

The Measurement Of Thrust In Competitive Swimming: The Association Between Different Thrust Variables

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Background

- Swimming acceleration and velocity are the net balance between Drag Force and Thrust.
- It is a standard procedure to do the decomposition of the Thrust-Time curve, assessing the swimmer's thrust.
- However, **there is not a convention or standard procedure on the variables to be selected.**
- Researchers report on regular basis either the Peak Thrust, Mean Thrust or Thrust-Time Integral.
- It is yet unclear to which extend these variables can be used, reported and interpreted interchangeably.

Purpose

To analyse the association between different thrust variables performing arm-pulls in competitive swimming.

Hypothesis

There is a strong association across different thrust variables performing arm-pulls in competitive swimming.

Methods

Participants

- 14 competitive swimmers
- 671 arm-pull cycles

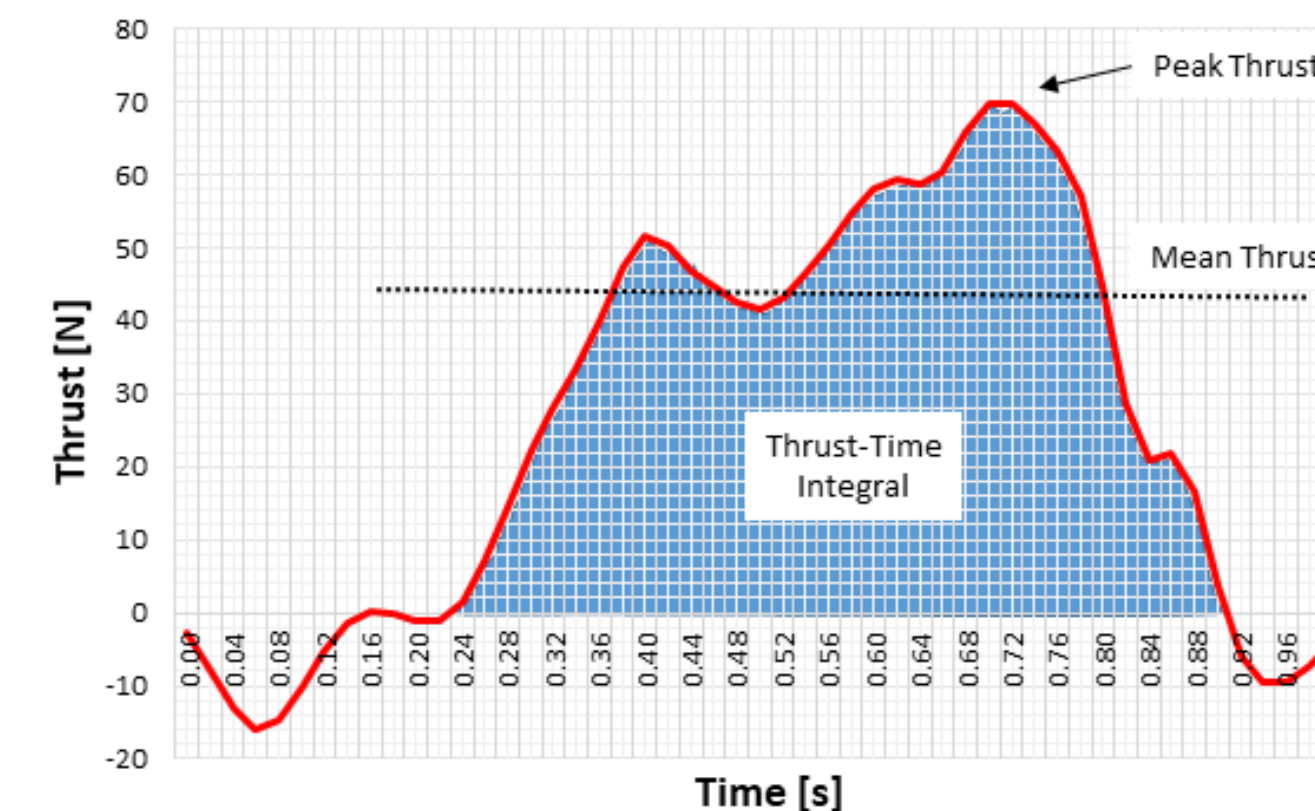
Data Collection



- 25m swim trials
- At front-crawl
- Pressure differential sensors
- Placed on the hands
- Customised software (LabVIEW®) was used to acquire time-series ($f=50\text{Hz}$).



