ANALYSIS OF SEBT TEST INDICATORS OF MALE REPRESENTATIVES OF KYOKUSHINKAI KARATE AND BOXING IN A SIX-MONTH MEASUREMENT INTERVAL

АНАЛІЗ ПОКАЗНИКІВ ТЕСТУ SEBT У ПРЕДСТАВНИКІВ ЧОЛОВІЧОЇ СТАТІ З КІОКУШИНКАЙ КАРАТЕ ТА БОКСУ В ПІВРІЧНОМУ ІНТЕРВАЛІ ВИМІРЮВАНЬ

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Abstracts

Purpose – to compare SEBT indicators, obtained with a six-month interval of measurements in male representatives from Kyokushinkai karate and boxing. **Materials and methods.** The results of the study were obtained at the Ivan Bobersky Lviv State University of Physical Culture in May and November 2023. Physically healthy, uninjured male qualified boxers (n=8) and Kyokushinkai karate athletes (n=10) aged 18–22 years, who are University students, took part in the collection of experimental material. **Research methods:** the analysis of literary sources and Internet; measurement of Star Excursion Balance Test indicators; methods of mathematical statistics. **Research results.** The results confirmed the overall reproducibility of the SEBT test. Differences in SEBT positions in both types of martial arts were unreliable in the absolute majority of indicators, except for position 7 among boxers and position 6 among representatives of Kyokushinkai karate. The indicated individual positions had a significantly better result after six months of training athletes in both types of martial arts after the first measurement. SEBT indicators demonstrate the asymmetric influence of the left-sided combat stance on the motor balance for all boxers, regardless of their training scheme or training program: left leg tend to deteriorate in positions 2, 3, 4, 5, 6, 7, and 8 (position 1 remained unchanged); right pushing leg improved in positions 4, 6, and 7, and slightly decreased in positions 1, 2, 3, and 5 (position 8 remained unchanged); left arm experienced an improvement trend in almost all positions (from 2 to 8); right arm show trends for improvement in positions 2, 3, 4, and 5, and some deterioration in positions 1, 6, 7 and 8. Kyokushinkai karate athletes showed: a trend toward improvement in most of the left leg SEBT measures; most of the SEBT positions of the left arm tend to deteriorate; SEBT indicators of the right leg improved in the "lower" positions 3, 4, and 5, but positions 6 and 8 are slightly worsened; most of the right arm positions during the half-year training period tend to deteriorate. **Conclusion.** The SEBT technique has high reliability and reproducibility of results over time. The results of SEBT in long time intervals (half a year, for example) can reflect the influence of a certain sport on the amplitude of movements and dynamic balance of athletes.

Key words: Star Excursion Balance Test, boxing, Kyokushinkai karate, martial arts.

Мета – порівняти показники SEBT, отримані із шестимісячним інтервалом вимірювань, у представників чоловічої статі з Кіокушинкай карате та боксу. **Матеріали та методи.** Результати дослідження отримані у Львівському державному університеті фізичної культури імені Івана Боберського у травні та листопаді 2023 року. Фізично здорові, не травмовані кваліфіковані боксери (n=8) та спортсмени з Кіокушинкай карате (n=10) віком 18–22 роки, які є студентами університету, брали участь у зборі експериментального матеріалу. **Методи дослідження:** аналіз літературних джерел та Інтернету; вимірювання показників Star Excursion Balance Test; методи математичної статистики. **Результати досліджень.** Результати підтвердили загальну відтворюваність тесту SEBT. Відмін-

