

# Mental toughness and perfectionism in judo: differences by achievement and age. The relation between constructs

## Authors' Contribution:

- A Study Design
- B Data Collection
- C Statistical Analysis
- D Manuscript Preparation
- E Funds Collection

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## Abstract

### Background & Study Aim:

The relationship between *mental toughness* (MT) and *perfectionism* has not been established to date. The main aim of this study is: knowledge about MT, *perfectionistic strivings*, and *perfectionistic concerns* of judo athletes by achievement level and age; relationship between MT and *perfectionism* dimensions.

### Material & Methods:

A total of 118 judokas (24 females) aged between 16 and 69 years (mean age = 28.73 ±13.96) were divided into sub-elite (national medallists), elite and veterans (both international medallists). *The Sports Mental Toughness Questionnaire* (SMTQ) was used to measure MT. Following Gotwals and Stoeber's guidelines, *perfectionistic strivings* and *perfectionistic concerns* were measured by using different subscales from two questionnaires.

### Results:

Veterans scored higher than elite and sub-elite athletes on MT ( $F_{(2,115)} = 14.59$ ;  $p < 0.001$ ;  $\eta^2 p = 0.20$ ), showing that MT is age-dependent but does not seem to discriminate between judokas exceeding a certain competitive-level threshold. *Perfectionistic strivings* global scores only differed between veterans and sub-elite groups ( $F_{(2,115)} = 7.08$ ;  $p = 0.001$ ;  $\eta^2 p = 0.11$ ), specific analyses of the personal standards subscale showed that veterans and elite athletes scored higher than sub-elites, whereas on the strivings for perfection subscale, veterans scored higher than both elite and sub-elite athletes. Linear regression models showed that MT is positively associated with *perfectionistic strivings* ( $B = 0.39$ ;  $SE B = 0.05$ ;  $p < 0.001$ ), and negatively associated with *perfectionistic concerns* ( $B = -0.25$ ;  $SE B = 0.04$ ;  $p < 0.001$ ).

### Conclusions:

These results seem to indicate that some *perfectionism* characteristics could be trainable. Future studies could determine how MT improvements impact on *perfectionism* dimensions.

### Keywords:

concerns • combat sport • psychological preparation • stress • strivings

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### Conflict of interest:

The authors of this study declare that they have no conflicts of interest

### Ethical approval:

The study was approved by the Ethics Committee of the University of Novi Sad (Serbia)

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**Achievement** – the level of performance attained by the athlete. Status as the outcome of personal effort in open competition with others (e.g., in the Olympic Games) [46].

**Achievement** – *noun* the successful completion of something demanding [47].

**Achievement goal** – *noun* a personal goal that an athlete sets for himself or herself [47].

**Achievement sport** – *noun* a sport in which the aim is to achieve some independent goal that does not purely depend on beating an opponent, e.g. archery [47].

**Combat sport** – *noun* a sport in which one person fights another, e.g. wrestling, boxing and the martial arts [47].

**Competition** – a contest in which a winner is selected from among two or more participants. In sport, competition is socially regulated and is generally direct. Competition is a strong motivating force which may be directed against a person's own standards or against the performance of others, or the two combined [46].

**Performance** – the observable act of carrying out a process which may vary according to circumstances, motivation, mood etc. The manner of activity including sporting activity [46].

**Performance** – *noun* the level at which a player or athlete is carrying out their activity, either in relation to others or in relation to personal goals or standards [47].

**Psychological preparation** – mental preparation in which competitors learn how to deal with psychological stresses and achieve optimal levels of arousal so that they will be able to perform to the best their ability [46].

**Stress** – *noun* 1. physical pressure on an object or part of the body  
2. a factor or combination of factors in a person's life that make him or her feel tired and anxious  
3. a condition in which an outside influence such as overwork or a mental or emotional state such as anxiety changes the working of the body and can affect the hormone balance [47].

