

Taekwondo: evolution of average height in world competitions

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Abstract

Taekwondo, an ancient Korean martial art based mainly on the use of kicking techniques, became an official Olympic discipline in the 2000 Sydney edition. Its rapid spread in the immediate post-war period is mainly due to the continuous changes in the rules of the competition of combat (*kyorugi*), characterized by two main goals from its origins: the safeguard of the competitors' safety on the one hand, and the search for the increasingly objective formula for assigning scores on the other. Recently, we have witnessed the introduction of protection kits equipped with electronic sensors, which almost completely exclude the interpretation of the score and human error. Moreover, it is clear that these variations and changes in the rules have substantially changed the entire performance model, and consequently the morphology of the typical combat athlete. The research was conducted through the collection and the statistics of the heights of the athletes who took part in the World Championship, from the first edition of Seoul 1973 to the 2019 edition of Manchester. The research takes into consideration 216 athletes that arrived on the World Championship podium (gold, silver and bronze), all aged between 18 and 35 (senior categories), divided into 8 weight categories -54 kg, -58 kg, -62 kg, -67 kg, -72 kg, -78 kg, -84 kg, +84 kg male and -47 kg, -51 kg, -55 kg, -59 kg, -63 kg, -67 kg, -72 kg, +72 kg female). The working hypothesis was to verify that the average height of the medalled athletes has been increasing before and after the regulation changing occurring between 2007 and 2009, favouring the biomechanical advantage dictated by longer lower levers (higher reach). The results obtained by comparing the average heights in both men and women confirm with a good approximation that the average height of the athletes has increased between 2007 and 2008 editions due to an electronic scoring system introduction. For what concerns the conclusions, it's possible to confirm the starting hypothesis; the average height increases, bringing an important advantage in terms of biomechanical reach for the lower limbs.

Key words: Taekwondo, reach, world championship, height.

Introduction

Taekwondo, literally *the art of flying kicks and punches*, is a Korean martial art based mainly on the use of kicking techniques, and its most popular style, the WTF taekwondo is also an Olympic discipline; at first it was demonstrative (1988 Seoul Olympics and 1992 Barcelona Olympics), then became fully integrated into the Olympic circuit from 2000 Sydney edition. Taekwondo originated from the union of the external styles of North China and the *taekkyon*, an ancient Korean martial art literally meaning "*fighting with the legs*". Only after the end of World War II it was possible to merge the combat techniques and the native styles into a single product, called taekwondo. In Korea it soon became a national sport, and was included in the Korean national games since the beginning of the '60s; at the same time, it started to spread in the rest of the world thanks to the birth of the various world federations, distinguishing itself from other disciplines for its dynamism and spectacular power, and for the effectiveness of its leg techniques.

The regulations of taekwondo's "*kyorugi*" (combat) discipline have undergone many variations and changes since May 28, 1973, i.e. the year of their first draft. From the very first moment, these changes have increased the spectacular power and the executive speed of the techniques, while preserving in any case the safety of the competitors. We have witnessed the introduction of body protectors, helmets and protections for the lower and upper limbs, up to the use of information technology for scoring.

Currently it is possible to witness the maximum impartiality of the scoring, with totally electronic protection kits that completely exclude human error. It is clear that these advances in the rules have substantially changed, generation after generation, the interpretation and implementation of combat both from a technical-tactical and physical-conditional point of view. These changes have increasingly selected the morphology of the athletes suitable for the new performance models, identifying the reach of the lower limbs as a very significant competitive advantage. The measurement of the athletes' height, which directly connected to the reach of the lower limbs and included in the set of Anthropometric Measurements together with other parameters in the

literature, can therefore, be the first and evident index of a change in the evolution phase. The research has been conducted in order to provide a preliminary overview on the average height growth occurring between the 2007 and 2009 World Championship following the introduction of the electronic score system.