ності показників позицій SEBT в обох видах одноборств були недостовірними за абсолютною їх більшістю, за винятком позиції 7 у боксерів та позиції 6 у представників карате Кіокушинкай. Зазначені окремі позиції мали достовірно кращий результат через півроку підготовки спортсменів в обох видах одноборств після першого вимірювання. Показники SEBT демонструють асиметричний вплив лівосторонньої бойової стійки на руховий баланс у всіх боксерів, незалежно від схеми тренувань та програми підготовки: ліва нога має тенденцію до погіршення в позиціях 2, 3, 4, 5, 6, 7 та 8 (позиція 1 залишилася без змін); права поштовхова нога покращилася в позиціях 4, 6, 7 і дещо погіршилася в позиціях 1, 2, 3 і 5 (позиція 8 залишилася без змін); ліва рука зазнала тенденції до покращення майже в усіх положеннях (від 2 до 8); у правої руки спостерігаються тенденції до покращення в положеннях 2, 3, 4 і 5 та деяке погіршення в положеннях 1, 6, 7 і 8. Спортсмени з Кіокушинкай карате продемонстрували: тенденцію до покращення більшості показників SEBT для лівої ноги; більшість позицій SEBT лівої руки мають тенденцію до погіршення; показники SEBT правої ноги покращилися в «нижніх» позиціях 3, 4, 5, але дещо погіршилися позиції 6 і 8; більшість положень правої руки впродовж піврічного періоду підготовки мають тенденцію до погіршення. **Висновок.** Методика SEBT має високу надійність і відтворюваність результатів у часі. Результати SEBT у тривалих інтервалах часу (наприклад, півроку) можуть відображати вплив певного виду спорту на амплітуду рухів і динамічну рівновагу спортсменів.

Ключові слова: Star Excursion Balance Test, бокс, Кіокушинкай карате, бойові мистецтва.

Introduction. For more than two decades, scientists from many countries have used the Star Excursion Balance Test method in their research, which is aimed at studying the dynamic balance of a person. The Star Excursion Balance Test (SEBT) is a dynamic test that requires strength, flexibility, and proprioception and has been used to qualitatively assess physical performance, detect chronic ankle instability, and identify athletes at increased risk of musculoskeletal injury (upper and lower extremities). This method is widely used, mainly in medical and rehabilitation research, and is considered reliable enough, as evidenced by the results of studies by several scientists [12; 16; 18; 20]. In addition, researchers Robinson & Gribble [23] studied the kinematic performance indicators of the Star Excursion Balance Test (SEBT).

One of the most recent studies was conducted by scientists from China [26], which demonstrated the validity of the SEBT method as a tool for assessing the dynamic balance of the upper limb girdle, their neuromuscular control and proprioceptive properties. Scientists consider this test to be reliable and reproducible for assessing dynamic balance. There is a simplified, modified Y-test along with the classic, eight-ray variant of SEBT testing [2]. An interesting study was conducted by Japanese scientists Endo & Miura [5], who determined the relationship between distance measurements in the SEBT test and posture and leg muscle strength in 9 students. At the same time, the force of flexion and extension of the lower limbs in the hip and knee joints was measured using an isokinetic platform. Testing revealed that the associated factors differed for dominant and non-dominant legs.

Several works have been devoted to the study of lower extremity injuries in people of different ages, which were carried out using the SEBT method [3; 7; 11], which are aimed at studying chronic instability of the ankle joint. So, the goal in their work, researchers from the USA [3] set out to determine whether the kinematics of the lower limbs in 20 people with ankle instability (CAI) differ in the anteromedial, medial, and posteromedial positions during SEBT testing, compared to 20 healthy individuals. As a result, the researchers did not find any differences when performing exercises to reach the maximum distance in all positions while maintaining balance. Other experts [1] in their research, at the same time as measuring SEBT, determined the electromyographic activity of the thigh and trunk muscles in 22 healthy adults. The researchers found that the activation of the trunk and thigh muscles depended on the position of the SEBT. This information can be used during the rehabilitation of the thigh and trunk muscles.

Scientists have conducted several studies on injuries of the lower extremities and asymmetry in representatives of game sports – basketball, handball, and football [6; 21; 24; 25]. The relationship between the age of young teenage

soccer players and the index of limb symmetry and the standards of the modified mSEBT test was also investigated [19].

French scientists [4] used a modified Y-Star Excursion Balance Test. According to the results of the analysis of the study on 11 handball players for 25 weeks, it was found that a week before the injury there was a decrease in the composite result during repeated measurements of the mSEBT. According to scientists, a difference of 4 centimeters on the front-back axis of the test is not a significant indicator of the risk of injury.

