ORIGINAL ARTICLE

The issue of early specialization in karate: the same pool of katas in all top-level WKF competition age categories

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A Study Design
B Data Collection
C Statistical Analysis
D Manuscript Preparation
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Abstract

Background and Study Aim: The issue of early specialization occurs in many sports. Since it has been announced that karate will make its first appearance at the Olympic Games in 2020, number of karate competitors especially in youth age categories keeps rising. Considering children and youth should be protected from the risks of the early specialization. The aim of the study is the knowledge whether karatekas in individual age groups compete with the same pool of *katas* and whether there are any differences in performance scoring.

Material and Methods: To compare the *kata* sport performance in individual age categories we chose four top-level WKF karate competitions (Youth League and Karate A Series). The sample consisted of 1,348 athletes (551 seniors, 241 juniors, 327 cadets and 229 young cadets).

Results: Out of the overall number of 102 official *katas* in the WKF list there was performed 37 *katas* (36%). There was no significant difference among age categories in the choice of *kata* χ^2 (27, n = 1,956) = 24.50, p = 0.60. We determined significant differences in technical, athletic and total score (p<0.01), however there was only small or almost medium effect.

Conclusions: To prevent early specialisation and all the issues connected to it, we recommend to distribute *katas* age-appropriately based on technical and athletic demandingness.

Key words: burnout • depletion • martial arts • youth • risk of injury • seniors

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INTRODUCTION

Sport specialisation – athletes limiting participation to a single sport, which they train for and compete in on a year round basis [30].

Burnout – ***noun*** a feeling of depression, fatigue and lack of energy caused by stress and overworking the body [31].

Energy cost – the amount of energy or power used during physical activity.

Karate – martial art originating from Japan, practitioners use their hands and feet to deliver and block blows.

Kata – meaning literally "form", is a detailed choreographed pattern of movements made to be practised alone or in groups and in unison when training. It is practised as a way to memorise and perfect the movement being executed.

Kumite – is a semi-contact karate competitive concurrence, where two athletes perform various kicking, punching and blocking techniques towards each other with maximum control in order to gain points and win the match. Destruction is fictive.

Karate WKF – according to World Karate Federation, karate has been recognised as an Olympic sport since 2016 and it has been added to the sports programme for the Olympic Games Tokyo 2020.

Karateka – an athlete practising karate.

Kumite – freestyle sparring or fighting.

Sport performance – integral component of sport as the process and as the (measurable or assessable) result (product) of sport actions. Furthermore, it is also viewed in a normative context as the optimal mastering of a motor task.

Sport performance structure – a purposeful arrangement of factors affecting sports performance and relationships among them.

Sport performance structure depletion – insufficient range of sport–specific motor skills caused by early specialisation that leads to low level of variability.

The issue of early sport specialisation is often connected to increase of functional disorders of the musculoskeletal system and injury incidence, decrease of the sport performance growth dynamics in adulthood, sport performance structure depletion, early drop-out, etc. Such findings were established in several sports, e.g. hockey, tennis, judo, track and field, swimming, soccer, or volleyball [1-5].

Early sports specialization, or early single-sport specialization, is believed to be potentially damaging to the long-term physical and mental health of athletes and has not been validated as a requirement for competitive success in sport [6]. This problem has been associated with increased rates of overuse injury, burnout, decreased motivation for participation, and sports withdrawal [7-9].

Early single-sport specialization may be defined by the following criteria:

1. Participation in intensive training and/or competition in organized sports greater than 8 months per year (essentially year-round) [9].

2. Participation in 1 sport to the exclusion of participation in other sports (limited free play overall) [7].

3. Involving pre-pubertal (seventh grade or roughly age 12 years) children [10].

4. Early involvement in competitive sport [11].

In karate, the trend of early sports specialization continues with tournaments and competitive leagues being increasingly available [10]. The international-level participants are getting younger also in karate. At the WKF world championships, 16-years old karatekas have been allowed to participate since 1999 and 14-year-olds since 2009. Karatekas that are 12 years old and older have been allowed to enter top-level competitions since 2018. WKF introduced Karate 1 – Youth League, which includes cadets, juniors and U21. The Karate 1 – Youth League is a newly created competition conceived to highlight the impact of karate in youth [12] Youth karatekas compete in the same individual disciplines as seniors in *kata* and *kumite*.

