

Quasi-apparatus *shime waza* test (QASWT) – validation procedure

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- A Study Design
- B Data Collection
- C Statistical Analysis
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Abstract

Background and Study Aim:

Judo is the only Olympic sport where it is acceptable to the win by suffocation of competitor. Alternatively, by capitulate of a competitor due to the applied chokehold technique (*shime waza*). Despite the popularity of judo therapy in Japan, the clinical effects of *shime waza* are unknown. The studies aim to validate the quasi-apparatus *shime waza* test (QASWT) from two perspectives: the safety of practising judo and clinical applications.

Material and Methods:

Twenty juvenile judo athletes (14 boys, 6 girls) in age between 10 to 12 years (10.7 ± 0.73) were tested. Authorial QASWT was applied. The accuracy of this test was based on Delphi method (assessed by 5 competent judges). The reliability test was determined by a test-retest method with an interval of 7 days. Trial 1 (progressive choking): experienced judo instructor counts loudly (in Polish) "hundred twenty-one" (lowest range of applied choking strength) to "hundred twenty-five" (the highest range), applying alongside with it *kata-ju-ji-jime* (single cross hold) with increasing strength. Surrendering (tapping out) by the participant (or symptoms of fainting) ends the trial. Assistant starts stop-watch at the beginning of counting and stops it at the moment of surrendering (strength needed to surrender were necessary to verification in progressive version $F_{SWprogres}$). The difference in Trial 2 is in applying determined for each participant strength from the beginning ($F_{SWcorrect}$). Indicators: $F_{SWprogres}$ and $F_{SWcorrect}$ in a scale from 1 to 5; time of choking tolerance $t_{TSWprogres}$ and $t_{TSWcorrect}$ (in seconds with precision to 0.01); *Shime Waza Index* ($SWI_{progres}$ and $SWI_{correct}$ respectively) from 0 to 1 (it is determining ability of choking tolerance in proportion of $t_{TSWprogres}$ and $t_{TSWcorrect}$ to constant value of 5.99 seconds).

Results:

Full agreement between competent judges confirms high accuracy QASWT. Moreover, regularity of SWI reduction between trial 1 and 2 ($SWI_{progres}$ and $SWI_{correct}$ respectively: test $0.83 \pm 0.20 \div 0.70 \pm 0.25$; re-test $0.85 \pm 0.17 \div 0.72 \pm 0.27$) was confirmed. Very high reliability was confirmed by test-retest results of following QASWT indicators: F_{SW} ($r = 0.973$); $SWI_{progres}$ ($r = 0.910$), $SWI_{correct}$ ($r = 0.770$); all $p < 0.01$. Lower correlation of $t_{TSWprogres}$ ($r = 0.622$) and $t_{TSWcorrect}$ ($r = 0.627$) both $p < 0.01$ indicators do not give solid bases to question reliability for that category of diagnostic tools.

Conclusions:

Applied methodology of QASWT fulfils medical and ethical standards of safety for people who are using *shime waza* during judo and self-defence training. This innovative tool of prophylaxis and therapy based on elements of martial arts (e.g. fear reduction, stress-resistant training, increasing surviving abilities), when applied reasonably, may have positive effects in treatment and therapy of some disorders. This application requires the interdisciplinary cooperation of specialists in a field of medicine, physiotherapy, agonology (with judo qualifications), psychology and medical biotechnology.

Keywords:

Delphi method • innovative agonology • judo therapy • katsu • survival ability

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Validation – the action of checking or proving the validity or accuracy of something (Oxford Dictionaries).

Accuracy – the quality or state of being correct or precise (Oxford Dictionaries); **accuracy** in parts of methodological books is synonymous of **validity** (degree to which a test or instrument measures what it purports to measure; can be categorized as *logical, content, criterion, or construct validity* [32, p. 193]), whereas **validity** (relevance) include **accuracy** and **reliability**.

Reliability (feasibility) – human operator's **R**. is understood as his ability to faultlessly perform functions vested in him under defined conditions and within a specific time segment. Object's **R**. in the normative sense (one of the possible definitions – authors' emphasis for the purposes of this work) is the probability that in a certain period (**O**, **t**) changes in the specific properties of the object will not exceed the specific limits under certain conditions of the object's existence [77].

Test-retest method – method of determining stability in which a test is given one day and then administered exactly as before a day or so later [32, p. 200].

The Delphi method (Delphi technique) – a method of group decision-making and forecasting that involves successively collating the judgments of experts [76].

Quasi-apparatus test – can be conducted with simple instruments (a stopwatch, a ruler, a measuring tape, etc.) [80].

Non-apparatus test – that motoric test (exercise endurance test) of the required reliability (accurate and reliable), which use does not require even the simplest instruments [80].

Manoeuvre Q-G – it is a variant of maneuverer M-1 and L-1, based on Chinese

INTRODUCTION

Among locking techniques in martial arts, there are also using chokehold techniques (shime waza). Judo is the only Olympic sport where choking is allowed. Legal areas of human actions by means of martial arts, where people are thought ways and techniques of chokings are *hapkido, Brazilian ju-jitsu, ju-jitsu, krav maga, kung-fu, sambo, unifiight* (as well as other martial arts, with local or regional impact and self-defence art). As one of signed under Czestochowa Declaration 2015 HMA against MMA" [1] we stand out of MMA (mixed martial arts) formula. This legal activity we are calling, as its shameful mission is, neo gladiatorship.

Despite numerous reports of injuries or even deaths in judo, there are no cases, when someone got serious trauma due to chokehold technique. In all history of judo, there were no deaths because of use of that kind of techniques [2]. Therefore, it remains officially accepted during judo competitions. Although choking or passing out may seem to be rough and brutal techniques, it brings no damage to the brain [3]. After application of choking technique, the opponent may try to defend to the point of losing consciousness (*ochi*), or give up by tapping out (*maitta*) [4].