Working assumption

The research was carried out by collecting and analyzing the current height of the athletes who took part in the World Championships from 1999 to 2019. Of all the 704 athletes who made it to the World Championship podium (gold, silver and bronze medals), only a set of 216 has been taken into consideration due to a lack of further and more detailed data. The first, second and third place winners in each weight category were involved in the male and female taekwondo categories. Therefore, the sample consisted of 216 athletes, all aged between 18 and 35 years (senior category). The working hypothesis considered was to verify that the average height of the medalists in the eleven editions of the World Championship has been increasing from pre 2007 and post 2009 edition, favoring the biomechanical advantage resulting from longer lower limbs, i.e. from a longer reach. Comparing the 216 medalists for the male and female categories, we tried to predict the average increase in each weight category first, and for gender differences then. The average height value has been deduced by considering the whole athlete pool for both the pre and post 2008 World Championships. This procedure aims to provide a general perspective over average height for each Olympic weight category; the Olympic category has been obtained by merging the two related world championship classes (i.e. -54 and -58 world championship categories are merged into the -58 Olympic category). As far as the categories are concerned, it is useful to point out that the weight categories existing up to the 2007 edition were the following:

Male weight categories	Female weight categories
-54kg	-47kg
-58kg	-51kg
-62kg	-55kg
-67kg	-59kg
-72kg	-63kg
-78kg	-67kg
-84kg	-72kg
Over 84kg	Over 72kg

From the 2009 edition of the World Championship until the 2019 edition, the weight categories were partly modified by increasing or decreasing the weight in both male and female categories as follows:

Male weight categories	Female weight categories
-54kg	-46kg
-58kg	-49kg
-63kg	-53kg
-68kg	-57kg
-74kg	-62kg
-80kg	-67kg
-87kg	-73kg
Over 87kg	Over 73kg

This change was probably due to the fact that taekwondo, which has been included among the official Olympic sports starting from 2000 Sydney Olympics, as previously mentioned, involves merging the 8 weight categories into just 4 categories in the Olympic competition:

Male weight categories	Female weight categories
-58kg	-49kg
-68kg	-57kg
-80kg	-67kg
Over 80kg	Over 73kg

All this involves and implies the possibility of analyzing and assimilating the athletes' heights for carrying out the statistic survey for the Olympic categories too, since an athlete participating for example in the -54kg men's category (which is not officially included in the Olympics) is indirectly integrated into the -58kg category. For this reason, as part of the subsequent analysis and discussion of the data, the statistical indexes relating to the medalists of the World Championships in question will be discussed through the only 4 categories present in the Olympic Games (referring to the merging of the categories mentioned above).

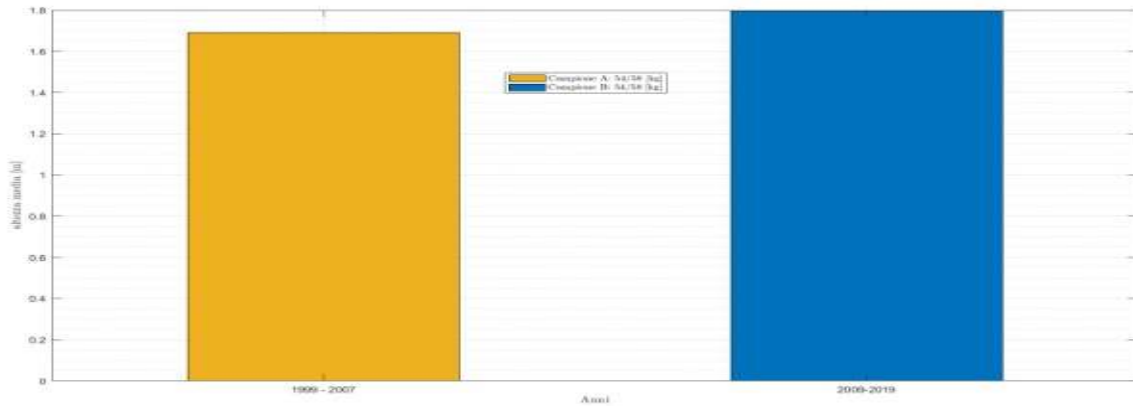
In addition, a distinction between two periods was made: the first related to the World Championships from 1999 to 2007, and the second to the World Championships from 2009 to 2019. The reason for this distinction was the above-mentioned change/variation in the 8 categories, which was implemented since the tournament held in Copenhagen, Denmark, from October 14 to 18, 2009

