, height, weight and gender.¹⁹

In Taekwondo, points can be obtained by using a foot technique: delivering a kick using any part of the foot below the ankle or a fist technique: delivering a punch using a tightly clenched fist to the torso. In 2003, rule changes introduced an increase in point value of head contacts in adult competition to 2-points, compared to a standard 1-point value for kicks to the torso as well as an additional point for an eight-count knockdown.²⁰ Winning by superiority is possible by two ways. One method

Table 1 Demographic profiles of athletes ($n = 128$). Data are means ($\pm$ SD).

Characteristics	Males		Females	
	Winners ($n = 16$)	Others ($n = 48$)	Winners ($n = 16$)	Others ($n = 48$)
Age (yrs)	25.0 (3.53)	24.81 (4.31)	22.81 (2.80)	22.91 (4.52)
Height (m)	1.83 (.09)	1.79 (.08)	1.68 (.08)	1.70 (.06)
Weight (kg)	74.92 (14.65)	73.13 (12.41)	59.85 (9.44)	60.73 (8.65)
Body Mass Index	22.01 (2.64)	22.46 (2.35)	21.0 (2.36)	20.69 (1.92)

is termed “point gap,” meaning if an opponent leads a match by a seven-point gap, the match is terminated and the leader wins by superiority. The second method of winning by superiority is by “point ceiling.” Point ceiling is defined as a win by superiority by the competitor who first reaches a score of twelve points. If a winner cannot be decided after three rounds a fourth round is conducted. If neither competitor scores a point in the fourth round the winner shall be decided by superiority. Specifically, the opponent that has technically dominated the round through aggressive match management, the greatest number of techniques executed, the greatest use of advanced techniques both in difficulty and complexity and the better display of competition.

Penalties are considered as prohibited acts in Taekwondo. Two types of penalties exist: Kyong-go and Gam-jeom. A Kyong-go is a warning penalty and two Kyong-go's is counted as a gain of one point for the opponent. Gam-jeom is a deduction penalty and is counted as an additional point for the opposing contestant.²⁰

The purpose of this study was to identify physiological attributes of winners (gold, silver and bronze medalists) verses non-winners who competed in the 2008 Olympic Games. We compared the results of this study to previous studies by the author to look for a trend of winner's verses non-winners. Results of this study allow Taekwondo coaches and competitors to practice evidence-based success in sport.

Methods

The data for this study was obtained from the official 2008 Olympic website, <http://en.beijing2008.cn/> a public domain website. The information obtained from this website

includes the following: participant's weight, height, date of birth, country, round report, points obtained, warnings (kyong-go, gam-jeom), deduction points, type of score (defensive kicks, offensive kicks, offensive and defensive punches), list of referee and judges with country origin.

T tests were used to compare winners versus non winners stratified by gender in terms of age, height, weight and BMI. Chi-squared testing was used to compare winners versus non winners for type of score as well as type of warning received after stratifying by gender and then weight class. Also, Chi-squared testing was used to compare 2008 results with the results from both the 2000 and 2004 Olympic games for differences in proportion of scores by defensive kicks and differences in proportions of penalties to warnings. Statistical analysis was conducted using the STATA version 10 software. Variables were coded and labelled prior to analysis.

Results

There were no significant differences found between winners and non-winners with respect to age, height, weight or BMI stratified by gender. Descriptive statistics for the sample according to age, height, weight, and BMI can be found in Table 1.

2008 data

No statistically significant association was found between success (winners versus non winners) and the distribution of type of score for either men or women. Furthermore, no significant association between success and type of warning was found for either men or women (i.e. type of warning received, kg or gj, was not dependent on whether the athlete was a winner or non-winner).