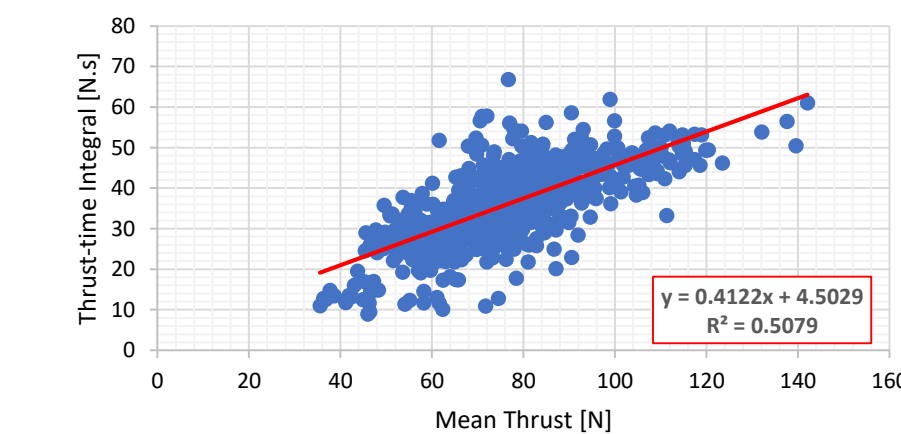
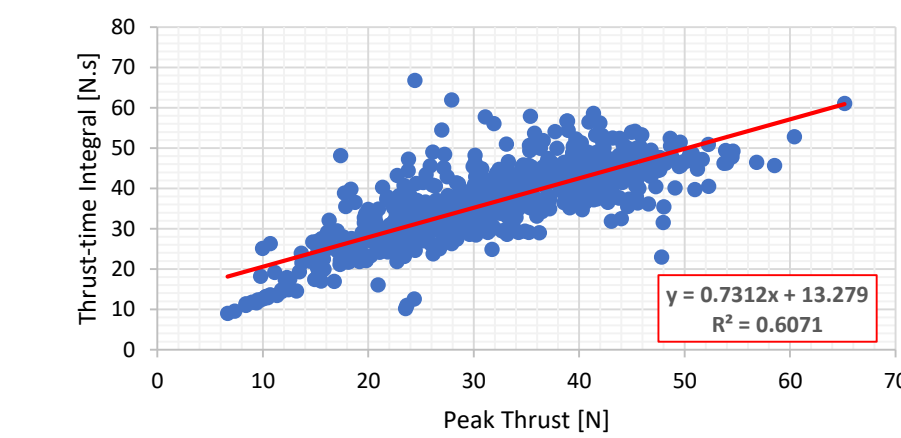
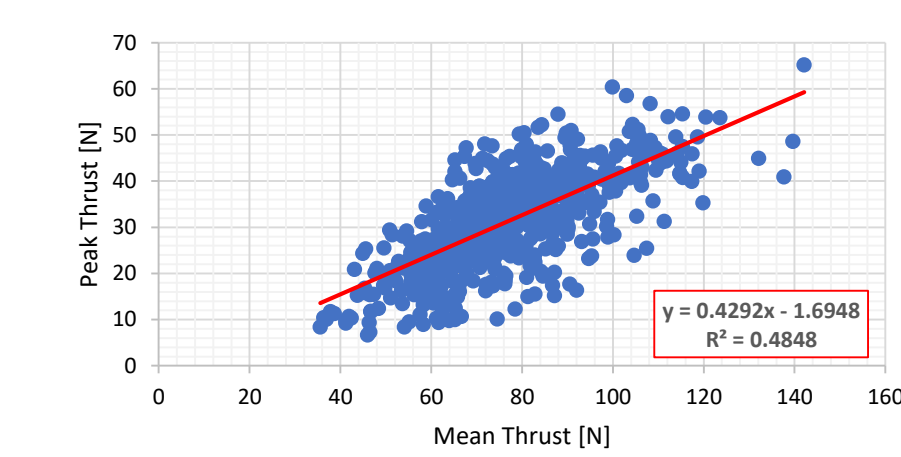
Variables



Statistical Analysis

- Simple Linear Regression Models across the three thrust variables:
 - Coefficient of determination (R^2)
 - Standard error of estimate (S)
 - Interception on Y-axis (c)
 - $P < 0.05$

Results






- All Coefficients of Determination were significant ($P < 0.001$)
- Peak Thrust vs. Mean Thrust was $R^2 = 0.49$
- Thrust-time Integral vs. Peak Thrust was $R^2 = 0.61$.
- Thrust-time integral vs. Mean Thrust was $R^2 = 0.51$
- Interception on Y-axis at the origin of the pairwise variables noted in the same SI unit (i.e. Newton) were very close to zero ($-1.6948 < c < 4.5029$)
- Standard error of estimate was acceptable ($6.54 < S < 12.14$)

Conclusions

There is a **strong association** between different thrust variables, even though the proportion of the variance is about 50-60%.

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