

KINESIOLOGY & COACHING

MOHSEN KAZEMI^{1(ABCDEF)}, ALAN HETHERINGTON^{2(ABCDEF)}, FROHER AHMADI^{3(ABCDEF)},
SAMANTHA DUNCAN^{4(ABCDEF)}

¹ ORCID 0000-0003-0245-2281

Canadian Memorial Chiropractic College, Toronto, Ontario (Canada)

² ORCID 0000-0002-8998-0249

Canadian Memorial Chiropractic College, Toronto, Ontario (Canada)

³ ORCID 0000-0003-2158-0633

Canadian Memorial Chiropractic College, Toronto, Ontario (Canada)

⁴ ORCID 0000-0003-4537-3161

Canadian Memorial Chiropractic College, Toronto, Ontario (Canada)

Corresponding author: Mohsen Kazemi, Professor, Department of Graduate Studies and Research, Canadian Memorial Chiropractic College, Toronto, Ontario – Canada M2H 3J1

e-mail: mkazemi@cmcc.ca ; Phone: 1-416-482-2340 ext 237

Initial Considerations for Height Categories as a Replacement of Weight Categories in Senior Taekwondo Athletes

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Abstract

Background. Taekwondo (TKD) like many combat sports utilizes weight as a measure to categorize competitors. In an attempt to gain advantage over opponents, athletes practice rapid weight loss to qualify for the lowest weight class possible. This practice is routine despite being fundamentally dangerous to the health of athletes. Height is a measurement that cannot be exploited for competitive advantage and has the potential to be a healthier alternative for sport classifications.

Purpose and aim. This study evaluated the relationship between weight and height categories in classifying competitive senior TKD athletes for the potential of using height as a healthier grouping method.

Methods. The height and weight of 118 male (n=83) and female (n=35) athletes were measured by either physical measurement during weigh-in at the Canadian National Taekwondo Championships (n=31) or following Covid-19 restrictions, athletes (n=87) were given an online survey for height and weight. The athletes were categorized by sex and senior Olympic weight category. The athletes were then grouped by 4 proposed height categories based on CDC height weight growth charts.

Results. We found that 80.72% of male athletes remained within ± 1 category when categorized by height and 94.29% of female athletes remained within ± 1 category when categorized by height. **Conclusions.** Height categorization does little to disrupt current competition cohorts while disincentivizing unhealthy rapid weight loss practices in TKD athletes and providing more equitable competition by matching athletes of similar height and reach.

Introduction

Taekwondo (TKD) is a sport categorized by weight, similar to other combat sports such as karate, judo, jujutsu, wrestling, boxing, and mixed martial arts, in which athletes are classified by comparable body mass for competition. This classification system in combat sports is intended to reduce the disparities between competitors

in terms of strength, agility, and leverage [Kazemi *et al.* 2011; Reale *et al.* 2017b]. It is considered advantageous to be the largest individual within a weight division in order to be stronger, more powerful and have better control compared to opponents [Kazemi *et al.* 2011; Reale *et al.* 2017a, 2017b]. By qualifying for the lowest weight class possible, athletes can ensure that they will be the largest of their competitors, but this comes at a cost.

In order to achieve the lowest weight class they can, combat athletes will engage in rapid weight loss (RWL) around competitions [Kazemi *et al.* 2017; Matthews *et al.* 2019]. Studies on weight loss strategies used in combat sports found that skipping meals was the most common in TKD with secondary strategies that included, increased exercise, restricting fluid ingestion and gradual dieting [Barley *et al.* 2018]. The practice of RWL prior to competition can have significant physiological and psychological effects on athletes that negatively impact performance. Elite wrestlers using dehydration through liquid and nutrition restriction as well as sweat rooms for RWL demonstrated a positive correlation between the amount of weight lost and athlete depression levels [Isik *et al.* 2013]. Furthermore, Kurt and Sagiroglu (2015) studied the problems that could arise through RWL in young combat athlete and concluded that RWL had negative effects on mood, physical performance, and physiological performance. These combat athletes presented with decreased short-term memory, vigor, concentration, self-esteem and increased fatigue, rage and depression [Kurt, Sagiroglu 2015]. RWL has shown to be a fundamentally dangerous practice in other weight categorized sports [Matthews *et al.* 2019; Alderman *et al.* 2004; Filare *et al.* 2001].

