

KINESIOLOGY & COACHING

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Trainers' understanding of choosing the frequency speed of kick test (FSKT) for taekwondo practitioners

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Abstract

Aim. The frequency speed of kick test (FSKT) is performed by taekwondo athletes and practitioners in a short version (10s), and an intermittent version (5 sets x 10s effort/10s pause). The purpose of the present study was to determine the views of coaches with different academic backgrounds on the frequency speed of kick test (FSKT).

Material, Methods and Results. To start, ten sports scientists with more than 10 years' experience were consulted about the questions. After the final version of the questionnaire was constructed, the experts were asked to answer the questionnaire. 94 subjects participated in the study. They were allocated into one of following three groups: (1) non-graduates (n = 32); (2) graduates (n = 34) and (3) post-graduates (n = 28) in physical education and/or sports sciences. The main results were: a) the subjects consulted considered that the tests were 'easy' (48%) or 'very easy' (53%) to understand; (b) the application of the tests were considered 'practicable' (50%) or 'very practicable' (49%); c) most interviewees considered FSKT_{10s} (76%) and FSKT_{mult} (60%) to be predominantly anaerobic. However, for both tests some participants considered them to be predominantly aerobic (FSKT_{10s} = 25%; FSKT_{mult} = 40%).
Conclusions. Based on the results of this study, we may conclude that coaches, and strength and conditioning professionals considered that the FSKT is a test that can be applied and understood and mainly assesses anaerobic fitness. However, a different interpretation of the tests' measures is associated with the professional degree of the coach, or strength and conditioning coach.

Introduction

Taekwondo is performed in three 2-min rounds and during a competition day between four and seven matches take place [Hausen *et al.* 2017; Bridge *et al.* 2018]. The combat is predominantly aerobic, but the main actions are supplied mainly by anaerobic alactic metabolism [Campos *et al.* 2012; Lopes-Silva *et al.* 2015; Lopes Silva *et al.* 2018]. The proportions of effort and pause in taekwondo are between 1:2 – 1:8 [Hausen *et al.* 2017; Santos, Franchini, Lima-Silva 2011; Del Vecchio, Antunez, Bartel 2016]. Recently, the specificity principle has been recommended and applied in measurement and monitoring tools [Hoffman 2012; Harman 2008].

In taekwondo, measurement is traditionally performed using general tests [Bridge *et al.* 2014], but recently, there has been an increased interest of sports scientists in sport-specific test development that can be easily applied during all the season present scientific criteria [Chaabene *et al.* 2018]. The frequency speed of kick test (FSKT) has been used and described in different recent publications [Santos, Franchini 2018; Santos *et al.* 2020]. The FSKT test is performed using the semicircle technique named *bandal tchagui* in an all-out mode. The FSKT has conducted in two versions: one 10s bout (FSKT_{10s}) and another involving five 10s bouts interspersed by 10s intervals (FSKT_{mult}). The measures generated are total number kicks by

set and/or during the whole test and kick decrement index (KDI).

Knowing that coaches' opinion is determinant to make decisions about the training process, it is necessary to know how and what they understand about a taekwondo-specific test. However, until the present moment, no coaches and S&C opinions were recorded about the FSKT for taekwondo. Thus, the aim of the present study was to investigate the understanding of procedures and the energetic demands of the FSKT. It was hypothesized that most professionals would easily understand the procedures for conducting the test as well as the energy systems contribution of both FSKT versions. The second hypothesis was that the professionals with the highest academic qualifications would have a better understanding of the procedures and applications of the FSKT in comparison to those who did not a degree in physical education and sport sciences.

Material and Methods

Design and Subjects

Logical validation was performed through the use of a questionnaire. After explaining the objectives of the present study, those who agreed to participate answered the questionnaire. The same questionnaire was presented in two formats: electronic – which was accessed after receiving a link – and the printed version. Both formats contained exactly the same content and were used to reach more potential subjects, a similar strategy was used in previous studies [Simenz, Dugan, Ebben 2005; Ebben, Hintz, Simenz 2005; Ebben, Carroll 2004].

The random non-probabilistic method was used to select the sample of individuals on whom data were collected. Initially, a total of 96 possible participants were consulted. Of these, 94 subjects accepted to participate in the study. The subjects were allocated into one of following three academics groups: (1) non-graduates (n = 32); (2) graduates (n = 34) and (3) postgraduates (n = 28) of physical education and sport. All subjects were selected by experience in taekwondo and/or strength and conditioning coach. After presenting the objectives and clarifications the subjects were invited to sign the Informed Consent Term. The subjects were asked about the procedures, viability, and objective of FSKT_{10s} and FSKT_{mult}. All procedures were approved by the Institutional Research Ethics Committee.