Results

Analysis of male category results

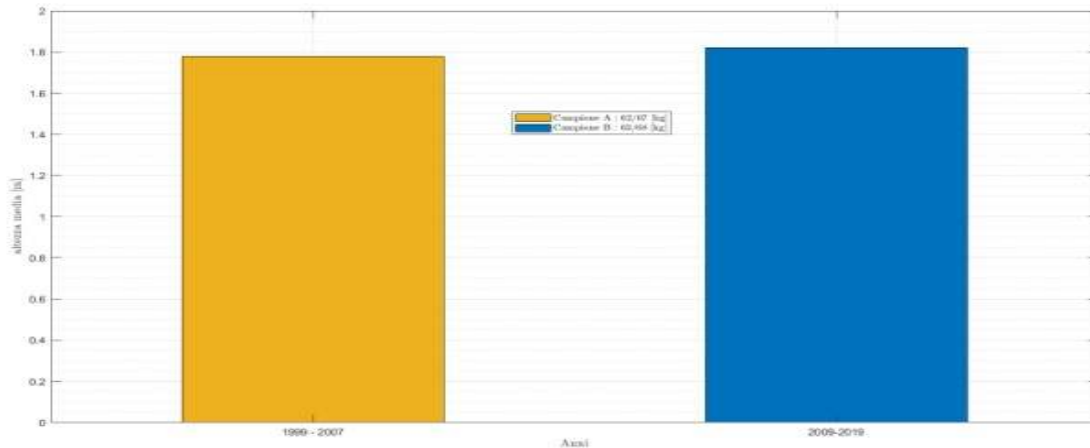
MALE -58KG CATEGORY

This category is the only one that did not undergo any change in weight in the 2007 -2009 transition; it started being practiced in 1999, and is formed by athletes participating in the classic -54kg and -58kg categories. Although undergoing no changes, the average height of the medalists has increased considerably. From 1999 to 2007 the sample of medalists reached 1.70 cm, in the following decade the winners gained almost 10 cm, reaching an average height of 1.80 cm.



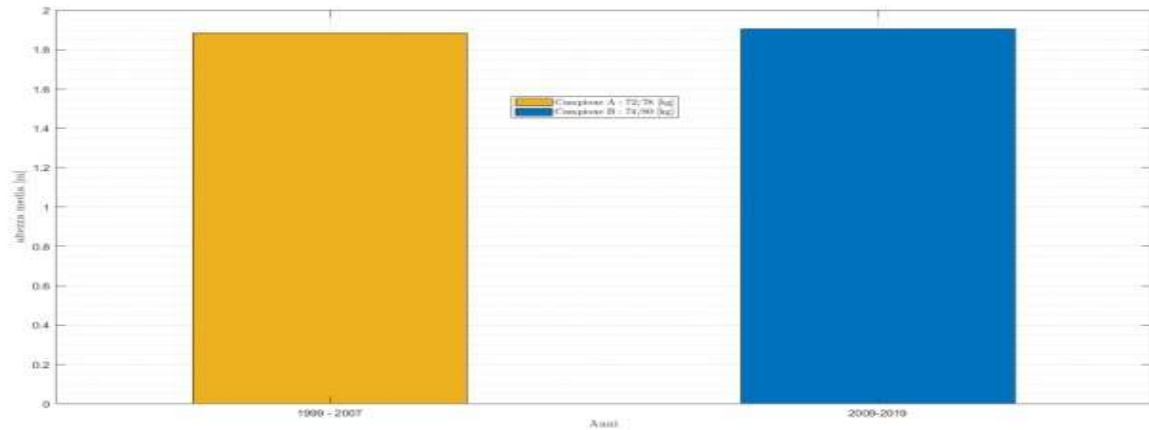
MALE -68 kg CATEGORY

This weight category is usually accessible to athletes weighing less than 68 kg; until 2007 it was available to athletes in the -62kg and -67kg categories, which later changed into -63kg and -68kg. Although the change in weight was minimal (1kg), the height of the athletes who won the medal increased considerably. The first sample for the 1999 -2007 period recorded an average height of 1.78cm, while in the following decade, the average height was 1.82cm (+4cm).