In Canadian TKD, a high percentage of competitors use weight cycling as a pre-competition routine [Kazemi *et al.* 2005, 2011]. To avoid the negative consequences of RWL, height categories have been suggested as a potential replacement for weight categories in striking martial arts [Franchini *et al.* 2012; Dubnov-Raz *et al.* 2015; De La Fuente 2018; Kazemi 2017]. Dubnov-Raz *et al.* (2015) suggested using height as a healthier and equitable categorization by measuring the relationship between height and weight in paediatric karate fighters. There was a strong correlation between height and weight in which 33% of the athletes remained the same category while 74% of the athletes moved at most ± 1 category when divided by height [Dubnov-Raz *et al.* 2015]. De La Fuente (2018) also studied height as a potential classification standard. A strong correlation was found between height and weight in which 22.77% of the athletes remained in the same category while 68.18% of subjects moved only ± 1 category from their original category [De La Fuente 2018]. The results suggest that height categories have the potential to be a healthier categorization of athletes with marginal disruption of current divisions. Moving from adjacent weight classes may be less important in striking martial arts like TKD where opponents stand far apart, advancing swiftly to strike with punches and kicks compared to full-contact fighting and grappling sports. It is even common practice in TKD training for athletes of different weight classes to workout together because lower weight class athletes produce similar kicking force to their heavier counterparts [Estevan *et al.* 2012]. Based on the strate-

gic differences of TKD, limb length can provide a greater tactical advantage than weight without compromising health. The rule change would allow for proper nutrition, strength training, and muscle development of athletes in addition to providing short, highly skilled athletes the opportunity to flourish with evenly matched competition [Kazemi 2017].

Purpose

The aim of this study was to gain knowledge of whether height categories can be used as a solution to address the health concerns of weight categories while maintaining competitive balance in TKD.

Methods

Participants

The study sample consisted of 118 male ($n=83$) and female ($n=35$) amateur taekwondo athletes aged 18-64. Active TKD participants 18 years or older registered to participate in the Canadian National TKD Championship met the inclusion criteria for in-person sampling. Active TKD participants aged 18 years or older registered with TKD Canada and not previously measured at the Canadian National TKD Championship met the inclusion criteria of online survey data collection. Exclusion Criteria consisted of TKD Participants under 18 years old or not meeting the inclusion criteria. Thirty-one participants, male ($n=25$) and female ($n=6$), participated in this study during the Canadian National Taekwondo Championships, January 18-19 in Laval, QC, Canada. Following COVID-19 restrictions, 87 male ($n=58$) and female ($n=29$) TKD athletes responded to an online survey sent through Taekwondo Canada. Written informed consent was acquired from all athletes before participation in the study. Ethical approval was acquired from Canadian Memorial Chiropractic College Research Ethics Board (#1911X01).

Table 1. Descriptive statistics of the study population measured at competition. Age; male ($n=82$), female ($n=33$), height and body mass; male ($n=25$), female ($n=6$).

Variable	Male (M \pm SD)	Female (M \pm SD)
Age (years old)	28.63 \pm 11.28	22.78 \pm 6.16
Height (cm)	183.66 \pm 5.87	163.67 \pm 6.46
Body mass (kg)	77.10 \pm 13.77	48.50 \pm 0.40

Measures

At the Canadian National Taekwondo Championship, those participants who consented to participate in the study were assigned a number to ensure confidentiality.

The height of the athlete was measured by a wall-mounted stadiometer, obtaining values to the nearest 0.1 cm. Subjects were barefoot with their feet and knees jointed; heels, gluteus, shoulders, and head touching the wall and head correctly aligned in the Frankfort plane, according to the International Society for the Advancement of Kinanthropometry (ISAK) guidelines for measurement of standing height [Marfell-Jones *et al.* 2006]. For body mass, subjects were individually weighed using calibrated scales to the nearest 0.1 kg, while barefoot, wearing shorts and t-shirts given by tournament officials. Sex, date of birth, height in centimeters (in 5 cm ranges), weight in kilograms (in senior taekwondo weight class ranges), and weight class at last competition (in weight class ranges) were self-reported via an online survey using SurveyMonkey.com.

Design and Procedure

In TKD competitions, athletes are categorized by sex, age, and weight. For senior TKD athletes (≥ 18 years old), there are eight categories, each with an increment of four kilograms for National and international championships. However, there are only four weight categories per sex for regional and Olympic Games. Initial data was collected in person at the Canadian National Taekwondo Championship. However, during data collection COVID-19 pandemic happened and all tournaments were cancelled. As such, the rest of the data was obtained via online self-reported survey. Descriptive analysis of the data consisted of frequency distribution tables divided according to sex and organized by eight ascending weight and height groupings (Female; $<46\text{kg}$ to $>73\text{kg}$, $>150\text{cm}$ to $<190\text{cm}$, Male; $<54\text{kg}$ to $>87\text{kg}$, $>150\text{cm}$ to $<190\text{cm}$). Frequency distribution tables were also produced for age, sex, and source of data. The descriptive analysis was then used to divide the athletes according to sex and then re-classify within one of four senior Olympic weight categories and one of four height categories of 10cm increments based on the CDC height weight growth chart (Table 2) [Center for Disease Control and Prevention 2015, Kazemi 2017]. Associated height and weight categories were numbered 1 to 4 and analyzed in a frequency table.

