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DIFFERENCES IN KINEMATIC PARAMETERS OF ATHLETES OF DIFFERENT RUNNING QUALITY

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ABSTRACT: The aim of the study was to determine the differences among subjects of different sprinting quality in the variables of running dynamics in the 100 m sprint event and in the variables of kinematic indicators (stride frequency, stride length, foot-ground contact duration, airborne phase duration). The research was conducted on a sample of 133 physical education teacher male students, aged 19 to 24 years (age 21.7 ± 1.08 yrs; body height 180.8 ± 6.98 cm; body mass 76.6 ± 7.62 kg), first year students at the Faculty of Kinesiology, University of Zagreb, who regularly attended their athletics classes. Basic descriptive statistical parameters were computed. Cluster analysis was used to determine sprinting-quality-based homogeneous groups of subjects. The qualitative differences among the subjects pertaining to the defined groups were established by canonical discriminant analysis. One significant discriminant function was obtained differentiating the group of students who performed well from all the other groups of students with poorer sprint performance. The best performance group demonstrated running technique characterised by the shortest foot-ground contact time in the phases of starting acceleration and maximum speed running, and a larger stride length in the phase of maximum speed running.

KEY WORDS: sprint, stride frequency, stride length, foot-ground contact duration, airborne phase duration, dynamics of running, speed progression

INTRODUCTION

Sprinting, a cyclic locomotor stereotype of human movement, consists of maximum-rate running strides. Recently, many research studies have been conducted to investigate sprinting performance factors. From the biomechanical point of view, various components that determine the velocity of running are actually elements of running technique: frequency or rate of strides performed, stride length, duration of foot-ground contact and duration of airborne phase, or of flight [2,4,5,7,17, 18,20,21,25,26]. The maximum sprinting velocity is the result of a sensitive relationship between stride length and stride frequency. Their ratio is individually defined and automated: the enhancement of the stride rate usually means a decrease in the stride length, and vice versa. Both parameters are interrelated and individually conditioned by morphological and physiological characteristics, motor abilities, and energy capacities of a person. Stride length depends mainly on body height, or leg length. On the other hand, stride rate depends primarily on the central nervous system functioning at the cortical and subcortical level and it is strongly genetically determined [13,16,19,20,22,23].

Previously published running technique analyses and presentations of the running styles of the best national and international sprinters, that is, of their kinematic indicators, demonstrated in competition and training sessions alike, have already contributed significantly to the understanding of the nature of human movement as manifested in elite sprint performance and maximum exertion.

So far sprinting competition activity has been analysed with top-level athletes of various quality, from those of national quality [1,9-12,14,16,26,27] to European and world championships and Olympic games finalists [6-8,15,17,21,22-26]. However, almost none of the research has focused on the 100 m competition activity of university students and/or non-selected (according to the criteria of track-and-field) male persons aged 19 to 24 years. That is why the authors decided to direct their attention to the kinematic parameters of untrained subjects. They presumed their findings might be helpful in the teaching/learning process in physical education and in coaching with beginners and late starters.

The study has two main goals:

• To determine speed progression or running dynamics and to indicate any specific features of students' performance in the 100 m sprint;

• To determine the probable differences among homogeneous groups of students formed according to similarities in running quality as presented by kinematic indicators (stride frequency, stride length, contact duration, airborne phase duration) demonstrated in the segments of starting acceleration and maximum speed running in the 100 m sprint.

MATERIALS AND METHODS

Subjects. The population of the investigation was made up of students of the Faculty of Kinesiology, University of Zagreb, future physical education teachers, who were positively selected for the study with regard to their aptitude, including their motor abilities, energy capacities and motor knowledge and skills. The research was conducted on a sample of 133 male students, aged 19-24 years (average age 21.7 ± 1.08 yrs; body height 180.8 ± 6.98 cm; body mass 76.6 ± 7.62 kg), who regularly attended the first year classes prescribed by the university study of kinesiology curriculum.

The Faculty of Kinesiology Scientific Research Ethics Committee approved the study, and written informed consent was obtained from the subjects.