With the new kata evaluation procedure, introduced in January 2019 because of the Olympic Games, technical and athletic performances are examined (Table 1). A panel formed by seven judges evaluates the performances, and scores are given according to the technical and athletic presentation of the *katas*. The system automatically eliminates the two highest and two lowest scores for both criteria; the total amount of points is calculated by the factor of 70% for technical performance and 30% for athletic performance (both criteria, according to the previous rules of the WKF, were equally important in the evaluation).

The evaluation for technical performance includes: stances, techniques, transitional movements, timing, correct breathing, focus ("*kime*") and conformance (consistency in the performance of the *kihon* of the style *Ryu-ha* in the *kata*), while the athletic performance evaluation is based on strength, speed and balance. The first bow of the *kata* starts the performance evaluation and the last bow concludes it.

All the competitors participating in a WKF event are divided into pools of eight karatekas, with the four competitors getting the highest scores moving into the next round. Athletes with lesser points will be eliminated until only two groups of eight competitors remain. At this stage, the top three competitors from both pools will qualify for the final bouts, with the second and third-ranked karatekas from each group competing for bronze and the two top athletes clashing for gold.

Number of *katas* performed to win depends on number of athletes. Usually it is four or five rounds, ergo *katas*.

In WKF competition, competitors may perform only *katas* from the official WKF *kata* list. The total number of all *katas* is 102. Competitors choose their *katas* based on the round of the competition, how challenging are their opponents, and their current training level. The *kata* must be carefully planned because it can only be used once in a particular competition. Different techniques, jumps, length of *kata* and competitors skills should be taken into consideration as well. All those demands make it essential for a karateka to choose their *katas* tactically [14].

There has been studies researching different length of *katas* (*Unsu* lasts 138 ±4 s [15] and *Pinan nidan* lasts approximately 20 s [16]), however they emphasise the physiological demands. The above-mentioned studies prove, that performing individual *katas* causes different body response which should be respected within the

Table 1. Sample of result of assessment [13].

Variable	Judge 1	Judge 2	Judge 3	Judge 4	Judge 5	Judge 6	Judge 7	Total	Factor	Result
Technical performance	8.0	8.2	7.8	7.8	8.4	~~8.4~~	8.2	24.4	0.7	17.10
Athletic performance	7.8	8.2	7.8	8.2	8.2	8.4	~~8.4~~	24.6	0.3	7.38
									Total:	**24.48**

long-term athlete development plan. The length and intensity of a specific *kata* determines the energy cost. It is not recommended for children and youth to perform physical activities that are energetically too demanding, as it may increase the risk of injury or overload. High intensity performance in acidosis zone (anaerobic loading) is not appropriate for 12 to 14 year-old children. Arriaza [17] determined high level of acidosis at Karate World Championship (from 6.8 to 10.6 $mmol^{-1}$). To prevent those issues he National Strength and Conditioning Association [18] provides age-specific guidelines for resistance and strength training. In spite of this, it seems that youth age categories compete with the same pool of *katas* as their senior counterparts.

The aim of the study is the knowledge whether karatekas in individual age groups compete with the same pool of *katas* and whether there are any differences in performance scoring.

MATERIAL AND METHODS

Study design

To compare the *kata* sport performance in individual age categories we chose four top-level WKF karate competitions, two for seniors age category (Karate1 Series A – Istanbul May 17-19, 2019; Karate1 Series A – Montreal, June 21-23, 2019) and two for juniors, cadets and young cadets age categories (Karate1 Youth League – Limassol, May 3-7, 2019; Karate1 Youth League – Umag, July 5-7, 2019).

The relationship among the most used katas and all the age categories was determined. Technical score, athletic score and total score was compared across all the age categories.