Table 2. Proposed competition height categories for Olympic senior taekwondo athletes (≥ 18 years old)

Height Category	Female Height (cm)	Current Weight Category (kg)	Male Height (cm)	Current weight category (kg)
1	<159.9	<49	<169.9	<58
2	160-169.9	49-57	170-179.9	58-68
3	170-179.9	57-67	180-189.9	68-80
4	>180	>67	>190	>80

Results

The descriptive data are shown in Table 1. Age for male ($n=82$) and female ($n=33$), height and weight for male ($n=25$) and female ($n=6$). Age was misreported in 4 individuals and excluded from the data. The exact height and weight were only collected from athletes at competition.

The distribution of male athletes by height and weight categories shows how many individuals remained in the same category if separated by height instead of weight (Table 3). The data demonstrates 27.71% of the male athletes remained in the same category by height as they did by weight, 53.01% moved ± 1 category, and 19.28% fell outside by more than 1 category.

Table 3. Distribution of male athletes in the Olympic height and weight categories

Weight	Height			
	Categories	1	2	3
1	2	1		
2	4	10	3	
3	1	5	2	
4	1	14	31	9

The distribution of female athletes by height and weight categories showed how many individuals remained in the same category if separated by height instead of weight (Table 4). The data show 57.14% of the female athletes remained in the same category by height as they did by weight, 37.14% moved ± 1 category, and only 5.71% fell outside by more than 1 category.

Table 4. Distribution of female athletes in Olympic height and weight categories

Weight	Height			
	Categories	1	2	3
1	5			
2	3	10	1	
3		5	3	
4		2	4	2

Discussion

Under the weight class model, athletes regularly practice RWL to qualify for the lowest weight category possible. A lack of restriction in sports rules to limit frequent dieting and extreme weight loss methods may contribute to the widespread use and negative health impact [Franchini *et al.* 2012]. Additionally, RWL has been shown to be a dangerous practice in other weight category sports [Matthews *et al.* 2019; Alderman *et al.* 2004; Filare *et al.* 2001].

RWL appears to provide no benefit to performance, suggesting that TKD athletes are unjustifiably subjecting themselves to this harmful weight-loss method [Kazemi *et al.* 2011; Artioli *et al.* 2010]. As previously stated, significant losses of body mass and frequent dieting can result in negative consequences for athletes [Isik *et al.* 2013; Kurt, Sagiroglu 2015; Filare *et al.* 2001; Pettersson Berg 2014; Thai *et al.* 2011; Sagayama *et al.* 2014]. Twenty percent of the athletes from a British TKD club reported that they had never received advice on healthy eating and appropriate weight loss practices [Fleming *et al.* 2009]. An issue facing many weight-classed athletes is inadequate education on the potential health risks and negative outcomes associated with weight cycling. A solution is to categorize participants by height to protect the health of athletes. Height categories may reduce the practice of rapid weight loss used by most TKD athletes while maintaining fair measurable classifications. It has been suggested height and a lower BMI are important factors for success given the important reach and kicking in TKD [Kazemi 2017; Kazemi *et al.* 2006, 2013].

Unlike other combat sports such as judo and wrestling, TKD is not significantly dependent on mass for the performance of sport-specific tasks [Reale *et al.* 2017a, 2017b; Estivan *et al.* 2012]. Previous studies found that TKD athletes in all weight categories were capable of producing similar impact forces with a roundhouse kick [Estivan *et al.* 2012]. Therefore, fighting a heavier athlete would not be as unfavourable as fighting with a height disparity. Unlike weight, which can be manipulated by an individual to their benefit, height is a non-modifiable factor that would allow athletes of similar reach to compete. This would demand a focus on developing technical skills and athletic abilities. We found when athletes were categorized by height instead of weight, 27.71% of male athletes remained in the same category, while 53.01% moved ± 1 category. For female athletes, 57.14% remained in the same category when they were categorized by height instead of weight and 37.15% moved ± 1 category.