General physiological mechanism of being choked to the point of losing consciousness is known thanks to a studies of Kodokan Judo Institute scientists in 1958. Participants who submitted themselves to choking techniques were monitored using X-rays and electroencephalograms (EEG), which shows that oxygen deficit in the cerebrum and carotid sinus reflex is the main reason of passing out [5]. On the continuation of this research, it comes out that whole body is responding to a chokehold. As a reflex, the cardiac silhouette is shrinking while chokehold is being held and returns to its proper volume around 10 seconds after participant regains consciousness. Venous return and cardiac output decreases which indicates global changes in the cardiovascular system and not only in a cerebral blood circulation

system [6]. Carotid sinus decreased because of increased pressure on carotid arteries. This pressure increases heart rate and blood pressure in general [7].

Most of the studies focused on EEG recording of judo practitioners after losing consciousness. On the first studies, the point of passing out was around 10 seconds. EEG recordings show that being choked in some way is like having epilepsy seizure in some way. Probably due to tachycardia and hypertension on the carotid sinus reflex. Normal brain activity was regained completely up to one 1 minute from returning to consciousness [8]. Another study reveals changes in EEG activity of a brain as well as a decrease in cerebral blood flow. Unconsciousness was set after around 15 seconds and last for around 15 seconds. Again, brain waves return to normal. Moreover, none persisting changes in the brain could be traced [9]. Next studies involve ultrasonography techniques. Application of cross-choke techniques (*juji-jime*) results in a reduction of blood flow in the medicerebral artery, resulting in severe cerebral hypoxia [10].

Newest studies indicate, that application of a chokehold to the point of losing consciousness cuts off cerebral blood flow completely and may be dangerous in terms of hemodynamics of brain [4]. Despite chokehold time was similar to a previous study (generally 7-15 seconds), studies of oxygenation of a brain and its recovery last much longer than its EEG activity. Even when tapping out, so remaining conscious, choking may lead to loss of cerebrum functions like memory and judgement, mental functions, intelligence and some cognitive capabilities may not return to its former state in a couple of seconds, so rest after chokehold should be considered [11]. However, all up-to-date findings did not state clearly, that properly applied chokeholds might be harmful or cause permanent damages to one's brain. On the other hand, some abilities, such as visual acuity is increased after choking [12], as well as acoustic sensitivity [13] which opens a new

area of research, based on that premises, that in yet-to-be-known extent, chokeholds may be applied as supplementary techniques for improving some abilities.

Judo practice in a sport dimension implicated four significant premises. First of all, chokeholds techniques (*shime waza*) are efficient means of attaining victory on the highest level of sport competition (Olympic, World or Continental Championship [14-17]). Secondly, efficient defence against this category of offensive actions of professional judo athletes is a proof, that human being can withstand for dozens of seconds against external forces (pressure for neck arteries), which may cause hypoxia of a brain. As for a third premise, there is lack of documented cases of permanent body injuries or deaths due to the application of *shime waza* techniques during judo events of the highest level of competition. Lastly, none of the Olympic combat sport besides judo allows this kind of means as a possibility of attaining victory. In contrary, epidemiology of drastic results of combat sports indicates kicks, breaking of a weapon's blade (in fencing), fall as the effect of throw, collision or intentional foul, such as a bite.

Therefore, we are allowed to make at least two assumptions: 1) chokehold techniques (*shime waza*) are safe and may be efficient by means of a soft self-defence in horizontal or vertical posture; 2) motor similarity of defence against chokehold during judo fighting in horizontal posture (contraction of breathing muscles alongside with neck muscles, tucking a chin to the chest, temporary holding a breath, contraction of leg muscles to release from opponent, whom is blocking by sitting or laying on judo athlete) to a method of contra measures against acceleration of +GZ in military aviation (maneuverer Q-M; see glossary) opens a field of innovative exploration of a hypoxia phenomenon on a edge of judo practice, health science and medicine.

Application of *shime waza* during judo competition is allowed since a junior category, which is according to an existing regulation from 13 years old, but national criteria of judo associations are able to make its regulations [18, 19]. There is none worldwide system of attaining a training degree. All of them are based on Kodokan techniques [19-23]. The recommended Kodokan educational criteria is an

obtaining at least 5 kyu degree by the participant. For example, Polish Judo Association (no age requirements): 5 kyu could be obtained after at least 50 judo lessons after attaining 6 kyu; *kata jujime* is required during an exam for 4 kyu (minimum 6 months from attaining 5 kyu); it is allowed during competition from 14 years old (age group U16) [18].

Review of available literature does not bring information about death as a result of choking during a training or judo competition. Exemption (not associated with a judo sport practice) is related to a police intervention of Technical Report TR-01-2007 Canadian Police Research Centre (CPRC) [24]. That is why basic criteria of inclusion for choking techniques (*shime waza*), so according to a terms of CPRC "carotid neck resistant techniques" for a training of self-defence art and professional training of on-demand a uniformed services is teaching a basic techniques of katsu (art of resuscitation used in judo [25]).

The studies aim to validate the quasi-apparatus *shime waza* test (QASWT) from two perspectives: the safety of judo practitioners and clinical applications.

MATERIAL AND METHODS

Participants

Twenty juvenile judo athletes with technical level 4 kyu (14 boys, 6 girls) in age between 10 to 12 years (10.7 ± 0.73), all 4 kyu were tested, training experience 3-4 years, training sessions twice a week, every 90 minutes. None of the participants had ever experienced an effect of judo chokeholds in the past. Inclusion criteria: positive medical examination; at least degree of 5 kyu; no health contraindicators during testing days; participation in at least 6 judo tournament for the kids (balanced win/lost ratio). Exclusion criteria: fear of being choked; medical contraindicators at the day of the test.