Subjects

The sample consisted of 1,348 athletes (551 seniors, 241 juniors, 327 cadets and 229 young cadets) who competed at the investigated top-level karate events. These athletes are top-level national representatives which applies they reach the highest WKF ranking positions for selection to the continental and the World Karate Championships.

Statistical analysis

The statistical analyses were carried out using the SPSS 21.0 program for Windows (SPSS, Inc., Chicago, IL, USA). Data's normality was checked through the Shapiro-Wilk test.

The Chi-square test was used to analyze if there were statistically significant differences between *katas* used in various age categories.

For comparison of non-parametric data (athletic score, technical score, total score) the non-parametric equivalent to ANOVA, the Kruscal-Wallis test and post-hoc Mann-Whitney U-tests were conducted. Effect sizes (r) were calculated using standard formula for non-parametric tests using the following scale for interpretation: $r \geq 0.5$ (large effect), $r \geq 0.3$ and $r < 0.5$ (medium effect), and $r < 0.3$ (small effect). The significance level of $p < 0.05$ was used.

Ethical Considerations

This study was approved by the Ethics Committee of the Faculty of Physical Education and Sports, Comenius University, Bratislava, Slovakia (reference number 04/2019). Consent from the subjects was not necessary, as all data was collected via online free sources.

RESULTS

The athletes performed 2,229 *katas* in total (711 seniors, 531 juniors, 594 cadets and 393 young cadets' *katas*).

Out of the overall number of 102 official *katas* in the WKF list there was performed 37 *katas* (36%). In the top ten of the most performed *katas* occur the same ones in different order in all age categories

Table 2. The most performed *katas* per age categories.

Seniors (n = 551)				Juniors (n = 241)			Cadets (n = 327)			Young cadets (n = 229)			Total (n = 1,348)		
Kata		count	%	Kata	count	%	Kata	count	%	Kata	count	%	Kata	count	%
1.	Papuren	101	14.2	Suparinpei	71	13.3	Gojushiho sho	88	14.7	Gojushiho sho	70	17.6	Gojushiho sho	278	12.4
2.	Suparinpei	93	13.1	Gojushiho sho	68	12.7	Papuren	66	11.1	Suparinpei	37	9.3	Suparinpei	253	11.3
3.	Anan dai	90	12.6	Anan dai	68	12.7	Chatanyara Kushanku	55	9.2	Papuren	34	8.5	Papuren	244	10.9
4.	Unsu	73	10.3	Chatanyara Kushanku	53	9.9	Anan dai	53	8.9	Gojushiho dai	33	8.3	Anan dai	242	10.8
5.	Chatanyara Kushanku	71	10.0	Unsu	48	9.0	Suparinpei	52	8.7	Anan dai	31	7.8	Chatanyara Kushanku	210	9.4
6.	Gojushiho sho	52	7.3	Papuren	43	8.1	Unsu	47	7.9	Chatanyara Kushanku	31	7.8	Unsu	193	8.6
7.	Anan	52	7.3	Kanku sho	38	7.1	Kanku sho	47	7.9	Kanku sho	31	7.8	Gojushiho dai	153	6.8
8.	Gojushiho dai	39	5.5	Gojushiho dai	37	6.9	Gojushiho dai	44	7.4	Unsu	25	6.3	Kanku sho	150	6.7
9.	Gankaku	35	4.9	Anan	37	6.9	Anan	41	6.9	Anan	19	4.8	Anan	149	6.6
10.	Kanku sho	34	4.8	Gankaku	18	3.4	Gankaku	21	3.5	Gankaku	10	2.5	Gankaku	84	3.7

(Table 2). A significant relationship between the age categories and top ten most performed *katas* does not exist χ^2 (27, n = 1,956) = 24.50 p = 0.60.

Six out of ten most performed *katas* occur also in the top ten of the best evaluated *katas* (Table 3), however two best evaluated *katas Shisochin* a *Ohan* do not appear in the top ten of individual age categories.

A Kruskal-Wallis H test showed that there was a statistically significant difference in total score between the age categories, $\chi^2(3) = 50.65$, $p = 0.00$, with a mean total score of 23.34 ±2.10 for seniors, 23.15±1.68 for juniors, 23.05 ±1.61 for cadets and 22.65 ±1.53 for young cadets.