Table 2 *Techniques used to score.*

Weight Category	Technique						
	Offensive Kick 1-pt	Offensive Kick 2-pt	Defensive Kick 1-pt	Defensive Kick 2-pt	Offensive Punch	Defensive Punch	Knock Down
Males							
<58 kg	33	5	42	0	0	1	0
<68 kg	39	2	49	1	0	0	0
<80 kg	40	4	55	3	0	1	1
>80 kg	50	6	63	1	0	0	0
Total	162	17	209	5	0	2	1
Females							
<47 kg	28	5	33	4	0	0	0
<57 kg	24	4	42	5	0	0	0
<67 kg	33	2	50	2	0	0	0
>67 kg	48	2	32	34	0	0	0
Total	133	13	157	45	0	0	0

When analyzing the men's data stratified by weight class, no significant association was found between weight class and type of score. Among women, however, the type of score was found to be dependant upon weight class ($p = 0.033$). For the women, it was observed that the group with the highest proportion of one point offensive kicks versus other types of score was the >67kg weight class (58.5%) compared to the <67kg (38.8%), <57kg (34.3%) and <47kg (0.424).

For all athletes, offensive one and two point kicks accounted for approximately 39% of techniques used to score for male winners and 38% of techniques used to score for female winners.

Comparisons of 2008 to 2004 and 2000 data

A higher proportion of scores by defensive kicks was found among male competitors in 2008 (0.539, $n = 388$) versus 2004 (0.345, $n = 1018$) ($p < 0.0001$). For women the result was similar in 2008 (prop = 0.580, $n = 348$) and 2004 (prop = 0.392, $n = 684$), $p < 0.0001$). This is contrary to previous studies which recorded offensive kicks were the technique of choice to score among winners.

The proportion of penalties to warnings did not change

significantly from 2004 to 2008 for men ($p = 0.34$) or women ($p = 0.34$). The frequency of warning for males decreased from 2004 (3.725 per match) to 2008 (1.276 per match) an approximate change of 65.7%. Deductions among males decreased by 58.1% from 2004 (1.413 per match) to 2008 (0.592).

Among women, there was a 20% decrease in warnings per match from 2004 (2.32) to 2008 (1.855). Regarding penalty deductions per match a decrease of 34.8% was seen from 2004 (0.747) to 2008 (0.487).

Discussion

Two previous studies investigated the profile of Olympic Taekwondo athletes that participated in the 2000 and 2004 Olympic Games.^{5,19} This study as well as the last two studies did not find any statistically significant differences between winners and non-winners with regards to average age, weight, height and BMI. There are, however, some trends that were observed.

The average age of male winners was slightly more than that of non-winners. This trend is contrary to findings from the 2000 Olympic Taekwondo athletes but similar to the trend observed in 2004.^{5,19} In the 2008 Olympics,

Table 3 *Types of Warnings Received*

<i>Weight Category</i>	<i>Kyong-go (KG)</i>		<i>Gam-jeom (GJ)</i>	
	<i># events</i>	<i>Average KG per match</i>	<i># events</i>	<i>Average GJ per match</i>
Males				
<58 kg	25	1.3	12	.64
<68 kg	26	1.36	11	.58
<80 kg	22	1.16	10	.52
>80 kg	24	1.26	12	.64
<i>Total</i>	97	5.08	45	2.38
Females				
<47 kg	38	2.0	11	.56
<57 kg	41	2.2	10	.52
<67 kg	28	1.46	7	.36
>67 kg	34	1.78	9	.46
<i>Total</i>	141	7.44	37	1.9

female winners were slightly younger than female non-winners. This was the same trend observed in the 2000 and 2004 Olympics.^{5,19} This may suggest that younger female Taekwondo athletes have a better chance to succeed.

The average height of male winners was slightly more than non-winners, which corresponds well with previous studies. However, the average height of the female winners was slightly lower than that of non-winners, which is contrary to the female Taekwondo athletes in the 2000 and 2004 Olympic games.^{5,19} This finding may relate to the fact that the difference in height for winners gave them a significant biomechanical advantage over their shorter competitors. Taller athletes have longer upper and lower limbs, which translates into longer levers providing them with greater ability to cover a larger area with less energy. It has been suggested that a certain somatotype (specifically, an ecto-mesotype) may have a better chance at excelling in competition.⁸

The male winners were slightly heavier than the male non-winners whereas the female winners were slightly lighter than their counterparts. This trend was different for the 2004 Olympic Taekwondo athletes where both male and female winners were slightly heavier than the

non-winners.¹⁹ The 2000 Olympic male and female Taekwondo winners were lighter than the non-winners.⁵