Variables and testing procedures

In this research two groups of variables were measured:

Group One: Speed progression or running dynamics over the running course of 100 m.

Latent reaction time (LRT), split times (T) of running over: 10 m (T10 m), 20 m (T20 m), 30 m (T30 m), 40 m (T40 m), 50 m (T50 m), 60 m (T60 m), 70 m (T70 m), 80 m (T80 m), 90 m (T90 m) and 100 m (T100 m).

From these raw results the following was calculated:

Average running speed or velocity (V) (segmental times) over ten 10-metre segments: from the start to the 10th metre (V0-10 m), 10-20 m (V10-20 m), 20-30 m (V20-30 m), 30-40 m (V30-40 m), 40-50 m (V40-50 m), 50-60 m (V50-60 m), 60-70 m (V60-70 m), 70-80 m (V70-80 m), 80- 90 m (V80-90 m) and 90-100 m (V90-100 m).

The measurement was conducted by means of an electronic measurement device consisting of photocells and the respective software. The subjects performed the task three times. The time interval between the first and the second test was one day, and between the second and the third measurement it was four days. All segmental times were measured in hundredths of a second. Prior to the testing procedure, the subjects completed a warm-up, and after the completion of the testing procedure, a cool-down workout. The best performance out of three was taken as valid and from it the rest of the parameters were calculated. All the tests were performed on an IAAF officially approved 100 m track and the measurers were well trained for the task.

Group Two: Kinematic parameters [12]

In the test assessing *start acceleration – 20 m running from the crouched (sprinting) start position* over the tensiometric carpet: *stride frequency* (SASF), *stride length* (SASL), *contact duration* (SACD) and *airborne phase duration* (SAAPD), and in the test assessing *maximum speed* running – *20 m running from a flying start (after a 20 m run-up)* over the tensiometric carpet: *stride frequency* (MSSF), *stride length* (MSSL), *contact duration* (MSCD), and *airborne phase duration* (MSAPD).

Kinematic measurements of start acceleration and maximum speed running were conducted by means of a 20 m long contact track, or carpet (ERGO TESTER – Bosco; Italy), with the measuring electronic system and respective computer software. Each subject performed the tests twice, with a pause of 15-20 minutes between two trials. Prior to the testing procedure, the subjects completed a warm-up session, and after the completion of the testing procedure a cool-down session. Kinematic parameters were measured by a team of trained measurers from the Institute for Sport of the Faculty of Sport, University of Ljubljana, Slovenia.

Data analysis

Basic descriptive parameters were computed for all the variables: arithmetic mean (Mean), minimum result (Min), maximum result (Max), and standard deviation (SD). Normality of distribution was tested by means of the Kolmogorov-Smirnov (K-S) test at the error level of 0.05. The Ward method of hierarchical cluster analysis [29], based on the Euclidean distances, was used to determine relatively homogeneous groups of students of different quality of sprinting. The result was a tree diagram representing the whole process of hierarchical grouping and the level at which each entity was included in the respective group.

The differences among the homogeneous groups, obtained by means of cluster analysis, were established by canonical discriminant analysis. The significance of the obtained discriminant function was tested by Bartlett's χ^2 test. The method allowed the following to be computed: eigenvalues of the discriminant functions (λ), coefficients of canonical correlation (Rc) and Wilks' lambdas (Wλ), correlations of the variables with the discriminant function (structure matrix) and values of the group centroids on the discriminant function.

RESULTS

The analysis of the obtained descriptive indicators and of the results of the K-S test (Table 1) demonstrated the good fit of the data (normal distribution) of all the variables of speed progression and of the kinematic parameters at the error level of 0.05, except for the variable *latent reaction time* (LRT), in which only a slight positive asymmetry was found. The authors presumed that the obtained distribution pattern would not have a significant influence on the intra-group correlations.