In general *kata Shisochin* received the highest athletic score. However, it was performed only two times, similarly *kata Pachu* was performed only three times. After eliminating those two *katas* it became apparent that in the highest athletic score *kata* ranking in seniors and juniors dominate longer *katas*, whereas cadets

Table 3. Total score for 10 best evaluated *katas*.

	Seniors (n = 551)			Juniors (n = 241)			Cadets (n = 327)			Young cadets (n = 229)		
	Kata	Mean	SD	Kata	Mean	SD	Kata	Mean	SD	Kata	Mean	SD
1.	Shisochin	25.49	1.00	Ohan dai	23.67	1.57	Pachu	23.96	0.06	Gankaku	24.10	1.45
2.	Chibana no k.	24.67	1.72	Chibana no k.	23.59	1.43	Suparinpei	23.66	1.31	Unshu	23.83	0.93
3.	Kururunfa	24.34	1.50	Gankaku	23.45	1.67	Kururunfa	23.61	1.61	Heiku	23.65	0.98
4.	Sansai	24.06	1.46	Ohan	23.30	1.43	Anan dai	23.58	1.56	Kusanku	23.47	3.58
5.	Chatanyara Kushanku	23.78	2.09	Papuren	23.18	1.88	Nipaipo	23.54	2.40	Anan dai	23.33	0.89
6.	Anan dai	23.64	1.55	Anan	23.07	1.19	Ohan	23.54	0.97	Sansai	23.29	1.07
7.	Papuren	23.61	1.77	Chatanyara Kushanku	22.93	1.47	Chatanyara Kushanku	23.52	1.29	Nipaipo	23.28	1.72
8.	Anan	23.49	1.95	Anan dai	22.91	1.36	Chibana no k.	23.52	1.54	Unsu	23.18	1.47
9.	Kosoukun dai	23.44	2.40	Suparinpei	22.91	.61	Papuren	23.48	1.41	Papuren	23.14	1.09
10.	Ohan	23.26	2.14	Unshu	22.84	1.50	Anan	23.41	1.25	Chatanyara Kushanku	23.10	1.13

Table 4. Athletic score for 10 best evaluated *katas*.

	Seniors (n = 551)			Juniors (n = 241)			Cadets (n = 327)			Young cadets (n = 229)		
	Kata	**Mean**	**SD**	**Kata**	**Mean**	**SD**	**Kata**	**Mean**	**SD**	**Kata**	**Mean**	**SD**
1.	Shisochin	7.71	0.21	Ohan dai	7.28	0.49	Pachu	7.23	0.04	Gankaku	7.21	0.48
2.	Chibana no k.	7.37	0.52	Chibana no k.	7.19	0.40	Suparinpei	7.08	0.40	Unshu	7.08	0.30
3.	Kururunfa	7.27	0.44	Gankaku	7.18	0.42	Anan dai	7.07	0.46	Heiku	7.04	0.42
4.	Sansai	7.19	0.47	Ohan	7.14	0.36	Ohan	7.04	0.32	Kusanku	7.02	1.10
5.	Chatanyara Kushanku	7.11	0.64	Papuren	7.06	0.49	Kururunfa	7.04	0.59	Nipaipo	6.98	0.50
6.	Anan dai	7.06	0.48	Anan	7.05	0.44	Chibana no k.	7.04	0.47	Sansai	6.98	0.30
7.	Papuren	7.05	0.55	Chatanyara Kushanku	7.03	0.53	Chatanyara Kushanku	7.03	0.40	Anan dai	6.95	0.31
8.	Anan	7.02	0.60	Anan dai	6.98	0.42	Papuren	7.03	0.44	Unsu	6.93	0.47
9.	Kosoukun dai	6.99	0.72	Suparinpei	6.92	0.58	Nipaipo	7.02	0.69	Papuren	6.91	0.35
10.	Suparinpei	6.96	0.59	Kanku sho	6.91	0.48	Unsu	7.01	0.31	Chatanyara Kushanku	6.90	0.36

and young cadets received the highest athletic score with shorter *katas* – *Pachu* in cadets and *Gankaku* in young cadets.

