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# SOMATIC BUILD VS SPORTS RESULT OF POLE VAULT CONTESTANTS AGED 18-19

## BUDOWA SOMATYCZNA A WYNIK SPORTOWY W SKOKU O TYCZCE 18-19-LETNICH ZAWODNIKÓW

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S u m m a r y

The experimental research was conducted in the years 2006-2009 and included 19 athletes aged 18-19, training pole vault in 'Zawisza' Bydgoszcz Sports Club, TS 'Olimpia' Poznań, Gdańsk Pole Vault Center, 'Gwardia' Piła, and 'Śląsk' Wrocław.

The purpose of this study was to determine relationships between somatic parameters and athletic result in pole vault among junior pole vaulters (aged 18-19).

The following research methods and tools were used in the study: evaluation of physical development, fitness testing, athletic results recording and methods of statistical analysis.

The analysis showed significant differences of somatic features and fitness results among individual athletes.

Statistically significant relationships in pole vault occurred between the volume of the chest cavity during exhalation, the volume of the chest cavity during inhalation, the body weight and the length of the upper limb (0.68, 0.62, 0.49, and 0.48, respectively).

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S t r e s z c z e n i e

Badania poznawcze prowadzono w latach 2006-2009, którymi objęto 19 zawodników w wieku 18-19 lat uprawiających skok o tyczce w klubie sportowym „Zawisza" Bydgoszcz, TS „Olimpia" Poznań, Ośrodek skoku o tyczce Gdańsk, „Gwardia" Piła, „Śląsk" Wrocław.

Celem badań było określenie zależności, jaka zachodzi pomiędzy parametrami somatycznymi a wynikiem sportowym w skoku o tyczce, tyczkarzy w kategorii junior (18-19 lat).

W pracy wykorzystano następujące metody i narzędzia badań: ocena rozwoju fizycznego, testowanie sprawności fizycznej, rejestracja wyników sportowych i metody statystycznego opracowania.

Analiza wykazała znaczne zróżnicowanie cech somatycznych i wyników sprawności fizycznej u poszczególnych ćwiczących.

Istotne statystycznie zależności skoku o tyczce, wystąpiły pomiędzy objętością klatki piersiowej przy wydechu, objętością klatki piersiowej przy wdechu, masą ciała i długością kończyny górnej (odpowiednio 0,68, 0,62, 0,49, 0,48).

***Key words:*** somatic features, athletic result, correlation
***Słowa kluczowe:*** cechy somatyczne, wynik sportowy, korelacja

## INTRODUCTION

Men's pole vault is one of the most complex and spectacular track and field events, in which the best athletic results are achieved by athletes of a very diverse somatic structure [1, 2]. Specialists highlight that achieving the best results in a given sport or event is related to the level of fitness, learning the technique

and tactics, somatic structure and a number of other relationships [1, 3]. Researchers emphasize that the type of body of every man is his biological property, which is influenced considerably by genetics, i.e. a feature highly unchangeable during his ontogenesis [4, 5, 6, 7]. Due to this reason, a proper selection of children as regards their somatic structure to appropriate sports contributes to satisfactory assumptions that in the future, these young people will meet the body structure conditions that will allow them to compete with the best.

An important role in pole vault is played by somatic structure, particularly some of its proportions that have a specific path of their development [5, 8,]. It is still impossible to determine which parameters of somatic structure will serve a criterion in individual age categories of athletes training pole vault.

The purpose of the study was to determine relationships between somatic parameters and pole vault results among junior pole vaulters (aged 18-19) take place.

## MATERIAL AND METHODS

Cognitive research was conducted in 2006 – 2009 and included 19 athletes aged 18 – 19, training pole vault in 'Zawisza' Bydgoszcz Sports Club, TS 'Olimpia' Poznań, Gdańsk Pole Vault Center, 'Gwardia' Piła, and 'Śląsk' Wrocław.

18- and 19-year-old athletes participated in training activities in the sport club 5–7 times a week. Each training unit lasted for 60–120 minutes. In addition, they had earlier participated in physical education classes in school for 3–4 hours a week, focusing on development of general fitness.