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## INTRODUCTION

Judo is a combat sport with high physical and psychological demands in which athletes compete in different weight categories. Recently, the interest on judo-related psychological factors has increased, as these provide a mean to improve judokas' performance [1-3]. However, specific information about personality characteristics related to success is still scarce [4]. During combats, athletes experience extreme pressure, since they have to simultaneously attack and defend while concealing their intentions from the opponent under time pressure [5]. Furthermore, before competitions, judokas usually accrue stress [6] and suffer rapid weight loss that could negatively impact on their capacities [7, 8]. In this demanding context, being mentally tougher and more *perfectionistic* than the opponent could be crucial to maintain optimal psychological states and so, to improve achievement.

*Mental toughness* (henceforth, MT) is a multifaceted construct that enables people to effectively manage stress, and recover after setbacks [9, 10]. Evidence shows that this trait is related to successful sport performance; the higher MT, the better athlete performance is [11-13]. Although there are several models that evaluate MT's construct validity (e.g., MTQ48, [14]; MTL, [15]; PPI-A, [16]), the *Sport Mental Toughness Questionnaire* model (SMTQ) [17] has been proved as a suitable scale to measure this construct in combat sports [4]. Bull et al. [18] triggered the debate on whether MT is a personality trait, a state of mind or a set of simpler psychological characteristics. Although recent research has considered it like a stable trait [19], other investigation shows that MT may be better conceptualized like a state like concept varying across situation and time [20]. Also, several studies seem to indicate a positive association with age and years of experience [13, 21]. In this sense, comparing elite competitors of different ages (i.e., current elite athletes vs. veteran athletes) could help solve whether MT is age-dependent or independent.

On the other hand, *perfectionism* is a personality trait consisting of striving for flawlessness and setting exceedingly high standards for

performance, accompanied by a tendency to make overly critical evaluations [22, 23]. *Perfectionism* has also been attributed to high-level athletes, and consists of two dimensions: *strivings* and *concerns* [24]. *Perfectionistic strivings* are related to self-oriented motivation for perfection, and setting of high personal performance standards, and show a predominantly positive relationship with several performance indicators such as self-confidence, success expectations, or goals orientation [25, 26]. In contrast, *perfectionistic concerns* are related to preoccupation over making mistakes, fear of negative social evaluation, discrepancies between expectations and performance, and negative reactions to imperfection, and are usually associated with negative reactions in sport [27]. Nevertheless, the debate about whether *perfectionism* has adaptive or maladaptive consequences on sport performance is still open [28].

Moreover, analysing the interactions between constructs related to sport success could provide worthy information for coaches to enhance psychological interventions and to make adjustments during the training program. On the one hand, findings have shown strong positive relations between MT and dispositional flow [29, 30], as well as other positive sport-related factors such as self-talk or emotional control [31] or resilience [32]. On the other hand, Hill [33] reported that *perfectionistic strivings* are associated with lower levels of total burnout in junior soccer players, while *perfectionistic concerns* are associated with higher levels of burnout. *Perfectionism* has also been related to self-determined motivation and coping [34], and competitive anxiety [35]. The relationship between MT and *perfectionism* has not been established to date, and it could be useful for clarifying positive and negative implications of *perfectionism* in sport.

Given the aforementioned reasons, MT and *perfectionism* were analysed between sub-elite, elite and elite veteran judokas. The SMTQ model [17] was used to measure MT. *Perfectionistic strivings* and *perfectionistic concerns* were measured using Sport-MPS 2 [36] and MIPS [37] following the guidelines offered by Gotwals [28] and Stoeber [38].

The first aim of this study is knowledge about MT, *perfectionistic strivings* and *perfectionistic concerns* in judokas of different achievement level and age. Our first hypothesis states that higher achievement and age should be related to higher levels of MT (1a: veterans > elite > sub-elite). For *perfectionistic strivings* a similar relation with competitive level, but not with age, was expected, since *perfectionism* has been observed to be mostly age-independent [23, 38] (1b: veterans = elite > sub-elite). An opposite relation was expected for *perfectionistic concerns* (1c: veterans = elite < sub-elite).