A Kruskal-Wallis H test showed that there was a statistically significant difference in athletic score between the age categories, $\chi^2(3) = 56.00$, $p = 0.00$, with a mean total score of 6.98 ±0.58 for seniors, 6.94 ±0.51 for juniors, 6.90 ±0.49 for cadets and 6.77 ±0.47 for young cadets (Table 4).

Technical performance evaluation of *katas* in the individual age categories differs with the most performed *katas* not present at the top of the list of best technically evaluated *katas* (Table 5), with the exception of cadets and young cadets, where competitors performing *Anan dai* had substantial point lead when compared to competitors performing *Gojushiho*. A Kruskal-Wallis H test showed that there was a statistically significant difference in technical score between the age categories, $\chi^2(3) = 49.36$, $p = 0.00$, with a mean total score of 16.39 ±1.34 for seniors, 16.21 ±1.18 for juniors, 16.15 ±1.13 for cadets and 15.88 ±1.07 for young cadets.

In the observed indicators there were determined significant differences across all age categories (p = 0.00) except for the difference between cadets and juniors. When comparing the oldest

Table 5. Total score for 10 best evaluated *katas*.

	Seniors			Juniors			Cadets			Young Cadets		
	Kata	**M**	**SD**	**Kata**	**M**	**SD**	**Kata**	**M**	**SD**	**Kata**	**M**	**SD**
1.	Shisochin	17.78	0.79	Ohan dai	17.22	1.48	Pachu	16.73	0.10	Gankaku	16.88	0.98
2.	Chibana no k.	17.30	1.20	Chibana no k.	16.84	1.03	Suparinpei	16.58	0.93	Unshu	16.75	0.63
3.	Kururunfa	17.07	1.07	Gankaku	16.73	0.90	Kururunfa	16.57	1.03	Heiku	16.61	0.57
4.	Sansai	16.86	1.01	Papuren	16.60	1.09	Nipaipo	16.52	1.71	Kusanku	16.45	2.47
5.	Chatanyara Kushanku	16.68	1.47	Ohan	16.59	0.77	Anan dai	16.51	1.12	Anan dai	16.38	0.60
6.	Anan dai	16.58	1.08	Anan	16.54	1.01	Ohan	16.49	0.67	Sansai	16.31	0.78
7.	Papuren	16.56	1.23	Chatanyara Kushanku	16.42	1.15	Chatanyara Kushanku	16.49	0.90	Nipaipo	16.30	1.23
8.	Anan	16.47	1.36	Anan dai	16.31	1.02	Chibana no k.	16.48	1.09	Unsu	16.25	1.02
9.	Kosoukun dai	16.45	1.68	Suparinpei	16.26	1.31	Papuren	16.45	0.99	Papuren	16.23	0.75
10.	Suparinpei	16.41	1.37	Unshu	16.19	0.90	Anan	16.42	0.86	Chatanyara Kushanku	16.20	0.78

Table 6. Comparison of technical, athletic and total score across all age categories.

Age categories	Variable	Mean	SD	U	Z	p	r
Seniors - Juniors	Technical	0.18	0.07	171,674.00	–2.74	0.01	–0.08
	Athletic	0.04	0.03	177,549.00	–1.80	0.07	–0.05
	Total	0.18	0.10	173,804.50	–2.39	0.02	–0.07
Seniors – cadets	Technical	0.24	0.07	186,589.00	–3.63	0.00	–0.10
	Athletic	0.08	0.03	190,424.50	–3.06	0.00	–0.08
	Total	0.29	0.10	188,062.50	–3.41	0.00	–0.09
Seniors – young cadets	Technical	0.50	0.08	105,373.00	–6.77	0.00	–0.20
	Athletic	0.22	0.03	104,120.00	–7.02	0.00	–0.21
	Total	0.69	0.11	105,098.50	–6.82	0.00	–0.21
Juniors–cadets	Technical	0.06	0.07	154,358.50	–0.62	0.54	–0.02
	Athletic	0.04	0.03	151,708.00	–1.10	0.27	–0.03
	Total	0.10	0.11	153,624.50	–0.75	0.45	–0.02
Juniors – young cadets	Technical	0.33	0.08	87,063.00	–4.31	0.00	–0.14
	Athletic	0.17	0.03	81,569.00	–5.68	0.00	–0.19
	Total	0.50	0.12	85,287.00	–4.75	0.00	–0.16
Cadets – young cadets	Technical	0.27	0.08	99,456.50	–3.94	0.00	–0.13
	Athletic	0.14	0.03	95,507.00	–4.84	0.00	–0.15
	Total	0.40	0.12	98,091.00	–4.25	0.00	–0.14