Body mass index (BMI) is a reliable indicator of calculating total body fat percentage related to morbidity and mortality.²¹ Estimating body fat percentage by utilizing the calculated BMI has some disadvantages, as it may overestimate body fat in individuals who are of large muscular build, such as athletes. It may also underestimate body fat percentage in individuals who have lost muscle mass, such as the elderly.²¹ The data from this study suggests that both male and female winners had lower average BMI's in comparison to non-winners. In general, these findings mirror those of Heller¹⁵ who found that male and female Taekwondo black belts demonstrated extremely low estimated body fat percentages, and increased amounts of lean body mass. Elite female Taekwondo athletes were found to be more mesomorphic with less fat than collegiate female Taekwondo athletes.²² Heller et al.¹⁵ reported low adiposity for their male and female athletes. The 2008 male winners had a lower BMI compared to the male non-winners. This trend was also reported in the last two studies of Olympic Taekwondo athletes that participated in the 2000 and 2004 games.^{5,19}

Contrary to the female winners in the 2000 and 2004 Olympics, the female 2008 Olympic Taekwondo winners had higher BMI than their non-winner counterparts.

Another accurate indicator of body-fat composition is to calculate the height-weight ratio. This method is more accurate in terms of taking into account the muscular build of an athlete. Future studies may find it beneficial to incorporate this measure of body-fat composition, as it may provide further insight into the somatotype of successful athletes in competition. This study chose to use the BMI measure in order to demonstrate a clearer comparison with the author's previous studies.^{5,19}

As it was in the 2004 Olympics,¹⁹ the 2008 Olympic Taekwondo competitors used kicks to score 100% of the techniques used to score. In the 2000 Olympic games⁵ kicks were used to score 98% of the time. A chi-square test of difference in proportions show us that there is a significantly higher proportion of scores by defensive kicks among male competitors in 2008 (0.539) versus 2004 (0.345). For women the result was similar in 2008 (prop = 0.580) and 2004 (prop = 0.392). This is contrary to previous studies which recorded offensive kicks, was the technique of choice to score among winners. This may indicate a shift in scoring technique to more conservative tactics. The proportion of penalties to warnings did not change significantly from 2004 to 2008 for men ($p = 0.34$) or women ($p = 0.34$). The frequency of warning for males decreased from 2004 (3.725 per match) to 2008 (1.276 per match) an approximate change of 65.7%. Deductions among males decreased by 58.1% from 2004 (1.413 per match) to 2008 (0.592). Among women, there was a 20% decrease in warnings per match from 2004 (2.32) to 2008 (1.855). Regarding penalty deductions per match a decrease of 34.8% was seen from 2004 (0.747) to 2008 (0.487). The observed decreased in number of warnings and utilization of defensive technique to score in 2008 winners indicates a shift from aggressive tactics to more conservative one.

One of the limitations of this study is the assumption that the referees and judges were unbiased in their decision. A video analysis of each match to find proper scoring would shed light on how fair the referees and the judges were. Future research to look at the injuries and their relationship with winning as well video analysis of the kind of techniques i.e. round house kicks versus back kick etc. are recommended. A further limitation of our study is the

utilization of BMI. Future studies should thrive to use height-weight ratio. Also, there is a paucity of research on relationships between injury pre and during competition and Taekwondo athlete performance and success. As such future studies should look into this relationship over extended periods of time.

Conclusions

Although not statistically significant, male winners were slightly older, taller, with lower BMIs versus non-winners. Female winners were slightly younger, shorter, with greater BMI's versus non-winners. There was a significant decrease in frequency of warnings from 2004 to 2008. Unlike 2004, the 2008 Olympic Taekwondo competitors used more defensive kicks to score. These suggest a shift from aggressive tactics to score to a more conservative one.

