

MORPHOLOGY DIFFERENCES BETWEEN ELITE C1 AND K1 CANOE SLALOM COMPETITORS

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INTRODUCTION

Anthropometric parameters are an important factor of white-water slalom (canoe slalom) performance. However, differences between kayak (K1) and canoe (C1) category are not clear. The aim of this study was to identify if morphology (body constitution and composition) differences existed between elite kayak and canoe paddlers.

METHODS

The survey included a total of 30 male (15 C1 and 15 K1) canoe slalom paddlers who competed in the 2022 ICF Canoe Slalom World Cup in Prague. A battery of anthropometric dimensions was assessed for these competitors according to standardized anthropometric techniques (Ridge et al., 2007). Body composition was determined through bioimpedance analysis using the multifrequency octopolar device Tanita MC-980 (Tanita Co., Tokyo, Japan). Somatotypes were calculated according to Heath & Carter (1990). Paddlers were assessed on consecutive days, two days before the World Cup event. To eliminate inter-rater variability, all measurements were conducted by a single experienced examiner. Descriptive statistics were used to compare canoe and kayak paddlers. To determine differences between the groups an independent student's T-test was used. Statistical significance was set at $p < 0.05$. To determine practical differences between canoe and kayak paddlers Cohen's d was calculated. Effect sizes were classified as trivial (0 - 0.2), small (0.2 - 0.6), moderate (0.6 - 1.2), large (1.2 - 2.0) and very large (> 2.0) (Hopkins, 2006).



RESULTS

There were no significant anthropometric differences between C1 and K1 paddlers. Elite slalom male competitors are characterized as having average body height (~180 cm), average weight (~75 kg), ectomorphic mesomorph somatotype (1.4 - 5.3 - 2.7), well-developed trunk (chest girth: ~100 cm) and arm muscles (flexed arm girth: ~35 - 36 cm; forearm girth: ~29 - 30 cm), and low muscle hypertrophy of legs and low body fat (~8 - 9 %).