Studies accepted by the Bioethics Commission at the Regional Medical Chamber in Gdansk, Poland, Resolution KB – 17/17.

Five competent judges (professors of sport science or medical science, everyone also the judo trainers of master class) assessed authorial choking judo test (copyright: Oleksy M, Kalina RM, Jagiełło W) during validation procedure (the

rules of therapeutic gymnastic. A pilot is manoeuvring by willpower, preparing his body for tolerance of overload without forcing a specific body posture. In a moment, when he feel arising overload, he immediately contracts muscles in the following order: both lower limbs, abdominal muscles, breathing muscles alongside with muscles of the shoulder girdle and a neck. Contraction of a muscle goes alongside with temporary hold of breath. After that, he performs short, intensive breaths with the frequency of 60 per minute. This manoeuvre rises tolerance of overloads up to 3G [75].

Kyū – the series of grades that precede *dan* ranks. *Ikkyū* is the grade immediately below *shodan* [25].

Judogi – is the formal Japanese name for the traditional uniform used for judo practice and competition [81].

On-demand and uniformed public services – in Poland they consist of professional formations (police, armed forces, border guard, fire service). The characteristic features of these groups are as follows: orders, uniforms, being placed in barracks, restrictions on private and family life, a possibility to receive special perks from the state [78].

Personal safety – a justified sense of survival ability in various emergency situations, either of external nature (e.g. violence, aggression, unintended fall, fire, tsunami) or internal nature (e.g. stress, disease, fear) [38].

Lab testing – noun testing for something such as a biomechanical analysis that is carried out in a controlled private environment [79].



Figure 1. Confirmation of the judo expert qualification responsible for applying *kata-juji-jime* (single cross hold) during the experiment.

accuracy part). Moreover, Oleksy Michał (first author of this manuscript) finished a jutsu course under Henshi Terry Wingrove, dedicated to chokeholds techniques and specific methods of consciousness restoration (*katsu*) (Figure 1). As a judo expert (and also for everyday trainer studied judo athletes) perform all judo choking test during the experiment.

Design

Quasi-apparatus shime waza test (QASWT)

Author's QASWT was applied, and it is an original scientific achievement with application value. **Presumptions:** valid description of individual tolerance of choking in judo (threshold of suffocation) is a very difficult methodological challenge, even in simplified laboratory condition. The most significant interaction between biological and mental factors slips under control. They are sensitive to different modification of internal nature (regarding the personality of a man) and external (environmental influence). The condition of overcoming this difficult situation in a methodological sense is to correctly pick up judo athletes with the possible similar features, motor and mental experiences regarding judo

practice. The variance of the results of validation procedure of QASWT will be a reflection of factors described above for every person in a short period (7 days).

Assumptions: main factors of restricting repeatability of applied force and necessary time for achieving a physiological effect of choking are two factors: (1) experience of "being choked" for the first time (every following experience will accumulate adaptive effects, and because of the ethics we cannot expect from a human to do not undertake at least simplest manoeuvres like a pattern of pilot resisting to an overload of acceleration +GZ), (2) choked person in laboratory condition (excluding judo sport fight, where it is crucial to undertake active defence against chokehold techniques) can accumulate even contrary experiences (especially fear, curiosity, will of risk). In a case of applying QASWT among tested judo athletes, there could be worries about being ashamed due to the premature sign of surrender and/or informal competition of showing off with a high level of threshold of suffocation.

Table 1. Indicators quasi-apparatus *shime waza* test (QASWT).

Variable	Indicator	Indicator value (force range and time)					
choking force (contractual units)	$F_{SWprogress}$ $F_{SWcorrect}$	1	2	3	4	5	maintaining the force range „5”
time of choking tolerance (seconds)	$t_{TSWprogress}$	0.01	2.00	3.00	4.00	5.00	until the moment: “maitta” or “stop” command
	$t_{TSWcorrect}$	1.99	2.99	3.99	4.99	6.00	
verbal boundary, when judo expert increases force of choking: „hundred twenty ...”		two	three	for	five	six	“127, 128 ...”

Usage of QASWT algorithm: judo expert (experienced judo instructor) explains physiological basis of a chokehold by pressure on carotid artery (with hands or by use of collar of judogi) and simplest katsu technique in a case of fainting (rising legs of the person, who is lying on the back). Then he demonstrates and explains rules of application of kata-juji-jime (single cross hold) in vertical posture during QASWT (Figure 2). After that, he explains criteria of evaluation, demonstrates and explains a way of stopping chokehold during QASWT (give up: maitta) by tapping out and clarifies a role of assistant.

**Figure 2.** The way of performing the *kata-juji-jime* (single cross hold).

Evaluation criteria: Trial 1 (progressive choking): judo expert is applying kata-juji-jime and counts loudly (in Polish) “hundred twenty one” (while speaking, it is equivalent to period of 1 second) and uses the lowest choking force until saying “122” etc. (equivalent in English: “one one thousand; two one thousand; three one thousand, etc”) (Table 1). When he says “hundred twenty-five”, he starts using the highest choking force (“5” is the highest range). If judo athlete does not give up (not signalling “maitta”/tapping out), then judo expert continues the counting 126, 127 etc., while maintaining a force in a range of “5”. Surrendering (tapping out) by participant or symptoms of fainting (then the judo expert gives the “stop” command) ends the trial. Assistant starts stopwatch at the beginning of counting and stops it at the moment of surrendering (strength needed to surrender were necessary to verification in progressive version $F_{SWprogress}$). The difference in Trial 2 (after a dozen seconds break, and in case of fainting after five minutes from Trial 1) is in applying determined for each participant strength from the beginning ($F_{SWcorrect}$). **Indicators:** $t_{TSWprogress}$ and $t_{TSWcorrect}$ time of choking tolerance (in seconds with precision to 0.01); *Shime Waza Index* ($SWI_{progress}$ and $SWI_{correct}$ respectively) from 0 to 1 (it is determining ability of choking tolerance in proportion of $t_{TSWprogress}$ and $t_{TSWcorrect}$ to constant value of 6 seconds, as a safe threshold); $F_{SWprogress}$ and $F_{SWcorrect}$ choking force in a scale from 1 to 5 (contractual units).

