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Correlation analysis between Special Judo Fitness Test and Uchikomi Shuttle Run Rest

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Abstract

Background and Study Aim. Since 1995 (Sterkowicz), Special Judo Fitness Test (SJFT) has been validated and is widely used in order to measure Judo competitors' Judo specific stamina. The purpose of this study was the knowledge about the correlation between the SJFT and the USRT (Uchikomi Shuttle Run Test that integrates Judo specific movements into shuttle run test) in order to seek for a possibility to employ the method practically at physical education class settings in Japan for examining Judo specific abilities.

Material and Methods. Eighteen Judo competitors (means and SD: age = 20.3±1.2; height: 171.6±6.2cm; weight: 76.2±12.2kg) volunteered to complete both the SJFT and USRT. We specifically measured frequencies of the USRT and calculated the indices for SJFT. The USRT involves a 10m interval with one uke and another uke. First, a tori sets in the middle of the interval and reach to lift one uke and another, respectively and repeatedly (the tori has to ippon seoi nage, at least lift the uke). A tori attempts to accurately synchronize the beep sounds that starts at the speed of 17km per hour and increases 1km per hour in thirty seconds. A point the tori fails to follow the beeping tempo is the end. We counted the frequencies that the tori did ippon seoi nages within the time.

Results. Pearson correlation analysis revealed that the frequencies of USRT were significantly associated with the index of SJFT ($r = –0.56$; $p = 0.015$).

Conclusions. The results indicated that the USRT is a possible measure that can evaluate a combined abilities of physical education students' Judo specific and general endurance capacities.

Keywords: performance test • science of martal arts • training

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Introduction

Judo competitions are the best opportunity to evaluate multidimensional athletic performance such as technical, tactical, motor, psychological and theoretical aspects [1]. Previously, Sogabe A, Maehara K, Yamasaki S. [2] examined the composite time of each game element such as tachiwaza, newaza, and mate, when Japanese national judo athletes were in the selection. The researchers found the average duration of competition for male was 5 minutes and 20 seconds (SD = ± 2 minutes 47 seconds), and in turn, considering the case until championship stage, an athlete possibly compete 5 or 6 competitions, which indicates that the athlete compete ranges from 26 minutes 40 seconds to 32 minutes per day. In addition, they reported the average frequency for waits (mate) was 8.67 times (SD = ±5.64 times) as well as the average duration for waits (mate) was 9.09 seconds (SD = 4.67 seconds). If simply calculated the average timing in acquiring waits (mate) by using the total competition durations, an athlete acquire a wait (mate) per 30.9 seconds for 9.09 seconds by some reasons (e.g., giving a point, instruction, and warning). Thus, as is often the case with judo competitions, 5 or 6 times of intermittent exercise occur and in turn, judo athletes perform multiple offensive and defensive techniques such as kumite, tachiwaza, and newaza continuously for approximately 30 seconds. Taking the uniqueness into account, Sterkowicz introduced Special Judo Fitness Test (SJFT) in 1995 as a unique performance evaluation procedure for judo athletes. The measurement consists of nagekomi and 6 meters dash, which are evaluated in frequencies of nagekomi and heart rates which are both immediate and 1 minute later. As a result, SJFT index is calculated as a standard (a small index indicates better performance) [3]. The SJFT is currently prevailed as a useful and reliable measurement method for judo specific athletic abilities all over the world [4].

In Japan, on the other hand, running ability based evaluation methods such as 400 sprint [5,6] and 800 meter run [6], 20 meter shuttle run test [7], were used for measuring judo athletes' physical abilities, which judo specific exercises and skills are not specifically included. Nevertheless, majority of Japanese adolescent students have experienced the 20 meter shuttle run test since the Japanese ministry of education recommends physical education teachers to evaluate students' overall physical endurance. Moreover, the Japanese ministry of education made budo compulsory at junior high schools in 2012. Responding to the order, many junior high schools choose to teach judo, which raises many cases that junior high school students are first being exposed to practice judo at the age. Therefore, we proposed an easy and safe alternative evaluation method namely Uchikomi Shuttle Run Test (USRT) that combines uchikomi and the 20 meters shuttle run test. We carefully selected uchikomi component because novice judo students are assumed not necessarily to be skilled at ukemi, so uchikomi is more protective against injuries at physical education classes. The current study hypothesizes that the frequencies of USRT are negatively correlated to the SJFT index.