## RESEARCH METHODS

The following methods and research tools were used in the thesis:

- evaluation of physical development,
- testing physical dexterity,
- recording sports results,
- methods of statistical description.

In order to conduct the evaluation of physical development, somatic build measurements including the following indexes were used.

- body height (basis-vertex),
- weight,
- torso length (suprasternale-symphysiom),
- lower limb length (basis-symphysion),
- upper limb length (acromion-dactylion III),
- shoulder width (acromion-acromion),
- pelvis width (iliocristale-iriocristale),
- thigh circumference,
- shank circumference,
- arm circumference,
- volume of the chest during inspiration,
- volume of the chest during exhalation,
- chest breadth (the difference of the chest volume during inspiration and exhalation).

Using the above parameters, somatic build index according to Rohrer was calculated on the basis of defining the relation of the body weight to its height.

$$\frac{\text{Body weight (g)} \times 100}{\text{Body height (cm)}^3}$$

**In the course** of the research a pair of large bow compasses, scales and measuring tape were used.

During the construction of physical dexterity attempts, the system of control indexes suitable for competition requirements of pole vault was taken into account [9]:

- running speed for 30-m distance with a high start (s),
- running speed for 15-m distance with a 20-meter run-up,
- running speed for 15-m distance with a 20-meter run-up with a pole (s),
- running speed for 15-m distance with a 20-meter run-up with setting a pole (s),
- strength – measured by the long jump with a 20-meter run-up (cm),
- explosive strength – measured by the long jump with a 20-meter run-up,
- strength of back muscles and shoulder girdle – measured by lifting feet to the horizontal bar from straight arm overhang 5 times in good time (s),
- strength of back muscles and shoulder girdle – measured by lifting feet to the horizontal bar from straight arm overhang (quantity),
- strength of shoulder girdle and shoulders' muscles – measured by climbing 3-meter rope (s),
- strength of shoulder girdle and shoulders' muscles, horizontal pull-ups (quantity),
- strength of shoulder girdle and shoulders' muscles, 5 horizontal pull-ups in good time (s),
- pole vault test (cm),

•coordination and explosive strength measured by "flying" over the crossbeam from back somersault through a handstand (from the mattress) (cm),
•strength – measured by 4-kg shot put thrown back over the head (m).

Before performing the planned tests, the trainees were informed in detail about the way of performing them, and right before the tests a fifteen-minute warm-up was conducted with a coach responsible for its course.

Detailed analysis of athletic results was performed with the use of records from official competitions. The gathered material was statistically analyzed with examination of minimum, maximum and average values, and variations of the examined parameters, whereas Pearson correlation coefficients were deemed as statistically significant at $p<0.05$.

## ANALYSIS OF RESEARCH RESULTS

Analyzing physical development of athletes training pole vault, it is noticed that there are fluctuations in the value of standard deviation among individual parameters between 1.62 cm (arm width) and 6.14 cm (lower limb length).

The average height of athletes, aged 18-19, is 184.389 cm. The tallest pole vaulter has 191 cm in height, and the shortest one - 174 cm. A high diversification can be noticed in the athletes' body weight (from 60 to 80 kg), with the average weight amounting to 74.23 kg.

The average width of the shoulder girdle and pelvic girdle amounted to 41.38 cm and 30.58 cm, respectively. The difference between the highest and lowest value of the shoulder girdle width amounted to 3.62 cm, and in the case of the pelvic girdle – 3.62 cm.

On the other hand, the average values of the length of the lower and upper limbs amounted to 93.09 cm and 80.12 cm, respectively.

Interesting results were achieved while measuring sizes of the thigh, the shin and the shoulder. The average value of these sizes amounted to 52.53 cm, 36.72 cm and 28.72 cm, respectively. The highest diversification occurred in the thigh size (standard deviation 4.44), where the maximum size amounted to 61 cm, and the minimum size was 43 cm.

Measurement of the volume of the chest cavity during exhalation and inhalation indicated the average value of 99.42 cm and 90.47 cm, respectively, whereas the average value of the chest expansion amounted to 8.56 cm.

The average value of the torso length of was 55.84 cm, whereas the difference between the longest and shortest value amounted to 11 cm.