In a study of 169 child and adolescent karate athletes, when recategorized from weight to height, 33% remained in the same category while 74% moved at most ± 1 category [Dubnov-Raz *et al.* 2015]. An 83% decrease in the variation of height within groups was traded off with a moderate increase in the range of weights which is of lesser importance in combat [Dubnov-Raz *et al.* 2015]. Categorization by height in 153 adolescent TKD athletes found that 22.77% of athletes remained in the same category as they were by weight, while 68.8% moved ± 1 category [De Le Fuente 2018]. Furthermore, with up to 85% of the TKD athletes performing weight loss practices to compete at a lower weight class, the natural weight class of athletes is usually one class heavier [Kazemi 2017]. In association with our results, these findings suggest that classifying TKD athletes by height may reduce the differences in body size with minimal displacement

from category cohorts. Not considering height in athlete classification may even contribute to more unequal competition as shorter athletes will not have equitable reach to strike taller opponents. Besides maintaining competitive integrity, height classification will provide an opportunity for healthier competition preparation by discouraging RWL. In turn, reducing the rate of eating disorders and weight preoccupation in this athlete group. One of the criticisms of using height categories is that the heavier athlete can produce a greater pushing force during sparring. This could be easily managed by banning pushing and giving a warning as a deducted point to the athlete who practices this during the match.

In national and international level TKD competitions (regional and world championships), athletes are categorized into 8 weight categories, but only 4 categories during international games competitions (regional games such as Pan-American Games, Asian Games, Olympic Games etc.). To meet this discrepancy, athletes are required to alter their training and diet habits to conform to the new classes. We suggest a consideration to have all competition standardized into 4 categories to ease the physiological and psychological strain caused by having to change training strategy between different levels of competition. For this reason, we matched our subjects to the 4-category system to demonstrate its utility.

A significant limitation of the current research was the multiple strategies used to collect data due to the COVID-19 pandemic, leading to the combined analysis of measured discrete data with self-reported interval data. In addition, the potential errors associated with self-reported data are potentially limiting. Future research should attempt to reveal whether different senior athlete ages are impacted differently by height classification. Investigating the utilization, satisfaction, and injury rate during height-based TKD competition would shed more light on this innovation.

Conclusions

The results demonstrated a close relationship between height and weight classifications. As such, it is reasonable to suggest that a height-based categorization might cause moderate change to the current competition cohorts. However, it would substantially improve the health standards of TKD athletes and shift the emphasis to skill and sports-specific technique.

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Wstępne rozważania dotyczące kategorii wzrostu jako zastąpienia kategorii wagowych w przypadku starszych zawodników taekwondo

Słowa kluczowe: taekwondo, szybka utrata masy ciała, wzrost, sportowcy, kolarstwo ciężarowe, olimpijski, klasyfikacja, kategorie

Streszczenie

Tło. Taekwondo (TKD), podobnie jak wiele sportów walki, wykorzystuje wagę jako miarę do kategoryzacji zawodników. Próbując uzyskać przewagę nad przeciwnikami, sportowcy ćwiczą szybką utratę wagi, aby zakwalifikować się do najniższej możliwej kategorii wagowej. Ta praktyka jest rutynowa, mimo

że jest zasadniczo niebezpieczna dla zdrowia sportowców. Wzrost jest miarą, której nie można wykorzystać do przewagi konkurencyjnej i może być zdrowszą alternatywą dla klasyfikacji sportowych.

Cel i cel. Badanie to oceniało związek między kategoriami masy i wzrostu w klasyfikacji startujących zawodników Taekwondo seniorów pod kątem potencjalnego wykorzystania wzrostu jako zdrowszej metody grupowania.

Metody. Wzrost i wagę 118 zawodników płci męskiej (n=83) i kobiet (n=35) mierzono za pomocą pomiarów fizycznych podczas ważenia na Narodowych Mistrzostwach Kanady w Taekwondo (n=31) lub zgodnie z ograniczeniami Covid-19, zawodnicy (n=87) otrzymali ankietę online dotyczącą wzrostu i wagi. Sportowcy zostali podzieleni na kategorie według płci

i olimpijskiej kategorii wagowej seniorów. Sportowcy zostali następnie pogrupowani według 4 proponowanych kategorii wzrostu na podstawie wykresów wzrostu masy ciała CDC.

Wyniki. Autorzy stwierdzili, że 80,72% sportowców płci męskiej mieściło się w zakresie +/-1 kategorii przy podziale według wzrostu, a 94,29% sportowców płci żeńskiej mieściło się w przedziale +/-1 kategorii przy podziale według wzrostu.

Wnioski. Kategoryzacja wzrostu w niewielkim stopniu zakłóca obecne grupy zawodów, jednocześnie zniechęcając do niezdrowych praktyk szybkiego odchudzania u sportowców z TKD i zapewniając bardziej wyrównane współzawodnictwo poprzez dopasowywanie sportowców o podobnym wzroście i zasięgu.