and the youngest age categories we determined almost medium effect, in the other cases, the effect was small (Table 6).

DISCUSSION

Kata competition performance has been analysed by only two studies so far Čierna [19] and Augustovičová et al. [14]. To the best of our knowledge, no study has dealt with the comparison of the top-level *kata* competition performance in terms of age categories before. When comparing the trend of kata choice for competition with the study of Augustovičová et al. [14] we determined that *kata Annan* is no longer in the current ranking and it has been replaced by its longer equivalent *Annan Dai*. It is quite alarming that all the age categories at WKF top-level karate events use the same pool of *katas*, the only thing that changes is the order of *katas*. On one hand, it can be thrilling to witness young karatekas perform the most difficult *katas* and win competitions, on the other hand the issue of the early specialisation arises.

The positive of the above mentioned is that technical drill and the great number of the repetitions of whole katas can perfect the *kata*, however, it may become tedious for young karatekas. Sequences (*tzuki – strikes*) may be trained individually/in isolation and be connected at a later time.

Repetition of the same routine often becomes tedious for young athletes and the pressure to win from a very young age decreases the element of fun. This may lead to increase in dropout, as according to Bompa and Carrera [20] the major causes for dropping out of sport include lost interest, no longer fun and too much emphasis on winning.

Finally, there is the tendency of some coaches to make their trainees elite in very young age, often as a result of their own ambition. In order to ensure advantage over their opponents they tend to specialise too early – focus is only on one discipline as early as at 12 years of age.

Wall and Côté [2] interviewed the parents of 12 adolescent hockey players, 8 engaged and 4 dropouts. They found that the sample shared very similar sport backgrounds, but the dropouts began off-ice hockey training at a younger age and spent more hours per year in such training, compared to the players who were still engaged in the sport. On the other hand, there are athletes

who specialize early and do not experience negative outcomes because of an autonomy–supportive social environment [21].

On one hand, performance during the initial stages of events has been highlighted as a key component to success in many sports such as bobsledding, skeleton bobsleigh, and swimming [22]. Conversely, other studies showed that early specialization is a large factor in rates of injury and the premature dropout of many talented young athletes [5]. It has also been found that general evidence of linear development from junior to senior was quite scarce (less than 7%) across 256 elite athletes in 27 different sports [23]. Tendency of early specialization generally leads to a greater demand of commitment by youth athletes, creating much more pressure in the physical, psychological and social dimensions [11].

Therefore we recommend to develop motor skills by means of general physical preparation and in youth age categories perform *katas* different from the ones expected to be used during the peak of athletic career. Subsequently, this ensures capability to respond to a wide range of various physical tasks and to use a wide bank of technical skills. Furthermore, insufficient bank of motor skills may lead to sport performance structure depletion, which is typical for combat sports or martial arts. The fact that karatekas in youth age categories perform the same *katas* as seniors leads to the issue of so called depleted specialisation with low level of variability which consequently decreases the level of success. Such approach does not allow the utilisation of the full range of techniques that ensure greater variability of tactics and fight strategy.

In Italy, to avoid this kind of depletion, there are performed not only compulsory *katas* from the official list in the finals, but also free *katas* [24]. In Slovakia [25] and in Italy [24] karate unions included agility (the basis of sport performance structure) in competitions.