An analysis of biological development among the pole vaulters allowed us to show the relationships resulting from this natural development, and first of all from the adaptation process of the body taking place under the influence of stimuli used in pole vault training.

Tab. 1 shows somatic structure parameters in junior athletes (aged 18-19).

Tab. 1. *Research results of somatic development in 18- and 19-year-old pole vaulters*

| No | Examinet parametres | Statistical quantities | 18-19 years old (n-19) |
|---|---|---|---|
| 1. | body height (cm) | M | 184,89 |
| | | SD | 5,70 |
| | | min | 174,00 |
| | | max | 191,00 |
| 2. | body weight (kg) | M | 74,23 |
| | | SD | 5,33 |
| | | min | 60,00 |
| | | max | 84,00 |
| 3. | shoulder width (cm) | M | 41,38 |
| | | SD | 2,08 |
| | | min | 36,70 |
| | | max | 45,00 |
| 4. | pelvis width (cm) | M | 30,58 |
| | | SD | 2,48 |
| | | min | 26,00 |
| | | max | 34,20 |
| 5. | lower limb lenght (cm) | M | 93,09 |
| | | SD | 6,14 |
| | | min | 83,40 |
| | | max | 101,00 |
| 6. | upper limb lenght (cm) | M | 80,12 |
| | | SD | 3,87 |
| | | min | 73,00 |
| | | max | 85,00 |
| 7. | thight circumference (cm) | M | 52,53 |
| | | SD | 4,44 |
| | | min | 43,00 |
| | | max | 61,00 |
| 8. | shang circumference (cm) | M | 36,72 |
| | | SD | 1,94 |
| | | min | 33,00 |
| | | max | 40,50 |
| 9. | arm circumference (cm) | M | 28,92 |
| | | SD | 1,62 |
| | | min | 27,00 |
| | | max | 32,50 |
| 10. | volume of the chest inspiration (cm) | M | 99,42 |
| | | SD | 5,31 |
| | | min | 90,00 |
| | | max | 112,00 |
| 11. | volume of the chest exhalation (cm) | M | 90,47 |
| | | SD | 4,51 |
| | | min | 80,00 |
| | | max | 101,00 |
| 12. | chest breadth (cm) | M | 8,56 |
| | | SD | 1,83 |
| | | min | 5,00 |
| | | max | 11,00 |
| 13. | torso lenght (cm) | M | 55,84 |
| | | SD | 2,35 |
| | | min | 51,00 |
| | | max | 62,00 |

Based on the conducted analysis of slenderness of the body determined by Rohrer index, which in comparison with the earlier studies by the author on younger pole vaulters indicated the height [11], it can be assumed that it occurs under the influence of the applied training loads and the period of biological development of the polled athletes. It has a direct impact on growth of their muscle mass as well as on a wider shoulder girdle and lowering dynamics of the body height. This index amounted to 1.17 (Tab. 2).

Tab. 2. *Body structure index according to Rohrer*

| No. | Rohrer index |
|---|---|
| | Age |
| | 18 - 19 lat |
| 1. | 1,17 |

An analysis of fitness testing results indicated significant fluctuations of the standard deviation from 0.04 (the first /0-5m/ section of 15-m run with planting the pole) to 55.62 in pole vault in individual attempts.

In a 30-m run, the average value amounted to 3.93 s, minimum – 3.57 s, and maximum – 4.28 s. In a 15-m run with the pole, the average values amounted to 1.74 s and 1.84 s.

In a 15-m run with planting the pole, the average value amounted to 1.96 s, whereas the difference between the best and worst result was 0.45 s. In individual, three 5-meter stretches of this run, the worst results were achieved between the tenth and fifteenth meter, which is caused by athlete's preparation to plant the pole.

There are interesting results in standing and running long jump. In both attempts, in particular in long jump with approach, there is a high spread of results (the standard deviation is 15.72 and 45.77, respectively). The average results in standing and running long jump amounted to 280.21 cm and 597.26 cm. One of the athletes gave the shortest jump with the result of 253 cm, and the longest jump was 302 cm. In running long jump, the difference between the best and worst result amounted to 153 cm.

