Correction for environmental factors between competitions with a numerical model in sprint kayak

Kent Klitgaard[1,2], Jonas Juhl[1], Mathias Kristiansen[1], Mark de Zee[1]
[1]ExerciseTech, Department of Health Science and Technology, Aalborg University, Aalborg, Denmark
[2]BMC Laboratory, The Swedish School of Sport and Health Sciences, Stockholm, Sweden Email: Kent.Klitgaard@kanot.com

Summary

Environmental factors like wind and water currents affect sprint kayaking performance. In this study a numerical model was developed to correct for these variations, enabling fairer athlete assessments. Thirty-two kayakers participated, performing 500 m sprints at two national regattas. Strength tests and body composition measurements were also conducted. The model, which included factors like body mass and wind speed, showed that corrected times explained more variance than non-corrected values, indicating its effectiveness.

Introduction

Environmental factors such as wind and water currents significantly affect sprint kayaking performance, making it challenging to compare results across different competitions (1). To address this Juhl and colleagues (2) developed a numerical model to simulate and correct for environmental variations. This study applies a similar numerical correction model to standardize performance evaluations in sprint kayaking across competitions.

Methods

Thirty-two trained kayakers (23 males, 9 females; age: 19.5 ± 3.5 years; body mass: 77.9 ± 10.2 kg; height: 1.80 ± 0.08 m) participated in this study. Each athlete performed a 500 m race at two national regattas, with their fastest time recorded at each race. On a separate day, strength tests (bench press and bench pull) and body composition measurements (using a GE Lunar iDXA scanner) were conducted. The following variables were entered into the model: 500 m time, body mass, height, water temperature, water density, water kinematic viscosity, air pressure, air temperature, wind speed, and air density. Additionally, race profiles from the work of Goreham and colleagues (3) were used in the model. The goal of the model is to estimate the time in circumstances without wind and current.

A partial least squares (PLS) regression analysis was employed to assess the relationship between these independent variables and the dependent variable (500 m time). Additionally, sub-analyses were performed to evaluate the contributions of strength and body composition parameters.

Results and Discussion

Table 1: Recorded 500m at two national regattas vs calculated time. And the regression coefficients from the PLS analysis.

	500m time	R^2 PLS analysis
Recorded times	112.3 ±7.7	0.52
Calculated times	113.9±6.6	0.59
Difference	1.54% ±1.8	0.07

The analysis revealed that the corrected 500 m times (113.9 ± 6.6 s) showed a stronger relationship with environmental and performance variables (R^2 = 0.59) compared to the recorded times (112.3 ± 7.7 s, R^2 = 0.52). The model's correction reduced the performance time discrepancy by 1.54% ± 1.8%.

Conclusions

Correcting race times using the numerical model enhanced the explained variance in performance outcomes, suggesting that environmental corrections lead to fairer comparisons across competitions. These findings support the model's potential for standardizing performance evaluations in sprint kayaking.

Acknowledgments

The authors would like to thank the Novo Nordisk Foundation and Team Danmark for funding this project.

References

[1] Matzka M, et al (2019) IJSPP (7):958-964.
[2] Juhl et al.(2024Proc. Inst. Mech. Eng. Pt. P J.(4):328-338.
[3] Goreham, J. Aet al (2020). S Biomec, 22(11), 1444–1459.