If the judo athlete tolerates choking for more than 6 seconds, then the *Shime Waza Index* (progress or correct) should be written in the individual characteristic as “1+” (in brackets time in seconds). In group statistical calculations such results are expressed by the positive value of the variance coefficient of the choking time (the maximum SWI remains 1).

The accuracy criteria of QASWT(Delphi method)

Presumptions and assumptions formulated above were a subject of acceptance of neglect by 5 competent judges. Safety guarantee of being exposed to choking force in a scale from 1 to 5 (contractual units) for a participant of this experiment and maintain methodological criteria of repeatability is a unique qualification of judo expert and experience of an assistant.

The reliability criteria of QASWT (test-retest method)

The reliability test was determined by a test-retest method with an interval of 7 days. As a main criteria of repeatability of results in a similar laboratory conditions (temperature, humidity, intensity of illumination, design of a room, lack of noise and vibrations etc.) we took two statistical indicators: lack of difference in an mathematical means of assessed variables (similarity of variances) and value of correlation coefficient of tested pair of variables $r \geq 0.500$ [26, 27]. Accordingly, to those assumptions, we made following pairs of the indicator in relation to test-retest conditions for Trail

1: $F_{SWprogress}$, $t_{TSWprogress}$, $SWI_{progress}$ and for Trial 2: $F_{SWcorrect}$, $t_{TSWcorrect}$, $SWI_{correct}$

Independent form is verifying a zero hypothesis according to a formula of "test-retest" we analyse statistical indicators listed before as Trial 1 vs Trial 2 separately from an empirical data from stage test and stage retest. This methodological procedure sought to enhance synthesis of empirical argumentation (in the discussion section) by undertaken presumptions and assumptions (an aspect of test accuracy) along with the providing a reliability test.

In a purpose of determining a modification influence of different factors (stimuli) on a value of applied indicators, we assume arbitral, unified scale based on a limit of 100% (Table 2).

Statistical analysis

Estimation of empirical data included: arithmetic mean, standard deviation (\pm) and extreme values (min \div max). The significance of the differences between the two averages was tested using a *t-test for correlated samples*. The correlation coefficient between pairs of specified variables.

RESULTS

Stage test

During Trail 1, highest range ($F_{SWprogress}$ "5") of choking force dominates over rest (55% among 20 judo athletes). Two participants did not exceed a limit of 6 seconds (that is why the mean value of $SWI_{progress}$ is 0.99). Only for one person, judo expert establishes $F_{SWprogress}$ "2" (in contractual units). Usage of individual value of choking force ($F_{SWcorrect}$) in Trial 2 made in case of 15 judo athletes (75%) reduction of choking tolerance time. In set force range "4" everyone reduction of time of choking tolerance by 1.9 to 3.23 seconds ($p < 0.025$) and from 24% to 54% SWI ($p < 0.01$) – for the directional test (Table 3).

All there main groups of indicators computed for 20 participants are additionally correlated between Trial 1 and Trial 2. There is a clear linear correlation between $F_{SWprogress}$ and $F_{SWcorrect}$. Both time necessary for achieving "maiita" or "stop" command during Trial 2 (shorter by a mean of 1 second), as well as SWI (decreased by 13%) correlated respectively: 0.763 and 0.720 ($p < 0.01$). During Trial 2 there is clear tendency of reduction ($p < 0.01$) for both indicators (which are logically connected) informing mostly of physiological possibilities of choking tolerance (Table 4).

Stage retest

Most of the tendencies affirmed during stage test were confirmed by empirical data obtained from stage retest (Table 5). Only one participant

Table 2. Criteria unified scale of indicators based on a limit of 100%.

Indicator QASWT			Threshold value indicator as 100% and comments
name	unit	symbol	
choking force	contractual units (1 to 5)	F_{SW}	5
time of choking tolerance	seconds	t_{TSW}	10 clinical time limit of toleration of choking applied by judo expert [2, 4, 6-9]
Shime Waza Index	from 0 to 1	SWI	1

Table 3. Indicators quasi-apparatus *shime waza* test (QASWT) – distribution due to the choking force used by young judo athletes (n = 20) from subgroups (stage test).