The aim of the research by E. Margnes & T. Paillard [17] was to study the mechanisms of imbalance and the mechanisms of postural regulation in judokas in order to draw some ideas for training. The role of the grip (kumi-kata) is fundamental for the judoka, since it provides aesthetic information about his own movements and positions, as well as about the movements and positions of his opponent, it also allows to control, attack and defend the forces applied against the opponent, as well as to control the judoka's own balance. The researchers did not use the SEBT technique here.

Postural and neuromuscular parameters were studied [10] in healthy prepubertal male taekwondo practitioners (n=12) compared to controls (n=17). Taekwondo practitioners performed better than non-taekwondo practitioners who were active on the SEBT. The authors hypothesized that taekwondo practice would stimulate the sensory input and motor output of the postural system, which would improve its efficiency. In addition, the dynamic nature of taekwondo would develop lower limb muscle strength. The authors concluded that in a sample of healthy prepubertal males, taekwondo appears to improve postural and neuromuscular functions, but further studies are needed.

A group of other researchers [22] studied the features of anthropometric indicators in elite representatives of various types of martial arts – kickboxing, karate and taekwondo. The study design involved the determination of 22 anthropometric indicators. The analysis of elite bodybuilding and combat sports athletes confirmed the presence of features due to the specifics of martial arts. The indices of the ratio of limb segments reflect the features of the martial arts technique. This should also be assessed as a positive prognostic factor. The validity of using special indices when monitoring the functional state of athletes is confirmed, especially illustrating the ratio of limb segments.

A group of scientists [8] studied bilateral asymmetries of lower limb strength and dynamic balance in child athletes: 28 fencers (19 boys and 9 girls) and 28 taekwondo athletes (19 boys and 9 girls) were examined for single-leg hops and SEBT performance. This study suggests that child athletes in both laterally dominant and non-laterally dominant sports showed interlimb asymmetries in leg strength and dynamic balance. According to these scientists, gender should be an important factor when assessing bilateral differences in leg strength and dynamic balance in child athletes. In another study, the same authors [9] examined single-leg hop performance, Star Excursion Balance Test (SEBT), and muscle flexibility (hamstring and gastrocnemius) in 13 elite male young taekwondo athletes under both rest and fatigue conditions to examine interlimb asymmetry. The results suggest that fatigue significantly affects interlimb asymmetry in hop performance and dynamic balance in young athletes, while the variation in interlimb asymmetry after fatigue may differ across tests. For injury prevention purposes, practitioners should consider assessing interlimb asymmetry in children under both rest and fatigue conditions and consider the fatigue response of each leg in functional testing.

We conducted research using the SEBT method of Yoshinkan aikido, boxing, and Kyokushin karate athletes [15]. The results of the analysis of the test indicators revealed significant differences in the representatives of the above-mentioned martial arts. The application of the SEBT technique made it possible to compare:

– Indicators in eight positions between the left and right sides of the athletes' body separately in each type of martial arts;

– Indicators in eight positions between the left and right sides of the body of athletes of various types of martial arts.

In another study of ours using the SEBT technique [14] it was established that its indicators may be related to the level of qualification of athletes: in representatives of male Kyokushin karate and level 1 DAN, the amplitude of SEBT indicators turned out to be greater than that of Kyokushin karate fighters with level 1 KYU.

We also compared male athletes in WKF karate, fencing, and Hopak hand-to-hand combat [13]. The analysis of the results of the study revealed better SEBT indicators in fencers, compared to representatives of the karate version of the WKF and Hopak hand-to-hand combat. This is especially observed in SEBT indicators of the lower extremities. This fact is explained by the specificity of many years of training in fencing, where the result depends precisely on the development of the athletes' lower limbs. At the same time, SEBT indicators of the upper limbs in fencers do not have the same bright manifestation. Karate fighters have a slight advantage in the SEBT indicators of the belt of the upper and lower limbs, compared to the SEBT indicators of Hopak hand-to-hand combatants. Given the above, we reasonably assume that long-term participation in a certain type of martial arts has an impact on anthropometric indicators and SEBT.

Therefore, the dynamic balance and amplitude of movements of the representatives of different martial arts according to the Star Excursion Balance Test (SEBT) method requires further study. In our opinion, along with the diagnostic orientation of this technique, it is possible to use it further to create certain models by sports, improve the training process of different athletes by borrowing techniques from other sports to develop the necessary qualities, as well as create a testing database athletes for further analysis and correction of training.