The average 100 m sprint time (T100M) of the observed subjects, the Faculty of Kinesiology students, was 13.00 seconds, with sprint times ranging from 11.55 s to 14.40 s (Table 1). When evaluated

TABLE 1. DESCRIPTIVE STATISTICAL INDICATORS: ARITHMETIC MEAN (Mean), MINIMUM (Min) AND MAXIMUM (Max) RESULT, STANDARD DEVIATION (SD), COEFFICIENTS OF VARIABILITY: SKEWNESS (Skew) AND KURTOSIS (Kurt), AND MAXIMAL DEVIATION OF THE RELATIVE CUMULATIVE EMPIRICAL FREQUENCY FROM THE RELATIVE THEORETICAL FREQUENCY (max D) OF THE VARIABLES OF RUNNING DYNAMICS AND KINEMATIC PARAMETERS

n=133	Mean	Min	Max	SD	Skew	Kurt	max D
LRT (s)	0.24	0.11	0.56	0.10	1.91	3.57	0.20
T10M (s)	2.28	2.04	2.57	0.09	0.05	0.53	0.06
T20M (s)	3.56	3.22	3.94	0.13	0.03	0.56	0.06
T30M (s)	4.74	4.32	5.19	0.16	0.03	0.35	0.05
T40M (s)	5.90	5.32	6.47	0.21	0.00	0.50	0.06
T50M (s)	7.05	6.39	7.76	0.25	0.00	0.46	0.05
T60M (s)	8.21	7.40	9.07	0.30	0.01	0.49	0.06
T70M (s)	9.38	8.42	10.38	0.35	-0.01	0.51	0.07
T80M (s)	10.57	9.39	11.69	0.41	-0.07	0.55	0.07
T90M (s)	11.77	10.48	13.04	0.46	-0.07	0.53	0.06
T100M (s)	13.00	11.55	14.40	0.51	-0.04	0.40	0.06
SASF (k/s)	4.14	3.52	4.74	0.25	0.01	-0.14	0.05
SASL (m)	1.41	1.24	1.66	0.09	0.36	-0.05	0.07
SACD (ms)	147.89	121.00	182.00	11.11	0.16	0.34	0.05
SAAPD (ms)	95.95	72.00	118.00	10.33	0.11	-0.40	0.07
MSSF (k/s)	4.22	3.57	4.90	0.25	0.05	0.04	0.05
MSSL (m)	2.01	1.71	2.39	0.12	0.25	0.02	0.07
MSCD (ms)	117.82	94.63	141.67	9.63	0.14	-0.30	0.05
MSAPD (ms)	120.08	97.50	143.00	10.14	-0.01	-0.62	0.05

$TEST_{0.05}$=0.12

TABLE 2. SEGMENTAL RUNNING TIMES ACHIEVED BY SUBJECTS OF DIFFERENT SPRINTING QUALITY (COMPARISON OF THE RESULTS OBTAINED IN OUR STUDY [STUDENTS] AND THE RESULTS OBTAINED BY CHENGZI [CHINESE AND OLYMPICS GROUP] [9])

	0-10m	10-20m	20-30m	30-40m	40-50m	50-60m	60-70m	70-80m	80-90m	90-100m
Chinese (10.45 s)	1.94	1.08	0.97	0.91	0.91	0.93	0.94	0.91	0.92	0.94
Olympics (10.02 s)	1.91	1.05	0.95	0.89	0.86	0.85	0.87	0.87	0.88	0.89
Students (13.00 s)	2.04	1.27	1.18	1.15	1.15	1.15	1.16	1.18	1.20	1.23
v (m/s) Chinese (10.45)	5.15	9.25	10.30	11.02	10.95	10.74	10.70	10.98	10.88	10.66
%max v	45.98	83.90	93.50	100	99.40	97.50	97.10	99.60	98.70	96.70
v (m/s) Olympics (10.02)	5.24	9.54	10.52	11.19	11.62	11.75	11.49	11.47	11.36	11.22
%max v	44.55	81.19	89.50	95.20	98.80	100	97.70	97.50	96.60	95.40
v (m/s) Students (13.00)	4.90	7.85	8.45	8.68	8.68	8.64	8.56	8.43	8.32	8.13
%max v	56.47	90.43	97.35	100	100	99.54	98.62	97.12	95.85	93.66

by the competition criteria of the 100 m race, the results may be described as, expectedly, very inconsistent. Such a large dispersion of results was an argument for the determination of several homogeneous groups of subjects.