Choice of *katas* should be restricted also for top-level competitions, not only national ones as in Croatia, Slovakia or Italy. We recommend the restriction for energy–cost reason as well. *Kata UNSU* [15] is longer and energetically more demanding than *kata Pinan nidan* [16]. Cierna and Barinec [26] determined 12.6 $m.mol^{-1}$ lactate level in competition, which is substantial acidosis that can be dangerous for children and in addition maximum heart rate and blood lactate is higher in competition compared to training.

A lot of jumps and techniques in *kata* is of unilateral nature, resulting in the overuse of knees, hip joints and occurrence of imbalance in musculoskeletal apparatus, such as in tennis [27, 28] or other sports [29].

The biomechanics of those movements adheres to the same pattern. That is the reason to perform all *katas* over time – to develop the body as a whole.

The difference between adults and youth categories can be observed only in the score, effect size is small to medium. We had presumed that we would determine a greater score difference among individual age categories, both in technical and athletic component of the total score. Achieved score seemingly depends on how the referees distribute points in the evaluated group and not on the actual performance, as it is the case in gymnastics or figure skating, which can be more motivating for karatekas.

In the elimination rounds we recommend to introduce compulsory *katas*, similar to original programme in figure skating. Furthermore, there is recommended to divide *katas* based on the level of difficulty, or assign coefficient of difficulty, as in figure skating, gymnastics or diving.

LIMITATIONS OF THE STUDY

Considering the fact that U14 is a new age category and that new rules were implemented in January 2019 we have only studied four competitions – two for youth and two for seniors. We tried to compensate this fact by choosing competitions in which competitors from all the continents were represented.

CONCLUSIONS

Karate athletes used only 36% *katas* from the complete WKF list, with no significant difference between *katas* performed by seniors and by karatekas in younger age categories determined. Consequently, competitors that are as young as 12 years old perform the same *kata* (form, the same movement patterns) as adults, which according to scholarly literature may lead to early specialisation. That is often connected with the premature end

of athletic career, the occurrence of overuse injuries or injuries caused by unilateral loading. There were significant differences between adults and younger athletes in technical, athletic and total score. However, we believe that those differences do not have sufficient magnitude to represent performance differences among individual age categories. To preserve the method of progression in motor skills development we recommend division of *katas* into pools for individual age categories.

HIGHLIGHTS

It is alarming, that youth perform *katas* from the same pool as adults and therefore also have the same loading intensity. Major issues resulting from this kind of early specialisation are the high risk of burnout and dropout and also high risk of injury.

