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Paula Velloso Breviglieri[1(ABDEF)], Maria Emilia Soares Possa[1(ABDEF)],
Vitor Moura Campos[1(ABDEF)], Clare Humberstone[2(CDEF)],
Emerson Franchini[1,2(ABCDEF)]

[1] Martial Arts and Combat Sports Research Group, School of Physical Education and Sport, University of Sao Paulo (Brazil)
[2] Combat Centre, Australian Institute of Sport (Australia)
Correspondence: Emerson Franchini, address: Av. Prof. Mello Moraes, 65, Cidade Universitaria, Sao Paulo, Brazil, ZIP: 05508-030,
phone: 55 11 309102124, e-mail: efranchini@usp.br

Judo world ranking lists and performance during cadet, junior and senior World Championships

Abstract

Background. In 2009, the International Judo Federation established the Judo World Tour and the judo Ranking List (WRL), initially for senior and then for cadet and junior athletes. However, no study has investigated its predictive power for World Championships for senior, junior or cadet age groups.

Problem and aim. To verify the relationship between ranking, short-term performance variables and World Championship performances.

Method. Data from 230 male cadet, 198 female cadet, 339 male junior, 241 female junior, 437 male senior, and 289 female senior judo athletes were analyzed. Stepwise multiple linear regression was conducted to predict points attained in the World Championship for each sex and age group.

Results. The WRL and short-term performance could predict between 5% and 27% of the result in the World Championships for these groups. For seniors, being among the top ranked athletes in the draw, but having performed a lower number of competitions, were factors associated to a better performance; for juniors, being among the top ranked athletes in the draw (for males), being the best ranked athlete and presenting a higher winning percentage in the year of the competition (for females), better predicted performance; for cadets, a higher number of wins up to the World Championship, but a lower number of total matches up to this event, were the main factors associated with performance.

Conclusions. World Championship performance for cadet, junior and senior male and female judo athletes could only be partially predicted (5% to 27%) by the WRL and by the performance in competitions in the year of the event.

Introduction

Since 2009, judo athletes aiming to achieve high-level competitive success have taken part in a series of competitions which are part of the Judo World Tour and are classified accordingly in the World Ranking List. Rankings were initially applied to the senior category (above 21 years-old), and then extended to junior (under 20 years-old) and cadet (under 18 years-old) athletes [IJF 2017]. There are three clear benefits to pursuing a high world ranking: the top eight ranked athletes are seeded in draws to avoid the best athletes competing against each other in the initial phases of competitions

[Franchini, Julio 2015], an annual money prize is given to the number one athlete for each senior weight category, and the senior ranking list is used to qualify athletes to the Olympic games [IJF 2017].

The world rankings consider the competitions in the last two years, attributing 100% of values obtained in the last year and 50% of the values obtained in the 13th to the 24th months before the date considered. Additionally, a system of points is attributed depending on competitive level. Seniors take part in Continental Open (100 points for the champion), Grand Prix and Continental Championship (700 points for the champion), Grand Slam (1000 points for the champion), Masters (1800 points

for the champion), and World Championship (2000 points for the champion) competitions. Second placers receive 70%, and two third-placed athletes receive 50% of the points attributed to the first placer, while other smaller amounts of points are given for other positions. For seniors, the five best results, plus the result of either Masters or Continental Championship, for each year are taken into account. Thus, athletes adopt different strategies to guarantee a better performance and accumulate more points during the competitive season [Franchini *et al.* 2017]. For cadets and juniors the competitions considered are the Continental Opens (100 points for the champion), Continental Championship (200 points for the champion) and World Championship (500 points for the champion), and the best three results from Continental Opens plus the results from Continental and World Championships each year constitute the points systems, while all other aspects are the same as used in the senior category.

Authors who have been interested in analyzing the impact of ranking position on Olympic Games medal distribution have used a variety of approaches to do so, which has led to variable conclusions [Franchini, Julio 2015; Guilheiro, Franchini 2017; Lascau, Rosu 2013]. Using simple frequency distributions, Lascau and Rosu [2013] indicated that 81% of medals distributed during London Olympic Games were gained by top eight ranked judo athletes. Conversely, using a multiple regression analysis approach, Franchini and Julio [2015] indicated that only 24% (for females) to 26% (for males) judo performance in the 2012 London Olympic Games could be predicted by variables derived from the World Ranking List. Finally, using a Bayesian approach, Guilheiro and Franchini [2017] calculated the probability of seeded male athletes (i.e., top eight ranked athletes) winning a medal was 41.1% (in London 2012) and 42.9% (in Rio 2016), while for females the probabilities were 35.7% (in London 2012) and 44.6% (in Rio 2016).