The purpose of this study is to compare SEBT indicators separately, which were obtained with a six-month interval of measurements in male representatives from Kyokushinkai karate and boxing.

Materials and methods. The results of the study were obtained at the Ivan Bobersky Lviv State University of Physical Culture at the Department of Fencing, Boxing and National Martial Arts in May and November 2023. Physically healthy, uninjured male qualified boxers and Kyokushinkai karate athletes aged 18–22 years, who are University students, took part in the collection of experimental material. It should be noted that all athletes were divided into two groups based on the type of martial arts they engage in, and not on the basis of belonging to a specific scheme or a specific training program. Each of them had their own trainer for the type of martial arts. For statistical processing and analysis, the SEBT results of only those individuals who were tested twice with an interval of six months were selected. In addition, a necessary condition was also the presence of the same movement asymmetry in the group of athletes – right-sided or left-sided. Thus, the results of 8 right-handed boxers and 10 representatives of Kyokushinkai karate, who were also right-handed, were selected for comparison.

Research methods used in the study:

– The analysis of literary sources and materials from the Internet on the topic of the study was used as a standard method of summarizing information on the topic of the work;

– Measurement of Star Excursion Balance Test (SEBT) indicators;

– Methods of mathematical statistics using the applied official program Statistica-7.

The measurement of SEBT indicators was carried out on a special canvas, manufactured similarly to the products of the company Movement Assessment Technologies Pty Ltd (www.mataassessment.com, www.mataassessment.com/megamat), which allowed to obtain the SEBT indicators of the upper and lower extremities in representatives of the above-mentioned sports in eight provisions (Figure 1).

Each of the eight directions (or positions) of the Star Excursion Balance Test (SEBT) has a generally accepted international name (here and in the tables below): 1 – anterior, 2 – anterolateral, 3 – lateral, 4 – posterolateral, 5 – posterior, 6 – posteromedial, 7 – medial, 8 – anteromedial.

SEBT testing itself was carried out in compliance with the following requirements:

– the athlete must be dressed in light clothes and barefoot. After that, he stands in the center of the canvas and waits for further instructions;

– using the right leg as the leg that reaches the maximum point in the given direction and the left leg for balance (as the supporting leg), the athlete must complete the circuit in a clockwise direction (8 directions). Hands should be pressed to the hips or fixed behind the back;

– balancing on the right leg, the athlete must perform the same pattern (8 directions) in a counter-clockwise direction;

– with hands firmly planted on the hips or behind the back, the athlete should be instructed to reach the target with one leg as far as possible and lightly touch the line before returning to the starting vertical position;

Fig. 1. Fragment of SEBT indicators measurement

– with a pencil (in our case, we fixed it with chips), the test administrator marks the place where the athlete touched the line with his big toe. The results are recorded in the protocol with an accuracy of 0.5 cm;

– when passing the test of the upper limbs, the athlete must take the following position: the supporting arm is strictly vertical, the back is straight, and the legs are shoulder-width apart. The athlete should be instructed on how to reach the target with one hand as far as possible and lightly touch the line before returning to the starting position;

– with a pencil (in our case, we fixed it with chips), the test administrator marks the place where the athlete touched the line with the middle finger of the hand. The results are recorded in the protocol with an accuracy of 0.5 cm;

– the test for each leg (arm) is repeated three times for all directions of reach before changing the foot (arm), according to the following scheme: left leg – right leg – left arm – right arm;

– after the athlete has made 3 successful passes with each leg (arm) in all directions, he is allowed to leave the test area;

– the test administrator records data from each attempt to calculate the athlete's post-test SEBT score.

In this work, as in previous studies, we calculated indicators of the arithmetic mean value (Mean), and standard deviation of the arithmetic mean (Std. Dev.), and also used the Wilcoxon Matched Pairs Test statistical method, since SEBT indicators obtained in small groups were compared on dependent samples – that is, the results of the same individuals were compared.