References

- 1 Lee MG, Kim YG. Effects of short-term weight loss on physical fitness, isokinetic leg strength, and blood variables in male high school Taekwondo players. The 1st International Symposium for Taekwondo Studies; 2007 May 16–17; Beijing, China. P. 47–57.
- 2 Markovic G, Vucetic V, Cardinale M. Heart rate and lactate responses to taekwondo fight in elite women performers. *Biol Sport*. 2008; 25(2):135–146.
- 3 Butios S, Tasika, N. Changes in heart rate and blood lactate concentration as intensity parameters during simulated Taekwondo competition. *J Sports Medicine and Physical Fitness*. 2007; 47 (2):179–85.
- 4 Wojtas A, Unierzyski P, Hurnik E. Fitness and skill performance characteristics of Polish Female national Taekwondo squad members. *International J Performance Analysis in Sport*. 2007; 7 (3):1–8 (8).
- 5 Kazemi M, Waalen J, Morgan C, White AR. A Profile of Olympic Taekwondo competitors. *J Sports Sci Med*. 2006; CSSI:114–121.
- 6 Kazemi M, Pieter W. Injuries at a Canadian National Taekwondo Championships: a prospective study. *BMC Musculoskeletal Disorders*. 2004; 5:22.
- 7 Pieter W, Bercades LT, Kim GD. Relative total body fat and skinfold patterning in Filipino national combat sport athletes. *J Sports Sci Med*. 2006; CSSI:35–41.
- 8 De Oliveira FCL. Injuries in the taekwondo athletes. The 1st International Symposium for Taekwondo Studies. 2007; May16–17; Beijing, China. P. 197–206.
- 9 Pieter W, Kazemi M. Competition injuries in young Canadian Taekwondo Athletes. The 1st International Symposium for Taekwondo Studies; 2007 May 16–17; Beijing, China. P. 197–206.

- 10 Beis K, Abatzides G. Injuries of the taekwondo athletes in the official championships of the Greek taekwondo federation. The 1st International Symposium for Taekwondo Studies; 2007 May 16–17; Beijing, China. P. 229–237.
- 11 Phillips JS, Frantz JM, Amosum SL, Weitz W. Injury surveillance in taekwondo and judo during physiotherapy coverage of the seventh All Africa Games. *South African J Physio.* 2001; 57:32–34.
- 12 Birrer RB, Halbrook SP. Martial arts injuries: The results of a five year national survey. *Am J Sports Med.* 1988; 16 (4):408–410.
- 13 Callen SD, Brunner DM, Devolve KL, Mulligan SE, Hesson J, Wilber RL, Kearney JT. Physiological profiles of elite freestyle wrestlers. *J Strength Conditioning Res.* 2000; 14(2):162–169.
- 14 Giampietro M, Pujia A, Bertini I. Anthropometric features and body composition of young athletes practicing karate at a high and medium competitive level. *Acta Diabetologia.* 2003; 40:S145–S148.
- 15 Heller J, Peric T, Dlouha R, Kohlikova E, Melichna J, Novakova H. Physiological profiles of male and female taekwon-do (ITF) black belts. *J Sports Sci.* 1998; 16:243–249.
- 16 Toskovic NN, Blessing D, Williford HN. Physiologic profile of recreational male and female novice and experienced Tae Kon Do practitioners. *J Sports Med Phys Fitness.* 2004; 44:164–172.
- 17 Mengli. Difference in somatotype and body composition in female taekwondo athletes. The 1st International Symposium for Taekwondo Studies; 2007 May 16–17; Beijing, China. P. 59–64.
- 18 Melhim AF. Aerobic and anaerobic power responses to the practice of Taekwondo. *Br J Sports Med.* 2001; 35:231–235.
- 19 Kazemi M, Cassella C, Perri G. 2004 Olympic Taekwondo Athlete Profile. *JCCA.* 2009; 53 (2):144–152.
- 20 World Taekwondo Federation [Online]. 2007 August 16 [cited 2008 May 15]. Available from: URL:<http://www.wtf.org>. 2007
- 21 Bickley LF, Szilagy PG. (2003) *Bates' Guide to Physical Examination and History Taking*. 8th edition. Philadelphia: Lippincott Williams & Wilkins. 59–62.
22. Gao B, Zhao Q, Liu B. Measurement and evaluation on body composition and figure of taekwondo athlete. *J Xi an Insitute Phys Educ.* 1998; 15:29–33.