The second aim is relationship between MT and *perfectionism*. We hypothesized MT to be positively related to *perfectionistic strivings* (2a), and both of them to predict sport success. On the contrary, a negative association between MT and *perfectionistic concerns* was expected (2b).

## MATERIAL AND METHODS

### Participants

This cross-sectional study was carried out in accordance with the Declaration of Helsinki and was ethically approved by the Ethics Committee of the University of Novi Sad (Serbia). Prior to the administration of the questionnaires, written informed consent from all athletes was obtained.

A total of 118 judokas (24 females) from Serbia, Croatia, Slovenia, Bosnia and Herzegovina and Montenegro aged between 16 and 69 years (mean age = 28.73 ±13.96 years) took part in this study. Sub-elite group: composed of 42 judokas (10 females) who won at least one medal in national competitions (Serbia, Croatia, Slovenia, Bosnia and Herzegovina or Montenegro) during the previous 4 years, mean age = 20.90 ±3.01 years; mean competitive experience = 10.12 ±3.19 years; medals per participant = 1.07. Elite group: composed of 43 judokas (9 females) who won at least one medal at international competitions (World Championship or European Championship) during the previous 4 years. mean age = 20.86 ±4.33 years; mean competitive experience = 10.61 ±3.06 years; medals per participant = 1.12. Elite veteran group: composed of 33 judokas (5 females) who won at least one medal at international competitions (Olympic Games or World Championship or European Championship) during their careers. Mean age = 48.94 ±9.69 years; mean competitive experience = 36.21 ±5.36 years; Medals per participant = 1.22.

### Measures

**Mental toughness.** The *Sports Mental Toughness Questionnaire* (SMTQ) [17] was used to measure MT. This 14-item scale provides a total MT score and three subscales scores: *confidence*, *constancy* and *control*. Item examples include: for *confidence*, “I have qualities that set me apart from other competitors”, “I can regain my composure if I have momentarily lost it”; for *constancy*, “I give up in difficult situations”, “I get distracted easily and lose my concentration”; and for *control*, “I am overcome by self-doubt”, “I get anxious by events I did not expect or cannot control”. Participants rated the items on a 4-point Likert scale anchored by 1: not at all true and 4 5: very true. Cronbach coefficients alpha for all dimensions were “adequate” [39] for *confidence*  $\alpha = 0.77$ , for *control*  $\alpha = 0.69$ , and for *constancy*  $\alpha = 0.70$ .

**Perfectionistic strivings and perfectionistic concerns.** Following Gotwals [28] and Stoeber’s [38] guidelines, *perfectionistic strivings* and *perfectionistic concerns* were measured by using different subscales from two questionnaires. On the one hand, The *Sport Multidimensional Perfectionism Scale* (Sport-MPS 2) was used [36]. This questionnaire consists of 42 items and 6 subscales. Item examples include: for *personal standards*, “If I do not set the highest standards for myself in my sport, I am likely to end up a second-rate player”; for *concern over mistakes*, “If I fail in competition, I feel like a failure as a person” and for *doubts about actions* “I usually feel unsure about the adequacy of my pre-competition practices”. Participants rated the items on a five point Likert scale anchored by: 1. not at all true and 5. very true. All dimensions showed acceptable internal consistency, for *personal standards*  $\alpha = 0.76$ , for *concern over mistakes*  $\alpha = 0.71$  and for *doubts about actions*  $\alpha = 0.74$ . On the other hand, *Multidimensional Inventory of Perfectionism in Sports* (MIPS) [37] is a 10-item scale with 2 subscales. Item examples include: for *negative reaction to imperfection*, “I feel depressed if I have not been perfect”; and for *striving for perfection*, “I strive to be as perfect as possible”. Participants rated the items on a five point Likert scale anchored by: 1. not at all true and 5. very true. Cronbach alpha coefficients for all dimensions were acceptable, for *striving for perfection*  $\alpha = 0.79$  and for *negative reaction to imperfection*  $\alpha = 0.72$ .