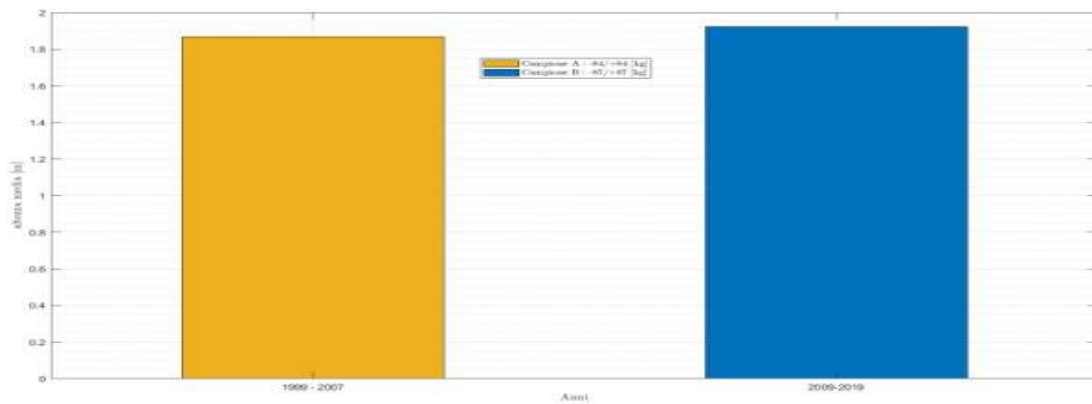
MALE -80 kg CATEGORY

The -80kg Olympic category, including the merging of the -72kg and -78kg categories first and of the -74kg and -80kg categories later, showed a considerable difference in height. In the years before the 2008 Beijing Olympics, the sample in question recorded an average height of 1.88cm; in the following years, however, an increase of +2cm was recorded, reaching a height of 1.90cm among the world medalists.



MALE +80kg CATEGORY

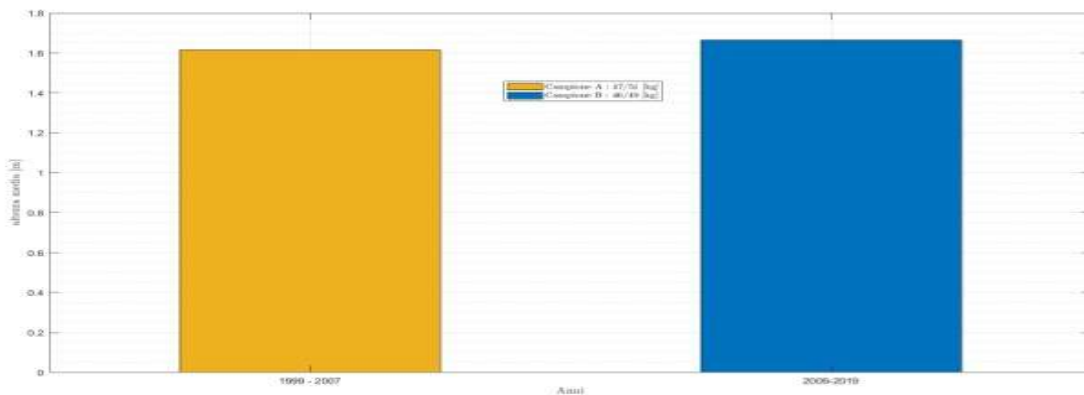
The +80kg category underwent as little weight change as the -58kg category. The average height of the winners and other medalists at the World Championships from 1999 to 2007 was 1.87cm, while it increased in the following decade to 1.92cm, adding +4cm of height to the average winner.