No studies have yet investigated the relationship between world ranking and performance in World Championships for seniors, juniors or cadets. In judo, athletes place a very high importance on the results of the World Championships, second only to the Olympic Games. But two key characteristics may mean that the relationship between ranking-related variables and competitive performance may differ from the relationship observed in Olympic Games; the World Championships are disputed annually (except in the Olympic year), and allow more athletes to take part, including more than one athlete for each country.

As well as world ranking, it is possible that variables describing the competition performances of an athlete in the months leading into the World Championships, such as number of competitions and win: loss record may add precision to performance predictions. These variables may reflect more recent competition performance than the two-year World Ranking window and therefore may provide a better insight into likely performance outcomes leading into a major event.

The goal of the present study was to examine the relationship between world ranking, recent performance trends and performance of male and female cadet, junior and senior judo athletes during the 2017 World Championships.

Material and Methods

Samples
Data from all male and female athletes who took part in 2017 Judo World Championships for cadet, junior and senior age groups were analyzed in the present study. Specifically, 230 male cadet, 198 female cadet, 339 male junior, 241 female junior, 437 male senior, and 289 female senior judo athletes participated in their age group World Championship and had their data analyzed.

Ethical Issues
The results published on the International Judo Federation official website for the Judo World Tour statistics (www.judobase.ijf.org) were retrieved on 2nd November 2017, after searching for the World Championship and the World Ranking List published before this event for each age group.

Previous works [Franchini, Julio 2015; Guilheiro, Franchini 2017; Lascau, Rosu 2013] concerning the World Ranking List also used this public database, and there are no ethical issues related to the analysis and interpretation of these data, since it is from an open access website and all results were retrieved in secondary form and not generated by experimentation. Additionally, athletes' individual identification is not reported as only the final results of each competition and the ranking position were used.

Variables
The dependent variable for each athlete was their result achieved at the World Championship. Due to the knock-out-format of judo competitions, there is a limited amount of precision that can be achieved using the raw competition result; placings at competitions include 1st, 2nd, 3rd, 5th, 7th, multiple 17th placed athletes, multiple 33rd placed athletes, etc. Greater precision on competition results were achieved by instead using the IJF points allocation for the World Championships competition result (www.judobase.org). This system allocates points to represent performance at the specific competition based on not only final result, but number of matches won during the competition. Higher points represent a better result. For example, two athletes losing at the round of 32, while one had won one match on the round of 64 and the other conducting his/her first match on round of 32, receive different points (200 points

for the athlete who won one match and 20 points to the athlete who just lost, even considering that both were eliminated in the same phase and both would have the same final result of 17th place).

The independent variables were ranking-derived ones, specifically: world ranking position and ranking position among the athletes taking part in the World Championship (as not all athletes positioned in the ranking took part in this specific event). Other independent variables reflected the athlete's competition history in 2017 prior to the World Championships; number of competitions, matches, wins and percentage of wins during the competitions.

Statistics

After confirming the homogeneity of variances through the Levene test, the Pearson correlation was used to determine the relationship between variables. Stepwise multiple linear regression was conducted to predict points attained in the World Championship for each sex and age group. Colinearity analysis was also conducted. The descriptive results were presented as the coefficient of correlation value (R), the coefficient of determination value (R^2), adjusted R^2 value, standard error of the estimate (SEE) and significance level (P). All analyses were conducted separately for female and male athletes of each age group. Significance level was set at 5% for all analyses. Significant multiple linear regressions for each age and sex groups were presented. For simple linear regression only the equation with higher R^2, among those significant, was presented. The data were analyzed in the SPSS software, version 17.

Results

Table 1 presents the equations predicting the performance in the World Championship based on different World Ranking System, number of matches, number of wins and percentage of wins in the year of the World Championship for each age and sex groups.

As can be seen on Table 1, variables predicting performance in the World Championship were different depending on age and sex. For the senior male and female judo athletes, the top ranked athletes in the draw, but who performed a lower number of competitions, were those with better performance. For the junior group, the male top ranked athletes in the draw presented were those with better performance, while the best ranked female athlete, presenting higher winning percentage in the year of the competition were those who performed better in the World Championship. For the cadet group, a higher number of wins up to the World Championship, with lower number of total matches up to this event, were the factors related to higher performance in the World Championship.

