

Referee's bias explain red color advantage in taekwondo

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Abstract:

Previous research supports the notion that wearing red color uniforms enhances human performance in sports competitions; however, such results might have been contaminated by referees' bias. The purpose of this study was to evaluate the influence red color in taekwondo fights when athletes wore a vest linked to an automatic scoring system. We evaluated 718 fights from the World Taekwondo Championships 2013. Potential moderator variables gender, weight category, competition round, victory method, and performance asymmetry were evaluated. A one-sample binomial test revealed that the proportion of winning a combat was similar when wearing red or blue uniforms ($p = 0.478$). A multiple logistic regression analysis failed to explain the influence of moderator variables in winning a combat ($R^2 = 0.04$). In conclusion, red color does not enhance human performance in Taekwondo. Previous research showing otherwise might have been biased by human error in refereeing.

Key words: color, performance, sports, technology, fair play..

Introduction

Evolutionary psychology theory proposes that in animals the red color is related to dominance status and intimidation (Hill & Barton, 2005). In sports, where dominance and intimidation are important, contestants wearing red uniforms theoretically would have a competitive advantage (Attrill, Gresty, Hill, & Barton, 2008; Hill & Barton, 2005). The empirical support for this claim has been described in Olympic combat sports (Hill & Barton, 2005) and in an analysis over a 55-year period of the English football (soccer) (Attrill et al., 2008). However, in judo, no differences in performance have been reported in contestants wearing blue or white uniforms (Dijkstra & Preenen, 2008); and no red advantage has been confirmed in the Spanish soccer league (García-Rubio, Picazo-Tadeo, & González-Gómez, 2011).

Taekwondo, a combat sport played between two competitors, is judged by a referee. Before the Olympic games held in London 2012, referees relied on their personal expertise to score competitors. In this sport, red or blue color is worn in the protective gear to allow referees to differentiate between contestants during high-speed movements (Pieter, 1991). Red color might impact a referee's perception and evidence has shown that in combat sports such as taekwondo, referees positively-biased their scores towards those dressed in red (Hagemann, Strauss, & Leissing, 2008).

Electronic scoring systems are now required in competitions with the aim of reducing potential referee's bias and promote the Olympic spirit of fair play (Hagemann et al., 2008; International Olympic Committee, 2013). Therefore, the purpose of the study was to evaluate whether wearing red color would influence the outcome in taekwondo fights when participants wore a vest linked to an electronic scoring system.

Method

Participants and Procedures

Data from 718 combats for male ($n = 490$) and female ($n = 322$) taekwondo athletes were retrieved from the official World Taekwondo Championship 2013 Results Book (World Taekwondo Federation, 2013). In the tournament, it is mandatory for participants to wear a protective vest wireless-connected to an electronic scoring system. Also, a closed caption video system recorded each combat. The video was available to coaches if they wanted to challenge a referee's decision. Based on the official World Taekwondo Ranking, the best participants were randomly assigned red or blue color and then were seeded into different competition brackets. This assignment method prevented best performers to combat each other during the first competition rounds. The lower-ranked participants were randomly assigned to the competition brackets.

Athletes competed on their weight category and a victory was awarded in different ways: a) the highest number of points at the end of the third round, b) a difference score ≥ 12 pts. after the second round, c) knockout, d) winning a point in the fourth round if the combat was tied in the third round, e) referee's decision if a tie remains in the fourth round, f) disqualification of the opponent due to repetitive warnings, withdrawal, or no-show of the opponent.

Data were recorded on gender, the color of each participant's outfit, weight category, the color of the winner of the combat, and the method of victory. Asymmetry was recorded for each combat based on a methodology described before (Hill & Barton, 2005). Briefly, the asymmetry was defined as the point difference based on the combat outcome. Thus, the first quartile included combats with high asymmetry (i.e., large point differences) and the fourth quartile included combats with no asymmetry (i.e., reduced differences).

Statistical analysis

Statistical analyses were performed using the SPSS version 20.0 and JMP, version 7. A non-parametric binomial test was used to determine the probability of winning based on the clothing color. A logistic binary regression model was used to analyze the association between color worn by winners and independent moderator variables gender, weight category, competition round, victory method, performance asymmetry, and the interaction between gender and weight category. Statistical significance was set *a priori* at $p < 0.05$.

Results

We found that 369 (51.4%) and 349 (48.6%) fights were won by contestants wearing blue and red color, respectively. The one-sample binomial test revealed that the proportion of winning a combat was similar when wearing red or blue uniforms ($p = 0.478$). The multiple logistic binary regression analysis showed a low predictive value of moderator variables in winning a combat when wearing red or blue (R^2 logit = 0.04). The inclusion of all variables in the analysis generated the highest predictive power ($\chi^2 = 41.82$, $p = 0.09$). Wald's test showed that variables failed to predict the probability to winning a combat based on the color red or blue (Table 1).

Table 1. Influence of moderator variables on the outcome of taekwondo fights.

Source	Wald's χ^2	p =
Gender	0.09	0.770
Weight category	10.17	0.179
Gender x Weight category	12.54	0.084
Competition round	10.60	0.102
Victory method	3.56	0.829
Performance asymmetry	3.62	0.306

Discussion

Based on our analyses, we conclude that red color does not enhance human performance in taekwondo, and that the evolutionary psychology of color theory (i.e., winning by wearing red is explained by an evolutionary or cultural association of the color with dominance and aggression), that might exert a psychological effect in an athlete who wears red does not apply to this combat sport. We suggest that their previous research might have been biased by not taking into consideration the human error in refereeing, a phenomena described before (Boyko, Boyko, & Boyko, 2007; Hagemann et al., 2008; Lopez & Snyder, 2013; Rodenberg & Choong Hoon, 2009). We agree with other interpretation that proposes the perception of colors triggers a psychological effect in referees that can lead to bias in evaluating identical performances (Hagemann et al., 2008), a subject that deserves further examination.

Conclusions

In conclusion, the results from this study indicate that there is no human response to colors in the combat sport of taekwondo but a referee bias response. New technology might come to solve the problems associated to fairness in sports.

Conflicts of interest: none

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