Cluster analysis was used to determine homogeneous groups of subjects according to the 10-metre segmental running times in the 100 m sprint. In Figure 1 a tree diagram of the hierarchical grouping of subjects is presented. Four relatively homogeneous groups were obtained:

Group A consisted of 7 subjects
Group B consisted of 44 subjects
Group C consisted of 52 subjects
Group D consisted of 30 subjects.

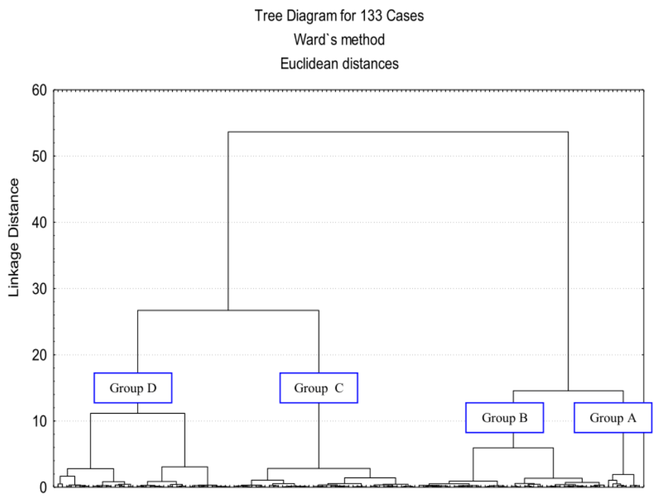

FIG. 1. TREE DIAGRAM OF HIERARCHICAL GROUPING OF THE 133 STUDENTS ACCORDING TO THE 10 M SEGMENTAL RUNNING TIMES FROM THE START TO THE FINISH OF THE 100 M TRACK.

TABLE 3. ARITHMETIC MEANS AND STANDARD DEVIATIONS IN THE VARIABLES OF RUNNING DYNAMICS ACHIEVED BY THE FOUR GROUPS OF STUDENTS

	Group A		Group B		Group C		Group D	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
LRT (s)	0.21	0.14	0.24	0.12	0.23	0.07	0.25	0.10
T10M (s)	2.13	0.06	2.23	0.06	2.30	0.06	2.38	0.08
T20M (s)	3.32	0.06	3.48	0.07	3.58	0.06	3.70	0.09
T30M (s)	4.40	0.06	4.63	0.07	4.77	0.06	4.95	0.10
T40M (s)	5.44	0.09	5.74	0.08	5.93	0.07	6.17	0.13
T50M (s)	6.49	0.09	6.86	0.09	7.09	0.07	7.38	0.15
T60M (s)	7.53	0.12	7.98	0.09	8.26	0.07	8.62	0.16
T70M (s)	8.58	0.14	9.11	0.10	9.43	0.08	9.86	0.18
T80M (s)	9.63	0.18	10.26	0.11	10.63	0.09	11.12	0.19
T90M (s)	10.72	0.21	11.43	0.12	11.84	0.11	12.40	0.22
T100M (s)	11.85	0.22	12.62	0.13	13.07	0.14	13.71	0.23