Table 1. Predictive equations of World Championship performance in male and female, cadet, junior and senior judo athletes.

Age Group	Sex	Equation	R	R^2	Adjusted R^2	SEE	P
Senior	Male	WCP = 494.175 - (8.081 x RE)	0.431	0.186	0.184	319.33	< 0.001
		WCP = 631.393 - (9.566 x RE) - (28.595 x NCWC)	0.463	0.214	0.210	314.09	< 0.001
	Female	WCP = 622.643 – (15.036 x RE)	0.471	0.222	0.220	366.98	< 0.001
		WCP = 817.476 - (17.298 x RE) - (44.195 x NCWC)	0.519	0.270	0.265	356.21	< 0.001
Junior	Male	WCP = 88.122 - (1.964 x RE)	0.285	0.081	0.079	90.57	< 0.001
	Female	WCP = 73.446 - (0.642 x RE)	0.176	0.031	0.027	107.61	0.006
		WCP = 39.804 - (0.591 x RE) + (60.301 x WPYWC)	0.228	0.052	0.044	106.67	0.002
Cadet	Male	WCP = 20.906 + (5.278 x NWWC)	0.349	0.122	0.118	104.40	< 0.001
		WCP = 40.680 + (21.654 x NWWC) - (13.287 x NMWC)	0.427	0.183	0.175	100.94	< 0.001
	Female	WCP = 31.211 + (4.923 x NWWC)	0.286	0.082	0.077	112.80	< 0.001
		WCP = 45.956 + (21.839 x NWWC) - (13.166 x NMWC)	0.378	0.143	0.134	109.25	< 0.001

WCP: World Championship points (points conferred based on athletes performance according to the ranking system rules); RE: ranking entry (position in the ranking among the athletes taking part in the World Championship); RP: ranking position (position in the World Ranking List); NCWC: number of competitions up to the World Championship; NWWC: number of wins up to the World Championship; NMWC: number of matches up to the World Championship; NMWC: number of matches up to the World Championship; WPYWC: win percentage in the year of the World Championship; R: coefficient of correlation value; R^2: coefficient of determination value; SEE: standard error of the estimate; P: significance level.

Discussion

The main results of our study were that the two-year World Ranking List and competitive performance during the year of World Championships could predict between 5% and 27% of the performance in the World Championships for cadet, junior and senior male and female judo athletes. Considering the maximum amount of points for each age group and the standard error of estimate for each equation generated, the percentage of error was between 16% and 23% for these age groups. It is important to consider that the variables predicting performance in the World Championship varied between age groups: for seniors, being among the top ranked athletes in the draw, but having performed a lower number of competitions, were factors associated to a better performance; for juniors, being among the top ranked athletes in the draw (for males), being the best ranked athlete and presenting a higher winning percentage in the year of the competition (for females), were the best predictive variables of performance; for cadets, presenting a higher number of wins up to the World Championship, but having a lower number of total matches up to this event, were the main factors associated to a better performance in the World Championship.

Thus, for seniors and juniors, being well-positioned in the ranking or being among the best ranked athletes were variables important to performance, suggesting that long-term variables and consistent performance over the two-year period on which the ranking is based are relevant for performing well in the World Championship. These results are similar to the findings of Franchini and Julio [2015], when reporting the predictive variables for judo Olympic performance, i.e., a higher ranking position was associated with better performance in this competition, indicating that the stability in performance in the period considered for the ranking construction is relevant for performance in high-level competitions such as Olympic Games and World Championships. For senior and cadet athletes, exposing themselves as little as possible during the year of the World Championship was also relevant for a better performance in this event. In fact, a recent publication [Franchini *et al.* 2017] observed that 10 to 13 weeks without competing before the senior World Championship was associated to an increased odds ratio (2.39 for females and 3.16 for males) to perform well in this competition, compared to a shorter period without competing (6 or less weeks). These authors suggested that the best athletes seem to try to focus on the minimal number of competitions needed to have a good ranking position. As the number of valid competitions is between five and six depending on the age group, the participation in this number of competitions would result in approximately nine to ten weeks if a similar interval is adopted along the season. However, as the World Championship is the main competition in