Statistical indicators	Time of choking tolerance (seconds)		Shime Waza Index (from 0 to 1)		Choking force
	t _{TSWprogress}	t _{TSWcorrect}	SWI _{progress}	SWI _{correct}	F _{SWprogress} F _{SWcorrect}
	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1 & 2
	force range "2" (n = 1)				status of individual indicator changes
					5%
results	2.11	2.57	0.35	0.43	improvement (t: 0.46 s; SWI: 0.08)
differences	0.46		0.08		
	force range "3" (n = 4)				20%
mean & SD	3.62 ±0.1	3.57 ±0.40	0.61 ±0.05	0.60 ±0.06	one improvement (t: 0.38 s; SWI: 0.07)
min ÷ max	3.28 ÷ 3.93	2.98 ÷ 3.81	0.55 ÷ 0.66	0.23 ÷ 0.44	
differences	0.05		0.01		three reduction (t: 0.13 to 0.30 s; SWI: 0.03 to 0.07)
correlation	0.667		0.592		
	force range "4" (n = 4)				20%
mean & SD	4.37 ±0.23	2.24 ±0.57	0.73 ±0.04	0.37 ±0.10	everyone reduction (t: 1.9 to 3.23 s; SWI: 0.24 to 0.54)
min ÷ max	4.06 ÷ 4.63	1.4 ÷ 2.65	0.68 ÷ 0.77	0.23 ÷ 0.44	
differences	2.13^		0.36^^		
correlation	-0.832		-0.851		
	force range "5" (n = 11)				55%
mean & SD	7.09 ±1.55	5.85 ±2.01	0.99 ±0.03	0.85 ±0.18	three improvement (t: 0.24 to 1.75 s; SWI: 0.04 to 1+)
min ÷ max	5.53 ÷ 11.1	3.16 ÷ 9.25	0.92 ÷ 1	0.53 ÷ 1	
differences	1.24		0.13		eight reduction (t: 0.24 to 4.71 s; SWI: 0.07 to 0.47)
correlation	0.440		0.096		

directional test: ^p<0.025; ^^p<0.01

improve his tolerance (from a range "3" to the range "4") both in a Trial 1 (t_{progress} 4.91 seconds; SWI_{progress} 0.82) and Trial 2 (t_{progress} 5.59 seconds; SWI_{progress} 0.93). Increase difference (up to 1.46 second) time of choking tolerance between trial 1 and trail 2 could be explained by lowering both of indicators (Table 6).

The accuracy of the QASWT

All competent judges accepted presumptions and assumptions, structure and methodology of the QASWT application and evaluation criteria. The empirical dataset in Tables 3 to 6 in some manner confirms that QASWT is based on real presumptions and assumptions.

First author, judo expert in this intervention (Michael, 8 years of judo experience) set his maximum range of Fsw by choking from the beginning with maximum force the second author (Roman, 50 years of judo experience), who respond accordingly to methodological preset. After 12 second, Roman obtained a limit of choking tolerance (he resigned of the possibility of *maiita* reaction due to preset program). This experience stands a basis for a Michael to learn how to differentiate of a range of Fsw in a rhythm rate of a 1 second with loud counting of "121", "122"... to "126" (safe clinical limit, while in Polish each number spoken loudly corresponds with real 1 second period). By nodding ahead, Roman indicate, if he feels the

Table 4. Indicators quasi-apparatus *shime waza* test (QASWT) – distribution due to the choking force used by 20 young judo athletes (stage test)

Statistical indicators	Time of choking tolerance (seconds)		Shime Waza Index (from 0 to 1)		Choking force
	$t_{TSWprogress}$	$t_{TSWcorrect}$	SWI _{progress}	SWI _{correct}	$F_{SWprogress}$ $F_{SWcorrect}$
	Trial 1	Trial2	Trial 1	Trial2	Trial 1 & 2
mean & SD	5.60 ± 2.09	4.50 ± 2.17	0.83 ± 0.20	0.69 ± 0.25	4.25 ± 0.97
min ÷ max	2.11 ÷ 11.1	1.4 ÷ 9.25	0.35 ÷ 1	0.23 ÷ 1	2 ÷ 5
differences	1.10**		0.14		0
correlation	0.708**		0.665**		1.00

**p<0.01;

difference of stimuli and he stopped a watch each time Michael spoke 6. This period of learning how to differentiate Fsw researchers set after 7 days.

Reliability of the QASWT (test-retest)

Analysis of correlation of main indicators of QASWT accordingly to a principle of “test-retest” confirms the necessary reliability of this category of diagnostic tools. The conclusion is referring to a Trail 1 (Table 7) and Trial 2 (Table 8). Similarities of results (arithmetical mean of variances and correlation coefficient) is a proof that a period of a week did not bring adaptation changes. It means that this experience obtained during the first experiment (“stage test”) is not efficient modification stimuli. Therefore, there is expected that phenomena of an adequate force of influence on one’s body will cause changes (temporary or relatively permanent) in tolerance of choking, and it will be exposed by such diagnosis of QASWT.

Visualization of results of validation procedure according to criteria of unified scale on the set limit for 100% accumulated both aspects – accuracy and reliability of the QASWT (Figure 3). Applied force during Trial 2 ($F_{SWcorrect}$) by force set for each participant in Trial 1 ($F_{SWprogress}$) causes an individual physiological reaction (subjective) connected to an unknown stressor for participants. Therefore, its is the natural response of a body to shortening a time of choking tolerance during Trial 2 (in a physiological and psychological aspect) for this new stressor. The biggest difference is 4% (which is not statistically significant) is referring to a prolonged time of choking tolerance during Trial 1 in relation to “test-retest”.

DISCUSSION

Synthesis of results compiled in tables alongside with other observations during this experiment proves that QASWT meets all methodological criteria of such diagnostic tool for the purpose of its application in sport, physical education and health-related training [26-27, 28-35]. The main condition of effective application of this quasi-apparatus multidimensional test is cooperation of judo expert with an assistant. The most useful indicators are FSW (choking force) and SWIndex (*Shime Waza Index*).