| Variable | Canoe (n=15) | | Difference | | Kayak (n=15) | |
|--------------------------|-----------------|---------------|------------|------|-----------------|---------------|
| | Mean \pm SD | Range | P | D | Mean \pm SD | Range |
| Age (years) | 27.7 \pm 6.0 | 19 - 39 | 0.70 | 0.14 | 28.5 \pm 4.9 | 22 - 36 |
| Body mass (kg) | 74.5 \pm 6.4 | 56.5 - 84 | 0.66 | 0.16 | 75.6 \pm 6.8 | 63.1 - 89.6 |
| Height (cm) | 179.6 \pm 5.8 | 167.1 - 191.5 | 0.66 | 0.15 | 180.5 \pm 4.9 | 172.1 - 191.7 |
| Body mass index | 23.1 \pm 1.5 | 20.2 - 25.9 | 0.86 | 0.20 | 23.2 \pm 1.4 | 19.4 - 25.2 |
| Sitting height (cm) | 94.4 \pm 2.9 | 89.7 - 103 | 0.73 | 0.13 | 93.9 \pm 4.4 | 83.5 - 101.2 |
| Arm span (cm) | 185.5 \pm 6.1 | 172 - 193.5 | 0.78 | 0.10 | 186.2 \pm 7.6 | 170 - 199.5 |
| Sitting/body height (%) | 0.53 \pm 0.01 | 0.51 - 0.55 | 0.32 | 0.63 | 0.52 \pm 0.02 | 0.46 - 0.54 |
| Arm span/body height (%) | 1.03 \pm 0.02 | 0.99 - 1.08 | 0.90 | 0 | 1.03 \pm 0.03 | 0.94 - 1.09 |
| Humerus breadth (cm) | 7.2 \pm 0.4 | 6.3 - 7.9 | 0.18 | 0.28 | 7.3 \pm 0.3 | 6.8 - 8.0 |
| Femur breadth (cm) | 9.8 \pm 0.5 | 8.7 - 10.8 | 0.25 | 0.40 | 10.0 \pm 0.5 | 9.0 - 10.8 |
| Forearm girth (cm) | 29.5 \pm 1.4 | 26.5 - 31.4 | 0.19 | 0.29 | 29.9 \pm 1.3 | 28.0 - 32.9 |
| Flexed arm girth (cm) | 35.6 \pm 1.9 | 31.5 - 39.9 | 0.82 | 0.04 | 35.5 \pm 2.4 | 29.3 - 39.5 |
| Chest girth (cm) | 100.0 \pm 6.9 | 88.5 - 110.3 | 0.34 | 0.36 | 102.0 \pm 3.6 | 94.6 - 107.0 |
| Thigh girth (cm) | 50.7 \pm 2.8 | 46.6 - 56.5 | 0.88 | 0.06 | 50.9 \pm 3.2 | 43.2 - 55.5 |
| Calf girth (cm) | 35.5 \pm 1.7 | 32.0 - 37.6 | 0.36 | 0.37 | 36.1 \pm 1.5 | 33.0 - 39.0 |
| Body fat (%) | 9.1 \pm 2.9 | 5.6 - 16.2 | 0.08 | 0.71 | 7.3 \pm 2.1 | 3.0 - 11.2 |
| Endomorphy | 1.4 \pm 0.5 | 0.9 - 2.7 | 0.27 | 0.22 | 1.3 \pm 0.4 | 0.7 - 2.2 |
| Mezomorphy | 5.2 \pm 1.1 | 2.1 - 6.8 | 0.32 | 0.20 | 5.4 \pm 0.8 | 3.9 - 6.7 |
| Ectomorphy | 2.7 \pm 0.7 | 1.5 - 3.8 | 1 | 0 | 2.7 \pm 0.7 | 1.6 - 4.6 |
| Hand-grip right hand | 56.5 \pm 7.5 | 46.1 - 73.7 | 0.08 | 0.67 | 61.4 \pm 6.9 | 52.3 - 71.3 |
| Hand-grip left hand | 54.7 \pm 6.8 | 44.8 - 68.0 | 0.07 | 0.70 | 59.4 \pm 6.6 | 48.2 - 71.1 |

Table 1: Comparison between male canoe and kayak paddlers.