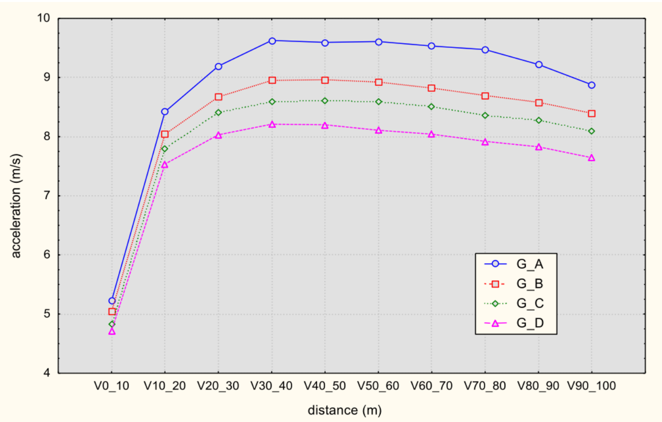

FIG. 2. AVERAGE RUNNING SPEEDS (m/s), THAT IS, VELOCITY CURVES OF SPRINT OF THE FOUR GROUPS OF STUDENTS OVER THE 100 M TRACK, OBSERVED ACROSS THE 10 SEGMENTS.

TABLE 4. RESULTS OF DISCRIMINANT ANALYSIS OF THE FOUR HOMOGENEOUS GROUPS OF STUDENTS OF DIFFERENT SPRINT QUALITY BASED ON THE KINEMATIC PARAMETERS

DF	λ	Rc	wλ	χ^2	df	p
1	1.64	0.79	0.34	137.5363	24	0.00
2	0.11	0.31	0.89	15.1581	14	0.37
3	0.02	0.13	0.98	2.0344	6	0.92

Abbreviations: numbers of the discriminant function (DF), eigenvalues (λ), canonical correlation (Rc), Wilks' lambda (wλ), χ^2 test, degrees of freedom (df), level of significance (p)

TABLE 5. CENTROIDS OF GROUPS A, B, C, D ON THE FIRST DISCRIMINANT FUNCTION OF THE OBTAINED KINEMATIC PARAMETERS

	DF1
G_A	3.77
G_B	0.73
G_C	-0.14
G_D	-1.71

The basic descriptive parameters were calculated for all the homogeneous groups in the variables of running dynamics (Table 3, Figure 2)

In Table 4 the following are presented: eigenvalues (λ), canonical correlation coefficients (Rc), Wilks' lambda (Wλ) and the results of χ^2 test, which was used to test statistical significance of the obtained discriminant function in the space of kinematic parameters.

The results (Table 4) indicate that one discriminant function statistically significantly distinguishes the four groups of students of different sprint performance based on the kinematic parameters measured during the running phases of starting acceleration and maximum speed running, at an error level lower than 0.01.

Tables 5 and 6 display the group arithmetic means on the first discriminant function (Table 5) and the structure of the first discriminant function, as well as the groups' arithmetic means of the kinematic parameters (Table 6).

It is clear from Table 5 that the values of groups A and B are negative, whereas the values of groups C and D are positive. On the discriminant function the group arithmetic means of the kinematic parameters are ranked in descending order from group A to group D, with a somewhat larger difference between group A and the rest of the groups, among which somewhat smaller differences were registered.

DISCUSSION

If the 100 m sprint performance of the population of kinesiology students is compared to the performance of the population of top-level sprinters [2,3,9,15,17,23-28], it becomes obvious that students' performance is under average in all the measured segments of the 100 m sprint (Table 2). The top-level sprinters commonly achieve the maximum speed of running between the 50th and the 60th metre (M. Green, D. Chambers, T. Montgomery et al.), 40th and 60th metre (B. Surin), or between the 50th and 70th metre (O. Thompson, K. Streete-Thompson) [9,17], whereas the investigated students achieved it between the 30th and 50th metre [2,3].

TABLE 6. STRUCTURE OF THE DISCRIMINANT FUNCTION (DF1) AND THE MEANS (Mean) OF THE KINEMATIC PARAMETERS ACROSS THE GROUPS

	DF1	Mean A (11.85 s)	Mean B (12.62 s)	Mean C (13.07 s)	Mean D (13.71 s)
SASF	0.19	4.35	4.17	4.12	4.08
SASL	0.11	1.43	1.43	1.41	1.39
SACD	-0.33	134.29	146.61	147.17	154.20
SAAPD	0.07	97.57	95.77	97.40	93.30
MSSF	0.19	4.41	4.28	4.18	4.17
MSSL	0.28	2.13	2.03	2.02	1.95
MSCD	-0.39	104.05	116.17	117.73	123.59
MSAPD	0.08	123.50	118.49	122.67	117.12