Lower values of the correlation coefficient for the time of exposure to choking force are not surprising. In case of FSW in range of „2” is between 2.00 and 2.99 seconds, while the range of “5” is between 5.00 seconds for *maiita* or to a moment of fainting. The result of 5.00 (raw result), in the unified scale based on the pre-set limit of 100%, is 50%, while as a basis of computing SWIndex it is 0.83 (with a clinically safe limit of 6 seconds). When the result exceeds 6 seconds, then SWIndex in individual characteristic is recorded as 1+ (in brackets, raw result), in group calculations as “1”. However, precise measurement of time of choking has at least one more important meaning in a methodological sense. The possibility of correcting subjective sense of the force applied by judo expert and vice versa (time measured by an assistant). For example, when measurement of *maiita* effect is 3.01 to 3.09, it will be closer to a range “2” (limit at 2.99 seconds) when spoken by judo expert exposure to choking force in a formula of progressive choking (Trial 1), therefore wrongly classified. Measurement 3.1 seconds, in that case, should be corrected to a range “3” by an assistant. That is why there is the necessity of effective cooperation between judo expert and assistant.

Table 5. Indicators quasi-apparatus *shime waza* test (QASWT) – distribution due to the choking force used by young judo athletes (n = 20) from subgroups (stage retest).

Statistical indicators	Time of choking tolerance (seconds)		Shime Waza Index (from 0 to 1)		Choking force
	t _{progress}	t _{correct}	SWI _{progress}	SWI _{correct}	F _{SWprogress} F _{SWcorrect}
	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1 & 2
					status of individual indicator changes
	force range "2" (n = 1)				5%
results	2.99	2.84	0.50	0.47	reduction (t: 0.1 5s; SWI: 0.03)
differences	0.15		0.03		
	force range "3" (n = 3)				15%
mean & SD	3.85 ±0.24	3.19 ±0.50	0.65 ±0.04	0.53 ±0.08	one improvement (t: 0.01 s; SWI: 0.00)
min ÷ max	3.57 ÷ 3.99	2.63 ÷ 3.58	0.60 ÷ 0.67	0.44 ÷ 0.60	
differences	0.66		0.12		two reduction (t: 0.36 to 0.62 s; SWI: 0.11 to 0.23)
correlation	-0.671		-0.693		
	force range "4" (n = 5)				25%
mean & SD	4.44 ±0.47	3.01 ±1.77	0.74 ±0.08	0.50 ±0.29	two improvement (t: 0.01 to 0.11 s; SWI: 0.01 to 0.11)
min ÷ max	4 ÷ 4.99	1.5 ÷ 5.59	0.67 ÷ 0.83	0.25 ÷ 0.93	
differences	1.43		0.24		everyone reduction (t: 2.09 to 3.27 s; SWI: 0.34 to 0.54)
correlation	0.221		0.256		
	force range "5" (n = 11)				55%
mean & SD	7.55 ±1.75	5.56 ±2.14	0.98 ±0.05	0.83 ±0.21	two improvement (t: 0.24 to 4.73 s; SWI: 0.04 to 1+)
min ÷ max	5.06 ÷ 11.12	2.87 ÷ 10.51	0.84 ÷ 1	0.48 ÷ 1	
differences	1.99[^]		0.15		nine reduction (t: 0.11 to 5.75 s; SWI: 0.06 to 0.52)
correlation	-0.153		0.275		

directional test: [^]p<0.05

While using QASWT, expert's evaluation should not be underestimated in the process of constant observation of judo students in training and competition, when that evaluation is associated with results of laboratory measurements. By "laboratory conditions" we understand every application of QASWT or other quasi-apparatus or non-apparatus tests accordingly its methodological criteria. As a good example, there could be mentioned results of an observation made by Mosler [36, 37], who applied one quasi-apparatus and two-non apparatus test before, in the middle and after three sessions of judo health-related training. This recommendation is based on years of practice by two co-authors of this paper (Kalina and Jagiełło, first since 1973 [38,

39]) using multidimensional non-apparatus and quasi-apparatus test in sport, self-defence education and health-related training on practice and for scientific purposes [40-49].

Szopa et al. [27] are highlighting, that most of the test used for the purpose of measurements of motor effect is exposing relatively low coefficients of repeatability (0.5 to 0.8). Multidimensional QASWT although it relies on the physical (motor) impact on the body of a potential competitor during judo competitions or on the aggressor during self-defence, it does not qualify for the motoric test. However, it meets methodological criteria motor simulation [38, 39]. Therefore, pre-set criteria of repeatability on a value of $r \geq 0.500$

Table 6. Indicators quasi-apparatus *shime waza* test (QASWT) – distribution due to the choking force used by 20 young judo athletes (stage retest).

Statistical indicators	Time of choking tolerance (seconds)		Shime Waza Index (from 0 to 1)		Choking force
	$t_{TSWprogress}$	$t_{TSWcorrect}$	$SWI_{progress}$	$SWI_{correct}$	$\frac{F_{SWprogress}}{F_{SWcorrect}}$
	Trial 1	Trial2	Trial 1	Trial2	Trial 1 & 2
mean & SD	5.99 ±2.22	4.38 ±2.04	0.85 ±0.17	0.69 ±0.26	4.30 ±0.92
min ÷ max	2.99 ÷ 11.12	1.5 ÷ 10.51	0.50 ÷ 1	0.25 ÷ 1	2 ÷ 5
differences	1.61**		0.16**		0
correlation	0.445*		0.626**		1.000

*p<0.05; **p<0.01

should be seen as the optimal limit for this category of innovative diagnostic tools. The perspective of its application reach such categories as professional sport and sport for all, occupational health service (OHS) or control of substances hazardous to health (COSHH) [50], and also prophylactic and therapeutic agonology [39, 51, 52].

Kalina [38, 39] is clearly pointing out difficulties incorrect set of the border between multidimensional psychomotor test and motor simulation. QASWT belongs to the first category. There are precisely set criteria of application of QASWT in laboratory conditions. Therefore every step non-strict with the rules may have an impact on the result to a degree when secondary validation by other researchers could abominate empirical data presented in this paper. Comparison of the result of QASWT applied by different judo experts (or the same with another assistant) is limited, event while testing the same person in a short period or during the same session. The main reason for that phenomena is a different perception of choking

force for specific people. Even with tools of modern technology, there is impossible to construct a device generating a choking force with no errors regarding exposure to applied “choking force” (not to mention it is differencing on a stage of $F_{SWprogress}$). There are at least two reasons why such conclusion does not negate the existence of such tool.