Material and Method

Participants

Eighteen Judo competitors (means and SD: age = 20.3±1.2years; height: 171.6±6.2cm; weight: 76.2±12.2kg, judo history; 11.0±1.2years) volunteered to complete both the SJFT and USRT at two different dates because of a consideration for their fatigue. The criterion for inclusion into the study group was previous participation in tournament bouts and no injuries/ body damages that would limit normal performance of judo exercises.

The study protocol was approved by the Human Ethics Committee of Konan University (No.14-14). Prior to participation, the risks and benefits of the study were thoroughly explained to all participants and written informed consent was subsequently obtained.

Special Judo Fitness Test

Special judo fitness test was carried out following the standardized warm-up procedure according to the instruction described by Franchini et al. [8]. The cards of individual experiments contained the number of throws performed within the 15-second segment A, 30-second segment B, and 30-second segment C. Duration of the rests between the segments was 10 s. The measurements of a minute heart rate (bpm) were recorded directly after the exercise and after a 1-minute rest using a heart rate monitor (Polar, RS800CX, Finland).

The SJFT index was calculated according to the following formula:

$$\text{SJFT Index} = \frac{\text{Final HR (bpm)} + \text{HR 1 min (bpm)}}{\text{Throws in total (N)}}$$

where:

Final HR – heart rate recorded immediately after the test.
HR1 min – heart rate obtained 1 minute after test.
Throws – number of throws completed during the test.

Lower index represented better results.

Furthermore, the participants answered to the question of the similarity between the effort perceived in the SJFT and during real competition. They used a 5-point forced-choice scale (1 minimum; 5 maximum).

Uchikomi Shuttle Run Test

The USRT involves a 10m interval with one uke and another uke. First, a tori sets in the middle of the interval and reach to lift one uke and another, respectively and repeatedly (the tori has to ippon seoi nage, at least lift the uke) (Figure 1). A tori attempts to accurately synchronize the beep sounds that starts at the speed of 17km per hour and increases 1km per hour in thirty seconds. A point the tori fails to follow the beeping tempo is the end. We counted the frequencies that the tori did ippon seoi nages (in uchikomi form) within the time (Figure 2). The measurements of a minute heart rate (bpm) were recorded directly after the exercise and after a 1-minute rest using a heart rate monitor (Polar, RS800CX, Finland). Furthermore, the participants answered to the question of the similarity between the effort perceived in the USRT and during real competition. They used a 5-point forced-choice scale (1 minimum; 5 maximum).

Statistics

First, means and standard deviations for each variable were computed. In order to test the main hypothesis for this study (i.e. the frequencies of USRT are negatively correlated to the SJFT index), a Pearson product-moment correlation analysis was conducted. Lastly, a paired sampled T Test was conducted to evaluate participants' perceived exertion for both USRT and SJFT.

Results

Descriptive statistics for all the variables were shown in Tables 1 and 2. Pearson product-moment correlation analysis was used to determine a significant correlation between USRT and SJFT. As hypothesized, the frequencies of USRT were negatively and significantly associated with the indices of SJFT ($r = –0.56$; $p = 0.015$; two-tailed). Next, a paired sampled T Test was conducted to examine if the participants' perceived exertion are significantly different or identical. As a result, the participants' perceived exertion on USRT ($M = 3.11$) and SJFT ($M = 3.00$) were not significantly different ($t = 0.316$, $df = 17$, $p = 0.756$ two-tailed).