Research results. The SEBT indicators of two measurements with a half-year interval of a group of boxers are presented in Table 1. According to the obtained data (see Table 1), reliable differences between the SEBT indicators of a specific group of boxers were established only in position 7 of their right supporting leg, which is the impetus for performing the accented blow by a right-handed boxer. This fact indicates the improvement of the SEBT indicators of this position in this group of boxers during the six-month training period. Position 7 is one of the most difficult in the SEBT test, and requires large amplitude in the musculoskeletal system of the pelvis and lower limbs, as well as balance when twisting the trunk vertically. The absence of reliable differences in the absolute majority of indicators of SEBT positions during the six-month training period only confirms the repeatability of the results of this test over time, which means its high reliability. During the half-year training period between the two SEBT measurements, there were some unreliable shifts (tendencies) in most positions of the upper and lower limbs of a specific group of boxers (Table 1):

Table 1

Star Excursion Balance Test indicators in boxing representatives (n = 8) in 1 and 2 measurements with a six-month interval, cm

Limb	Position SEBT	Measurement 1		Measurement 2		Wilcoxon Matched Pairs Test (Marked tests are significant at p < 0,05)		
		Mean	Std.Dev.	Mean	Std.Dev.	T	Z	p-level
Left leg	1	73.67	6.161	73.86	8.231	17.5	0.070	0.944
	2	**77.60**	5.346	74.52	9.276	10.5	1.050	0.293
	3	**75.41**	6.303	74.33	9.668	15.0	0.420	0.674
	4	**80.83**	8.279	76.05	12.259	7.0	1.540	0.123
	5	**80.08**	10.809	76.71	14.046	8.0	1.400	0.161
	6	**75.57**	12.912	74.96	15.891	15.0	0.420	0.674
	7	**69.33**	12.819	68.96	13.589	17.0	0.140	0.888
	8	**71.55**	3.643	70.07	7.669	16.0	0.280	0.779
Right leg	1	**74.81**	5.761	73.83	7.989	13.0	0.169	0.865
	2	**77.61**	5.071	76.23	7.657	14.5	0.490	0.624
	3	**76.63**	6.276	75.92	10.476	16.5	0.210	0.833
	4	78.57	12.768	**80.87**	12.346	17.0	0.140	0.888
	5	**82.12**	12.415	79.45	10.402	8.5	0.929	0.352
	6	76.41	13.676	**77.78**	10.948	15.0	0.420	0.674
	7	68.67	11.011	**73.95**	9.054	**0.0**	**2.520**	**0.012**
	8	69.42	6.088	69.87	8.113	11,0	0.507	0.612
Left arm	1	69.50	8.461	69.26	8.214	14,0	0.000	1.000
	2	75.42	6.887	**77.52**	8.065	10.0	0.676	0.498
	3	77.96	8.587	**85.28**	6.824	5.0	1.521	0.128
	4	90.53	13.561	**93.28**	10.031	12.0	0.338	0.735
	5	86.75	19.206	**88.91**	14.931	16.0	0.280	0.779
	6	71.86	13.120	**73.27**	10.259	13.0	0.700	0.483
	7	55.60	5.594	**58.25**	6.973	9.0	1.260	0.207
	8	62.52	8.202	**65.12**	9.955	10.0	0.676	0.498
Right arm	1	**69.57**	8.025	68.01	10.760	10.5	0.591	0.554
	2	74.12	9.057	**76.68**	8.423	9.0	0.845	0.398
	3	84.82	12.861	**86.70**	8.237	12.0	0.338	0.735
	4	91.75	24.364	**97.28**	9.155	10.0	0.676	0.498
	5	89.46	27.667	**91.20**	16.257	17.5	0.070	0.944
	6	**76.20**	16.983	73.41	10.627	13.0	0.700	0.483
	7	**60.50**	15.607	55.62	8.830	9.0	1.260	0.207
	8	**62.21**	8.664	61.50	9.940	10.0	1.120	0.262

– SEBT indicators of the left leg (located in front in the combat stance) tend to deteriorate in positions 2, 3, 4, 5, 6, 7, and 8 (position 1 remained unchanged);

– SEBT indicators of the right pushing leg improved in positions 4, 6, and 7, and slightly decreased in positions 1, 2, 3, and 5 (position 8 remained unchanged);

– SEBT indicators of the left arm (located in front of the fighting stance), which performs many functions – from defences and feints – to punches, experienced an improvement trend in almost all positions (from 2 to 8). This means that during six months of training, this group of boxers experienced quite qualitative changes in the amplitude of left-hand movements;

– SEBT indicators of the right arm (which is used to attack with an accented blow) show trends for improvement in positions 2, 3, 4, and 5, and some deterioration in positions 1, 6, 7 and 8.