Firstly, judo expert can set a maximal value of FSW in the testing day (daily disposition) and even confronting subjective differentiate the ranges of choking force in a rhythm of 1 second from “1” to “5” with help with the calibrated device (watch). Secondly, data of clinical effect of *shime waza* by exposure by FSW, which are obtained by personal measurement, could be referred to specific categories of patients. In medical literature, there is emphasised, that stimulating baroreceptors with low palpitation can provoke severe bradycardia or even stop the heart in some sensitive persons. It seems to be an adequate question, if medical doctors, who qualify for judo training (or generally for martial arts) seeks this kind of sensitivity

Table 7. Correlation of main indicators of QASWT accordingly to a principle of “test-retest” (indicators of the program “progress”).

Statistical indicators	Choking force (contractual units)		Time of choking tolerance (seconds)		Shime Waza Index (from 0 to 1)	
	$F_{SWprogress}$		$t_{TSWprogress}$		$SWI_{progress}$	
	test	retest	test	retest	test	retest
mean & SD	4.25 ±0.97	4.30 ±0.92	5.60 ±2.09	5.99 ±2.22	0.83 ±0.20	0.85 ±0.17
min ÷ max	2 ÷ 5	2 ÷ 5	2.11 ÷ 11.1	2.99 ÷ 11.12	0.35 ÷ 1	0.50 ÷ 1
differences	0.05		0.39		0.02	
correlation	0.973**		0.628**		0.910**	

**p<0.01

Table 8. Correlation of main indicators of QASWT accordingly to a principle of “test-retest” (indicators of the program “correct”).

Statistical indicators	Choking force (contractual units)		Time of choking tolerance (seconds)		Shime Waza Index (from 0 to 1)	
	$F_{SWcorrect}$		$t_{TSWcorrect}$		$SWI_{correct}$	
	test	retest	test	retest	test	retest
mean & SD	4.25 ± 0.97	4.30 ± 0.92	4.60 ± 2.13	4.58 ± 2.05	0.70 ± 0.25	0.72 ± 0.27
min ÷ max	2 ÷ 5	2 ÷ 5	1.4 ÷ 9.25	1.5 ÷ 9.51	0.23 ÷ 1	0.25 ÷ 1
differences	0.05		0.02		0.02	
correlation	0.973*		0.627*		0.726*	

**p<0.01

among candidates. In the context of this work and recommendation of *kata-jujii-jime* as chokeholds techniques in applied QASWT, personal safety is a much more important issue. Medical literature warns to do not palpate two carotid arteries at the same time. If there is no certainty, whether there are contraindicators for the participation of judo training (especially kids), for people prone to that phenomena, progressive choking (especially set of the limit of $F_{SWprogress}$) could serve as an efficient diagnostic tool.

During an experiment described in this paper, for most important expert observations we include hard to classify inclinations for couple of judo students clearly: it could be curiosity towards unknown experiences, determination to undertake a risk or impress to colleagues by making it to a limit of fainting (in our experiment their result range from 9.09 to 11.1 seconds). During the stage „test” one boy (Trial 1) and also one boy, but different (Trial 2). During stage „retest” one girl and two boys (Trial 1) and one boy (Trial 2) – each other person and not those of the stage „test”.

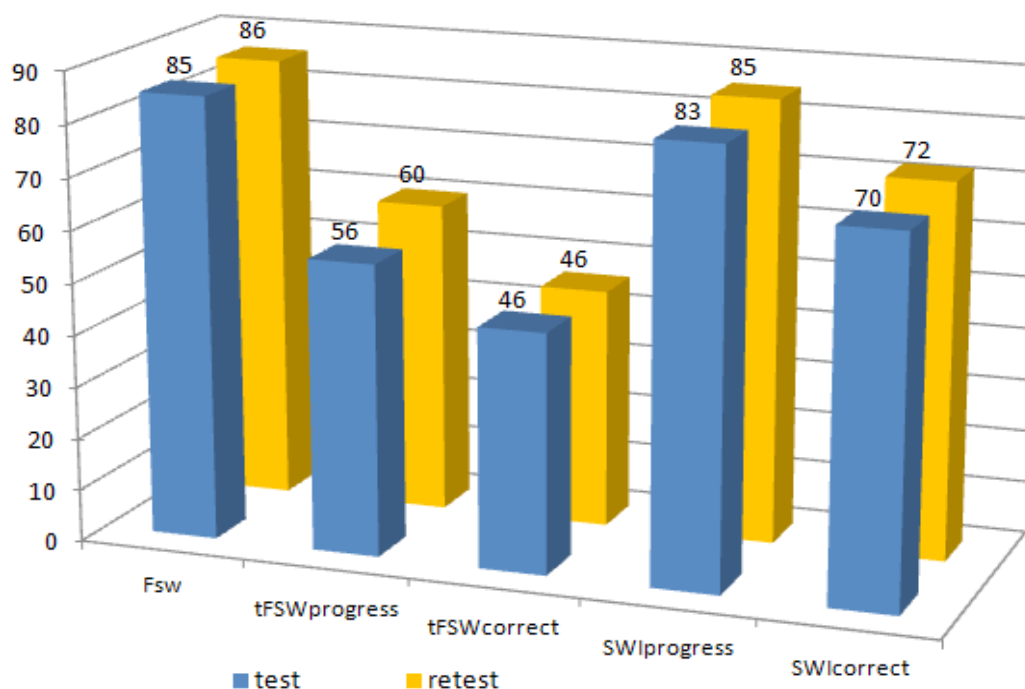


Figure 3. Values of the main QASWT indicators during the validation procedure according to the criterion of a uniform 100% contractual scale.