Procedures

Questionnaire Content Validation. At first, the questionnaire was sent to ten experts (Eight Ph.D. and two BSc) in sports science (ten with experience as strength and conditioning; six with experience as practitioners and/or combat sports athlete; and three with experience as coaches of combat sport). A few suggested comments were realized to change the content of the questionnaire. Secondly, to verify the content validation, the questionnaire was sent

to ten experts, in order to give their opinion on the clarity, applicability, and efficiency of the test in measuring the anaerobic component. The answers obtained by experts were tabulated and presented in Table 1.

Table 1. Content validation about the frequency speed of kick test by experts (n = 10).

N°	Question	Experts % (n = 10)
1	As to the understanding of the tests, do you consider them:	
	Very easy to understand	90.0 (9)
	Easy to understand	10.0 (1)
	Hard to understand	0.0 (0)
	Very hard to understand	0.0 (0)
2	As to the applicability of the tests, do you consider them:	
	Very practicable	50.0 (5)
	Practicable	50.0 (5)
	Few Practicable	0.0 (0)
	Impracticable	0.0 (0)
3	Do you believe that the FSKT_{10s} measures, predominantly:	
	Anaerobic fitness	100.0 (10)
	Aerobic fitness	0.0 (0)
4	Do you believe that the FSKT_{mult} measures, predominantly:	
	Anaerobic fitness	70.0 (7)
	Aerobic fitness	30.0 (3)

Questionnaire Application. After explaining the procedures and agreeing to participate in the study, the online questionnaire (Google Forms) or the printed version was released. The questionnaire was composed of three parts. In the first part, it was possible to see a brief explanation of the objectives of the study and then the description of FSKT_{10s} and FSKT_{mult}. In the second part, there was an illustration of the tests. Finally, in the third part of the questionnaire, the participant could visualize the questions of interest for the present study.

Statistical analysis

Data were presented as relative frequency and absolute frequency for all questions. The Chi-square test was used to analyze the data. Cramer's V test was used to describe the association between the degree of instruction and the response. The values of adjusted residue were observed and all values outside the range of -1.96 to 1.96 were considered. All analyses were performed using $\alpha = 5\%$.

Results

In Table 1 there are presented responses of 2 the frequencies (relative and absolute) of answers to the questions about the understanding, applicability, and energy systems contributions of FSKT_{10s} and FSKT_{mult}.

For question 1, an association between the degree of instruction and the respondents' response was found ($\chi^2(4) = 9.83$, $p < 0.043$; Cramer's V: 0.23). The answers that contributed to the alpha obtained were in the group of non-graduates (absolute frequency of response, the group of non-graduates: very easy to understand = 9, values expected = 14, adjusted residual value = -2.5, easy to understand = 23, value (absolute response frequency, postgraduates: very easy to understand = 18, expected value = 13, adjusted residual value = 2.4, easy to understand = 10, expected value = 15, adjusted residual value = -2.2). For the group of graduates and the other answers, no residual values were observed outside the range between -1.96 and 1.96 in the comparison between the observed and expected values.

In question 2, there was an association between the degree of instruction and the respondent's response ($\chi^2(4) = 9.67$, $p < 0.046$; Cramer's V: 0.23). The responses that contributed to the alpha obtained were in the group of non-graduates (absolute response frequency, a group of non-graduates: very viable = 9, expected value = 16, adjusted residual value = -2.9) and groups of graduates (absolute response frequency; graduates: very viable = 22, expected value = 16, adjusted residual value = 2.6). For the post-graduate group and the other answers, no residual values were observed outside the range between -1.96 and 1.96 in the comparison between the observed and expected values.

In question 3, there was an association between the degree of instruction of the subject and the given response ($\chi^2(2) = 15.59$; $p < 0.001$; Cramer's V = 0.41). The responses that contributed to the alpha obtained were in the group of

non-graduates (absolute frequency, non-graduate group: anaerobic fitness = 17, expected value = 24, adjusted residual value = -3.6, aerobic fitness = 15, expected value = 8, anaerobic fitness = 27, expected value = 21, adjusted residual value = 3.1, aerobic fitness = 1, expected value = 7, adjusted residual value = 3.6) and groups of post-graduates (absolute response frequency, group of postgraduates: anaerobic fitness = 27, expected value = 21, adjusted residual value = 3.1, aerobic fitness = 1, expected value = 7, adjusted residual value = -3.1). For the group of graduates and the other answers, no residual values outside the range of -1.96 to 1.96 were observed in the comparison between the observed and expected values.