The SEBT indicators of two measurements with a six-month interval in a certain group of Kyokushinkai karate representatives are shown in the table were installed only in position 6 of

the left leg. This SEBT position is also one of the most difficult when performing the test, requiring large amplitude in the musculoskeletal system of the pelvis and lower limbs, as well as balance when turning the trunk vertically. The remaining SEBT positions of Kyokushinkai karate representatives during the six-month training interval also have no significant differences, which indicate the repeatability and reliability of the SEBT test. It is worth noting that the trends of changes that occurred in the indicators of the SEBT positions of this group of athletes, as well as in boxers, have their characteristics (Table 2):

– Indicators of SEBT of the left leg tend to improve in positions 2, 3, 4, 5, 6, and 7 (position 1 remained unchanged, and position 8 slightly worsened);

– SEBT indicators of the right leg improved in positions 3, 4, 5, and 7 and slightly decreased in positions 6, and 8 (positions 1, and 2 remained unchanged);

– SEBT indicators of the left arm tend to worsen in positions 1, 2, 5, 6, 7, 8. Improvement of SEBT indicators occurred only in positions 3, 4;

– Right-arm SEBT indicators show worsening trends in positions 1, 2, 5, 6, 7, 8 and some improvement in position 3. Position 4 indicators remain unchanged.

Discussion. No information was found in the world's scientific literature regarding the use of the SEBT technique in such a direction of research, which is presented in this publication. We used this method for the first time in the sports and pedagogical direction, and not for sports medicine and rehabilitation [13; 14; 15]. The comparison of SEBT indicators in qualified boxers and representatives of Kyokushinkai karate with a measurement interval of six months confirmed the concept of the reproducibility of the SEBT test and its reliability. If you carefully review and compare the SEBT positions of the first and second dimensions in pairs (Tables 1 and 2), the proportionality of the indicators is noticeable to the naked eye. The reliability of the SEBT test is also mentioned by several authors presented in the Introduction of this publication [12; 16; 18; 20; 26].

The results of this study confirmed the overall reproducibility of the SEBT test. Differences in SEBT position indicators in groups from both types of martial arts were unreliable in the absolute majority of indicators, except for position 7 among boxers and position 6 among representatives of Kyokushinkai karate. The indicated individual positions had a significantly better result after six months of training athletes in both types of martial arts after the first measurement.

A comparison of the SEBT results of both measurements (May and November 2023) for both boxing and Kyokushinkai karate in these groups of athletes allowed us to identify certain features for each type of combat separately.

Representatives of boxing are characterized by bright trends for improvement in all indicators of SEBT of the left arm located in front of it in the fighting stance. This supports the concept that the front hand of boxers is multi-functional. On the contrary, the SEBT indicators of the left leg, which is located in front of the combat stance, suffered a tendency to deteriorate in all directions. It should be noted that this leg in a boxer's stance during a duel plays the role of a stopper and prevents the boxer from falling forward during striking movements – that is, the development of balancing on it is not provided for by the features of the boxer's stance. The fact obtained by the results of SEBT can be attributed to the shortcomings of the training of all boxers in this group. Regarding the SEBT results of the right leg in the boxers, there was an improvement in the indicators of the "hard" medial positions 7 and 6, as well as the lateral position 4. There was a slight decrease of 1 cm in the lateral positions of the SEBT of the right leg. With the SEBT indicators of the right arm in boxers, the trend was just the opposite – the improvement in the indicators of the lateral positions was accompanied by the deterioration of the indicators of the medial positions of the SEBT. That is, all the above-mentioned changes in boxers according to SEBT indicators demonstrate the asymmetric influence of the left-sided combat stance on the motor balance of all members of this group, regardless of the training scheme or training program of an individual trainer.