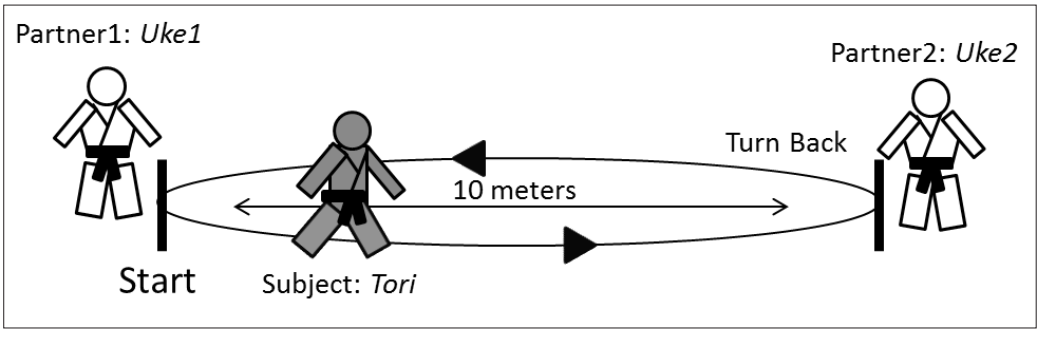

Figure 1. Method of The USRT

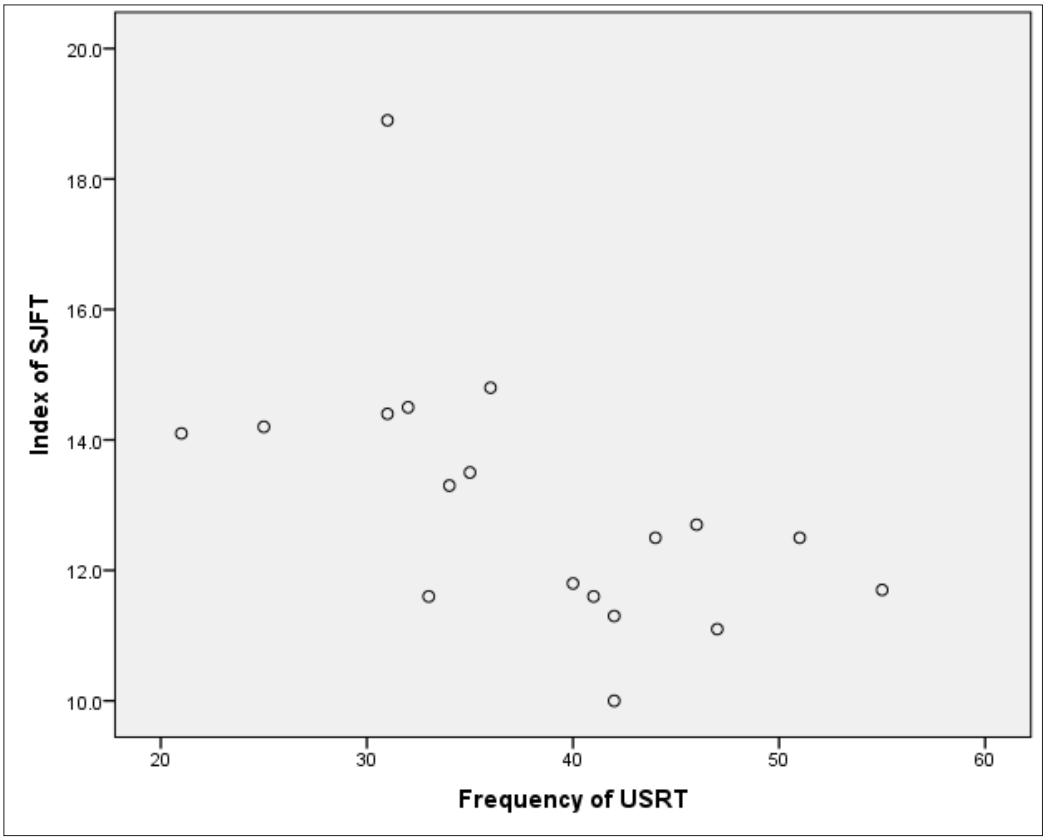

Figure 2. Scatter plot of the Index of SJFT and Frequency of USRT

Table 1. Mean and Standard deviation of the SJFT

SJFT	A	B	C	Total	HR immediately	1HR 1minute	index	Rating of Perceived Exertion
Mean	5.8	10.6	9.7	26.1	180.6	151.7	13.0	3.0
SD	0.9	1.7	1.5	3.9	7.0	12.3	2.0	0.9