Regarding *perfectionistic strivings*, good indices are *personal standards* (Sport-MPS 2) and *striving for*

A **Likert scale** – is a psychometric scale commonly involved in research that employs questionnaires. It is the most widely used approach to scaling responses in survey research, such that the term (or more accurately the **Likert-type scale**) is often used interchangeably with *rating scale*, even though the two are not synonymous (Wikipedia).

perfection (MIPS). On the other hand, *perfectionistic concerns* consist of three subscales: *concern over mistakes* and *doubts about actions* (Sport-MPS 2), and *negative reaction to imperfection* (MIPS). Global scores of both dimensions were calculated by summing standardized (Z-transformed) scores of mentioned subscales [40].

### Procedure

Data for the sub-elite and elite athletes were collected during the Serbian Championship (Nis, Serbia, 2014) and European Senior Cup (Sarajevo, Bosnia and Herzegovina, 2014). Data for elite veteran athletes were collected during the Veteran Meeting held in Novi Sad, Serbia, 2014. Data were collected from veterans coming from Serbia (Novi Sad, Belgrade and Nis), Bosnia and Herzegovina (Sarajevo), Slovenia (Ljubljana, Maribor and Slovenska Bistrica) and Croatia (Zagreb). Questionnaires were administered in a counterbalanced order.

The athletes completed a demographic questionnaire, the SMTQ, the Sport-MPS-2 and the MIPS. The demographic questionnaire asked participants to respond to questions regarding their gender, age and competitive experience in judo (measured in years), and results (type of medals) achieved in competitions.

### Statistical analysis

Descriptive analyses included means, standard deviation and ranges. Initial data checks showed the dependent variables met the assumptions of homogeneity of variance and normal distribution. Hypothesis 1 was tested, first, by means of multivariate analysis of variance (MANOVA) over the scores for the three key constructs, and then by means of subsequent analyses of variance (ANOVAs) on the different constructs, and Bonferroni-corrected post-hoc contrasts.

Secondly, the subscales of the three different constructs were submitted to three MANOVAs (followed by separate ANOVAs on subscales and Bonferroni-corrected post-hoc contrasts). To examine the relationship between *perfectionistic strivings* and *perfectionistic concerns* and MT (hypothesis 2) linear regression analyses were carried out using *perfectionism* dimensions global scores as predictor variables and MT global score as outcome variable. Similar analyses were performed using subscales of the constructs. Statistical analyses were conducted using IBM SPSS version 20.0 for Windows. The statistical significance was set at  $p < 0.05$ . For MANOVA multivariate  $\eta^2p$  and next  $\eta^2p$  were used to estimate effect sizes (in a 0 to 1 range).

**Table 1.** Descriptive statistic for SMTQ, Sport-MPS 2 and MIPS subscales, of elite, sub-elite and veterans judo athletes (n = 118).

Indicator	Competitive Level						Range
	elite (n = 43)		sub-elite (n = 42)		veterans (n = 33)		
	M <sup>††</sup>	SD <sup>§§</sup>	M <sup>††</sup>	SD <sup>§§</sup>	M <sup>††</sup>	SD <sup>§§</sup>	
<b>SMTQ*</b>							
Confidence	18.92	3.04	18.30	3.58	22.21	2.27	7-24
Control	10.61	1.99	11.17	1.95	11.21	1.76	5-14
Constancy	13.38	2.12	13.33	2.63	15.18	1.10	6-16
<b>S-MPS2<sup>†</sup></b>							
Personal standards <sup>‡</sup>	27.61	4.30	25.05	4.72	28.96	4.42	10-35
Concern over mistakes <sup>§</sup>	20.32	4.93	19.06	5.40	20.23	5.87	7-33
Doubts about actions <sup>§</sup>	13.82	4.24	14.29	5.33	11.67	4.35	6-25
<b>MIPS<sup>**</sup></b>							
Striving for Perfection Scale <sup>‡</sup>	19.47	4.24	19.06	4.13	21.79	4.49	6-25
Negative Reactions to Imperfection Scale <sup>§</sup>	14.16	4.13	14.43	5.33	13.58	5.15	5-24