In 'flight' over the bar, the average result was 77.5 cm, where the minimum value was 50 cm, and the maximum - 130 cm.

Pole vault results look interesting as well. This test showed the highest diversification of results. The difference between the worst and best results amounted to 191 cm. The best result was 551 cm. The remaining results of fitness test are presented in Tab. 3.

Tab. 3. *Fitness results of 18-19-year-old pole vaulters*

| No. | Fitness tests | Statistical quantities | Age 18 - 19 (n-19) |
|---|---|---|---|
| 1 | 30m run (s) | M | 3,93 |
| | | SD | 0,19 |
| | | min | 3,57 |
| | | max | 4,28 |
| 2 | 15 m run (s) | M | 1,74 |
| | | SD | 0,12 |
| | | min | 1,58 |
| | | max | 1,98 |
| 3 | 15m run with a vault (s) | M | 1,84 |
| | | SD | 0,10 |
| | | min | 1,66 |
| | | max | 2,03 |
| 4 | 15m run with a vault with planting (s) | M | 1,96 |
| | | SD | 0,12 |
| | | min | 1,65 |
| | | max | 2,10 |
| 5 | 0 - 5 m (s) | M | 0,63 |
| | | SD | 0,04 |
| | | min | 0,54 |
| | | max | 0,69 |
| 6 | 5 - 10 m (s) | M | 0,65 |
| | | SD | 0,05 |
| | | min | 0,54 |
| | | max | 0,71 |
| 7 | 10 - 15 m (s) | M | 0,69 |
| | | SD | 0,05 |
| | | min | 0,57 |
| | | max | 0,77 |
| 8 | Standing long jump (cm) | M | 280,21 |
| | | SD | 15,72 |
| | | min | 253,00 |
| | | max | 302,00 |
| 9 | Running long jump (cm) | M | 597,26 |
| | | SD | 45,77 |
| | | min | 542,00 |
| | | max | 695,00 |
| 10 | 3m rope climbing (s) | M | 5,16 |
| | | SD | 1,78 |
| | | min | 2,31 |
| | | max | 8,59 |
| 11 | Pull ups on a bar (number) | M | 15,26 |
| | | SD | 4,19 |
| | | min | 7,00 |
| | | max | 22,00 |
| 12 | Feet lift up to a suspended bar – training simulator (number) | M | 5,42 |
| | | SD | 2,09 |
| | | min | 3,00 |
| | | max | 9,00 |
| 13 | Feet lift up to a bar, 5x time trial (s) | M | 6,97 |
| | | SD | 1,71 |
| | | min | 5,13 |
| | | max | 10,93 |
| 14 | Pull ups on a bar – 5x time trial (s) | M | 6,04 |
| | | SD | 0,87 |
| | | min | 4,49 |
| | | max | 8,04 |
| 15 | "Flight" over the bar from back somersault through handstand from mat (cm) | M | 77,47 |
| | | SD | 25,35 |
| | | min | 50,00 |
| | | max | 130,00 |
| 16 | 4kg shot put backwards over the head (m) | M | 17,14 |
| | | SD | 1,58 |
| | | min | 14,12 |
| | | max | 21,59 |
| 17 | Pole vault result (cm) | M | 437,16 |
| | | SD | 55,62 |
| | | min | 360,00 |
| | | max | 551,00 |

Correlation analysis conducted between fitness results and somatic structure among 18-19-year-old pole vaulters indicated certain statistically significant relationships (Tab. 4).

