PRELIMINARY ATTEMPT TO DEVELOP A PATH-FLOW ANALYSIS MODEL FOR SWIMMING PERFORMANCE IN CHILDREN

INTRODUCTION

The goal of competitive swimming is to cover the total distance as fast as possible. The speed of the participants that resulted in the best performance was a key indicator of the athlete's performance. However, to improve performance, it is essential to understand the biomechanical and energetic variables that contribute to the quality of performance. This study aimed to define a relationship between biomechanical and energetic variables and swimming performance in children aged 10-13 years. The study was designed to be used with age-group swimmers.

METHODS

Participants: Ten male and female age-group swimmers with similar chronological age and gender. All swimmers were trained for at least 1 year and were able to be used in age-group due to several reasons. They were selected based on their swimming performance in previous competitions.

Data collection: Each swimmer performed a test in the middle of the 15-meter distance with an underwater start. The swimmers were evaluated using video analysis during the start. Swimming velocity was measured in the middle of 15m as:

\[ v = \frac{d}{t} \]

Where \( v \) is the mean swimming velocity, \( d \) is the distance covered by the swimmer, and \( t \) is the time spent swimming the distance and measured with a chronometer by an expert.

The swimming performance score was calculated using the formula:

\[ P = \frac{1}{t} \times \frac{1}{E} \times \frac{1}{F} \]

Where \( P \) is the performance score, \( t \) is the time spent, \( E \) is the energy expenditure, and \( F \) is the force generated.

The dependent variables were analyzed based on biomechanical and energetic parameters. The path model was developed according to meta-review papers about these relationships [1, 2] and the age-group swimmers' performance being generated in Figure 3.

RESULTS AND DISCUSSION

Table 1 presents descriptive statistics from all variables studied. Mean data values were somewhat within the range of values reported in the literature for swimmers with similar chronological age and gender [4, 5, 6]. Data dispersion, expressed as SD, was moderate-high for almost every variable. This same idea can be supported analyzing the range values.

Table 1. Descriptive statistics of biomechanical and energetic variables and swim performance.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
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<tbody>
<tr>
<td>v</td>
<td>1.5</td>
<td>0.2</td>
</tr>
<tr>
<td>E</td>
<td>120</td>
<td>15</td>
</tr>
<tr>
<td>F</td>
<td>1.2</td>
<td>0.1</td>
</tr>
</tbody>
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Figure 2 presents the confirmatory path-model for age-group swimmer's performance. Almost every partial relationship confirmed the hypothesis. The only exception was the relationship between v and performance (P<0.05), as it is considered in the literature that high performance is achieved in male-female subjects [10]. CV and SI did not include the final model as n-student test was not significant. New studies should focus in these phenomena's to clear out data reported here. The confirmatory model explained 56% of swimming performance variability. The coefficient of determination (R^2) was 0.56. This was achieved by the redefinition of the critical path model used to represent the swimming performance variables. The path model was appropriate, it does not explain 48% of the variance in performance, and the coefficient of determination (R^2) was 0.56. In this sense, the critical path model for swimming performance can be considered suitable for the theory presented. Although the model is appropriate, it does not explain 48% of the variance in performance. Swimming performance is a multifactorial phenomenon, where factors like psychological, anthropometric, genetic, motor control, and environmental aspects also play a significant role [1, 2, 7] and were not included in this model. Moreover, there are as well biomechanical and energetic variables that were not inserted, such as speed fluctuation, segmental velocity, energy cost or energy expenditure [1] since they are less suitable to be used with age-group swimmers.

CONCLUSION

As a conclusion, the model based on biomechanical and energetic variables, according to the relationships suggested, is appropriated to explain performance in age-group swimmers. However, the model should be expanded, including other variables in order to increase the prediction level of the swimming performance.

REFERENCES