According to Brüggemann et al. [8], world class sprinters' (first eight from the World Championships) average stride length is 1.93 m and stride frequency is 4.34 strides/second in the phase of starting acceleration, whereas in the phase of maximum speed running these parameters are on average 2.30 m and 4.78 strides/second, respectively. In the same article we can find the information that the fastest sprinters in the world – Johnson, Lewis and Burell – in their fastest races at the 1987 and 1991 World Championships, and at the 1988 Olympic Games, had in the phase of starting acceleration average stride length of 1.89 m and stride frequency of 4.29 strides/second, and in the phase of maximum speed running their average stride length was 2.45 m and frequency 4.75 strides/second, respectively. The best Slovenian sprinters' average stride length is 1.73 m and stride frequency is 4.52 strides/second in starting acceleration, whereas in maximum speed running these parameters are 2.21 m and 4.64 strides/second, respectively [13]. The kinesiology students' average stride length was 1.41 m and average stride frequency was 4.14 strides/second in starting acceleration and in the phase of maximum speed running these parameters were 2.01 m and 4.22 strides/second, respectively. The speed the best Slovenian sprinters develop over the 20 m distance from the crouch start, which is a direct indicator of starting acceleration ability, is 6.74 m/s, whereas the kinesiology students' speed was 5.81 m/s, which was 13.8% slower. A similar ratio is obtained when comparing speeds of running over the 20 m track from the flying start – the Slovenian sprinters' velocity was 10.22 m/s, and the kinesiology students' speed was 8.47 m/s, which was 17.2% slower. The average time of running over the 100 m distance for the best Slovenian sprinters [12,13] was 10.52 s, whereas the kinesiology students had the average running time of 13.00 s, which is a 19.1% poorer performance [2-4].

A lot of factors influence sprint performance or running efficiency. The obtained parameters confirm the real complexity of a seemingly simple motor activity which demands, in addition to the desirable genetically determined innate athlete's attributes, perfect performance of precisely defined, perfected, automated stereotypes/patterns of movement throughout the 100 m track, from the start to the finish line. Achieving this requires perennial hard work on widening the limits in technical and motor realization of sprint running specific phases. According to the research of Babić et al. [4], the results of which corroborated the findings of previous research studies [19,23], stride frequency and stride length are negatively correlated in the phase of maximal speed running due to the positive correlation between skeleton dimensionality and stride length, on the one hand, and the negative correlation between skeleton dimensionality and stride frequency, on the other. It was also concluded that stride length was positively influenced by power, whereas it was negatively influenced by subcutaneous fatty tissue.

Sprint efficiency may also be assessed through duration of either the foot-ground contact or the airborne phase of a running stride. The kinesiology students' average duration of contact and airborne phase in starting acceleration was 147.89 and 95.95 ms, respectively, and in the segment of maximum speed running these values were 117.82 and 120.08 ms [4], respectively. The best Slovenian sprinters had the following values of the mentioned parameters: in starting acceleration contact/flight 120.92/98.80 ms, and in maximum speed running 89.76/126.25 ms. The average contact times of the Slovenian sprinters in starting acceleration and maximum speed running were by 18.3 and 23.8% better than the same values of the kinesiology students. The average times of airborne phases the kinesiology students achieved in starting acceleration and maximum speed running were poorer than the values of the same parameters achieved by the Slovenian sprinters by 2.9 and 4.9%, respectively.

The students in group A (Table 1) were best in all the variables of running dynamics. Their total average running time was 11.85 s, and the standard deviation was 0.22, which corresponded to the results of junior quality sprinters. It is feasible to presume that these seven subjects had certain sprinting experience. They also had the best latent reaction time (LRT), as well as all the segmental times (T10 m - T100 m). Group B had somewhat poorer results than the students in group A in latent reaction time (LRT) and in all the variables of running dynamics (T10 m - T100 m). Still, they performed better than the students in groups C and D in all the variables of running dynamics (Figure 2). However, in the variable *latent reaction time* (LRT) group B was not as good as group C, although both groups were better than group D. The same regressive trend in all the variables of running dynamics (T10 m - T100 m) is obvious in groups C and D, except for the aforementioned variable *latent reaction time* (LRT). Group D consisted of students whose sprinting abilities and performance were distinctly the poorest.