Tab. 4. *Correlation analysis values of results of individual fitness tests and somatic structure among 18- and 19-year-old pole vaulters*

| Examined parameters | | Examined featurest - somatic measurements | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Body height (cm) | Body weight (kg) | Shoulder width (cm) | Pelvis width (cm) | Lower limb lenght (cm) | Upper limb lenght (cm) | Thight circum ference (cm) | shang circum ference (cm) | arm circum ference (cm) | volume of the chest inspiration (cm) | volume of the chest exhalation (cm) | chest breadth (cm) | torso lenght (cm) |
| Fitness tests | L.p. | A | B | C | D | E | F | G | H | I | J | K | L | Ł |
| 30m run (s) | 1 | -0,05 | -0,19 | -0,31 | 0,04 | -0,07 | 0,09 | -0,14 | -0,36 | -0,33 | -0,20 | -0,13 | 0,02 | -0,14 |
| 15 m run (s) | 2 | -0,20 | -0,44 | -0,09 | -0,27 | -0,06 | -0,35 | -0,15 | -0,28 | **-0,58** | **-0,62** | **-0,56** | -0,28 | -0,13 |
| 15m run with a vault (s) | 3 | -0,22 | -0,43 | -0,21 | -0,11 | -0,15 | -0,37 | 0,09 | -0,41 | -0,41 | **-0,65** | **-0,61** | -0,01 | -0,04 |
| 15m run with a vault with planting (s) | 4 | -0,29 | **-0,52** | -0,35 | -0,13 | -0,26 | -0,16 | -0,06 | -0,28 | -0,42 | **-0,57** | **-0,49** | -0,09 | 0,06 |
| 0 - 5 m (s) | 5 | -0,29 | **-0,51** | -0,45 | -0,13 | -0,26 | -0,13 | -0,14 | -0,23 | -0,42 | **-0,56** | **-0,48** | -0,10 | 0,01 |
| 5 - 10 m (s) | 6 | -0,06 | -0,43 | **-0,58** | -0,27 | -0,06 | 0,03 | -0,20 | -0,32 | -0,34 | **-0,54** | **-0,50** | -0,28 | -0,01 |
| 10 - 15 m (s) | 7 | -0,36 | -0,47 | -0,15 | -0,07 | -0,30 | -0,30 | 0,06 | -0,18 | -0,38 | **-0,54** | -0,38 | -0,04 | 0,06 |
| Standing long jump (cm) | 8 | 0,05 | 0,35 | 0,24 | 0,44 | -0,07 | 0,18 | 0,12 | 0,19 | 0,46 | **0,52** | **0,57** | 0,31 | 0,11 |
| Running long jump (cm) | 9 | 0,17 | 0,44 | 0,11 | 0,29 | 0,01 | 0,19 | 0,15 | 0,19 | **0,58** | 0,44 | **0,50** | 0,14 | 0,16 |
| 3m rope climbing (s) | 10 | -0,20 | -0,41 | -0,06 | -0,34 | -0,12 | -0,40 | -0,21 | -0,38 | **-0,65** | **-0,68** | **-0,60** | **-0,55** | -0,05 |
| Pull ups on a bar (number) | 11 | -0,04 | 0,13 | 0,12 | 0,16 | -0,07 | -0,08 | 0,31 | **0,55** | 0,40 | 0,29 | 0,12 | 0,19 | 0,24 |
| Feet lift up to a suspended bar – training simulator ( | 12 | 0,21 | 0,42 | 0,27 | 0,22 | 0,15 | 0,02 | 0,30 | 0,44 | 0,40 | 0,38 | 0,41 | -0,10 | 0,09 |
| Feet lift up to a bar, 5x time trial (s) | 13 | -0,02 | -0,19 | 0,12 | -0,27 | 0,02 | -0,26 | 0,06 | -0,13 | -0,42 | -0,38 | -0,39 | -0,36 | 0,09 |
| Pull ups on a bar – 5x time trial (s) | 14 | -0,06 | -0,22 | 0,05 | 0,00 | -0,05 | 0,13 | -0,14 | -0,28 | -0,40 | -0,19 | -0,13 | -0,12 | 0,12 |
| "Flight" over the bar from back somersault through | 15 | 0,37 | 0,40 | 0,20 | 0,39 | 0,38 | **0,51** | 0,06 | 0,11 | 0,30 | **0,58** | **0,48** | 0,42 | -0,10 |
| 4kg shot put backwards over the head (m) | 16 | 0,34 | **0,60** | **0,54** | 0,15 | 0,24 | 0,34 | 0,32 | 0,34 | **0,66** | **0,77** | **0,68** | 0,38 | 0,23 |
| Pole vault result (cm) | 17 | 0,36 | **0,49** | 0,34 | 0,29 | 0,36 | **0,48** | 0,15 | 0,26 | 0,38 | **0,62** | **0,68** | 0,36 | -0,06 |