\* The Sports Mental Toughness Questionnaire; <sup>†</sup> The Sport Multidimensional Perfectionism Scale;

<sup>‡</sup> perfectionistic strivings; <sup>§</sup> perfectionistic concerns; <sup>\*\*</sup> Multidimensional Inventory of Perfectionism in Sports; <sup>††</sup> mean; <sup>§§</sup> standard deviation.



## RESULTS

Relative to MT, *perfectionistic strivings* and *perfectionistic concerns* global scores, there was a significant multivariate effect of group, Wilks'  $\lambda = 0.76$ ,  $F_{(6,226)} = 5.44$ ,  $p < 0.001$ ,  $\eta^2 p = 0.12$ . Subsequent ANOVAs and post hoc comparisons for each dependent variable revealed significant effect on MT,  $F_{(2,115)} = 14.60$ ,  $p < 0.001$ ,  $\eta^2 p = 0.20$ , where veterans scored higher than elite and sub-elite judokas; and on *perfectionistic strivings* global scores,  $F_{(2,115)} = 7.37$ ,  $p = 0.001$ ,  $\eta^2 p = 0.11$ , where veterans scored significantly higher than sub-elite athletes. No significant effect was found for *perfectionistic concerns* global scores (Table 1).

Regarding to the MT subscales, there was a significant multivariate effect, Wilks'  $\lambda = 0.75$ ,  $F_{(6,226)} = 5.75$ ,  $p = 0.001$ ,  $\eta^2 p = 0.13$ . Subsequent analyses yielded a significant effect for *confidence*,  $F_{(2,115)} = 16.82$ ,  $p < 0.001$ ,  $\eta^2 p = 0.23$ , and for *constancy*,  $F_{(2,115)} = 8.95$ ,  $p < 0.001$ ,  $\eta^2 p = 0.14$ , where veterans scored significantly higher than elite and sub-elite athletes in both subscales. No significant differences were found for *control*.

Finally, there was a significant multivariate effect for *perfectionistic strivings* subscales Wilks'  $\lambda = 0.85$ ,  $F_{(4,228)} = 5.02$ ,  $p = 0.001$ ,  $\eta^2 p = 0.08$ . Further analyses yielded a significant effect for *personal standards*,  $F_{(2,115)} = 7.53$ ,  $p = 0.001$ ,  $\eta^2 p = 0.12$ , with veterans and elite athletes scoring significantly higher than sub-elite ones; and *striving for perfection*,  $F_{(2,115)} = 5.09$ ,  $p < 0.007$ ,  $\eta^2 p = 0.08$ , where veterans scored higher than elite/sub-elite athletes. There were no statistically significant effects for *perfectionistic concerns* subscales.

Model 1 showed a positive significant relationship between *perfectionistic strivings* and MT. On the contrary, higher levels of *perfectionistic concerns* significantly predicted lower levels of MT. Relative to specific relationships between subscales, model 2 revealed that *personal standards* positively predicted *confidence*. In contrast, *doubts about actions* negatively predicted *confidence*. Model 3 showed that negative reaction to imperfection and *doubts about actions* were negatively associated with *control*. Finally, Model 4 revealed that *personal standards* and *strivings for perfection* were positively associated with *constancy*. However, *doubts about actions* were negatively related to *constancy* (Table 2).

## DISCUSSION

Regarding MT, findings provide partial support for hypothesis 1a. Whereas differences were found between veterans and the other two groups, no differences were found between elite and sub-elite groups. These differences are attributable to the effect of age provided that veterans and elite group have similar achievement levels).