Table 2

Star Excursion Balance Test indicators in representatives of Kyokushinkai karate (n = 10) in 1 and 2 measurements at six-monthly intervals, cm

Limb	Position SEBT	Measurement 1		Measurement 2		Wilcoxon Matched Pairs Test (Marked tests are significant at p < 0,05)		
		Mean	Std.Dev.	Mean	Std.Dev.	T	Z	p-level
Left leg	1	80.46	7.937	80.23	8.522	27.0	0.050	0.959
	2	81.70	6.979	**82.67**	7.757	24.0	0.356	0.721
	3	79.77	8.064	**80.01**	12.126	27.0	0.050	0.959
	4	84.67	10.807	**85.41**	15.064	21.0	0.177	0.858
	5	80.32	12.913	**86.06**	14.220	17.5	1.019	0.308
	6	77.00	11.619	**83.05**	12.825	**7.0**	**2.089**	**0.036**
	7	64.77	13.681	**70.26**	13.062	9.0	1.599	0.109
	8	**76.37**	8.972	73.21	9.161	11.0	1.681	0.092
Right leg	1	79.35	8.228	79.09	8.584	26.0	0.152	0.878
	2	80.12	8.202	80.51	8.439	21.0	0.662	0.507
	3	78.33	9.551	**81.79**	12.107	18.5	0.917	0.358
	4	83.92	11.877	**88.95**	13.422	12.0	1.579	0.114
	5	84.53	12.194	**87.27**	11.889	18.0	0.968	0.332
	6	**78.70**	13.686	74.27	27.491	25.0	0.254	0.798
	7	66.59	15.595	**67.04**	13,383	27.0	0.050	0.959
	8	**72.93**	7.052	70,06	9.830	11.0	1.362	0.173
Left arm	1	**77.44**	9.338	75.41	5.954	22.0	0.560	0.575
	2	**83.11**	5.841	81.83	4.363	23.0	0.458	0.646
	3	88.96	6,768	**91.20**	8.697	17.0	0.651	0.514
	4	98.16	13.173	**100.40**	18.558	23.5	0.407	0.683
	5	**93.57**	16.573	92.36	19.064	21,0	0.177	0.858
	6	**80.85**	16.617	71.84	14.117	19,0	0.866	0.386
	7	**58.90**	8.055	54.17	7.304	11.0	1.362	0.173
	8	**67.03**	6.335	64.16	8.308	18.0	0.968	0.332
Right arm	1	**77.74**	7.944	74.59	8.961	21.0	0.662	0.507
	2	**83.51**	7.289	80.94	7.368	18.0	0.968	0.332
	3	89.67	7.005	**91.72**	6.742	26.0	0.152	0.878
	4	98.83	16.462	98.84	16.160	24.5	0.305	0.759
	5	**94.03**	17.630	89.97	18.257	23.0	0.458	0.646
	6	**75.93**	13.371	74.07	17.088	25.0	0.254	0.798
	7	**55.90**	5.136	54.78	7.533	22.5	0.509	0.610
	8	**67.89**	6.900	65.09	9.354	17.0	1.070	0.284

Representatives of Kyokushinkai karate during the six months of training in their sport are also characterized by certain dynamic trends. In contrast to the boxers, the Kyokushinkai karate showed a trend toward improvement in most of the left leg SEBT measures, and position 6 also has such improvement as reliability. Most of the SEBT positions of the left arm, mainly medial, in contrast to the indicators of boxers, tend to deteriorate in this group of karateka. Only the 3rd and 4th lateral positions tended to improve. SEBT indicators of the right leg of Kyokushinkai karateka improved in the "lower" lateral positions 3, 4, and 5. Medial positions 6 and 8 of the right leg of the karateka slightly worsened. Most of the SEBT positions of the right arm of Kyokushinkai karatekas during the half-year training period tend to deteriorate.

Conclusion. Summarizing the analysis of the above SEBT results for representatives of boxing and Kyokushinkai karate, the following conclusion can be made:

1. The SEBT technique has high reliability and reproducibility of results over time.

2. The results of SEBT in long time intervals (half a year, for example) can reflect the influence of a certain sport on the amplitude of movements and dynamic balance of athletes.

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