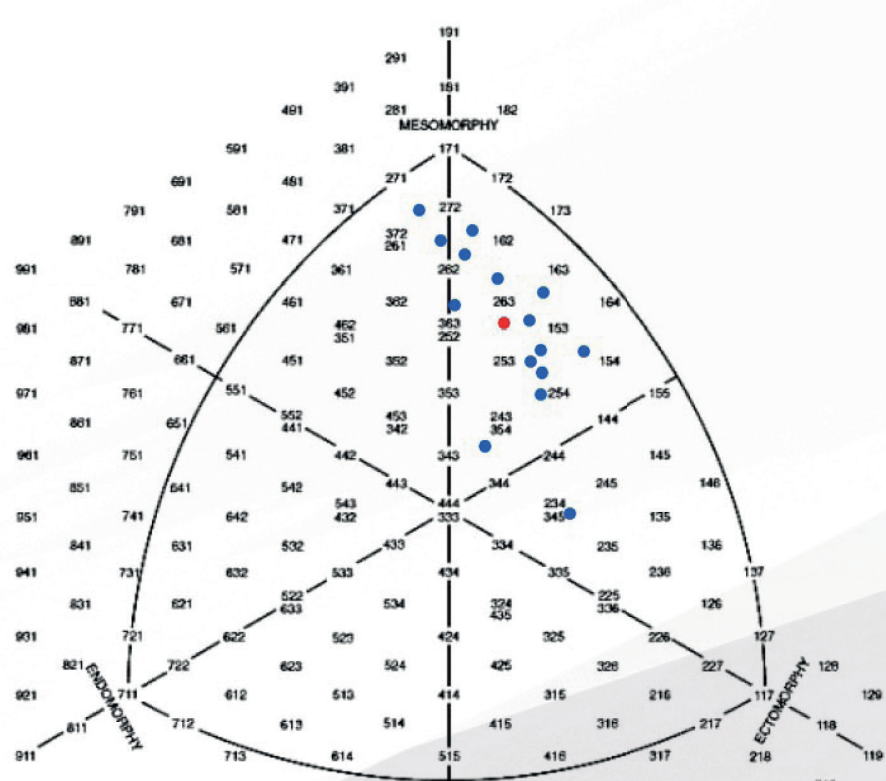


Figure 1: Somatograph of C1 men paddlers. • Individual somatotypes; • Average somatotype (1.4-5.2-2.7)

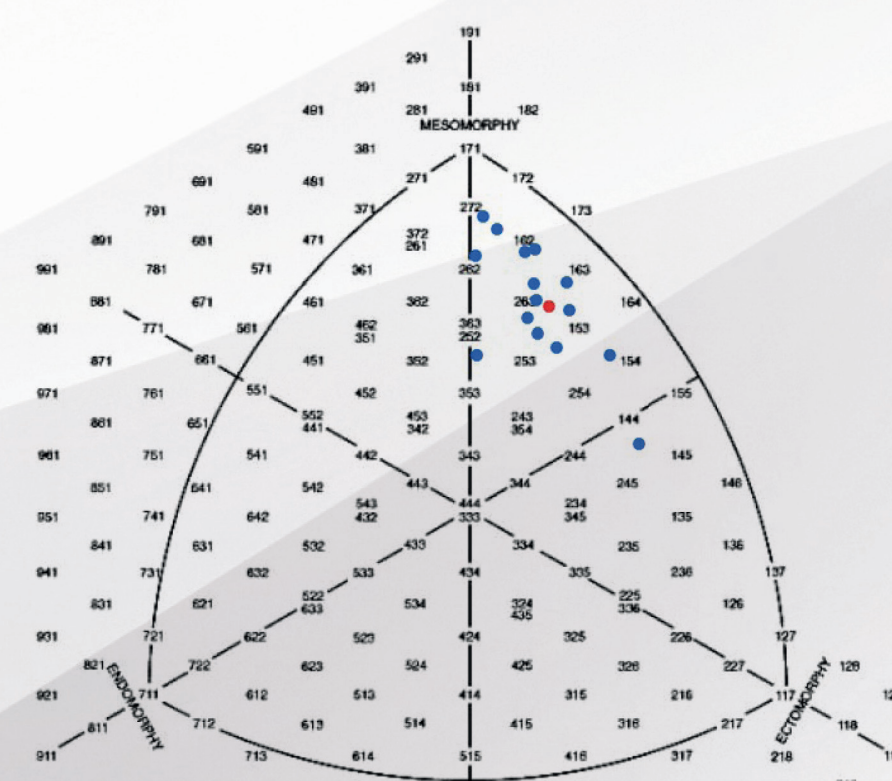


Figure 2: Somatograph of K1 men paddlers. • Individual somatotypes; • Average somatotype (1.3-5.4-2.7)

CONCLUSIONS

Generally, it is disadvantageous for canoe slalom athletes to have too high body weight. Body weight over 80 kg in male elite paddlers is rare, similarly body height greater than 190 cm is rare. We suggest developing strength without excessive leg hypertrophy. It is probably necessary in canoe slalom to have very well-developed muscles of the chest and arms, therefore body fat contribution should be kept low to maximize the strength to weight ratio.

DISCUSSION

Our findings are very similar to the findings of previous anthropometric research conducted in canoe slalom over the last several decades (Vaccaro et al., 1984; Ridge et al., 2007; Busta et al., 2018; Busta et al., 2022). This research confirms the findings of a previous study (Coufalová et al., 2021) which also found no morphological or strength differences between C1 and K1 paddlers. In contrast, canoe sprint athletes have greater body height and weight, have a more mesomorphic somatotype, and have more developed upper body muscularity, though they usually have a similar body fat percentage (Ackland et al., 2003).

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