REFERENCES

1. Balyi I, Way R. The Role of Monitoring Growth in Long–Term Athlete Development. A Supplement to: Canadian Sport for Life. Vancouver: Canadian Sport Centres; 2005
2. Wall M, Côté J. Developmental activities that lead to dropout and investment in sport. Phys Educ Sport Peda 2007; 12(1): 77-87
3. Barreiros A, Côté J, Fonseca AM. From early to adult sport success: Analysing athletes' progression in national squads. Eur J Sport Sci 2014; 14(Suppl 1): S178-82
4. Corrêa C, Tierling R, Treter GH et al. Early specialization in sports: A factor to be considered in brazilian tennis players? ITF Coa Sport Sci Rev 2016; 70 (24): 18-20
5. Fabricant PD, Lakomkin N, Sugimoto D et al. Youth sports specialization and musculoskeletal injury: a systematic review of the literature. Phys Sportsmed 2016; 44(3): 257-262
6. Baker J. Early Specialization in Youth Sport: A requirement for adult expertise? High Abil Stud 2003; 14(1): 85-94
7. Jayanthi N, Pinkham C, Dugas L et al. Sports Specialization in Young Athletes: Evidence–Based Recommendations. Sports Health 2013; 5(3): 251-257
8. Difiori JP, Benjamin HJ, Brenner JS et al. Overuse injuries and burnout in youth sports: A position statement from the American Medical Society for Sports Medicine. Br J Sports Med 2014; 48(4): 287-288
9. Myer GD, Jayanthi N, Difiori JP et al. Sport Specialization, Part I: Does Early Sports Specialization Increase Negative Outcomes and Reduce the Opportunity for Success in Young Athletes? Sports Health 2015; 7(5): 437-442
10. LaPrade RF, Agel J, Baker J et al. AOSSM Early Sport Specialization Consensus Statement. Orthop J Sports Med 2016; 4(4): 2325967116644241
11. Baker J, Cobley S, Fraser-Thomas What do we know about early sport specialization? Not much! High Abil Stud 2009; 20(1): 77-89
12. WKF.net. Karate 1 Youth League. [accessed 2019 Mar 5]. Available from: URL:https://www.wkf.net/karate1-main/#youth-league
13. World Karate Federation. Karate Competition Rules Contents [accessed 2019 Mar 5]. Available from: URL:https://www.wkf.net/structure-statutes-rules.php
14. Augustovicova DC, Argajova J, García MS et al. Top-level karate: analysis of frequency and successfulness of katas in K1 Premiere League. Ido Mov Culture J Martial Arts Anthrop 2018; 18(4): 46-53
15. Vujkov S, Calleja-González J, Krneta Z et al. Physiological responses the organism of karate athletes specialists of kata and kumite during simulated competition. Arch Budo 2015; 11: 365-370
16. Francescato P, Talon T, Francescato MP et al. Energy cost and energy sources in karate. Eur J Appl Physiol Occup Physiol 1995; 71(4): 355-361
17. Arriaza R. Karate. In: Kordi R, Maffulli N, Wroble RR et al. editos. Combat Sport Medicine. London: Springer-Verlag; 2009: 287-298
18. Faigenbaum AD, Kraemer WJ, Blimkie CJR et al. Youth resistance training: updated position statement paper from the national strength and conditioning association. J Strength Cond Res 2009; 23(5 Suppl): S60-79
19. Čierna D. Vplyv výberu kata na úspešnosť v súťaži karate. Telesná výchova a šport 2014; 3(24): 13-16 [in Slovak]
20. Bompa T, Carrera M. Conditioning Young Athletes. Champaign: Human Kinetics; 2015: 296
21. Horn TS. Social Psychological and Developmental Perspectives on Early Sport Specialization. Kines Rev 2015; 4(3): 248-266
22. West DJ, Owen NJ, Cunningham DJ et al. Strength and power predictors of swimming starts in international sprint swimmers. J Strength Cond Res 2011; 25(4): 950-955
23. Gulbin J, Weissensteiner J, Oldenziel K et al. Patterns of performance development in elite athletes. Eur J Sport Sci 2013; 13(6): 605-614
24. FIJLKAM. Regolamento di gara. Regolamento di gara [accessed 2019 Mar 5]. Available from: URL:https://www.fijlkam.it/karate/la–disciplina–karate/regolamenti.html [in Italian]
25. Slovenský zväz karate. Súťažné pravidlá slovenského zväzu karate k disciplíne karate agility účinné od 1.2.2017 [accessed 2019 Mar 5]. Available from: URL:http://www.karate.sk/880/karate-agility [in Slovak]
26. Cierna D, Barinec P. Physiological responses on training and competition load in karate kata discipline. In: Murphy M, Boreham C, De Vito G et al., editors. Book of Abstracts of the 23rd Annual Congress of the European College of Sport Science. Sport science at the cutting edge; 2018 Jul 4-7, Dublin, Ireland. Cologne: European College of Sport Science; 2018: 458
27. Bylak J, Hutchinson MR. Common sports injuries in young tennis players. Sports Med; 1998; 26(2): 119-132
28. Hayot C, Vigouroux L, Rossi J et al. Measurements of tennis players' specific forearm muscle force imbalance to assess the potential risk of lateral epicondylitis. Procedia Engineering 2014; 72: 174-179
29. Orchard J, Marsden J, Lord S et al. Preseason hamstring muscle weakness associated with hamstring muscle injury in Australian footballers. Am J Sports Med 1997; 25(1): 81-85
30. Hill GM, Simons J. A Study of the Sport Specialization on High School Athletics. J Sport Soc Issues 1989; 13(1): 1-13
31. Dictionary of Sport and Exercise Science. Over 5,000 Terms Clearly Defined. London: A & B Black; 2006

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