Analysis of the female category results

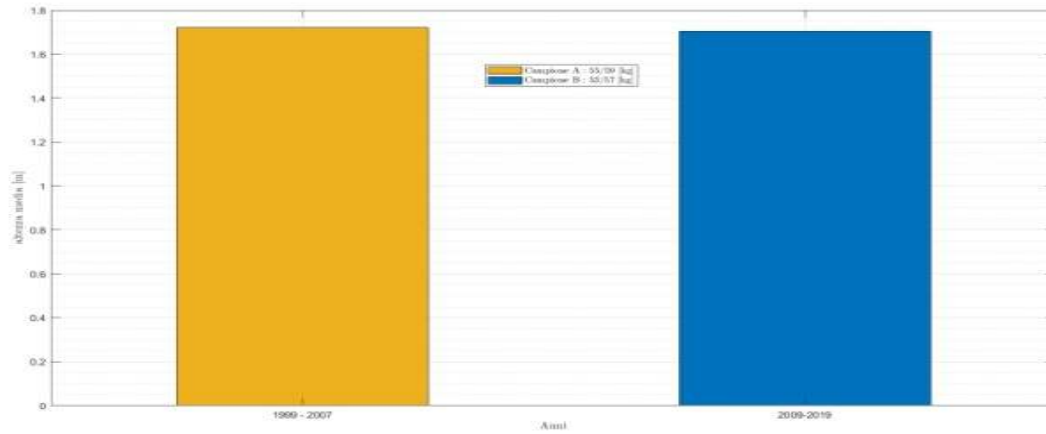
FEMALE -49KG CATEGORY

The first Olympic category, i.e. the -49kg one, is the result of the combination of the -46kg and -49kg categories (until the 2007 World Championship - 47kg and -51kg). In the sample considered, the world female medalists of the championships from 1999 to 2007 recorded an average height of 1.61cm, while in the following decade the height reached was around 1.67cm, with an increase of about +6cm.



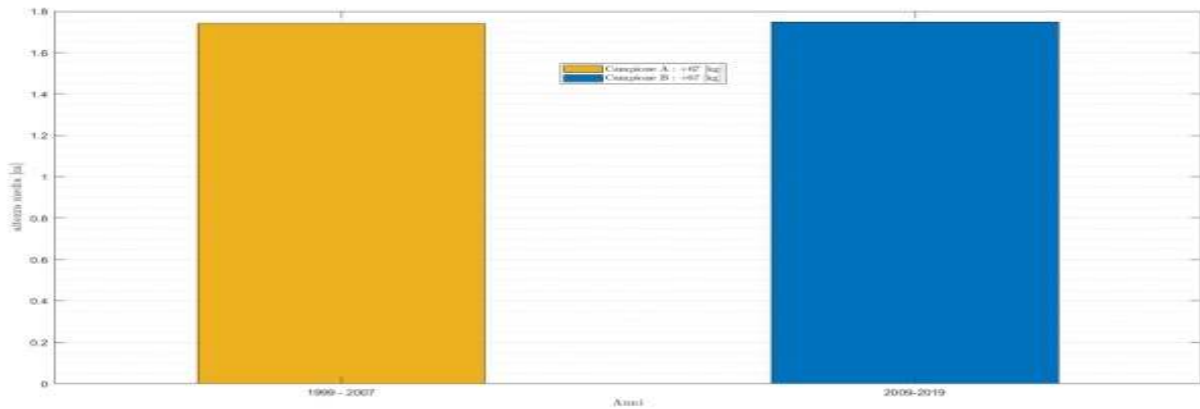
FEMALE -57 kg CATEGORY

This category, consisting of the merging of the -55kg and -59kg categories first and of the -53kg and -57kg later, recorded an average height of 1.72cm among the female world medalists, while in the following decade the winning athletes recorded an average height of 1.71cm, with a decrease of -1cm.