In question 4, there was an association between the instruction received and the response given ($\chi^2(2) = 7.28$, $p = 0.026$, Cramer's V = 0.28). The responses that contributed to the obtained alpha were in the group of non-graduates (absolute response frequency, group of non-graduates: anaerobic fitness = 13, expected value = 19, adjusted residual value = -2.7, aerobic fitness = 19, expected value = 13, adjusted residual value = 2.7). For the group of graduates and post-graduates, residual values outside the range of -1.96 to 1.96 were not observed in the comparison between observed and expected values.

Discussion

The main objective of this study was to determine how subjects involved with taekwondo understand the FSKT regarding procedures, application and energy systems contributions. The main results were: a) the experts

Table 2. Relative and absolute frequency of the questionnaire on understanding, applicability and energy predominance of the frequency speed of kick test for taekwondo (n = 94).

N°	Question	Non-graduates (n = 32)	Graduates (n = 34)	Post-graduates (n = 28)	Total (n = 94)	Statistical Output
1	As to the understanding of the tests, do you consider them:					Chi-square test: $\chi^2_{(4)} = 9.83$, $p = 0.043$; Cramer's V test: 0.23
	Very easy to understand	28.1 (9)	47.1 (16)	64.3 (18)	45.7 (43)	
	Easy to understand	71.9 (23)	50.0 (17)	35.7 (10)	53.2 (50)	
	Hard to understand	0.0 (0)	2.9 (1)	0.0 (0)	1.1 (1)	
	Very hard to understand	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	
2	As to the applicability of the tests, do you consider them:					Chi-square test: $\chi^2_{(4)} = 9.67$, $p = 0.046$; Cramer's V test: 0.23
	Very practicable	28.1 (9)	58.8 (20)	60.7 (17)	48.9 (46)	
	Practicable	68.8 (22)	41.2 (14)	39.3 (11)	50.0 (47)	
	Few Practicable	3.1 (1)	0.0 (0)	0.0 (0)	1.1 (1)	
	Impracticable	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	
3	Do you believe that the FSKT_{10s} measures, predominantly:					Chi-square test: $\chi^2_{(2)} = 15.59$; $p < 0.001$; Cramer's V test: 0.41
	Anaerobic fitness	53.1 (17)	79.4 (27)	96.4 (27)	75.5 (71)	
	Aerobic fitness	46.9 (15)	20.6 (7)	3.6 (1)	24.5 (23)	
4	Do you believe that the FSKT_{mult} measures, predominantly:					Chi-square test: $\chi^2_{(2)} = 7.28$; $p = 0.026$; Cramer's V test: 0.28
	Anaerobic fitness	40.6 (13)	70.6 (24)	67.9 (19)	59.6 (56)	
	Aerobic fitness	59.4 (19)	29.4 (10)	32.1 (9)	40.4 (38)	

consulted considered that the tests are ‘easy’ or ‘very easy’ to understand; b) the application of the tests were considered ‘practicable’ or ‘very practicable’; c) most interviewees considered FSKT_{10s} and FSKT_{mult} to be predominantly anaerobic. For both tests some participants considered them to be predominantly aerobic, but lower than the frequency of responses of those who considered the test to be predominantly anaerobic.

Several studies use general characteristics tests, such as the Wingate test, to access the anaerobic fitness of taekwondo practitioners and athletes [Bridge *et al.* 2014]. More recently, some authors have recommended tests performed with gestures, relevance, and specific characteristics of the modality [Chaabene *et al.* 2018; Hoffman 2012]. Thus, the researchers can contribute by offering valid tests to the trainers, which generates useful and easy to acquire measures. However, the tools used to measure the combat sports performance still do not present all scientific authenticity criteria [Chaabene *et al.* 2018]. In this study, the main objective was to test the logical validity of the FSKT, but also to determine how people with different backgrounds understand this instrument.

Based on the responses observed by the group, it can be said that the degree of instruction influences how the instructions are understood, the possibility of application and the energy predominance of the tests. These issues are of the utmost importance given that if the coach does not understand what the test is or does not consider it applicable, it will not be used and consequently the effort to investigate the scientific authenticity will be lost. In addition, if the coach does not know or has a different perception about what the test measures predominantly, it may be detrimental when selecting the tests that will be used throughout the competitive season. In the present study, statistically different results were observed when comparing the observed value and the expected value. For example, for question 1 respondents in the group of post-graduates have more often said that the test was much easier to understand than the group of non-graduates. The same occurred in the result of question 2 in which the group of graduates responded much more often than the application of the test is ‘Very practicable’. Although the response frequency was different, almost all participants responded favorably to questions related to the use of FSKT.