From these results, two interpretations can be made. The first possibility is that MT may not determine performance in high level judokas. It is important to remark that all three groups of the sample are medallists, some of them in national competitions (sub-elite group) and the others in international competitions (elite and veterans), that is, all participants are very high level athletes. It is possible that MT could be a key factor to differentiate between groups with larger differences in their achievement levels; for instance, amateur or semi-professional vs. professional athletes [21, 41]. Unfortunately, few papers analyse high level samples in specific sports, so that studies like ours, trying to find differences between more fine-grained different achievement groups are very much needed. A second interpretation arises from a potential limitation of the present study, namely, that only one model (SMTQ) was used to measure MT. To date, there are indeed several models (e.g., MT48 - [14]; MTI - [15]; PPI-A - [16]) which try to measure MT as construct. In this sense, it is possible that the scale used could be not sensitive enough to detect differences in judo. Our results seem to indicate that whereas *confidence* and *constancy* subscales are sensitive to differences in the context of judo, *control* appears as a less important subscale. Although prior research has considered SMTQ as the best model to analyse MT in combat sports [4], using alternative models could provide complementary information on this regard.

With regard to *perfectionistic strivings*, our findings partially support hypothesis 1b. In global scores, veterans rated significantly higher than the sub-elite group. In principle, these results precluded attributing those differences to achievement level or age, given that no differences were found between veterans and elite or elite and sub-elite groups. However, specific analyses of subscales clarify the above-mentioned differences. On the one hand, veterans and elite athletes scored higher in personal standards than sub-elite athletes, suggesting that this subscale

**Table 2.** Results from regression models basic on indicators of judo athletes (n = 118).

Indicator	B <sup>*</sup>	SE B <sup>†</sup>	β <sup>‡</sup>	p <sup>§</sup>
<b>Model 1<sup>**</sup></b>				
<i>Perfectionistic strivings</i> (global scores)	0.39	0.05	0.54	<b>0.001*</b>
<i>Perfectionistic concerns</i> (global scores)	-0.25	0.04	-0.043	<b>0.001*</b>
<b>Model 2<sup>††</sup></b>				
Personal standards <sup>††</sup>	0.31	0.08	0.42	<b>0.001*</b>
Strivings for perfection <sup>††</sup>	0.17	0.09	0.19	0.060
Negative reaction to imperfection <sup>§§</sup>	-0.07	0.08	-0.08	0.400
Concern over mistakes <sup>§§</sup>	-0.05	0.07	-0.08	0.460
Doubts about actions <sup>§§</sup>	-0.14	0.06	-0.19	<b>0.020*</b>
<b>Model 3<sup>***</sup></b>				
Personal standards <sup>††</sup>	-0.04	0.05	-0.10	0.427
Strivings for perfection <sup>††</sup>	0.06	0.06	0.12	0.294
Negative reaction to imperfection <sup>§§</sup>	-0.13	0.05	-0.31	<b>0.008*</b>
Concern over mistakes <sup>§§</sup>	-0.02	0.04	-0.07	0.573
Doubts about actions <sup>§§</sup>	-0.11	0.04	-0.28	<b>0.003*</b>
<b>Model 4<sup>†††</sup></b>				
Personal standards <sup>††</sup>	0.13	0.05	0.26	<b>0.021*</b>
Strivings for perfection <sup>††</sup>	0.13	0.06	0.23	<b>0.035*</b>
Negative reaction to imperfection <sup>§§</sup>	-0.06	0.05	-0.13	0.232
Concern over mistakes <sup>§§</sup>	-0.05	0.05	-0.11	0.335
Doubts about actions <sup>§§</sup>	-0.13	0.04	-0.27	<b>0.003*</b>

\* beta values; † beta values standard errors; ‡ standardized beta values; § p values;

\*\* dependent variable: *mental toughness* global scores; R<sup>2</sup> = 0.43; ΔR<sup>2</sup> = 0.42; p < 0.001;

†† dependent variable: confidence (*mental toughness* subscale); R<sup>2</sup> = 0.39; ΔR<sup>2</sup> = 0.36; p < 0.001;

§§ *perfectionistic strivings* subscales; §§ *perfectionistic concerns* subscales;