To determine the differences among the groups, obtained by cluster analysis of the measured kinematic parameters, discriminant analysis was applied. The results (Table 4) indicate that one discriminant function significantly distinguishes the four groups of students who are of different sprinting quality, as manifested in the measured kinematic indicators of starting acceleration and maximum speed running, with the error smaller than 0.01.

The negative pole of the discriminant function (Table 6) is best determined by the variable *maximum speed contact duration* (MSCD) and *starting acceleration contact duration* (SACD), whereas the positive pole is best determined by the variable *maximum speed stride length* (MSSL) and by a somewhat smaller projection of the variable *stride frequency* in both phases – of starting acceleration and maximum speed running (SASF and MSSF). Therefore it is feasible to conclude that group A, the subjects of which had the best sprint abilities, when compared to the other three groups, was predominantly characterised by the shortest foot-ground contact duration in both maximum speed running and start acceleration phases, as well as longer stride length in maximum speed running. The mentioned characteristics also differed among groups B, C, and D, but to a smaller extent, and in such a descending order. Stride frequency in start acceleration and maximum speed running segments had a smaller contribution to the differences among these groups, whereas other kinematic parameters did not differ significantly among the analysed groups. Similar results were obtained in the research by Čoh et al. [12] where two groups of elite sprinters were compared. The authors determined that, among the measured kinematic parameters, contact time was the most important generator of the difference ($p<0.01$) in sprint quality (average contact time 89.7 ms and 95.6 ms for the better and poorer group, respectively). The best sprinter in the analysed sample (10.21 s) had contact time of 86.7 ms. Contact time depends primarily on the vertical takeoff force, which is in the phase of maximum speed running 1778 ± 76 N for elite sprinters. The greatest ground reaction forces in the phase of contact occur in the time interval of 10 to 40 ms of the established foot contact with the ground. In order to resist such a force, the leg muscles must be adequately pre-activated and, simultaneously, the reflexive stretch mechanism, which ensures adequate muscle stiffness, must be activated. A crucial role in this is reserved for the *rectus femoris* muscle. Maximum sprint speed is the product of the optimal model, defined individually, of stride rate and stride length.

Regarding the above, high sprint performance is not possible without a complex, sprint-specific long-term training process, which focuses on neuromuscular improvement. In our research, running times over the 100 m track clearly demonstrated that the study group had not been subjected to such a training programme [4].

Stride frequency showed a relatively small positive correlation with the first discriminant function. The only parameter which exclusively differed among the runners in the segment of start acceleration was the acceleration foot-ground contact time. Contact time of the better sprinters in our study was on average 6.33 ms shorter than the time of the poorer runners. Surprisingly, the analysed samples of the Slovenian sprinters did not differ from each other in stride frequency, probably due to the fact that shorter contact times usually generate higher stride rates or frequencies. From the above, it is obvious that this phase of sprint over the 100 m track does not depend solely on the biomechanical structure of strides, but also on the efficiency of the start and on adequate intermuscular coordination of agonists and antagonists in running acceleration [10,13].

CONCLUSIONS

To conclude, sprint and high running performance, although it seems so simple and, at first glance, exclusively genetically determined, in fact requires a long-term learning and training process. Due to the short length of the running track, each mistake in running technique is visible and contributes significantly to poor performance. This research, conducted with a sample of physically active young men, who were not trained sprinters, but future physical education teachers and coaches, speaks in favour of much more time needed for learning enough skills and knowledge of teaching methods of running and sprinting technique during their education. They will use that knowledge in teaching their pupils and athletes how to run correctly, economically and efficiently. For those who aspire to high achievement in sprinting, specific sprinting training is indispensable for good performance.

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