There are studies using the FSKT [Santos, Franchini 2018; Santos *et al.* 2019], there are few moments and places of discussion about the application motives of a certain procedure in the training process. The same applies in the case of the selection and application of tests. Thus, one question was used to establish the coaches’ opinion concerning the energy predominance of FSKT_{10s} and FSKT_{mult}. In general, both tests were classified as predominantly anaerobic by the interviewees. However, when the response frequency was observed in groups, a great difference was noticed. For example, when comparing the group of non-graduates and the group of graduates

in questions 3 and 4, it was observed that the higher the level of education, the higher the frequency of response that FSKT_{10s} was predominantly anaerobic, whereas for FSKT_{mult} the higher frequency response in the group of non-graduates reported that it measures predominantly the aerobic fitness and the group of graduates judged that the test measures predominantly the anaerobic fitness.

Finally, the S&C professionals and sports scientists must apply different tests and interpret their results to make evidence-based decisions concerning the training program to help athletes achieve their goals and maximize their performance [Harman 2008]. They need to be able to identify, select and explain reasons for apply tests, to communicate clearly with the athletes and other professionals such as coaches, to evaluate scientific criteria associated with specific measurements and for administering test protocols properly and safely [Harman 2008].

Future studies are necessary to investigate the energy system contributions of taekwondo athletes to the FSKT.

Conclusions

Based on the results of the present study, we can conclude that the FSKT is a test that can be applied, understood and which assesses mainly the anaerobic fitness. The initial hypothesis was confirmed, most professionals easily understand the procedures for conducting the test as well as the energy systems contribution of both FSKT versions and professionals with more academic qualifications would have a better understanding of the procedures and applications of the FSKT in comparison to those who did not have a degree. Thus, it seems that the FSKT is a test that has logical validity as a measure of the anaerobic fitness of taekwondo practitioners and athletes, as proposed in previous studies. However, depending on who is participating in the process of choosing the test, there may be different interpretations according to the professional degree of the coach or S&C.

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References

1. Bridge C.A., Santos J.F.S., Chaabène H., Pieter W., Franchini E. (2014), *Physical and physiological profiles of taekwondo athletes*, “Sports Medicine”, vol. 44, no. 6, pp. 713–733.