Argumentation, which was formed at the beginning of this section is valid. During a stage "retest", the girl reduced an exposure time by 2.97 s (from 9.09 in Trial 1), and the boys reduced by 4.73 from 10.12 and by 3.18 from 9.21 second. All of the did not undertake such risk during stage "test": respectively Trial 1 versus Trial 2; girl 6.88 vs 4.32s; boys 7.87 vs 4.16s and 6.53 vs 6.15s. Therefore, we could assume, that there could be 15% of such events in a training group and it should be seen as a norm. Exceeding this norm should be the basis of immediate medical examination of such person, who did not give a *maiita* signal (especially during exposure for an FSW below range "5") and was on the verge of fainting.

Specificity of possible applications of QASWT drives from the diagnostic paradigm of physical fitness or motor competences [31, 53] based on an analysis of recommended test from analytical type. This paradigm dominates in sport, in physical education, in physiotherapy in OHS and COSHH. For example, there is systematic monitoring of a motor characteristic of judo athletes from children and teenagers [54-57] to Olympic and world championships medallists [58-61]. Commonly used test, repeated by many researchers are: standing broad jump, sit-ups, pull-up (mostly male), bent arm hang (children and female), hand grip, 50 m dash, 4x10 m shuttle run, 1000 m run. Application of the same test in a year of judo training (starting from the youth) allows following changes, which are the effects of interaction between body development factors in the ontogenesis and specific training stimuli. Jagiełło [62] based such observations on 8 indicators of the International Committee on the Standardisation of Physical Fitness Test (ICSPFT). Wolska-Paczowska [63] reach for reliable evidence, that alongside with years of experience, as well as the age of female athletes the strength of correlations of general fitness with sports level is lowering. Among 14 young representatives on a regional level (13-15 years, average 13.9±1.1), from among 8 indicators of ICSPFT, only two correlations were not significant (hand grip and bend trunk). None of ICSPFT indicator did not correlate with sports level either for junior (16-18 years) female national team members (n = 15) nor 11 senior female national team members (25.2 ±3.7 years).

Among ICSPFT indicators there is lack of indicator, which may measure the ability of balance [64]. Therefore balance (static or dynamic) of judo athletes, different authors measure using

recommended tests [43, 65-69]. On the contrary, Drowatzky and Zuccato [70] stated a long time ago, that between selected six measures of static and dynamic balance the highest correlation coefficient equalled 0.31 (coefficient of determination was only 9.61%). Since the body balance disturbance tolerance skills (BBDTs) is a motor ability of utilitarian importance, the diagnosis should be based on the most reliable test. The higher a level of BBDTS, the lower risk of fall is. About the reliability of the "Rotational Test" proves a fact, which among athletes representing 16 different disciplines disturbances of balance are tolerated on the higher level than judo athletes people who practice: performance on horse-back, gymnastics, sports dance, basketball [43].

Far more difficulties bring a clear determining of utility dimension of QASWT on this stage of exploration of this phenomena. The most convincing application is a direct relationship between preparation for judo competition and self-defence. Application of QASWT methodology (alongside with teaching a basis of *katsu*) for the practice of preparation of law enforcement (police) could greatly reduce the number of voices against the application of shime waza during police interventions [24]. This point out the grave issue from one of the greatest social paradox of our times. Care about the personal safety of criminals dominates over social tolerance of neo gladiatorship [1]. By public applause of viewers who surround cages and rings as well as streaming through media for worldwide range, there is not the only volition of human dignity, but also extreme devastation of participant's somatic structure. Reports, who expose this pathology are ignored. For example, Buse [71] observed 624 matches (1993-2003). He determines that 182 (28.3 ±3.4%) were stopped because of head impact, 106 (16.5 ±2.9%) because of musculoskeletal stress, 91 (14.1 ±2.7%) because of neck choke, 83 (12.9 ±2.6%) because of miscellaneous trauma. Buse's conclusion leaves no delusion: blunt force to the head resulted in the highest proportion of stopping the match. Moreover, Buse states, that if chokeholds techniques are efficiently applied during brutal fights, its shift towards police self-defence training and intervention techniques is irrational.

Possible applications of QASWT and shime waza training in medicine remains an open topic. However, the concept of Kalina and Marcinik [72] regarding shime waza training in increasing

tolerance of acceleration of +Gz among military pilots was not applied, it does not change the fact, that this perspective was left without cognitive values and possible applications. The issue of including judo and other martial arts to train military pilots did not limit itself to increasing tolerance of +Gz accelerations. Dynamic of technological progress and arising challenges for civilisations (terrorism, brutal interpersonal relations, the crisis of freedom etc.) leaves this problem on the verge of medicine and aviation psychology, sports science, praxeology and other specific science disciplines [73, 74]. We see the interdisciplinary approach for the application of QASWT and *shime waza* training on the edge of health prophylaxis and efficient actions, when a human is placed in a difficult external situation (necessity of countering physical violence or aggression) or internal (enhancing a treatment or therapy).

CONCLUSIONS

The applied methodology of QASWT fulfils medical and ethical standards of safety for people who are using *shime waza* during judo and self-defence training. This innovative tool of prophylaxis and therapy based on elements of martial arts (e.g. fear reduction, stress-resistant training, increasing surviving abilities), when applied reasonably, may have positive effects in treatment and therapy of some disorders. This application requires the interdisciplinary cooperation of specialists in a field of medicine, physiotherapy, agonology (with judo qualifications), psychology and medical biotechnology.

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