FEMALE -67 kg CATEGORY

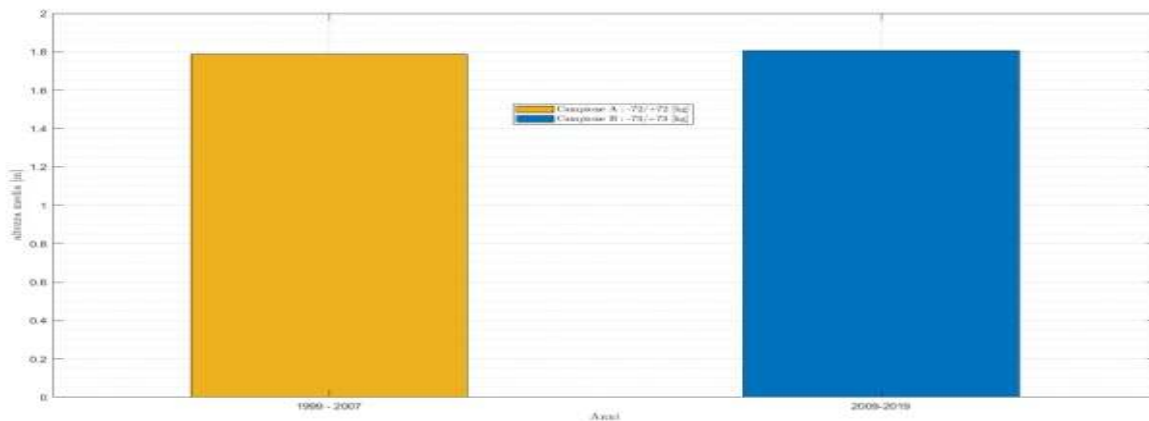
The -67kg category, which until 2007 was composed of athletes in the -63kg and -67kg categories, recorded an average height of 1.74cm among its winners, while in the following editions, until 2019, the category was formed by the merging of the -62kg and -67kg categories; the winning athletes recorded an average height of 1.75cm, with a significant variation of +1cm.



FEMALE +67 kg CATEGORY

In this category, which was formed by the athletes participating in the weight categories -72kg and over 72kg until the 2007 World Championships, the reference average height up to that time was 1.79cm.

In the following editions, until 2019, the winning athletes in the -73kg and over 73kg weight categories recorded an average height of 1.81cm, with a clear increase of +2cm.



Discussion:

Trend analysis and general conclusions

The first trend to take into account is that, for the male category, the average height of the sample of the athletes competing in the championships held between 1999/2007 and 2009/2019 increased for each weight category considered. What described above occurs in each male weight category; +10cm for the -58kg category, +4cm for the -68kg category, +4cm for the -80kg category, and +5cm for the +80cm category. The average increase in height between the 1999/2007 and 2009/2019 winners is also evident for the female categories. The trend can be found in three out of four weight categories, with the exception of the -57kg category sample. Therefore, an increase in height among the female winners/medalists of the world championships of +6cm for the -49kg category, +1cm for the -67kg category and +2cm for the +67kg category can be witnessed. For the -57kg category a -1cm decrease among the medal-winning champions can be observed. In conclusions, once analyzed the results, the confirmation of the first hypothesis outlined proved clear; the average height of the athletes who won medals increased considerably and gradually, when comparing the editions of the 1999/2007 and 2009/2019 taekwondo world championships.

The trend grew in seven out of the eight categories considered, with the only exception of the -57kg female category, which saw a decrease in the average height. This is probably due to the fact that the -57kg Olympic category formed before the 2008 Beijing Olympics by athletes belonging to the -55kg and -59kg categories, and then after the changes in the 8 classic categories used for the world championships (from -53kg and -57kg), is certainly the category that underwent the greatest change in terms of height-weight ratio. Essentially, it is the category where the change of weight decreased the most, with the choice to remove -2kg from the previous categories. This phenomenon probably led to the migration of several athletes to the higher categories, and to the advancement of some athletes from the lower weight categories to the new category formed. As mentioned in the starting hypothesis, this increase in height brought a significant biomechanical advantage for medalists in terms of reach.

Higher height means probably longer lower limbs, and in a sport with a prevalence of techniques performed with the lower limbs (soccer techniques), what previously mentioned becomes evident. A further reason can also be linked to the introduction of the scoring and electronic protection system, and to the continuous changes and updates in the rules of the competition made by the World Taekwondo Federation. Moreover, the change in the weights of the 8 classic categories could be a further reason too. We are therefore witnessing a radical transformation of the functional combat model in a clear and substantial way, favoring more and more the biomechanical advantage towards point fighting.

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