2. Bridge C.A., Sparks A.S., McNaughton L.R., Close G.L., Hausen M., Gurgel J., Drust B. (2018), *Repeated exposure to taekwondo combat modulates the physiological and hormonal responses to subsequent bouts and recovery periods*, "Journal of Strength and Conditioning Research", vol. 32, no. 9, pp. 2529–2541.
3. Campos F.A., Bertuzzi R., Dourado A.C., Santos V.G., Franchini E. (2012), *Energy demands in taekwondo athletes during combat simulation*, "European Journal of Applied Physiology", vol. 112, no. 4, pp. 1221–1228.
4. Chaabene H., Negra Y., Bouguezzi R., Capranica, L., Franchini E., Prieske O., Hbacha H., Granacher U. (2018), *Tests for the Assessment of Sport-Specific Performance in Olympic Combat Sports: A Systematic Review with Practical Recommendations*, "Frontiers in Physiology", vol. 9; doi: 10.3389/fphys.2018.00386.
5. Del Vecchio F.B., Antunez B., Bartel C. (2016), *Time-motion analysis and effort-pause relationship in taekwondo combats: A comparison of competitive levels*, "Revista Brasileira de Cineantropometria e Desempenho Humano", vol. 18, no. 6, pp. 648–657.
6. Ebben W.P., Carroll R. (2004), *Strength and conditioning practices of National Hockey League strength and conditioning coaches*, "Journal of Strength and Conditioning Research", vol. 18, no. 4, pp. 889–897.
7. Ebben W.P., Hintz M.J., Simenz C.J. (2005), *Strength and conditioning practices of Major League Baseball strength and conditioning coaches*, "Journal of Strength and Conditioning Research", vol. 19, no. 3, pp. 538–546.
8. Harman E. (2008), *Principles of test selection and administration* [in:] T.R. Baechle, R.W. Earle [eds.], *Essentials of strength training and conditioning*, Human Kinetics.
9. Hausen M., Soares P.P., Araujo M.P., Porto F., Franchini E., Bridge C.A., Gurgel J. (2017), *Physiological responses and external validity of a new setting for taekwondo combat simulation*, "PLoS One", vol. 12, no. 2, pp. e0171553.
10. Hoffman J.R. (2012), *Athlete testing and program evaluation* [in:] J.R. Hoffman [ed.], *NSCA's Guide to Program Design*, Human Kinetics, Champaign, IL, pp. 23–49.
11. Lopes-Silva J.P., Santos J.F.S., Artioli G.G., Loturco I., Abbiss C., Franchini E. (2018), *Sodium bicarbonate ingestion increases glycolytic contribution and improves performance during simulated taekwondo combat*, "European Journal of Sport Science", vol. 18, no. 3, pp. 431–440.
12. Lopes-Silva J.P., Santos J.F.S., Branco B.H.M., Abad C.C.C., Oliveira L.F., Loturco I., Franchini E. (2015), *Caffeine ingestion increases estimated glycolytic metabolism during taekwondo combat simulation but does not improve performance or parasympathetic reactivation*, "PLoS One", vol. 11, no. 10, pp. e0142078.
13. Santos J.F.S., Franchini E. (2018), *Frequency speed of kick test performance comparison between female taekwondo athletes*, "Journal of Strength and Conditioning Research", vol. 32, no. 10, pp. 2934–2938.
14. Santos J.F.S., Lopes-Silva J.P., Loturco I., Franchini E. (2020), *Test-retest reliability, sensibility and construct validity of the frequency speed of kick test in black-belt male taekwondo athletes*, "Ido Movement for Culture. Journal of Martial Arts Anthropology", vol. 20, no. 3, pp. 38–46; doi: 10.14589/ido.20.3.6.
15. Santos V.G., Franchini E., Lima-Silva A.E. (2011), *Relationship between attack and skipping in Taekwondo contests*, "Journal of Strength and Conditioning Research", vol. 25, no. 6, pp. 1743–1751.
16. Simenz C.J., Dugan C.A., Ebben W.P. (2005), *Strength and Conditioning Practices of National Basketball Association Strength and Conditioning Coaches*, "Journal of Strength and Conditioning Research", vol. 19, no. 3, pp. 495–504.

Rozumienie przez trenerów sposobu wyboru częstotliwości testu kopnięcia (FSKT) dla osób uprawiających taekwondo

Słowa kluczowe: sporty walki, sztuki walki, test terenowy, pomiar, anaerobowy

Streszczenie

Cel. Test częstotliwości szybkości kopnięcia (FSKT) wykonywany jest przez zawodników i praktyków taekwondo w wersji krótkiej (10s) oraz przerywanej (5 serii x 10s wysiłek / 10s pauza). Celem niniejszego badania było opisanie opinii trenerów z różnych środowisk akademickich na temat testu częstotliwości szybkości wykonywania kopnięcia (FSKT). Materiał, metody i wyniki. Po pierwsze, skonsultowano się z dziesięcioma naukowcami z dziedziny sportu z ponad 10-letnim doświadczeniem. Po zbudowaniu ostatecznej wersji kwestionariusza, eksperci zostali poproszeni o udzielenie odpowiedzi na pytania zawarte w kwestionariuszu. W badaniu wzięły udział 94 osoby. Respondenci zostali podzieleni na trzy grupy: (1) bez stopnia naukowego z wychowania fizycznego i/lub nauk o sporcie (n = 32); (2) absolwenci studiów licencjackich (n = 34) i (3) absolwenci studiów magisterskich i doktoranckich (n = 28) z wychowania fizycznego i/lub nauk o sporcie. Główne wyniki były następujące: a) ankietowani uznali, że testy były „łatwe” (48%) lub „bardzo łatwe” (53%) do zrozumienia; b) stosowanie testów uznano za „praktyczne” (50%) lub „bardzo praktyczne” (49%); c) większość respondentów uznała, że $FSKT_{10s}$ (76%) i $FSKT_{mult}$ (60%) są w przeważającej mierze anaerobowe. Jednak w przypadku obu testów niektórzy uczestnicy uznali je za w przeważającej mierze aerobowe ($FSKT_{10s} = 25\%$; $FSKT_{mult} = 40\%$). Wnioski. Na podstawie wyników niniejszego badania można stwierdzić, że trenerzy oraz specjaliści w dziedzinie siły i kondycjonowania uznali, że FSKT jest testem, który może być stosowany, rozumiany i oceniany głównie sprawność bez-tlenową. Jednak inna interpretacja środków stosowanych w testach jest związana ze stopniem wyszkolenia trenera lub trenera wytrzymałościowego i kondycyjnego.