$p < 0.05$ **bold**

The body weight is in statistically significant relationship with four fitness tests, including 15-m run with planting the pole, the first 5-meter section of this run /0 – 5 m/ (0.52, 0.51, respectively), 4 kg shot put backwards over the head (0.60) and pole vault (0.49). On the other hand, the width of the shoulder girdle and the length of the upper limb are in statistically significant relationship with two tests (the second 5-meter section /5 – 10 m/ of the run with planting the pole /0.58/ and 4 kg shot put backwards over the head /0.54/; "flight" over the bar from back somersault (0.51) and pole vault (0.48). The shin size is in statistically significant relationship at the level of 0.55 (with pull ups on a bar /quantity/). One of the most interesting ones was the relationship between the arm size and a test consisting in climbing a 3-m-long rope (0.65) and 4 kg shot put backwards over the head (0.66). This test indicates also a statistically significant relationship with 15-m run and long jump (0.58). As many as eleven statistically significant relationships have been found between the chest size during inhalation and exhalation and fitness tests. The size fluctuates from 0.48 (between the chest size during exhalation and "flight" over the bar from back somersault) to 0.77 (the chest size during inhalation and 4 kg shot put backwards). The chest expansion shows a significant relationship with climbing a 3-m-long rope (0.55). No statistically significant relationships were found between the remaining somatic features and fitness tests. The highest number of relationships occurs at a medium and low level of significance.

Tab. 5 presents relationships between individual somatic features and pole vault results. Statistically significant correlation is found between four of them. An interesting finding is the relationship between athletic result and the volume of the chest cavity during exhalation (0.68) and the volume of the chest cavity during inhalation (0.62). An interesting relationship is found between the body weight and the length of the upper limb (0.49, 0.48). The highest number of relationships occurs at a low and medium level of significance (Tab. 5).

Tab. 5. *Results of correlation analysis between somatic features and pole vault result among 18- and 19-year-old pole vaulters*

| No. | Examinet featurest | Age |
|---|---|---|
| | | 18-19 |
| 1 | Body height (cm) | 0,36 |
| 2 | Body w eight (kg) | **0,49** |
| 3 | Shoulder w idth (cm) | 0,34 |
| 4 | Pelvis w dth (cm) | 0,29 |
| 5 | Low er limb length (cm) | 0,36 |
| 6 | Upper limb length (cm) | **0,48** |
| 7 | Thigh circumference (cm) | 0,15 |
| 8 | Shank circumference (cm) | 0,26 |
| 9 | Arm circumference (cm) | 0,38 |
| 10 | Chest volume inspiration (cm) | **0,62** |
| 11 | Chest volume exhalation (cm) | **0,68** |
| 12 | Chest breadth (cm) | 0,36 |
| 13 | Torso length (cm) | -0,06 |

$p < 0.05$ **bold**

## DISCUSSION

Based on relationships between somatic features and any parameter specifying motor skills we can present differences which occur in a given group as well as individual athletes. Specialists determine this issue as very complex. According to their opinion, one cannot look for explicitness in individual relationships [12, 13].

Making a comparison between the height of the polled pole vaulters and the research results obtained by M. Napierała (2008), conducted in Kujawsko-Pomorskie Voivodeship, it can be confirmed that the athletes are taller than their peers (M. Napierała: 18-and-a-half-year-olds – 178.69 cm). In addition, a comparison between the body weight of our pole vaulters and the research results obtained by M. Napierała (2008) in Kujawsko-Pomorskie Voivodeship confirmed that the polled pole vaulters had a higher average body weight. In the research carried out by M. Napierała (2008), it looks as follows: M. Napierała - 18-and-a-half-year-olds – 71.89 kg.