non-Olympic year, the most successful athletes seem to adopt a more conservative approach when preparing to this competition and increase the interval between the previous competition and the main focus of the season [Franchini *et al.* 2017]. Some aspects can explain why 2.5 to 3 months are the optimal intervals: (a) from technical-tactical perspective, although the best ranked athlete is allocated in a theoretically easier pool, being among the best athlete is considered to attract a large focus from the opponents (studying their main actions and tactics to avoid them), and to generate some media and supporters pressure, factors that can negatively affect performance [Guilheiro, Franchini 2017]; (b) a high incidence of injuries is observed in judo competitions [Kim *et al.* 2015] and a higher number of participations is likely to increase the injury rate; (c) most judo athletes lose weight to compete [Artioli *et al.* 2010; Berkovich *et al.* 2016], and this process is considered very psychologically demanding for the athletes [Escobar-Molina *et al.* 2015; Franchini *et al.* 2012; Pettersson *et al.* 2012], and also associated to increased injury rate [Green *et al.* 2007]; (d) as judo is a highly physiologically demanding combat sport [Franchini *et al.* 2013], this interval is similar to the optimal training adaptation of the most important physical variables needed for success in judo, such as anaerobic power and capacity [Franchini *et al.* 2016a; Franchini *et al.* 2016b], muscle power, and strength-endurance development [Agostinho *et al.* 2015; Agostinho *et al.* 2017; Franchini *et al.* 2015], and aerobic fitness [Bonato *et al.* 2015; Franchini *et al.* 2016a] in previously highly-trained judo athletes.

The lower prediction power for cadet and junior groups may be related to the lower participation in competitions valid for their ranking lists and higher variability of performance at younger ages, as a process of consolidation of technique and tactic actions during competitions [Miarka *et al.* 2012; Miarka *et al.* 2014]. Furthermore, the cadet ranking is much less predictive of World Championship performance because a limited number of athletes take part in the ranking competitions, but more countries send their athletes to compete in the World Championship, and some of these athletes do it successfully, which is not so common for the senior athletes. Moreover, on the world tour there is a lower number of competitions for cadets and fewer points are given to each competition results for this age group. Thus, for cadets a successful exposure in a low number of competitions, to assure some international experience and increased confidence, seems to be the best approach.

Conclusion

World Championship performance for cadet, junior and senior male and female judo athletes could only be partially predicted – 5% to 27% – by the World Ranking List

and by the performance in competitions in the year of the event. Basically, long-term performance (ranking position or ranking entry) and a low, but successful, exposure during the year of the World Championship were the main variables explaining the performance in this competition.

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Światowe listy rankingowe w judo i wyniki osiągnięte przed kadetów, juniorów i seniorów podczas mistrzostw świata

Słowa kluczowe: sporty walki, analiza osiągnięć, zawody, kategorie wiekowe

Streszczenie

Tło. W 2009 r. Międzynarodowa Federacja Judo utworzyła *Judo World Tour* i listę rankingową judo (WRL), początkowo

dla seniorów, a następnie dla kadetów i juniorów. Jednak żadne badanie nie zbadało jej zdolności predykcyjnej do mistrzostw świata w grupach wiekowych: seniorów, juniorów i kadetów.

Problem i cel. Celem badania była weryfikacja związku między rankingiem, krótkoterminowymi zmiennymi wyników a wynikami osiągniętymi w czasie Mistrzostw Świata.

Metoda. Przeanalizowano dane uzyskane od zawodników judo: 230 kadetów, 198 kadetek, 339 juniorów, 241 juniorek, 437 seniorów i 289 seniorek. Stopniowo przeprowadzono regresję liniową, aby przewidzieć punkty zdobyte w Mistrzostwach Świata dla każdej płci i grupy wiekowej.

Wyniki. Lista rankingowa judo i krótkoterminowe osiągnięcia mogą pomóc w pomiędzy 5% a 27% w przewidzeniu wyników w Mistrzostwach Świata dla badanych grup. Czynnikiem, który przyczynił się do lepszych wyników seniorów była mniejsza liczba zawodów, w których brali udział. W przypadku juniorów, którzy byli jednymi z najlepszych sportowców w rankingu i juniorek prezentujących wyższy procent wygranych w roku zawodów, przewidywalność wyników była większa. W przypadku kadetów głównymi czynnikami związanymi z wynikami była większa liczba zwycięstw prowadząca do Mistrzostw Świata, ale mniejsza liczba wszystkich meczów.

Wnioski. Wyniki Mistrzostw Świata zawodników i zawodniczek judo w kategorii kadetów, juniorów i seniorów można przewidzieć tylko częściowo (5% do 27%) przy zastosowaniu listy rankingowej, a także wyników osiągniętych w zawodach w ciągu roku.