Table 2. Mean and Standard deviation of the USRT

USRT	Number	HR immediately	1HR 1minute	Rating of Perceived Exertion
Mean	38.1	182.1	145.0	3.1
SD	8.8	7.1	16.2	1.1

Discussion

The purpose of this study was to evaluate the USRT and examine the relationship between USRT and SJFT. Results revealed that the frequencies of USRT and the indices of SJFT were significantly and negatively correlated and deemed participants' perceived exertion on both USRT and SJFT fell in the similar spot. Additionally, significant correlations between pairs of testing dimensions were found: Number of Throws performed during SJFT and Number of Throws performed during USRT ($r = 0.62$, $p=0.007$), Final HR (bpm) in SJFT and Final HR (bpm) in USRT ($r=0.67$, $p=0.002$), HR 1 min (bpm) SJFT and HR 1 min (bpm) USRT ($r=0.79$, $p<0.001$).

Moreover, participants' immediate HRs from both USRT and SJFT did not differ, which indicates an equivalence of exercise level from these two evaluation methods. Taken together, the results support our proposed evaluation method can be useful to measure judo athletic abilities

A uniqueness of judo competition is that judo athletes repeat both aerobic such as trials of nage waza and kumite and anaerobic exercise of continuous body movements in 5 minutes (the length of judo competitions) [2]. Because judo requires both aerobic and anaerobic exercises, evaluation method should be adequate to measure the complex of judo performance. Although 20 meter shuttle run test [7] was designed to evaluate individuals' aerobic ability and Wingate Anaerobic Test (WAnT) [9] was designed to measure individuals' anaerobic abilities, both evaluation methods are independent and were not designed to capture both individuals' aerobic and anaerobic abilities at a time. Moreover, laboratorial evaluation methods in aerobic, anaerobic, lactate, and VO2 max levels are not practical for judo instructors and teachers. Therefore, this proposed method i.e., USRT can be useful for teachers at schools because they do not necessarily possess devices such as heart rate monitors and pedometers.

Our intention was to propose a reliable non-device dependent judo specific athletic ability evaluation method. One existing reliable evaluation method to measure judo specific athletic ability is the SJFT [3]. Previous research demonstrated that the results of SJFT were frequently and significantly associated with judo performance because the SJFT can capture an essential metabolic element that judo athletes need [10]. However, previous studies [11, 12] reported the WAnT were not consistently associated with the SJFT which can be a significant judo performance indicator. This inconsistency probably make sense because the WAnT does not cover the aerobic facet. On the other hand, 20 meter shuttle run test could be a consistent predictor of judo performance. According to the report that examined 20 meter shuttle run abilities of Japanese woman judo national team, those who were in 48 kg – 70 kg demonstrated higher frequencies (100 ± 5.4 times) of the test than the average frequencies (88 times) on the list of evaluation among the population in Japan [13]. Nevertheless, this 20 meter shuttle run test might not be an adequate evaluation method since it does not consider judo specific athletic abilities which might be necessary to add anaerobic aspect. In that regard, this proposed USRT covers both aerobic and anaerobic components to be evaluated, which might predict individuals' judo performance closer than simply evaluating the results of WAnT and/or 20 meter shuttle run test.

Despite these findings, this study has some limitations. First, the sample was restricted to a small college student sample. Future researchers should employ more diverse and larger population in order to support this USRT as a reliable evaluation method. Second, more studies are needed employing test-retest procedure, which can add more reliability of the USRT. Lastly, measuring more judo performance related variables and examining their associations with the USRT will provide further evidence. Future researchers should consider these criteria of limitation.

Conclusions

Overall results suggested the USRT can be a substitute of SJFT. Thus, the USRT which does not require any biomarker device, can be useful for physical education classes at schools and judo novices in order to test judo specific athletic abilities.

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