Comparing results of tests for slenderness of the body, determined by Rohrer's index, among 18-19 year old athletes to 11-14 year old [11] and 16-17 year old athletes [14] presented earlier, there was an increase. This index among young athletes aged 11, 12, 13 and 14 indicated trends of slenderness (1.09, 1.07, 1.04 and 1.02, respectively). On the other hand, the tested index among athletes aged 16-17 and 18-19 was showing gradual increase (1.14 and 1.17, respectively). It can be assumed that it takes place as a result of applied training loads and the period of biological development of athletes undergoing testing, which has a direct impact on growth of their muscle mass, the width of the pectoral girdle, and lower dynamics of the body height.

## CONCLUSIONS

- Analysis of test results of somatic structure (among 18-19 year old pole vaulters) showed its significant differentiation.
- Comparing Rohrer's index determining slenderness of the body among 18-19 year old athletes to their younger colleagues involved in pole vault, we can notice its increase.
- A high diversity of fitness results was confirmed (standard deviation - between 0.04 and 55.62).
- Substantial relations between fitness of pole vaulters and their individual values of somatic features were indicated, e.g. body mass with 4 kg shot put backward over the head (0.60).
- It was established that pole vault correlates statistically significantly with - with four somatic features (the volume of the chest cavity during exhaling and inhaling, with the body mass and length of the upper limb; 0.68, 0.62, 0.49, 0.48, respectively).

Based on this analysis, due to (among others) a small number of those examined, no explicit determination can be made as regards the relation between somatic structure, fitness tests and pole vault results.

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Erratum

ORIGINAL ARTICLE / PRACA ORYGINALNA

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# SOMATIC BUILD VS SPORTS RESULT OF POLE VAULT CONTESTANTS AGED 18-19

## BUDOWA SOMATYCZNA A WYNIK SPORTOWY W SKOKU O TYCZCE 18-19-LETNICH ZAWODNIKÓW

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S u m m a r y

The experimental research was conducted in the years 2006-2009 and included 19 athletes aged 18-19, training pole vault in 'Zawisza' Bydgoszcz Sports Club, TS 'Olimpia' Poznań, Gdańsk Pole Vault Center, 'Gwardia' Piła, and 'Śląsk' Wrocław.

The purpose of this study was to determine relationships between somatic parameters and athletic result in pole vault among junior pole vaulters (aged 18-19).

The following research methods and tools were used in the study: evaluation of physical development, fitness testing, athletic results recording and methods of statistical analysis.

The analysis showed significant differences of somatic features and fitness results among individual athletes.

Statistically significant relationships in pole vault occurred between the volume of the chest cavity during exhalation, the volume of the chest cavity during inhalation, the body weight and the length of the upper limb (0.68, 0.62, 0.49, and 0.48, respectively).

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S t r e s z c z e n i e

Badania poznawcze prowadzono w latach 2006-2009, którymi objęto 19 zawodników w wieku 18-19 lat uprawiających skok o tyczce w klubie sportowym „Zawisza" Bydgoszcz, TS „Olimpia" Poznań, Ośrodek skoku o tyczce Gdańsk, „Gwardia" Piła, „Śląsk" Wrocław.

Celem badań było określenie zależności, jaka zachodzi pomiędzy parametrami somatycznymi a wynikiem sportowym w skoku o tyczce, tyczkarzy w kategorii junior (18-19 lat).

W pracy wykorzystano następujące metody i narzędzia badań: ocena rozwoju fizycznego, testowanie sprawności fizycznej, rejestracja wyników sportowych i metody statystycznego opracowania.

Analiza wykazała znaczne zróżnicowanie cech somatycznych i wyników sprawności fizycznej u poszczególnych ćwiczących.

Istotne statystycznie zależności skoku o tyczce, wystąpiły pomiędzy objętością klatki piersiowej przy wydechu, objętością klatki piersiowej przy wdechu, masą ciała i długością kończyny górnej (odpowiednio 0,68, 0,62, 0,49, 0,48).

***Key words:*** somatic features, athletic result, correlation
***Słowa kluczowe:*** cechy somatyczne, wynik sportowy, korelacja

## INTRODUCTION

Men's pole vault is one of the most complex and spectacular track and field events, in which the best athletic results are achieved by athletes of a very diverse somatic structure [1, 2]. Specialists highlight that achieving the best results in a given sport or event is related to the level of fitness, learning the technique