\*\*\* dependent variable: control (*mental toughness* subscale); R<sup>2</sup> = 0.22; ΔR<sup>2</sup> = 0.18; p < 0.001;

††† dependent variable: constancy (*mental toughness* subscale); R<sup>2</sup> = 0.33; ΔR<sup>2</sup> = 0.30; p < 0.001.

is sensitive to the achievement level. On the other hand, veterans scored higher in *strivings for perfection* than both elite and sub-elite groups (without differences between elite and sub-elite), so this subscale could be age-dependent. These results are controversial since most research suggests that *perfectionism* remains fairly constant as age increases [40, 42]. Further research is needed to determine if *perfectionistic striving* is an important dimension of high-level judokas. More importantly, future analyses must determine if some characteristic of *perfectionism* are sensitive to increases with age.

Regarding *perfectionistic concerns* (hypothesis 1c), no differences were found between groups. There is no evidence suggesting this

*perfectionistic-related* dimension to remain important when the judokas' level exceeds a certain threshold.

Our second aim is relationship between MT and *perfectionism* (hypothesis 2a, 2b). Linear regression models corroborated hypothesis 2a. As shown in model 1, higher levels of *perfectionistic strivings* significantly predict higher levels of MT. More specifically, personal standards positively predicts *confidence* and *constancy*, and *strivings for perfection* is positively associated with *constancy* (models 2 and 4).

Finally, the relationship between *perfectionistic concerns* and MT strongly supported hypothesis 2c. Higher levels of *perfectionistic*

*concerns* significantly predicted lower levels of MT. Specifically, *doubts about actions* negatively predicted *confidence*, *control* and *constancy* (models 2, 3 and 4) and negative reaction to imperfection negatively predicted *control* (model 3).

All these findings are in accordance with the Gotwals [28] and Stoeber's [38] proposal about the dual nature of *perfectionism*. Regarding one potential meaning of *perfectionism*, *perfectionistic strivings* positively predicted MT, which is, in turn, directly related to performance, thus suggesting an adaptive role of *perfectionism* in sports contexts. Regarding the other potential meaning, *perfectionistic concerns* showed a negative association with MT, which suggests this characteristic to have negative consequences on sport performance. Not surprisingly, global *perfectionism* measures have mixed effects on performance.

## CONCLUSIONS

There are several limitations that must be acknowledged. In this study it was not possible to include a veteran sub-elite group in order to complete comparisons and provide further support to hypotheses stated. More research is needed to determine the impact of MT, *perfectionistic strivings* and *perfectionistic concerns* on judo specific samples to detect whether these constructs are crucial when athletes' performance exceed a certain threshold. Also, it is suggested to contrast between different models in order to determine specific characteristics of MT in judo.

Importantly, our study show that MT is not as discriminative in our high-level groups as it

seems to be between groups with larger achievement levels differences [21]. As it happens with other personality and cognitive variables, MT is an excellence mark, but does not make a difference once some level of excellence has been reached. Putting it in simple words, MT does not seem to be a key difference between the best and the second best. Also, our comparisons seem to indicate that *perfectionistic strivings* subscales are sensitive to achievement level and could be age-dependent, opening the possibility to be trainable characteristics.

Relative to the relationship between constructs, we have found strong positive association between *perfectionistic strivings* and MT and negative association between *perfectionistic concerns* and MT. In this sense, and taking into account that there is some evidence that MT can improve by training [43] future studies could determine, for example, how a MT training impact on *perfectionism* dimensions.

## HIGHLIGHTS

*Mental toughness* is seems to be a key difference between elite veteran judokas and the other two groups (elite and sub-elite). Our comparisons seem to indicate that *perfectionism strivings* subscales are sensitive to achievement level and could be age-dependent opening to be trainable characteristics. Also, there was strong positive association between *mental toughness* and *perfectionistic strivings*. Negative association between *mental toughness* and *perfectionistic concerns* suggest possibility of modelling athlete's psychological preparation.

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